REPORT NO. DOT-TSC-OST-77-29

TRANSPORTATION ENERGY EFFICIENCY PROGRAM (TEEP) REPORT ABSTRACTS

M.B. Munroe

APRIL 1977

DRAFT REPORT

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Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF THE SECRETARY
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System Development and Technology
Office of Systems Engineering
Washington DC 20590

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4. Title and Subtitle Transportation Energy Efficiency Program (TEEP) Report Abstracts		5. Report Date April 15, 1977
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7. Author(s) Mara B. Munroe*		8. Performing Organization Report No. DOT-TSC-OST-77-29
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS) OS714 R7508
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*Raytheon Service Company, Cambridge, MA 02142

16. Abstract

This bibliography summarizes the published research accomplished for the Department of Transportation's Transportation Energy Efficiency Program and its predecessor, the Automotive Energy Efficiency Program. The reports are indexed by corporate author, personal author, report number, and subject.

17. Key Words transportation energy, automotive fuel economy automobiles, engines, motor vehicles		18. Distribution Statement	
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PREFACE

This bibliography summarizes the published research accomplished for the Department of Transportation's Transportation Energy Efficiency Project and its predecessor, the Automotive Energy Efficiency Project. The report is separated into three sections. The first section contains abstracts of reports which are or will soon be available from the National Technical Information Service, Springfield, Virginia 22161. The reports which are not yet available are indicated by the suffix "U" after the report number. The second section includes abstracts of working papers and preliminary memoranda; these documants are available only with the approval of the author or program manager. The final section contains abstracts of reports which were requested by the Congress. These reports were accomplished by the Transportation Systems Center in cooperation with other government agencies, and are not solely the work of the Center.

The report abstracts are indexed by corporate author, personal author, report number, and subject.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

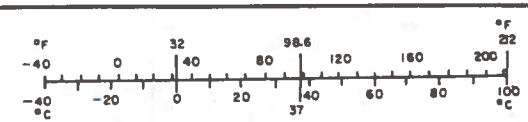

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

FINAL AND INTERIM REPORTS

Reports suffixed by the letter "U" are unpublished as of the publication of this Reports Bibliography. They will be published during 1977.

All other reports are now available to the public through the National Technical Information Service, Springfield, Virginia, 22161.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. DOT-TSC-OST-73-14	2. Government Accession No. PB-220-612	3. Recipient's Catalog No.
4. Title and Subtitle RESEARCH AND DEVELOPMENT OPPORTUNITIES FOR IMPROVED TRANSPORTATION ENERGY USAGE		5. Report Date September 1972
		6. Performing Organization Code DOT-TSC-TMP
7. Author(s) Transportation Energy Panel		8. Performing Organization Report No
9. Performing Organization Name and Address epartment of Transportation ransportation Systems Center endall Square ambridge, MA 02142		10. Work Unit No. R-3531
		11. Contract or Grant No. OS-314
12. Sponsoring Agency Name and Address epartment of Transportation ffice of the Secretary 00 7th Street, S. W. ashington, D. C. 20590		13. Type of Report and Period Covered Summary Technical Report
		14. Sponsoring Agency Code DOT-OST-TST-14

15. Supplementary Notes

April 1973

16. Abstract The almost complete dependence of transportation systems upon etroleum products makes the transportation sector vulnerable to in-reased prices of petroleum or insecure sources of petroleum. Since he dependence of transportation upon imported petroleum is projected o increase substantially over the next two decades, both short-and ong-term remedial actions should be initiated now and in the next ew years because of the long time needed to bring about evolutionary hanges in the Nation's transportation systems. Possible remedial ctions include:

1. Technological improvements for more efficient use of petroleum by transportation.
2. Technological changes to permit greater use of non-petroleum energy resources by transportation.
3. Shift of transportation demand to more efficient modes from less efficient modes.
4. Reduction of demand for transportation services.

ransportation energy demand projections are given and R&D tasks in ach of the first three categories are assessed.

17. Key Words Transportation, Energy, ransportation Energy, nergy Utilization, Fuel Economy, eat Engines		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151	
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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. DOT-TSC-OST-73-26	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle GAS TURBINE ENGINE PRODUCTION IMPLEMENTATION STUDY, VOLUME I: EXECUTIVE SUMMARY		5. Report Date JULY 1973
		6. Performing Organization Code
7. Author(s) D. E. Lapedes, L. Forrest, F. G. Ghahremani, O. Hamberg, W. U. Roessler, W. M. Smalley, M. Hinton, T. Iura, J. Meltzer		8. Performing Organization Report No. ATR-73(7323)-1, Vol. I
9. Performing Organization Name and Address URBAN PROGRAMS DIVISION THE AEROSPACE CORPORATION EL SEGUNDO, CALIFORNIA 90045		10. Work Unit No. OS314/R3531
		11. Contract or Grant No. EPA 68-01-0417
12. Sponsoring Agency Name and Address DEPARTMENT OF TRANSPORTATION OFFICE OF THE SECRETARY, OFFICE OF SYSTEMS DEVELOPMENT AND TECHNOLOGY WASHINGTON, D.C. 20590		13. Type of Report and Period Covered FINAL REPORT JANUARY 1973 - JULY 1973
		14. Sponsoring Agency Code

15. Supplementary Notes

CONTRACT ADMINISTERED BY:
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DIVISION OF EMISSION CONTROL TECHNOLOGY
ANN ARBOR, MICHIGAN 48105

16. Abstract

This report presents a summarization and assessment of available information pertaining to the potential for implementing mass production of gas turbine engine-powered automobiles. The main topic covered is the schedule requirement for that implementation. Emphasis has been directed toward identifying those critical or limiting factors affecting timely introduction of gas turbine engine concepts on a mass production basis. A description of basic automotive product development phases, engine manufacturing processes, and gas turbine engine current technology status are included to clarify and augment the discussions, and to permit the necessary understanding of the developed implementation schedules.

Based on data acquired during the period February 28 to April 30, 1973, a period of 8 to 10 years is a best estimate of the elapsed time until 300,000 gas turbine engines are mass produced annually. This estimate is based on a postulated overall product development schedule of slightly more than 11 years. Prior to major commitment of capital resources necessary for adherence to this schedule, automobile manufacturers must resolve three major issues: 1) improvements in engine fuel economy and exhaust emissions, 2) development of new mass production fabrication processes directed at reducing engine unit cost, and 3) statistical evidence of engine durability in fleet test cars.

17. Key Words: automobile, design and technology, engines, gas turbine, mfg. costs, mfg. processes, mass production schedules		18. Distribution Statement: DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.	
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AS TURBINE ENGINE PRODUCTION IPLEMENTATION STUDY, OLUME II: TECHNICAL DISCUSSION	JULY 1973
	6. Performing Organization Code
Author(s) D. E. Lapedes, L. Forrest, F. G. Ghahremani Hamberg, W. U. Roessler, W. M. Smalley, Hinton, T. Jura, J. Meltzer	8. Performing Organization Report No. ATR-73(7323)-1, Vol. II
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Supplementary Notes

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ANN ARBOR, MICHIGAN 48105

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Key Words		18. Distribution Statement
automobile design and technology engines gas turbine	mfg. costs mfg. processes mass production schedules	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

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4. Title and Subtitle HIGHWAY FUEL CONSUMPTION COMPUTER MODEL (VERSION I)		5. Report Date April 1974
		6. Performing Organization Code TMP
7. Author(s) H.H. Gould, A.C. Malliaris		8. Performing Organization Report No. DOT-TSC-OST-73-43
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS414/R4501
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address Department of Transportation Office of the Asst. Sec. for Systems Development and Technology, and Office of the Asst. Sec. for Policy and International Affairs Washington DC 20590		13. Type of Report and Period Covered Final Report January - September 1973
		14. Sponsoring Agency Code TST/44 & TPI 13
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16. Abstract

A Highway Fuel Consumption Computer Model is given. The model allows the computation of fuel consumption of a highway vehicle class as a function of time. The model is of the initial value (in this case initial inventory) and lumped parameter type. Parameters included in the analysis are (a) vehicle population in the initial year by fuel economy category and age, (b) the miles driven as a function of age, (c) vehicle survival as a function of age, (d) projections of vehicle populations as a function of time, and (e) the projected fractional mix, by fuel categories, of new vehicles introduced in the vehicle population.

17. Key Words Fuel Consumption Automobile Highway Fuel Consumption		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.	
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Title and Subtitle
FEDERAL LEGISLATION AFFECTING MOTOR VEHICLE DESIGN

5. Report Date
March 1975

6. Performing Organization Code

8. Performing Organization Report No.
DOT-TSC-OST-74-27

Author(s)
David Glater, Sarah Redfield

Performing Organization Name and Address
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Transportation Systems Center
Kendall Square
Cambridge MA 02142

10. Work Unit No. (TRAIS)
OS514/R5519

11. Contract or Grant No.

13. Type of Report and Period Covered
Interim Report
February - June 1974

Sponsoring Agency Name and Address
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Office of the Secretary
Office of the Ass't. Sec. for Sys. Dev. & Tech.
Office of Sys. Engr., Washington DC 20590

Sponsoring Agency Code

Supplementary Notes

Abstract

This report discusses federal legislation and regulations affecting, or having the potential to affect, the design and manufacture of motor vehicles.

The regulations included in this report are those in effect as of April 1, 1974. This report does not reflect changes in automobile emission standards under the Clean Air Act, which would result from enactment of H.R. 14368, the "Energy Supply and Environmental Coordination Act of 1974". Appendix E describes these changes.

17. Key Words
Federal Legislation, Motor Vehicle Design, Automobile Design

18. Distribution Statement
DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

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TECHNICAL REPORT STANDARD TITLE PA

1. Report No. DOT-TSC-OST-74-33	2. Government Accession No. PB 242-985	3. Recipient's Catalog No.
4. Title and Subtitle ROLLING RESISTANCE OF PNEUMATIC TIRES		5. Report Date May 1975
		6. Performing Organization Code
7. Author(s) S.K. Clarke, R.N. Dodge, R.J. Ganter, J.R. Luchini		8. Performing Organization Report No DOT-TSC-OST-74-33
9. Performing Organization Name and Address The Regents of the University of Michigan* Ann Arbor MI 48104*		10. Work Unit No. OS-514/R5523
		11. Contract or Grant No. DOT-TSC-316
12. Sponsoring Agency Name and Address U.S. Dept. of Trans. Office of the Sec. Office of the Ass't Sec. for Systems Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim Report May 74-July 74
		14. Sponsoring Agency Code
15. Supplementary Notes *Under contract to	U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142	

16. Abstract

Potential improvements in tire power transmission efficiency are worth seeking for gaining improved automotive fuel economy. Summaries herein of tire rollin resistance as influenced by tire construction and design, tire materials, and tir operating conditions indicate clearly that current trends towards smaller, lighter automobiles and increasing usage of radial tires, in addition to reduced speed lev els are positive contributions in their effort. Difficulties in obtaining accurat and relevant data are discussed, including the capabilities existing and new testi machinery, and the necessity for adopting standardized testing methods for tire rolling resistance.

17. Key Words Tire Rolling Resistance		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
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1. Report No. DOT-TSC-OST-74-38	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle METHANOL AS AN AUTOMOTIVE FUEL, WITH SPECIAL EMPHASIS ON METHANOL-GASOLINE BLENDS		5. Report Date
		6. Performing Organization Code
7. Author(s) A. Landman		8. Performing Organization Report No. DOT-TSC-OST-74-38
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. OS514/R5523
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology, Off. of Sys. Eng Washington DC 20590		13. Type of Report and Period Covered Final Report June 1974-October 1974
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

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

17. Key Words Methanol Methanol-Gasoline Blends Alternate Fuels for Automobiles		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
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1. Report No. DOT-TSC-OST-74-39.I	2. Government Accession No. PB 238 677	3. Recipient's Catalog No.
4. Title and Subtitle TECHNOLOGICAL IMPROVEMENTS TO AUTOMOBILE FUEL CONSUMPTION Volume I: Executive Summary		5. Report Date December 1974
		6. Performing Organization Code
7. Author(s) C. W. Coon et al		8. Performing Organization Report No. DOT-TSC-OST-74-39.I
9. Performing Organization Name and Address Southwest Research Institute* Energy Conversion Systems Section Department of Automotive Research San Antonio TX 78284		10. Work Unit No. (TRAIS) OS514/R5523
		11. Contract or Grant No. DOT-TSC-628
12. JOINTLY SPONSORED BY- U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington DC 20590 and U.S. Environmental Protection Agency Ann Arbor MI 48105		13. Type of Report and Period Covered Final Report June 1973-January 1974
		14. Sponsoring Agency Code
15. Supplementary Notes *Under Contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		

16. Abstract

This report is a preliminary survey of the technological feasibility of reducing the fuel consumption of automobiles. The study uses as a reference information derived from literature, automobile industry contacts, and testing conducted as part of the program requirements. The design changes, which are recommended for the purpose of maximizing fuel economy, have been derived after lengthy review against a series of constraints including regulatory requirements, technical feasibility, and cost effectiveness.

Several possible technological improvements are identified, documented, and evaluated with respect to fuel economy. Results are reported as percentage improvement in fuel economy by comparison with 1973 model year vehicles. The effect of vehicle emission control systems is considered in the evaluation procedure.

The most promising individual improvements are incorporated into three synthesized vehicle designs, and the projected fuel economy improvement for these vehicles is reported.

The status of the technology reported is that available in the time period of July 1973 to January 1974.

17. Key Words Automobiles, Fuel Economy, Powerplants, Transmissions, Drive Trains, Tires, Accessories, Aerodynamics, Weight, Fuel Consumption, Innovations		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-74-39.II A	2. Government Accession No. PB 238 678	3. Recipient's Catalog No.
4. Title and Subtitle TECHNOLOGICAL IMPROVEMENTS TO AUTOMOBILE FUEL CONSUMPTION Volume II A: Sections 1 through 23		5. Report Date December 1974
		6. Performing Organization Code
7. Author(s) C. W. Coon et al		8. Performing Organization Report No. DOT-TSC-OST-74-39.IIA
9. Performing Organization Name and Address Southwest Research Institute* Energy Conversion Systems Section Department of Automotive Research San Antonio TX 78284		10. Work Unit No. (TRAIS) OS514/R5523
		11. Contract or Grant No. DOT-TSC-628
12. JOINTLY SPONSORED BY- U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington DC 20590 and U.S. Environmental Protection Agency Ann Arbor MI 48105		13. Type of Report and Period Covered Final Report June 1973-January 1974
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15. Supplementary Notes *Under Contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		

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Volume II consists of two parts, Volume II A and Volume II B.

17. Key Words Automobiles, Fuel Economy, Powerplants, Transmissions, Drive Trains, Tires, Accessories Aerodynamics, Weight, Fuel Consumption, Innovations		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-74-39.IIB	2. Government Accession No. PB 238 679	3. Recipient's Catalog No.
4. Title and Subtitle TECHNOLOGICAL IMPROVEMENTS TO AUTOMOBILE FUEL CONSUMPTION Volume IIB: Sections 24 and 25 and Appendixes A through I		5. Report Date December 1974
		6. Performing Organization Code
7. Author(s) C. W. Coon et al		8. Performing Organization Report No. DOT-TSC-OST-74-39.IIB
9. Performing Organization Name and Address Southwest Research Institute* Energy Conversion Systems Section Department of Automotive Research San Antonio TX 78284		10. Work Unit No. (TRAIS) OS514/R5523
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12. JOINTLY SPONSORED BY- U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington DC 20590 and U.S. Environmental Protection Agency Ann Arbor MI 48105		13. Type of Report and Period Covered Final Report June 1973-January 1974
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1. Report No. DOT-TSC-OST-74-40.I	2. Government Accession No. PB 238 693	3. Recipient's Catalog No.
4. Title and Subtitle A STUDY OF TECHNOLOGICAL IMPROVEMENTS IN AUTOMOBILE FUEL CONSUMPTION Volume I: Executive Summary		5. Report Date December 1974
		6. Performing Organization Code
7. Author(s) Donald A. Hurter et al		8. Performing Organization Report No. DOT-TSC-OST-74-40.I
9. Performing Organization Name and Address Arthur D. Little, Inc.* Acorn Park Cambridge MA 02140		10. Work Unit No. (TRAIS) OS514/R5523
		11. Contract or Grant No. DOT-TSC-627
12. JOINTLY SPONSORED BY- U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington DC 20590 and U.S. Environmental Protection Agency Ann Arbor MI 48105		13. Type of Report and Period Covered Final Report June 1973 - Jan. 1974
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15. Supplementary Notes *Under Contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		

16. Abstract

A study was conducted to determine potential improvements in automobile fuel consumption based on innovative design and components. Standard and compact-size reference vehicles were selected, and a study of how power is used was conducted. Obvious technological innovations (e.g., powerplants (such as spark-ignited, turbocharged, stratified charge, electronic fuel injected, and diesel), transmissions and drive train systems, tires, accessories and auxiliaries, aerodynamics, and weight) that would save on fuel consumption were identified and evaluated, and then screened against program constraints. Operation of reference vehicles equipped with innovative components or redesigned was computer-simulated to predict fuel usage and performance. Techniques to measure fuel economy performance were also developed, and a statistical evaluation of published driving modes was performed. Compliance of innovative components with constraints (such as emissions and safety) and user requirements was determined. Optimized synthesized standard and compact-size vehicles were simulated and total systems evaluation of each vehicle was performed on the basis of fuel usage, performance, technical compatibility, compliance with constraints, user acceptability, and manufacturer adaptability. Synthesized vehicles were ranked in accordance with study objectives, and conclusions and recommendations on designs were drawn. Program plans for synthesized vehicles were also selected.

17. Key Words Automobiles, Fuel Economy, Powerplants, Transmissions, Drive Trains, Tires, Accessories, Aerodynamics, Weight, Fuel Consumption, Innovations		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 52	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-74-40.II	2. Government Accession No. PB 238 694	3. Recipient's Catalog No.
4. Title and Subtitle A STUDY OF TECHNOLOGICAL IMPROVEMENTS IN AUTOMOBILE FUEL CONSUMPTION Volume II: Comprehensive Discussion		5. Report Date December 1974
		6. Performing Organization Code
7. Author(s) Donald A. Hurter et al		8. Performing Organization Report No. DOT-TSC-OST-74-40.II
9. Performing Organization Name and Address Arthur D. Little, Inc.* Acorn Park Cambridge MA 02140		10. Work Unit No. (TRAIS) OS514/R5523
		11. Contract or Grant No. DOT-TSC-627
12. JOINTLY SPONSORED BY- U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington DC 20590 and U.S. Environmental Protection Agency Ann Arbor MI 48105		13. Type of Report and Period Covered Final Report June 1973 - Jan. 1974
		14. Sponsoring Agency Code
15. Supplementary Notes *Under Contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		

16. Abstract

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19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 238	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-74-40.III A	2. Government Accession No. PB 238 695	3. Recipient's Catalog No.
4. Title and Subtitle A STUDY OF TECHNOLOGICAL IMPROVEMENTS IN AUTOMOBILE FUEL CONSUMPTION Volume III A: Appendixes I through III		5. Report Date December 1974
		6. Performing Organization Code
7. Author(s) Donald A. Hurter et al		8. Performing Organization Report No. DOT-TSC-OST-74-40.IIIA
9. Performing Organization Name and Address Arthur D. Little, Inc.* Acorn Park Cambridge MA 02140		10. Work Unit No. (TRAIS) OS514/R5523
		11. Contract or Grant No. DOT-TSC-627
12. JOINTLY SPONSORED BY- U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington DC 20590 and U.S. Environmental Protection Agency Ann Arbor MI 48105		13. Type of Report and Period Covered Final Report June 1973 - Jan. 1974
		14. Sponsoring Agency Code
15. Supplementary Notes *Under Contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		

16. Abstract

A study was conducted to determine potential improvements in automobile fuel consumption based on innovative design and components. Standard and compact-size reference vehicles were selected, and a study of how power is used was conducted. Obvious technological innovations (e.g., powerplants (such as spark-ignited, turbocharged, stratified charge, electronic fuel injected, and diesel), transmissions and drive train systems, tires, accessories and auxiliaries, aerodynamics, and weight) that would save on fuel consumption were identified and evaluated, and then screened against program constraints. Operation of reference vehicles equipped with innovative components or redesigned was computer-simulated to predict fuel usage and performance. Techniques to measure fuel economy performance were also developed, and a statistical evaluation of published driving modes was performed. Compliance of innovative components with constraints (such as emissions and safety) and user requirements was determined. Optimized synthesized standard and compact-size vehicles were simulated and total systems evaluation of each vehicle was performed on the basis of fuel usage, performance, technical compatibility, compliance with constraints, user acceptability, and manufacturer adaptability. Synthesized vehicles were ranked in accordance with study objectives, and conclusions and recommendations on designs were drawn. Program plans for synthesized vehicles were also selected.

Vol. III is divided into two parts, Vol. IIIA and IIIB.

17. Key Words Automobiles, Fuel Economy, Powerplants, Transmissions, Drive Trains, Tires, Accessories, Aerodynamics, Weight, Fuel Consumption, Innovations		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 220	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-74-40.IIIB	2. Government Accession No. PB 238 696	3. Recipient's Catalog No.
4. Title and Subtitle A STUDY OF TECHNOLOGICAL IMPROVEMENTS IN AUTOMOBILE FUEL CONSUMPTION Volume III B: Appendixes IV through VII		5. Report Date December 1974
		6. Performing Organization Code
		8. Performing Organization Report No. DOT-TSC-OST-74-40.IIIB
7. Author(s) Donald A. Hurter et al		
9. Performing Organization Name and Address Arthur D. Little, Inc.* Acorn Park Cambridge MA 02140		10. Work Unit No. (TRAIS) OS514/R5523
		11. Contract or Grant No. DOT-TSC-627
12. JOINTLY SPONSORED BY- U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington DC 20590 and U.S. Environmental Protection Agency Ann Arbor MI 48105		13. Type of Report and Period Covered Final Report June 1973 - Jan. 1974
		14. Sponsoring Agency Code
15. Supplementary Notes *Under Contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		

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A study was conducted to determine potential improvements in automobile fuel consumption based on innovative design and components. Standard and compact-size reference vehicles were selected, and a study of how power is used was conducted. Obvious technological innovations (e.g., powerplants (such as spark-ignited, turbocharged, stratified charge, electronic fuel injected, and diesel), transmissions and drive train systems, tires, accessories and auxiliaries, aerodynamics, and weight) that would save on fuel consumption were identified and evaluated, and then screened against program constraints. Operation of reference vehicles equipped with innovative components or redesigned was computer-simulated to predict fuel usage and performance. Techniques to measure fuel economy performance were also developed, and a statistical evaluation of published driving modes was performed. Compliance of innovative components with constraints (such as emissions and safety) and user requirements was determined. Optimized synthesized standard and compact-size vehicles were simulated and total systems evaluation of each vehicle was performed on the basis of fuel usage, performance, technical compatibility, compliance with constraints, user acceptability, and manufacturer adaptability. Synthesized vehicles were ranked in accordance with study objectives, and conclusions and recommendations on designs were drawn. Program plans for synthesized vehicles were also selected.

Vol. III is divided into two parts, Vol. III A and Vol. III B.

17. Key Words Automobiles, Fuel Economy Powerplants, Transmissions, Drive Trains, Tires, Accessories, Aerodynamics, Weight, Fuel Consumption, Innovations		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 236	22. Price

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Technical Report Documentation Page

. Report No. DOT-TSC-OST-74-41	2. Government Accession No. AD-A009 214	3. Recipient's Catalog No.
. Title and Subtitle A REVIEW OF PROPOSED AUTOMOTIVE CARBURETOR CONCEPTS FOR IMPROVED FUEL ECONOMY		5. Report Date March 1975
		6. Performing Organization Code
. Author(s) M.G. Hinton, J. Meltzer, T. Iura, L. Forrest, W. Smalley, K. Swan		8. Performing Organization Report No. DOT-TSC-OST-74-41
. Performing Organization Name and Address The Aerospace Corporation* Environmental and Urban Division El Segundo CA 90245		10. Work Unit No. (TRAIS) OS514/R5523
		11. Contract or Grant No. F04701-74-C0075
2. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. & Tec. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered INTERIM REPORT May 1974 - September 1974
		14. Sponsoring Agency Code
. Supplementary Notes Under contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		

. Abstract

This report presents a brief summarization of available information pertaining to proposed concepts for improved automotive carburetors.

In particular, information is provided which depicts the development and performance characteristics of a selected number of advanced, novel, or new carburetors which have been brought to the attention of the Department of Transportation as having the potential to improve automotive fuel economy. To provide a basis of perspective, a discussion of the basic requirements, construction, method of operation, and inherent limitations of conventional carburetors and induction systems is also included.

. Key Words Automotive carburetors Conventional carburetors Induction systems		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 98	22. Price

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Technical Report Documentation Pag

1. Report No. DOT-TSC-OST-75-3	2. Government Accession No. PB 248 953/AS	3. Recipient's Catalog No.
4. Title and Subtitle FUEL CONSUMPTION OF TRACTOR-TRAILER TRUCKS AS AFFECTED BY SPEED LIMIT AND PAYLOAD WEIGHT		5. Report Date November 1975
		6. Performing Organization Code
7. Author(s) Anthony J. Broderick		8. Performing Organization Report No. DOT-TSC-OST-75-3
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS414/R6508
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Ass't Sec. for Sys. Dev. & Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report December 73 - July 1974
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The effect of speed limit and payload weight on fuel consumption was determined in tests of tractor-trailer rigs. Two virtually identical vehicles were used, one loaded with a 28,000 lb payload and the other carrying 42,000 lbs; each was driven over two different sets of terrain on the Massachusetts Turnpike at simulated speed limits of 50, 55 and 60 mph. Onboard TSC observers recorded data on tank-measured fuel consumption, trip average speed, etc. An analysis of the data led to the following conclusions: (1) Increased fuel consumption results from higher speed limits in the range of 50-60 mph; (2) Terrain is an important factor in determining the effect of speed limit on fuel consumption; (3) A payload increase from 28,000 lbs to 42,000 lbs is carried at no detectable increase in fuel consumption for the "hilly" route, and less than a 7 percent increase in fuel consumption for the route including a crossing of the Berkshire Mountains.

17. Key Words Tractor-Trailer Trucks, Fuel Consumption Payload Weight		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 36	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-75-4	2. Government Accession No. PB 247 761/AS	3. Recipient's Catalog No.
4. Title and Subtitle EFFECT OF VARIATION OF SPEED LIMITS ON INTER-CITY BUS FUEL CONSUMPTION, COACH AND DRIVER UTILIZATION, AND CORPORATE PROFITABILITY		5. Report Date November 1975
		6. Performing Organization Code
7. Author(s) A.J. Broderick, P. Davis, L. Leist, H. Miller, and E. Klaubert		8. Performing Organization Report No. DOT-TSC-OST-75-4
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS414/R6517
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology, Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report Dec. 1973 - July 1974
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The effect of speed limit and passenger load on fuel consumption was determined using actual intercity buses with simulated passenger loads over different types of terrain. In addition to road tests, laboratory type measurements were made on four intercity buses. Studies were also made to ascertain the effect of reduced speed limits on maintenance and operations. Principal conclusions were: 1) Increased fuel consumption results from higher speeds in the 50-60 mph range; 2) Terrain is an important factor in determining the effect of speed limit on fuel consumption; 3) No significant fuel savings are expected for intercity buses if speed limits are reduced in the 50-60 mph range over mountainous terrain; and 4) Reducing speed limits should reduce maintenance costs but increase direct operating costs.

17. Key Words Bus Fuel Economy Reducing Speed Limits		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 142	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-75-21	2. Government Accession No. PB 251 892	3. Recipient's Catalog No.
4. Title and Subtitle ANALYSIS OF THE FUTURE EFFECTS OF THE FUEL SHORTAGE AND INCREASED SMALL CAR USAGE UPON TRAFFIC DEATHS AND INJURIES		5. Report Date January 1976
		6. Performing Organization Code
7. Author(s) Hans C. Joksch		8. Performing Organization Report No. DOT-TSC-OST-75-21
9. Performing Organization Name and Address The Center for the Environment and Man, Inc.* 275 Windsor Street Hartford CT 06120		10. Work Unit No. OS514/R6520
		11. Contract or Grant No. DOT-TSC-839
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Ass't Sec. for Sys. Dev. & Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report June 1974 - Dec. 1975
		14. Sponsoring Agency Code

15. Supplementary Notes

*Under contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142

16. Abstract

The literature was reviewed and accident data were analyzed to establish relations between automobile size and the frequency of occupant death and injury. On the assumption of four future scenarios for the size of automobiles, the consequences for car occupant deaths were calculated. The present effects of the 55 mph speed limit and results that may be achieved by strict enforcement were estimated. The effects of the potential reduction of commuter traffic on vehicle deaths were estimated. The question of how the elimination of sunday travel would affect motor vehicle deaths was addressed.

17. Key Words Automobile Accidents, Motor Vehicle Deaths, Automobile Size, Speed Limit, Commuter Travel, Sunday Travel	18. Distribution Statement 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
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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-21A	PB 251 893	

4. Title and Subtitle
ANALYSIS OF THE FUTURE EFFECTS OF THE FUEL SHORTAGE AND INCREASED SMALL CAR USAGE UPON TRAFFIC DEATHS AND INJURIES
Executive Summary

5. Report Date
January 1976

6. Performing Organization Code

7. Author(s)
Hans C. Joksch

8. Performing Organization Report No.
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9. Performing Organization Name and Address
The Center for the Environment and Man, Inc.*
275 Windsor Street
Hartford CT 06120

10. Work Unit No.
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12. Sponsoring Agency Name and Address
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Office of the Secretary
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Office of Systems Engineering
Washington DC 20590

13. Type of Report and Period Covered
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June 1974 - Dec. 1975

14. Sponsoring Agency Code

15. Supplementary Notes
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Transportation Systems Center
Kendall Square
Cambridge MA 02142

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17. Key Words
Automobile Accidents
Motor Vehicle Deaths
Automobile Size
Speed Limit
Commuter Travel
Sunday Travel

18. Distribution Statement
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
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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-26.I		

4. Title and Subtitle	5. Report Date
LEAN MIXTURE ENGINES TESTING AND EVALUATION PROGRAM Volume I: Executive Summary	November 1975
	6. Performing Organization Code
	8. Performing Organization Report No. JPL 5040-12, Vol. I DOT-TSC-OST-75-26.I
7. Author(s) Mack W. Dowdy, Frank W. Hoehn and Tom G. Vanderbrug	
9. Performing Organization Name and Address Jet Propulsion Laboratory* 4800 Oak Grove Drive Pasadena, CA. 91103	10. Work Unit No. (TRAIS) OS 614/R6506
	11. Contract or Grant No. RA 74-38 TMP-0223
12. Sponsoring Agency Name and Address U.S. Department of Transportation, Office of the Secretary, Office of the Assistant Secretary for Systems Development and Technology, Office of Systems Engineering, Washington, DC 20590	13. Type of Report and Period Covered Final Report May - Dec. 1974
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15. Supplementary Notes

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Transportation Systems Center, Kendall Square
Cambridge, MA 02142

16. Abstract

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

17. Key Words	18. Distribution Statement
Automobiles Fuel Consumption Exhaust Emissions	Document is available to the public through the National Technical Informa tion Service, Springfield, Virginia 221

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-26. II		

4. Title and Subtitle	5. Report Date
LEAN MIXTURE ENGINES TESTING AND EVALUATION PROGRAM Volume II: Comprehensive Discussion	November 1975
	6. Performing Organization Code
7. Author(s) Mack W. Dowdy, Frank W. Hoehn and Tom G. Vanderbrug	8. Performing Organization Report No. JPL 5040-12, Vol. II DOT-TSC-OST-75-26. II
9. Performing Organization Name and Address Jet Propulsion Laboratory* 4800 Oak Grove Drive Pasadena, CA 91103	10. Work Unit No. (TRAIS) OS 614/R6506
	11. Contract or Grant No. RA 74-38 TMP-0223
12. Sponsoring Agency Name and Address U.S. Dept. of Transportation, Office of the Secretary, Office of the Assistant Secretary for Systems Development and Technology, Office of Systems Engineering, Washington, D.C. 20590	13. Type of Report and Period Covered Final Report May-Dec. 1974
	14. Sponsoring Agency Code

15. Supplementary Notes

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Cambridge, MA 02142

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17. Key Words	18. Distribution Statement
Automobiles Fuel Consumption Exhaust Emissions	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-26. III		

4. Title and Subtitle	5. Report Date
LEAN MIXTURE ENGINES TESTING AND EVALUATION PROGRAM Volume III: Appendices	November 1975
	6. Performing Organization Code
7. Author(s) Mack W. Dowdy, Frank W. Hoehn and Tom G. Vanderbrug	8. Performing Organization Report No. JPL 5040-12, Vol. III DOT-TSC-OST-75-26. III
9. Performing Organization Name and Address Jet Propulsion Laboratory* 4800 Oak Grove Drive Pasadena, CA 91103	10. Work Unit No. (TRAIS) OS 614/R6506
	11. Contract or Grant No. RA 74-38 TMP-0223
12. Sponsoring Agency Name and Address U.S. Dept. of Transportation, Office of the Secretary, Office of the Assistant Secretary for Systems Development and Technology, Office of Systems Engineering, Washington, D.C. 20590	13. Type of Report and Period Covered Final Report May - Dec. 1974
	14. Sponsoring Agency Code

15. Supplementary Notes

*Under Contract to: U.S. Department of Transportation
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17. Key Words	18. Distribution Statement
Automobiles Fuel Consumption Exhaust Emissions	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. DOT-TSC-OST-75-28	2. Government Accession No. PB 251 710	3. Recipient's Catalog No.
4. Title and Subtitle A STUDY OF AUTOMOTIVE AERODYNAMIC DRAG		5. Report Date September 1975
		6. Performing Organization Code
7. Author(s) Jack E. Marte, Robert W. Weaver, Donald W. Kurtz and Bain Dayman, Jr.		8. Performing Organization Report No. DOT-TSC-OST-75-28
9. Performing Organization Name and Address Jet Propulsion Laboratory* California Institute of Technology 4800 Oak Grove Drive Pasadena CA 91103		10. Work Unit No. OS514/R6506
		11. Contract or Grant No. RA 74-35-PR612-0248
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report August 1974 - April 1975
		14. Sponsoring Agency Code

15. Supplementary Notes

*Under Contract to: National Aeronautics and Space Administration Washington DC 20546 — U.S. Department of Transportation and Transportation Systems Center Kendall Square Cambridge MA 02142

16. Abstract

Reductions of aerodynamic drag in the 20-25% range through the use of several established drag-reduction devices and minor design changes have been demonstrated on three large sales-volume 1974 and 1975 model American automobiles. Comparisons of test techniques were made by testing one automobile both full-scale and as a 0.4-scale model in two different wind tunnels. Another vehicle was tested both full-scale in a wind tunnel and by the coast-down technique. Good comparative results were obtained.

17. Key Words Car Drag Reduction, Aerodynamics, Wind Tunnel, Coast-Down Test, Energy Conservation.		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 92	22. Price

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1. Report No. DOT-TSC-OST-75-30	2. Government Accession No. PB 246 157	3. Recipient's Catalog No.
4. Title and Subtitle ENGINE PERFORMANCE TEST OF THE HONDA CVCC		5. Report Date September 1975
		6. Performing Organization Code
7. Author(s) W. F. Marshall		8. Performing Organization Report No. DOT-TSC-OST-75-30
9. Performing Organization Name and Address U.S. Energy Research & Development Administration* Bartlesville Energy Research Center P.O. Box 1398 Bartlesville OK 74003		10. Work Unit No. OS514/R6506
		11. Contract or Grant No. RA-75-10
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Ass't. Sec. for Sys. Develop. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim Report January 1975
		14. Sponsoring Agency Code

15. Supplementary Notes

*In cooperation with: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142

16. Abstract

An engine test of a prototype Honda CVCC, 90.8-cubic-inch displacement, 4-cylinder engine was performed to determine its steady-state fuel consumption and emissions (HC, CO, NO_x) maps, and the data which were obtained are summarized.

17. Key Words Automobile, Engine, Powerplant, Performance, Test, Honda CVCC, Emissions, Fuel Consumption	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. DOT-TSC-OST-75-31	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AUTOMOTIVE ENERGY EFFICIENCY PROGRAM - PRESENTED PAPERS AT THE CONTRACTORS COORDINATION MEETING, JANUARY 15-17, 1975		5. Report Date June 1975
		6. Performing Organization Code
7. Author(s) Harold G. Miller, Chairman		8. Performing Organization Report No. DOT-TSC-OST-75-31
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, Mass. 02142		10. Work Unit No. OS514/R5515
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Assistant Secretary for Systems Development and Technology		13. Type of Report and Period Covered CONFERENCE PAPERS January 15-17, 1975
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This volume contains working papers presented at the Contractors Coordination Meeting of the Automotive Energy Efficiency Program held at the DOT Transportation Systems Center, January 15-17, 1975. This program is the Federal Government's major effort to assess the capability of the automotive industry to significantly improve the fuel economy of production vehicles and assess the related socio-economic effects.

The primary objective of the conference was to report on progress to date and future plans of the Automotive Energy Efficiency Program and to promote the exchange of information between government, industry and university investigators.

Twenty-two papers and illustrated lectures were presented at the conference, 20 of which are included in this volume. Some are copies of visual material and others are more formal technical papers.

17. Key Words Engines, Fuel, Aerodynamics, Tires, Emissions, Safety, Manufacturing		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
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1. Report No. DOT-TSC-OST-75-35	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AUTOMOBILE DRIVELINES		5. Report Date
		6. Performing Organization Code
7. Author(s) R.G. Colello		8. Performing Organization Report No.
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. OS514/R5523
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report June 1974 - Dec. 1974
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

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

17. Key Words AUTOMOBILES, DRIVELINES, DRIVETRAINS, TRANSMISSIONS, FUEL ECONOMY, FUEL CONSUMPTION	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

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1. Report No. DOT-TSC-OST-75-41 CG-D-124-75	2. Government Accession No. AD/A 009 214	3. Recipient's Catalog No.
4. Title and Subtitle A STUDY OF FUEL ECONOMY AND EMISSION REDUCTION METHODS FOR MARINE AND LOCOMOTIVE DIESEL ENGINES		5. Report Date September 1975 6. Performing Organization Code
7. Author(s) J.O. Storment, C.D. Wood, R.J. Mathis		8. Performing Organization Report No. DOT-TSC-OST-75-41 DOT-TSC-USCG-75-2
9. Performing Organization Name and Address Southwest Research Institute* Department of Engine and Vehicle Research P.O. Drawer 28510, San Antonio TX 78284		10. Work Unit No. OS614 CG607/R6505 R6001 11. Contract or Grant No. DOT-TSC-920
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Off. of the Asst. Sec. for Sys. Dev. & Tech./Off. of Sys. Eng. Washington DC 20590 U.S. Coast Guard Office of R&D Washington DC 20590		13. Type of Report and Period Covered Interim Report November 1974 - May 1975 14. Sponsoring Agency Code
15. Supplementary Notes *Under contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		

16. Abstract

This interim report presents the results of the first phase of a two-part program to investigate methods of improving fuel consumption and reducing exhaust emissions for in-service diesel engines used as prime movers in locomotives and several classes of Coast Guard vessels. The engines are large, medium-speed units with individual cylinder displacements in excess of 150 in^3 and power ratings from 2000 to 4000 brake horsepower. The study that is the subject of this report utilizes information that was obtained from the technical literature and from interviews of engine manufacturers, railroads, and engineering staffs of Coast Guard vessels.

Several methods were investigated for their potential to reduce fuel consumption and emissions, within the constraint of maintaining adequate locomotive and vessel operating flexibility and engine life. These methods included the retrofit of engines with existing state-of-the-art components (e.g., injectors, governor, turbocharger) of improved design, the adjustment of injection timing, and changes in engine operating modes (speed-power points). The effects of engine wear and maintenance on fuel consumption and emissions were investigated, as were the effects of ambient air properties (temperature, pressure, humidity).

The conclusions reached at the end of Phase I of the program resulted in several recommendations for additional investigation or evaluation by actual testing in Phase II.

17. Key Words Diesel Engines. Locomotives, Coast Guard, Fuel Consumption, Emissions		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
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1. Report No. DOT-TSC-OST-75-44	2. Government Accession No. PB 246 742	3. Recipient's Catalog No.
4. Title and Subtitle ENGINE PERFORMANCE TEST OF THE 1975 CHRYSLER-NISSAN MODEL CN633 DIESEL ENGINE		5. Report Date September 1975
		6. Performing Organization Code
7. Author(s) W.F. Marshall and K.R. Stamper		8. Performing Organization Report No. DOT-TSC-OST-75-44
9. Performing Organization Name and Address U.S. Energy Research and Development Administration* Bartlesville Energy Research Center P.O. Box 1398 Bartlesville OK 74003		10. Work Unit No. OS614/R6506
		11. Contract or Grant No. RA-75-10
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim Report June 1975
		14. Sponsoring Agency Code
15. Supplementary Notes *Interagency Agreement with:	U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142	

16. Abstract

An engine test of the Chrysler-Nissan Model CN633 diesel engine was performed to determine its steady-state fuel consumption and emissions (HC, CO, NO_x) maps. The data acquired are summarized in this report.

17. Key Words • Engine • Emissions • Fuel Consumption • Performance		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
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1. Report No. DOT-TSC-OST-75-46	2. Government Accession No. PB 246 681	3. Recipient's Catalog No.
4. Title and Subtitle A STUDY OF TECHNOLOGICAL IMPROVEMENTS TO OPTIMIZE TRUCK CONFIGURATIONS FOR FUEL ECONOMY		5. Report Date September 1975
		6. Performing Organization Code
7. Author(s) Donald A. Hurter, W. David Lee		8. Performing Organization Report No. DOT-TSC-OST-75-46
9. Performing Organization Name and Address Arthur D. Little, Inc* Acorn Park Cambridge MA 02140		10. Work Unit No. OS614/R6506
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12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. & Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report May 1974 - January 1975
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15. Supplementary Notes

*Under contract to: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142

16. Abstract

A study of truck fuel economy was undertaken for the U.S. Department of Transportation as a continuation of the Study of Technological Improvements in Automobile Fuel Consumption, report number DOT-TSC-OST-74-40.I-IV. The truck types that accounted for most of the fuel consumed were identified and modeled by computer analysis. Baseline fuel consumption was calculated for the major truck types over specific duty cycles. Design improvements in the truck were then modeled, and the effect on fuel economy was estimated. Those improvements considered cost effective and capable of meeting manufacturing and performance criteria were examined further for their economic impact. Total life cycle costs for the incorporation of improvements were developed for single improvements and combinations of improvements.

The study results indicated that fuel economy gains of up to 40% could be made in Classes I and II, 70-80% in Class VI van-type local delivery trucks, 15-30% in Class VIII depending on the type of truck and use. These four classes account for over 85% of the fuel consumed by the entire truck fleet.

It appears that the technological changes required to mass produce these more fuel efficient vehicles could be accomplished in the 1980's.

17. Key Words Fuel economy, power plants, transmissions, drive trains, tires, accessories, aerodynamics, fuel consumption improvement.		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 168	22. Price

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
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4. Title and Subtitle	5. Report Date
HIGHWAY VEHICLE RETROFIT EVALUATION -- PHASE I: ANALYSIS AND PRELIMINARY EVALUATION RESULTS Volume I: Sections 1 through 3	November 1975
	6. Performing Organization Code
7. Author(s) M.G. Hinton, J. Meltzer, T. Iura, L. Forrest, A. Burke, R. Kopa, W. Lee, K. Swan, F. Augustine, W. Smalley	8. Performing Organization Report No. DOT-TSC-OST-75-48.I
9. Performing Organization Name and Address The Aerospace Corporation* Environmental and Urban Division El Segundo CA 90245	10. Work Unit No. (TRAIS) OS614/R6506
	11. Contract or Grant No. F04701-74-C0075-1
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. & Tec. Office of Systems Engineering Washington DC 20590	13. Type of Report and Period Covered Interim Report May - October 1974
	14. Sponsoring Agency Code

15. Supplementary Notes

*Under contract to: U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge MA 02142

16. Abstract

This report in two volumes presents an analysis and preliminary evaluation of selected used-car and light-truck fuel economy retrofit devices.

In particular, information is provided that depicts the performance characteristics of retrofit devices that have been brought to the attention of the Department of Transportation as having the potential to improve automotive fuel economy. The spectrum of devices includes carburetors, acoustic and mechanical atomizers, lean-bleed devices, vapor injectors, fuel modifications, inlet manifolds, drivetrain components, drag reduction techniques, driver aids, cooling fans, valve timing, tuneups, exhaust-related systems, engine oils, oil additives, and filters.

Included where possible, are analyses of the general operational principles of a given device and its possible effects on spark ignition engine operation in order to substantiate or explain the available test data.

17. Key Words	18. Distribution Statement
Automotive retrofit devices, carburetors, induction-related systems, exhaust related systems, ignition systems, fuel modifications, drivetrain components, driver aids	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-75-48.II	2. Government Accession No. PB 252 555	3. Recipient's Catalog No.
4. Title and Subtitle HIGHWAY VEHICLE RETROFIT EVALUATION -- PHASE I: ANALYSIS AND PRELIMINARY EVALUATION RESULTS Volume II: Sections 4 through 13 and Appendix		5. Report Date November 1975
		6. Performing Organization Code
7. Author(s) M.G. Hinton, J. Meltzer, T. Iura, L. Forrest, A. Burke, R. Kopa, W. Lee, K. Swan, F. Augustine, W. Smalley		8. Performing Organization Report No. DOT-TSC-OST-75-48.II
9. Performing Organization Name and Address The Aerospace Corporation* Environmental and Urban Division El Segundo CA 90245		10. Work Unit No. (TRAIS) OS614/R6506
		11. Contract or Grant No. F04701-74-C0075-2
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. & Tec. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim Report May - October 1974
		14. Sponsoring Agency Code
15. Supplementary Notes *Under contract to:	U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142	

16. Abstract

This report in two volumes presents an analysis and preliminary evaluation of selected used-car and light-truck fuel economy retrofit devices.

In particular, information is provided that depicts the performance characteristics of retrofit devices that have been brought to the attention of the Department of Transportation as having the potential to improve automotive fuel economy. The spectrum of devices includes carburetors, acoustic and mechanical atomizers, lean-bleed devices, vapor injectors, fuel modifications, inlet manifolds, drivetrain components, drag reduction techniques, driver aids, cooling fans, valve timing, tuneups, exhaust-related systems, engine oils, oil additives, and filters.

Included where possible, are analyses of the general operational principles of a given device and its possible effects on spark ignition engine operation in order to substantiate or explain the available test data.

17. Key Words Automotive retrofit devices, carburetors, induction-related systems, exhaust related systems, ignition systems, fuel modifications, drivetrain components, driver aids		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-75-55	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle VEHICLE TEST PROCEDURE DRIVING SCHEDULES		5. Report Date
		6. Performing Organization Code
7. Author(s) Joseph C. Sturm		8. Performing Organization Report No. DOT-TSC-OST-75-55
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS614/R6508
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Off. of the Asst. Secy. for Sys. Dev. & Tech., Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report April 1974 - March 1975
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

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

17. Key Words Driving Schedule Driving Cycle Vehicle Test Procedure	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

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

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1. Report No. DOT-TSC-OST-75-56	2. Government Accession No. PB 251 479	3. Recipient's Catalog No.
4. Title and Subtitle STRATIFIED CHARGE ENGINES		5. Report Date January 1976
		6. Performing Organization Code
7. Author(s) Eric M. Withjack		8. Performing Organization Report No. DOT-TSC-OST-75-56
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS514/R6506
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. & Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report October - December 1974
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report reviews stratified charge concepts and engines, with emphasis on the important issues of exhaust emissions, fuel economy, and performance. Divided and open chamber designs are discussed. Potential improvements in exhaust emissions and fuel economy are considered in detail.

Significant engine programs discussed include those of the Ford, Texaco, and Honda companies. Other variations are described as information is available. Results of programs for the test and evaluation of newly developed and modified conventional engines, particularly engines in test vehicles, are provided.

A special addendum provides additional information current to March 1975, gleaned primarily from "Requests for Suspension of 1977 Emission Standards," filed by several of the automobile manufacturers.

17. Key Words Stratified Charge Engines Engines Prechamber Engines Swirl Stratified		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 114	22. Price

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1. Report No. DOT-TSC-OST-76-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AUTOMOTIVE ENERGY EFFICIENCY PROGRAM — PAPERS PRESENTED AT THE PROJECT COORDINATION MEETING, NOVEMBER 4-6, 1975		5. Report Date May 1976
		6. Performing Organization Code DOT-TSC-OST-76-1
7. Author(s) Harold G. Miller, Chairman		8. Performing Organization Report No.
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS614/R6517
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12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec'y for Dev. & Tech. Washington DC 20590		13. Type of Report and Period Covered Conference Papers November 4-6, 1975
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This volume contains working papers presented at the Project Coordination Meeting of the Automotive Energy Efficiency Program held at the DOT Transportation Systems Center, November 4-6, 1975. This program is the Federal Government's major effort to assess the capability of the automotive industry to significantly improve the fuel economy of production vehicles and assess the related socio-economic effects.

The primary objective of the conference was to report on progress to date and future plans of the AEEP as well as to promote the exchange of information between government, industry, and university investigators.

17. Key Words Engines, Fuel, Aerodynamics, Tires, Emissions, Safety, Manufacturing		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 336	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-9	2. Government Accession No. PB 251 932	3. Recipient's Catalog No.
4. Title and Subtitle ROLLING RESISTANCE OF TIRES MEASURED UNDER TRANSIENT AND EQUILIBRIUM CONDITIONS ON CALSPAN'S TIRE RESEARCH		5. Report Date March 1976
		6. Performing Organization Code
7. Author(s) D.J. Schuring		8. Performing Organization Report No. DOT-TSC-OST-76-9
9. Performing Organization Name and Address Calspan Corporation* 4455 Genesee St. Buffalo, New York 14221		10. Work Unit No. (TRAIS) OS 614/R6506
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12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of Systems Development and Technology Washington DC 20590		13. Type of Report and Period Covered Final Report April 1975 - Jan. 1976
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15. Supplementary Notes

*Under Contract To: U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge MA 02142

16. Abstract

Rolling loss tests were performed on 31 different passenger and 4 light truck tires on Calspan's Tire Research Facility (TIRF) under transient and equilibrium conditions. The tests were designed to determine the effects of load, speed, inflation pressure, tire temperature, slip angle, torque, tire construction, aspect ratio and wheel diameter. In addition, the influences of road curvature (flat roadway, drum) and trip length on rolling resistance were investigated. The results are presented in tables and graphs. They are expressed in terms of 12 power loss descriptors (for each tire), stating initial values, equilibrium values, and distances required to achieve equilibrium, for rolling resistance, contained air temperature, tread surface temperature, and inflation pressure.

17. Key Words Tires, rolling resistance, power loss, transient characteristics, equilibrium conditions, speed effects, load effects, inflation pressure, tire temperature, test equipment, drum, flat roadway.	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-13	2. Government Accession No. PB 254 571	3. Recipient's Catalog No.
4. Title and Subtitle STUDY OF AERODYNAMIC DRAG REDUCTION ON A FULL-SCALE TRACTOR TRAILER		5. Report Date April 1976
		6. Performing Organization Code
7. Author(s) L. L. Steers and L. C. Montoya		8. Performing Organization Report No. DOT-TSC-OST-76-13
9. Performing Organization Name and Address NASA Dryden Flight Research Center* P. O. Box 273 Edwards CA 93523		10. Work Unit No. (TRAIS) OS614/R6506
		11. Contract or Grant No. RA-74-31
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Office of Systems Engineering Washington DC 20590 / National Aeronautics and Space Administration Washington DC 20546		13. Type of Report and Period Covered Final Report March to December 1974
		14. Sponsoring Agency Code

15. Supplementary Notes
*Under a Reimbursable Agreement with: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142

16. Abstract

Aerodynamic drag tests were performed on a tractor-trailer combination using the coast-down method on a smooth, nearly level runway. The tests included an investigation of drag reduction obtained with add-on devices that are commercially available or under development. The tests covered tractor-trailer speeds ranging from approximately 35 to 65 miles per hour and included fuel consumption measurements. The study shows the effects of the various add-on devices on the aerodynamic drag, and for some devices on the fuel consumption. Results from a simulation of fuel consumption tests using a computer program are also included.

17. Key Words Aerodynamic Drag Tractor-Trailer Add-On Devices Fuel Economy	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

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1. Report No. DOT-TSC-OST-76-15	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AUTOMOTIVE ENERGY EFFICIENCY PROGRAM-PAPERS PRESENTED AT THE AUTOMOBILE ENGINE CONTROL SYMPOSIUM, JULY 8 AND 9, 1975		5. Report Date April 1976
		6. Performing Organization Code
7. Author(s) Compiled by Wolfgang V. Roessler*		8. Performing Organization Report No. DOT-TSC-OST-76-15
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS614/R6517
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12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington DC 20590		13. Type of Report and Period Covered CONFERENCE PAPERS July 8 and 9, 1975
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15. Supplementary Notes

*The Aerospace Corporation
2350 East El Segundo Blvd.
El Segundo CA 90099

16. Abstract

This volume contains papers presented at the Automobile Engine Control Symposium conducted at the U.S. Department of Transportation, Transportation Systems Center, Cambridge, Massachusetts, on July 8 and 9, 1975, as part of the Department's Automotive Energy Efficiency Program (AEEP).

The primary objective of the symposium was to provide a forum of technical interchange between investigators from industry, a governmental agencies, and universities, with regard to potential benefits in fuel economy and emissions resulting from the use of improved engine control techniques and systems.

Nineteen papers were presented at the conference, 17 of which are included in this volume. Some are abstracts or copies of visual material, while others are formal technical papers.

17. Key Words Fuel Economy Emission Standards, Engine Control Systems, Ultralean Engine Operation, Microprocessors		18. Distribution Statement DISTRIBUTION OF THIS DOCUMENT IS LIMITED TO PARTICIPANTS IN THE AUTOMOTIVE ENGINE CONTROL SYMPOSIUM AND TO A SELECT DISTRIBUTION CONTROLLED BY THE TSC AUTOMOTIVE ENERGY EFFICIENCY PROGRAM OFFICE.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 390	22. Price

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1. Report No. DOT-TSC-OST-76-18	2. Government Accession No. PB 258 442	3. Recipient's Catalog No.
4. Title and Subtitle MONITORING REPORT - AUTOMOBILE VOLUNTARY FUEL ECONOMY IMPROVEMENT PROGRAM		5. Report Date April 1976
		6. Performing Organization Code DOT-TSC-425
		8. Performing Organization Report No.
7. Author(s) W.M. Basham, S. Powel, H.H. Gould		
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS514/R6517
		11. Contract or Grant No.
		13. Type of Report and Period Covered Final Report Nov. 1974-Nov. 1975
12. Sponsoring Agency Name and Address U.S. Dept. of Trans., Office of the Secretary Office of Ass't Sec. for Sys. Dev. & Tech. Office of Systems Engineering Washington DC 20590		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

On October 8, 1974, President Ford announced the goal of a 40% improvement in fuel economy of automobiles to be achieved in the 1980 new car fleet compared to 14.0 MPH for 1974. The Secretary of Transportation was given the lead in developing the program to evaluate manufacturers' progress to achieve their fuel economy goals, to make periodic analyses of future plans of each manufacturer, and to report findings to the Energy Resource Council. This report discusses the domestic manufacturers' progress to date, reviews the manufacturers' future plans in general, and assesses the likelihood of their meeting the goals.

17. Key Words Data Base Fuel Economy		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 24	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-19	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Highway Vehicle Retrofit Evaluation Phase II Report Testing and Final Evaluation Results		5. Report Date November 1976
		6. Performing Organization Code
7. Author(s) M. G. Hinton, L. Forrest, W. B. Lee		8. Performing Organization Report No. DOT-TSC-OST-76-19
9. Performing Organization Name and Address The Aerospace Corporation* Environment and Energy Conservation Division El Segundo, CA 90245		10. Work Unit No. (TRAIS) OS514/R5523
		11. Contract or Grant No. F04701-74-C-0075
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. & Tec. Office of Systems Engineering Washington, DC 20590		13. Type of Report and Period Covered Final Report November 1975 - November 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

*Under contract to: U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge, MA 02142

16. Abstract

This report presents the results of engine dynamometer and vehicle chassis dynamometer tests conducted with selected automotive retrofit devices in the classes of ultrasonic carburetors, high-velocity intake manifolds, tuned exhaust systems, and high energy ignition systems. The test results obtained by the two test methods are compared and discussed.

17. Key Words Automotive retrofit devices, carburetors, induction-related systems, exhaust related systems, ignition systems		18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 106	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-22	2. Government Accession No. PB 254 686	3. Recipient's Catalog No.
4. Title and Subtitle ENGINE PERFORMANCE TEST OF THE 1975 GM 140-CID		5. Report Date June 1976
		6. Performing Organization Code
		8. Performing Organization Report No. DOT-TSC-OST-76-22
7. Author(s) W.F. Marshall and K.R. Stamper		
9. Performing Organization Name and Address U.S. Energy Research and Development Administration* Bartlesville Energy Research Center P.O. Box 1398 Bartlesville OK 74003		10. Work Unit No. (TRAIS) OS614/R6506
		11. Contract or Grant No. RA-75-10
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim Report August-September 1975
		14. Sponsoring Agency Code

15. Supplementary Notes

*Interagency Agreement with: U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142

16. Abstract

An engine test of the 1975 GM 140 cubic-inch-displacement, 4-cylinder engine has been performed to determine its steady-state fuel consumption and emissions (HC, CO, and NO_x) maps. The data acquired are summarized in this report.

17. Key Words Automobile, Engine, Powerplant, Performance, Test, Emissions, Fuel Consumption	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. 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	30	

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-27	2. Government Accession No. PB 262 015	3. Recipient's Catalog No.
4. Title and Subtitle 1975 AUTOMOTIVE CHARACTERISTICS DATA BASE		5. Report Date October 1976
		6. Performing Organization Code
7. Author(s) Moses Rouse and William Basham		8. Performing Organization Report No. DOT-TSC-OST-76-27
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS614/R6517T
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report June 1975 to June 1976
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

A study of automobile characteristics as a supportive tool for auto energy consumption, fuel economy monitoring, and fleet analysis studies is presented. This report emphasizes the utility of efficient data retrieval methods in fuel economy analysis, statistical data reporting, and fleet mix analysis. The methods of vehicle sample selection, computation methods for statistical reports, illustrative output examples, and instructions for operating the data base are presented in order to fully represent the 1975 automobile fleet characteristics. A statistics section in this report contains information that is useful in econometric modeling and the determination of automobile design characteristics.

17. Key Words Performance, Vehicle Characteristics, Vehicle Attributes, Fuel Economy, Emission Levels		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 140	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-36	2. Government Accession No. PB 259 330	3. Recipient's Catalog No.
4. Title and Subtitle FUEL CONSUMPTION, EMISSIONS AND POWER CHARACTERISTICS OF THE 1975 CHEVROLET 350-CID 2V AUTOMOTIVE ENGINE—EXPERIMENTAL DATA		5. Report Date September 1976
		6. Performing Organization Code
7. Author(s) W. F. Marshall and K. R. Stamper		8. Performing Organization Report No. DOT-TSC-OST-76-36 BERC/OP-76/19
9. Performing Organization Name and Address U.S. Energy Research and Development Administration* Bartlesville Energy Research Center P.O. Box 1398 Bartlesville OK 74003		10. Work Unit No. (TRAIS) OS514/R6517T
		11. Contract or Grant No. RA-75-10
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim Report May-June 1975
		14. Sponsoring Agency Code
15. Supplementary Notes *Interagency Agreement with:	U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142	

16. Abstract

Experimental data were obtained in dynamometer tests of the 1975 Chevrolet, 350 cubic-inch displacement, 2-bbl engine, to determine the steady-state fuel consumption and emissions of hydrocarbon, carbon monoxide and oxides of nitrogen. These data were obtained in detail adequate to construct performance maps for the entire speed/load operating range of the engine.

The objective of the test work was to obtain data that describe engine performance characteristics in engineering terms; the data are so presented. The comparative or judgmental assessment of engine performance was not an objective and such assessment is avoided.

17. Key Words IC Engines Fuel Economy Fuel Consumption Auto Emissions		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages 40	22. Price

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-76-37	PB 260 667	

4. Title and Subtitle	5. Report Date
THE ADVISABILITY OF REGULATING ELECTRIC VEHICLES FOR ENERGY CONSERVATION	August 1976
	6. Performing Organization Code: TSC-613
7. Author(s): S. F. Powel III and N. Rosenberg	8. Performing Organization Report No.: DOT-TSC-OST-76-37
9. Performing Organization Name and Address: U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge MA 02142	10. Work Unit No. (TRAIS): OS-T14/R6517T
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Office of the Secretary, Office of the Assistant Secretary for Systems Development and Technology, Washington DC 20590	13. Type of Report and Period Covered: Report to Congress, February-August 1976
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Vehicles that do not consume fuel are examined to determine if they should be included under the provisions of the Motor Vehicle Information and Cost Savings Act, as amended by Title III of the Energy Policy and Conservation Act. The manner of comparing energy requirements of these vehicles with energy requirements of fuel-consuming vehicles is considered, as is the application of the Act to vehicles that do not consume fuel, their market potential, and the effects of regulations on their production and their introduction into commerce.

17. Key Words	18. Distribution Statement
Life-Cycle Costs, Lead-Acid Batteries, Nickel-Zinc Batteries, Lithium/Aluminum-Iron Sulfide Batteries, Performance	DOCUMENT IS AVAILABLE TO THE U.S. 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	238	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-76-38	PB 260 541	

4. Title and Subtitle	5. Report Date
THE EFFECTIVENESS OF MILES-PER-GALLON METERS AS A MEANS TO CONSERVE GASOLINE IN AUTOMOBILES	October 1976
	6. Performing Organization Code: TSC-640
7. Author(s): M. Stephen Huntley, Jr., William Z. Leavitt	8. Performing Organization Report No.: DOT-TSC-OST-76-38
9. Performing Organization Name and Address: U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge MA 02142	10. Work Unit No. (TRAIS): OS-T14/R6517T
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Office of the Secretary, Office of the Assistant Secretary for Systems Development and Technology, Office of Systems Engineering, Washington DC 20590	13. Type of Report and Period Covered: Report to the Congress, January-July 1976
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report is the response of the U.S. Department of Transportation to a requirement of the Energy Policy and Conservation Act (PL-163) for an assessment of fuel flow instruments reading directly in miles per gallon (mpg). The report describes currently available mpg meters, their intallation, utility, and safety and presents an analysis of potential cost savings. It discusses means of encouraging purchase and the use of mpg meters as add-on equipment and considers issues associated with the mandatory installation of mpg meters in new cars. It concludes that it has not yet been demonstrated that the use of available mpg meters will improve fuel economy for typical drivers. It recommends that the Congress not require that each new automobile be equipped with an mpg meter and that no action be taken to promote the use of mpg meters in used cars at this time. Appendix A discusses other driver aids for conserving gasoline. Appendix B contains a summary to the request for information and public comment on fuel flow meters. Appendix C lists thirteen references.

17. Key Words	18. Distribution Statement
Driver Aids	DOCUMENT IS AVAILABLE TO THE U.S. 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	78	

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-39	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle COMPUTER-BASED RESOURCE ACCOUNTING MODEL FOR AUTOMOBILE TECHNOLOGY IMPACT ASSESSMENT		5. Report Date October 1976
		6. Performing Organization Code
7. Author(s) . Barton DeWolf, Christian Davis, Peter C. Heinemann		8. Performing Organization Report No. R-938
9. Performing Organization Name and Address The Charles Stark Draper Laboratory, Inc.* 68 Albany Street Cambridge MA 20139		10. Work Unit No. (TRAIS) OS-T14/R6517T
		11. Contract or Grant No. DOT-TSC-1021
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report July 1975-February 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

*Under contract to: U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge MA 02142

16. Abstract

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

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

17. Key Words Resource Accounting, Automobile, Motor Vehicles, Materials, Energy, Capital, Labor, Input-Output Model, Technology Assessment		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages / 22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-42	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle FUEL CONSUMPTION, EMISSIONS, AND POWER CHARACTERISTICS OF THE 1975 DATSUN 119-CID AUTOMOTIVE ENGINE--EXPERIMENTAL DATA		5. Report Date November 1976
		6. Performing Organization Code
7. Author(s) W.F. Marshall and K.R. Stamper		8. Performing Organization Report No. BERC/OP-76/16
9. Performing Organization Name and Address U.S. Energy Research and Development Administration* Bartlesville Energy Research Center P.O. Box 1398 Bartlesville OK 74003		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. RA-75-10
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim Report July 1975
		14. Sponsoring Agency Code
15. Supplementary Notes *Interagency Agreement with:	U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142	

16. Abstract

Experimental data were obtained in dynamometer tests of the 1975 Datsun, 119 cubic-inch displacement, 2-bbl engine to determine steady-state fuel consumption and emissions of hydrocarbon, carbon monoxide, and oxides of nitrogen. These data were obtained in detail adequate to construct performance maps for the entire speed/load operating range of the engine.

The objective of the test work was to obtain data that describe engine performance characteristics in engineering terms; the data are so presented. The comparative or judgmental assessment of engine performance was not an objective and such assessment is avoided.

17. Key Words IC Engines Fuel Economy Fuel Consumption Auto Emissions		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages 42	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-43	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle FUEL CONSUMPTION, EMISSIONS, AND POWER CHARACTERISTICS OF THE 1975 FORD 140-CID AUTOMOTIVE ENGINE--EXPERIMENTAL DATA		5. Report Date November 1976
		6. Performing Organization Code
7. Author(s) W. F. Marshall and K. R. Stamper		8. Performing Organization Report No. BERC/OP-76/15
9. Performing Organization Name and Address U.S. Energy Research and Development Administration* Bartlesville Energy Research Center P.O. Box 1398 Bartlesville OK 74003		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. RA-75-10
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim Report February-April 1976
		14. Sponsoring Agency Code
15. Supplementary Notes *Interagency Agreement with:	U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142	

16. Abstract

Experimental data were obtained in dynamometer tests of the 1975 Ford, 140 cubic-inch displacement, 2-bbl engine to determine steady-state fuel consumption and emissions of hydrocarbon, carbon monoxide, and oxides of nitrogen. These data were obtained in detail adequate to construct performance maps for the entire speed/load operating range of the engine.

The objective of the test work was to obtain data that describe engine performance characteristics in engineering terms; the data are so presented. The comparison or judgment of engine performance was not an objective and such assessments are avoided.

17. Key Words 1C Engines Fuel Economy Fuel Consumption Auto Emissions		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 40	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-45	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle SURVEY OF DRIVER AID DEVICES FOR IMPROVED FUEL ECONOMY		5. Report Date November 1976
		6. Performing Organization Code
7. Author(s) M. G. Hinton, L. Forrest, D. P. Duclos, T. H. Davey, R. R. Sheahan, K. B. Swan		8. Performing Organization Report No. DOT-TSC-OST-76-45
9. Performing Organization Name and Address Aerospace Corporation* Environmental and Energy Conservation Division El Segundo CA 90245		10. Work Unit No. (TRAIS) OS-T14 / R7514
		11. Contract or Grant No. F04701-75-C-0076
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. & Tec. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered INTERIM REPORT July 1975 - October 1975
		14. Sponsoring Agency Code
15. Supplementary Notes *Under contract to:	U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142	

16. Abstract

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

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

17. Key Words Driver aids; Manifold vacuum gages; Flowmeters; Accelerometers; Accelerator pedal feedback; Pyrometers; Cruise controls	18. Distribution Statement 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	164	

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-47	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle ENERGY USE AND OTHER COMPARISONS BETWEEN DIESEL AND GASOLINE TRUCKS		5. Report Date February 1977
		6. Performing Organization Code
7. Author(s) Kenneth M. Jacobs		8. Performing Organization Report No. DOT-TSC-OST-76-47
9. Performing Organization Name and Address State of Maine, Department of Transportation* Materials and Research Division Box 1206, Hogan Road Bangor ME 04401		10. Work Unit No. (TRAIS) PPA714/R7508
		11. Contract or Grant No. DOT-TSC-1042
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Systems Dev. and Tech. Office of Systems Engineering, Washington DC 20590		13. Type of Report and Period Covered Final Report Oct.1975-June 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

*Under contact to: U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge MA 02142

16. Abstract

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

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

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

17. Key Words Diesel Truck, Gasoline Truck, Fuel Usage	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 138	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76- 51	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AGGREGATE AUTO TRAVEL FORECASTING: STATE OF THE ART AND SUGGESTIONS FOR FUTURE RESEARCH		5. Report Date December 1976
		6. Performing Organization Code
7. Author(s) Robert E. Mellman		8. Performing Organization Report No. DOT-TSC-OST-76-51
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 02142		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. & Tech. Washington DC 20590		13. Type of Report and Period Covered Final Report May 1976 - June 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

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

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

17. Key Words Auto Travel Forecast VMT Model		18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 46	22. Price

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-76-52		

4. Title and Subtitle	5. Report Date
UNCERTAINTIES IN ESTIMATES OF FLEET AVERAGE FUEL ECONOMY: A STATISTICAL EVALUATION	November 1976
	6. Performing Organization Code
7. Author(s) F.T. Rabe	8. Performing Organization Report No. DOT-TSC-OST-76-52
9. Performing Organization Name and Address Environmental Impact Center* 55 Chapel Street Newton, MA 02158	10. Work Unit No. (TRAIS) OS714/R7508
	11. Contract or Grant No. DOT-TSC-1311
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for System Dev. & Tech. Office of Systems Engineering Washington DC 20590	13. Type of Report and Period Covered Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

*Under Contract to: U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge MA 02142

16. Abstract

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

17. Key Words	18. Distribution Statement
Fuel Economy Fleet Average Fuel Economy Fleet Stratification, Class variance, EPA FE Estimation Procedures	DOCUMENT IS AVAILABLE TO THE U.S. 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		

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-76-53	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle FIELD EVALUATION OF MILES-PER-GALLON METERS		5. Report Date October 1976
		6. Performing Organization Code
7. Author(s) Roger A. Banowetz and Louis J. Bintz		8. Performing Organization Report No. Project No. TSC/640-0235 GF
9. Performing Organization Name and Address Automotive Engineering Department* Automobile Club of Southern California 2601 South Figueroa Street Los Angeles, California 90007		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. Contract DOT-TSC-1160
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Sys. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report March 1977
		14. Sponsoring Agency Code

15. Supplementary Notes

*Under Contract to: U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge MA 02142

16. Abstract

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

17. Key Words Miles-Per-Gallon Meters Totalizer Analysis of Variance Driver aids Field Evaluation	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. 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
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-76-56 U		

4. Title and Subtitle	5. Report Date
Automobile Engine Control Parameters Study: status of engine control parameters	June 1976
	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s)	
9. Performing Organization Name and Address Aerospace Corporation* El Segundo, CA	10. Work Unit No. (TRAIS) OS714/R7508
	11. Contract or Grant No. RA 75-40
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590	13. Type of Report and Period Covered Interim report June 1975 to June 1976
	14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation
Transportation Systems Center
Cambridge, MA 02142

16. Abstract

This report presents detailed technical information describing the engine control practices utilized by selected automobile manufacturers to meet current and past emission regulations consistent with acceptable fuel economy and driveability characteristics. Section 1, Introduction, includes a brief description of the scope, method of approach, and overall objectives of the study. Section 2 reviews the design features and operational characteristics of the engine control approaches and tehcniques employed by the domestic and foreign automobile industry and presents a brief discussion of advanced control systems technology. Section 3 discusses the methodology utilized in the selection of the 28 engines reviewed in this report, and describes the features of the two non-exhaust related emission control systems, crankcase ventilation and evaporative emission control,which have been utilized on all automobile engines for a number of years and have remained nearly unchanged for that time period. This is followed by a detailed examination of the control techniques incorporated in the selected engines with particular emphasis on the efeects of control system modifications on vehicle fuel economy and emissions. The principal topics covered for each engine include engine modifications, intake system, carburetion, ignition, emission control devices and techniques, and fuel economy effects.

17. Key Words	18. Distribution Statement
	This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-1 DOT-TSC-NHTSA-77-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Study of Automobile Market Dynamics		5. Report Date November 1976
		6. Performing Organization Code
7. Author(s) Morton, A.S.; Strong, S.; Metcalf, E. Marple, G.; Freedman, A.		8. Performing Organization Report No.
9. Performing Organization Name and Address Arthur D. Little, Inc. Acorn Park Cambridge MA 02139		10. Work Unit No. (TRAIS) OS714/HS727 (R7508)
		11. Contract or Grant No. DOT-TSC-1060
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report July 1975--Nov. 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

under contract to: U.S. Department of Transportation
Transportation Systems Center
Kendall Square, CAmbridge MA 02142

16. Abstract

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

17. Key Words automobile, market dynamics, market shares, size classes, sales, fuel economy, gasoline taxes, excise taxes, regulation		18. Distribution Statement	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-77-11		

4. Title and Subtitle	5. Report Date
AUTOMOBILE SCRAPPAGE AND RECYCLING INDUSTRY STUDY - OVERVIEW REPORT	December 1975
	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s) Kaiser, R., Wasson, R.P. and Daniels, A.C.W.	
9. Performing Organization Name and Address H.H. Aerospace Design Company, Inc. Civil Air Terminal Bedford, MA 01730	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. DOT-TSC-1028
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, MA 02139	13. Type of Report and Period Covered Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

After an automobile has lost its utility as a mode of transportation, it is usually deregistered and disposed of as scrap. The principal factors which influence the recovery of materials from junked automobiles are reviewed and evaluated. These include the number and materials composition of the automobiles that are retired annually in the U.S.; the flow of junk automobiles into the commercial recovery cycle and problems associated with abandoned automobiles; operations of the auto wrecking industry where serviceable parts are salvaged; and the structure, operations and technology of the scrap industry which transforms automobile hulks into commercial grades of metal scrap. Since Federal laws and policies impact on the reclamation of materials from junked automobiles, a legal review of key legislation and policies is also included.

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

17. Key Words	18. Distribution Statement
Automotive materials, Automobile scrappage, Secondary materials recovery, Ferrous metal scrap, Nonferrous metal scrap, Plastic scrap, Rubber scrap.	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22151

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-12	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle: Automobile Characteristics Historical Data Base		5. Report Date: November 1976
		6. Performing Organization Code
7. Author(s): J.A. Milne, C. Cantwell, H. Eissler		8. Performing Organization Report No.
9. Performing Organization Name and Address: Chilton Company* Radnor, PA 19089		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. DOT-TSC-1174
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Office of the Secretary, Office of the Asst. Sec. for Syst. Dev. and Tech., Office of Systems Engineering, Washington DC 20590		13. Type of Report and Period Covered: Final Report May 1976 - Nov. 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

* under contract to: U.S. Department of Transportation, Transportation Systems Center, Cambridge, MA 02142

16. Abstract

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

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

Vehicles are reported by model year and grouped by manufacturer using production volume and fuel economy dependent attributes - ie: engine displacement, weight and transmission type as criteria to select representative vehicles. Models which are essentially duplicated by more than one division of a manufacturer - ie: Ford Maverick and Mercury Comet, are represented by a model of only one of the divisions.

Characteristics were documented for more than 1000 automobiles representative of total US sales of all Domestic and Imported automobiles for the model years indicated.

17. Key Words: Automobile Characteristics Data Base, Automobile Fuel Economy Attributes, Automobile Inertia Weights, Auto Production Volume		18. Distribution Statement: DOCUMENT IS AVAILABLE TO THE U.S. PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161	
19. Security Classif. (of this report): Unclassified	20. Security Classif. (of this page): Unclassified	21. No. of Pages	22. Price

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-77-13 U		

4. Title and Subtitle	5. Report Date
Transportation Cost Impact of the U.S. Gulf Coast Deepwater Ports.	August 1976
	6. Performing Organization Code
7. Author(s) A. Gezen, M.J. Kendrick, S.S. Khan	8. Performing Organization Report No.
9. Performing Organization Name and Address TERA, Inc.* Arlington, Virginia	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. DOT-TSC-1246
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590	13. Type of Report and Period Covered Final report
	14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

A deepwater port model was built to analyse and evaluate crude oil shipping patterns and costs from 49 source locations to 18 refining districts, and petroleum product shipping patterns and costs from those districts to 484 demand zones. The model is then used to develop estimates of the impacts of two specific deepwater ports, LOOP and Seadock, on petroleum distribution patterns and transportation costs.

17. Key Words	18. Distribution Statement
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-14 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Auto scrappage and recycling industry study: the automobile shredding industry		5. Report Date August 1976
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) Kaiser, R.		
9. Performing Organization Name and Address H.H. Aerospace Design Company, Inc. Civilian Air Terminal Bedford, MA 01730		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. DOT-TSC-1028
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report
		14. Sponsoring Agency Code

15. Supplementary Notes

under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

Automobile shredding is the present state of the art method of processing scrap auto husks. In this survey report, the history and present status of the automobile shredding industry in the U.S. are revised.

Technical characteristics of automobile shredding systems are discussed with special emphasis being placed on the different types of hammermills used in practice. Cost data for various commercial systems are presented.

17. Key Words automobile scrappage, ferrous metal scrap, hammermills, shredding, secondary materials recovery	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.

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

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-15	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Freight transportation energy: a bibliography		5. Report Date January 1977
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS) OS714
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This annotated bibliography was compiled as part of the Rail and Intermodal Energy Efficiency Subproject of the Transportation Energy Efficiency Project. It includes studies of transportation energy in general, freight transportation energy studies, and works concerned with specific modes, grouped by mode. The literature surveyed covered the time from January 1973 to November 1, 1976.

17. Key Words freight transportation energy trucking, rail, air	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE U.S. 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

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-16 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Automotive Manufacturing and Automotive Component Historical Contract 1970-1975		5. Report Date October 22, 1976
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) G. Fitzgibbons, L.H. Lindgren--Rath & Strong; J. Milne, P. Kaprielyan, Paul Brown--Chilton Co.; C. Gruener--Clayton Associates		
9. Performing Organization Name and Address George Clayton Associates* 25711 Southfield Road Southfield, MI 48075		10. Work Unit No. (TRAIS) OS 714 R 7508
		11. Contract or Grant No. DOT-TSC 1039
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report
		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

This report collects data on the manufacturing characteristics of automotive vehicles and components of the U.S. automobile fleet for model years 1970 through 1975. Tabulated data includes aftermarket selling price and dealer discounts for chassis piece parts for some 36 cars and trucks over this six-year span, finished part weights for the 1975 Chrysler Valiant, Satellite, and Fury automobiles, OEM and aftermarket automotive manufacturers and vendors, and cost estimates to construct "new" automobile major assembly manufacturing facilities.

17. Key Words automotive aftermarket, automobile manufacturing, automotive components	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-18 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Spark Ignition Performance Simulation Models with Special Emphasis on Engine Operating Characteristics		5. Report Date November 1976
		6. Performing Organization Code
7. Author(s) Thomas Trella		8. Performing Organization Report No.
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report contains documantation of two computer simulation analyses which are used for evaluation of spark ignition preformance. Emphasis is placed on the application of existing engine simulation models and correlation with real engine data. Topics of general interest in simulations which are pertinent to the two models are discussed. The first model deals with engine performance based on closed cylinder thermodynamics, and the second model deals with the simulation of induction system dynamics. Examples demonstrating the effect of engine operating parameters on engine performance, such as spark timing, exhaust gas recirculation, and fuel-air equivalence ratio, are illustrated for a constant combustion duration angle to show the applicability of the simulations for studies of this type. Finally, transformation relationships are developed which relate changes in engine preformance (BSFC, BSNOX) for the three engine operating conditions. Vehicle performance studies to account for engine performance tradeoffs and trends, as a result of application of the transformation relationships, will be documented in a separate report.

17. Key Words	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.		
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Technical Report Documentation Pa

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-77-19,I U		

4. Title and Subtitle	5. Report Date
Manufacturing Technology Assessment Volume I Automatic Transmission, Dual Catalytic Converter, Fuel Injection and Lightweight Diesel	6. Performing Organization Code
7. Author(s) Gene O. Cowie	8. Performing Organization Report No.
9. Performing Organization Name and Address Pioneer Engineering & Manufacturing Company 2500 East Nine Mile Road Warren, Michigan 48091	10. Work Unit No. (TRAIS) OS-514-R5518 11. Contract or Grant No. DOT-TSC-1045-1
12. Sponsoring Agency Name and Address Office of Systems Engineering U. S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development & Technology Washington,D.C. 20590	13. Type of Report and Period Covered Tasks I, V, VI, and VII Final Report July 1, 1975 thru August 1, 1976 14. Sponsoring Agency Code

15. Supplementary Notes
*Under Contract to: U.S. Department of Transportation
Transportation Systems Center
Kendall Square, Cambridge, MA 02142

16. Abstract Development costs for the subject automotive components are functions of th development time allotted, the resources committed to the development, and the nature and extent of the changes. Capital expenditures are a function of the nature and extent of the changes and the extent to which existing equipment and facilities can be converted. The time required to make major changes will largely depend upon the numbe of such changes undertaken since all will draw upon the resources of the machine tool and particularly the transfer line industry.

The cost of changes to the subject components was identified by performing a cost analysis following the procedures employed by the automobile manufacturers, utilizing experienced cost estimating personnel. The accuracy of the results is a function of the available product design information, which was derived from the engineering staf of automobile manufacturers and vendor firms, a literature search, and the experience judgment of the contractor.

Evaluations of tooling and manufacturing facility costs, development costs, and lead times were further aided by consultants experienced in automotive development an manufacturing.

Other volumes in this report:

Volume II - Transfer Line Study--State of the art and near term projections
Volume III - Part Tolerance Study--Performance factors affecting vehicle fuel consumption
Volume IV - Lightweight Materials Study--Potential weight savings and effects

17. Key Words	18. Distribution Statement
Manufacturing technology, Manufacturability, Cost Analysis Automatic transmission, Catalytic Converter, Fuel injection, Diesel engine	This document is scheduled for publication in 1977, after which it will be avaliable through the National Technical Information Service, Springfield, VA 22151.

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Technical Report Documentation Page

Report No. 'T-TSC-OST-77-19, II U	2. Government Accession No.	3. Recipient's Catalog No.
Title and Subtitle Manufacturing Technology Assessment Volume II - Transfer Line Study		5. Report Date
		6. Performing Organization Code
		8. Performing Organization Report No.
Author(s) Gene O. Cowie		
Performing Organization Name and Address Pioneer Engineering and Manufacturing Company 2500 East Nine Mile Road Warren, Michigan 48091		10. Work Unit No. (TRAIS) OS-514-R5518
		11. Contract or Grant No. DOT-TSC-1045-2
Sponsoring Agency Name and Address Office of Systems Engineering U. S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development & Technology Washington, D.C. 20590		13. Type of Report and Period Covered Task III Final Report July 1, 1975 thru August 1, 1976
		14. Sponsoring Agency Code

Supplementary Notes * Under Contract to: U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge, MA 02142

Abstract The transfer line industry provides manufacturing equipment which is ential to low cost high volume automotive production. It is a highly specialized ustry which requires considerable capital investment and personnel with substan- l experience.

The ability of the automotive industry to develop and produce new and revised ponents for greater fuel efficiency will be limited by the capacity of the nsfer line industry to manufacture the equipment necessary for the production of h components. The ultimate cost to the consumer will depend largely upon the lity of the transfer line and related industries to develop and build machinery h higher production rates at reasonable manufacturing costs.

This volume provides an assessment of these factors in light of the historical elopment of the transfer line industry. The information generated provided input Volume I.

Other volumes in this report:

Volume I - Automatic Transmissions, Fuel Injection, Dual Catalytic Converters and Lightweight Diesel Engines--An analysis of cost and impacts on industrial production capacities.

Volume III - Part Tolerance Study--Performance factors affecting vehicle fuel consumption

Volume IV - Lightweight Materials Study--Potential weight savings and effects

Key Words ufacturing technology, Manufacturability, t Analysis nsfer Line, Automatic Machining	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151

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Technical Report Documentation Pag

1. Report No. DOT-TSC-OST-77-19, III U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Manufacturing Technology Assessment Volume III - Part Tolerance Study		5. Report Date
		6. Performing Organization Code
7. Author(s) Gene O. Cowie		8. Performing Organization Report No.
9. Performing Organization Name and Address Pioneer Engineering and Manufacturing Company 2500 East Nine Mile Road Warren, Michigan 48091		10. Work Unit No. (TRAIS) OS-514 R5518
		11. Contract or Grant No. DOT-TSC-1045-3
12. Sponsoring Agency Name and Address Office of Systems Engineering U. S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development & Technology Washington, D.C. 20590		13. Type of Report and Period Covered Task IV Final Report July 1, 1975 thru August 1, 1976
		14. Sponsoring Agency Code

15. Supplementary Notes *Under Contract to: U. S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge, MA 02142

16. Abstract A search of the literature and inquiries of automobile manufacturers and supplier firms indicated that there is little if anything to be gained in fuel efficiency from closer control of manufacturing tolerances. Many components are not sensitive to tolerances in a way which would affect fuel efficiency. The new computerized control systems that respond to ambient conditions and engine output tend to make related components less tolerance sensitive. Where tolerances have been reduced, the objective was improved emissions control rather than fuel efficiency.

In view of these findings, the investigation focused upon six areas of vehicle dynamics. The effects of variations in each of these areas, the cumulative effects, and the contributions of each was identified. The investigation procedures consisted of an analysis of a 1975 Chevrolet utilizing analytic procedures commonly employed in the automotive industry.

Other volumes in this report:

Volume I - Automatic Transmissions, Fuel Injection, Dual Catalytic Converters and Lightweight Diesel Engines--An analysis of cost and impacts on industrial production capacities.

Volume II - Transfer Line Study--State of the art and near term projections

Volume IV - Lightweight Materials Study--Potential weight savings and effects

17. Key Words Manufacturing Technology, Manufacturability, Cost Analysis Production variations, Vehicle Dynamics	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-77-19, IV U		

4. Title and Subtitle	5. Report Date
Manufacturing Technology Assessment Volume IV - Lightweight Materials Study	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s) Daniel J. Chupinsky	
9. Performing Organization Name and Address Pioneer Engineering and Manufacturing Company 2500 East Nine Mile Road Warren, Michigan 48091	10. Work Unit No. (TRAIS) OS-514-R5518 11. Contract or Grant No. DOT-TSC-1045-4
12. Sponsoring Agency Name and Address Office of Systems Engineering U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development & Technology Washington, D.C. 20590	13. Type of Report and Period Covered Task II Final Report July 1, 1975 thru August 1, 1976 14. Sponsoring Agency Code

15. Supplementary Notes *Under Contract to: U. S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge, MA 02142

16. Abstract There is considerable experience with the use of steel automotive body components. Therefore costs of fabricating, handling, fastening, finishing and employee training relating to new steel parts can be predicted with a high degree of accuracy. The costs associated with parts made from lightweight materials cannot be projected with the same degree of confidence because of the lack of historical data. Several manufacturers of candidate materials would not forecast piece costs in production because of the unknowns.

The effort in this task, therefore, was concentrated in those areas where lightweight materials are being used and there is some historical data.

Other volumes in this report:

Volume I - Automatic Transmissions, Fuel Injection, Dual Catalytic Converters and Lightweight Diesel Engines--An analysis of cost and impacts on industrial production capacities.

Volume II - Transfer Line Study--State of the art and near term projections

Volume III - Part Tolerance Study--Performance factors affecting vehicle fuel consumption

17. Key Words	18. Distribution Statement
Manufacturing technology, Manufacturability, Cost Analysis Automotive bodies, Lightweight materials	This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA, 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-20 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Alternate Engine Cost Data Base		5. Report Date
		6. Performing Organization Code
7. Author(s) T.A. Barber, Ted K. Peng		8. Performing Organization Report No.
9. Performing Organization Name and Address Jet Propulsion Laboratory* 4800 Oak Grove Drive Pasedena, CA 91130		10. Work Unit No. (TRAIS) OS714 R7508
		11. Contract or Grant No. RA 74-40 TMP-0231
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report 7/74-6/75
		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

This report contains manufacturing cost data on alternate heat engines. Included are the Stirling cycle, the Brayton in two configurations, the free-turbine and the single-shaft, and the Rankine cycle engine. Both unit cost and the buildings and facilities costs required to manufacture eht engines are estimated.

Calculations validating the internal combustion engine data base* through aggregation of the materials and labor content are also included as part of a separate task.

*developed under contract DOT-TSC-803

17. Key Words Engine manufacturing cost	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.

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

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-21 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Evaluation of Lithium/Iron Sulfide Battery for Electric Automobile Propulsion		5. Report Date June 1975
		6. Performing Organization Code
7. Author(s) A.A. Chilenskas, W.W. Schertz, V.M. Kolba and R.O. Ivins		8. Performing Organization Report No.
9. Performing Organization Name and Address Argonne National Laboratory* Chemical Engineering Division 9700 South Cass Avenue Argonne, Illinois 60439		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. RA 74-34
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final Report July 1974-June 1975
		14. Sponsoring Agency Code

15. Supplementary Notes

* under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

Lithium/metal sulfide batteries are potentially attractive for use in automobiles because the electrode materials have a low equivalent weight and form cells of high specific energy. These batteries employ a molten salt electrolyte (LiCl-KCl eutectic; mp, 352° C) and operate at 400-450°C. Because of the high ionic conductivity of this electrolyte, the batteries are capable of very high discharge rates and thus can provide the high power needed for automobiles. The use of negative electrodes of solid lithium-aluminum alloy, which exhibits a lower lithium activity than molten lithium, has minimized reaction with ceramic separators and insulators in contact with the electrodes. With such electrodes, separators of boron nitride fabric have performed without failure for more than 3000 hr. The use of solid iron sulfide, rather than molten sulfur, has improved the capacity and life of the cells. The search for low-cost component materials continues in order to meet the cost goals for mass-amrket applications. The maintenance of high operating battery temperatures requires the development of an inexpensive, compact and high efficiency insulating jacket. Materials have been identified and designs have been proposed to satisfy these requirements, but prototype units have not yet been tested.

17. Key Words Battery, Lithium/Iron Sulfide Electric Vehicle		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-22 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Evaluation of automotive fuel flowmeters		5. Report Date January 1977
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) Baldwin Robertson and G. Paul Baumgarten		
9. Performing Organization Name and Address National Bureau of Standards* Mechanics Division, Fluid Meters Section Washington, D.C. 20234		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. RA 75-8
		13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

Fuel economy measurement procedures being developed by the Transportation Systems Center of the Department of Transportation require flowmeters to measure the gasolins consumed by the engine of an automobile either on the road or on a dynamometer. The contribution of the National Bureau of Standards to this work was to ascertain the environment in which the flowmeters will probably be used, to develop procedures for measuring their performance in a laboratory simulation of that environment, and to carry out illustrative measurements on a number of flowmeters.

This report discusses: (1) the environment of the flowmeter in an automobile, i.e., flowmeter temperature; fuel temperature, pressure, density, viscosity, color, opacity, flow pulsations, back flow, and swirl due to elbows; line voltage fluctuations; electromagnetic radiation from ignition; vehicle attitude with respect to the vertical; and vibration, (2) the test set-up and procedure used for evaluating and calibrating these meters in the laboratory under conditions simulating the automotive environment, (3) possible sources and magnitudes of errors in the calibration, and (4) results of illustrative tests on seven flowmeters.

17. Key Words flowmeters		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-23.I U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Hybrid Vehicle Technology Constraints and Application Assessment Study. Volume I: Summary		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) D.E. Lapedes, M.G. Hinton, L. Forrest, J. Kohlenberger, T. Ryan, H. Sampson, W. Smalley, G. Speisman, H. White		8. Performing Organization Report No.
9. Performing Organization Name and Address The Aerospace Corporation * Environment and Energy Conservation Division El Segundo, CA 90245		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. F04701-76-C-0077
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report April 1975-June 1976
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15. Supplementary Notes

*under contract to: U.S. Department of Transportation
Transportation Systems Center
Cambridge, MA 02142

16. Abstract

This report in four volumes presents analyses and assessments of both heat engine/battery, and heat engine/flywheel powered hybrid vehicles to determine if they could contribute to near-term (1980-1990) reductions in transportation energy consumption under several sets of operational conditions: urban driving; highway driving; and stop-start, low-speed delivery service conditions. In addition, the impact of such hybrid vehicle usage on vehicle-related exhaust emissions was determined, and the ability to accommodate a different energy resource base in the longer term was evaluated; i.e., by permitting a portion of the recharge energy for the on-board energy storage device (battery or flywheel) to be provided by wall-plug electric power from the utility industry instead of from the on-board heat engine. Alternative paths for power transmission from the heat engine to the vehicle drive wheels were considered along with the potential of regenerative braking to reduce vehicle energy consumption.

17. Key Words hybrid automotive vehicles, transportation energy consumption, automotive vehicle exhaust emissions, batteries, flywheels, motors, generators, heat engines, transmissions, regenerative braking		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-23.II U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Hybrid Vehicle Technology Constraints and Application Assessment Study. Volume II: Sections 1-4		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) D.E. Lapedes, M.G. Hinton, L. Forrest, J. Kohlenberger, T. Ryan, H. Sampson, W. Smalley, G. Speisman, H. White		8. Performing Organization Report No.
9. Performing Organization Name and Address The Aerospace Corporation* Environment and Energy Conservation Division El Segundo, CA 90245		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. FO4701-76-C-0077
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report April 1975-June 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

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17. Key Words Hybrid automotive vehicles, transportation energy consumption, automotive vehicle exhaust emissions, batteries, flywheels, motors, generators, heat engines, transmissions, regenerative braking		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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1. Report No. DOT-TSC-OST-77-23.III U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Hybrid Vehicle Technology Constraints and Application Assessment Study. Volume III: Sections 5-9		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) D.E. Lapedes, M.G. Hinton, L. Forrest, J. Kohlenberger, T. Ryan, H. Sampson, W. Samlley, G. Speisman, H. White		8. Performing Organization Report No.
9. Performing Organization Name and Address The Aerospace Corporation* Environment and Energy Conservation Division El Segundo, CA 90245		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. FO4701-76-C-0077
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report April 1975-June 1976
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16. Abstract

This report in four volumes presents analyses and assessments of both heat engine/battery, and heat engine/flywheel powered hybrid vehicles to determine if they could contribute to near-term (1980-1990) reductions in transportation energy consumption under several sets of operational conditions: urban driving; highway driving; and stop-start, low speed delivery service conditions. In addition, the impact of such hybrid vehicle usage on vehicle-related exhaust emissions was determined, and the ability to accommodate a different energy resource base in the longer term was evaluated: i.e., by permitting a portion of the recharge energy for the on-board energy storage device (battery or flywheel) to be provided by wall-plug electric power from the utility industry instead of from the on-board heat engine. Alternative paths for power transmission from the heat engine to the vehicle drive wheels were considered along with the potential of regenerative braking to reduce vehicle energy consumption.

17. Key Words Hybrid automotive vehicles, transportation energy consumption, automotive vehicle exhaust emissions, batteries, flywheels, motors, generators, heat engines, transmissions, regenerative braking	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.		
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-23.IV U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Hybrid Vehicle Technology Constraints and Application Assessment Study. Volume IV: Sections 10,11 and Appendix		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) D.E. Lapedes, M.G. Hinton, L. Forrest, J. Kohlenberger, T. Ryan, H. Sampson, W. Smalley, G. Speisman, H. White		8. Performing Organization Report No.
9. Performing Organization Name and Address The Aerospace Corporation * Environment and Energy Conservation Division El Segundo, CA 90245		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. F04701-76-C-0077
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report April 1975-June 1976
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15. Supplementary Notes

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16. Abstract

This report in four volumes presents analyses and assessments of both heat engine/battery, and heat engine/flywheel powered hybrid vehicles to determine if they could contribute to near-term (1980-1990) reductions in transportation energy consumption under several sets of operational conditions: urban driving; highway driving; and stop-start, low-speed delivery service conditions. In addition, the impact of such hybrid vehicle usage on vehicle-related exhaust emissions was determined, and the ability to accommodate a different energy resource base in the longer term was evaluated; i.e., by permitting a portion of the recharge energy for the on-board energy storage device (battery or flywheel) to be provided by wall-plug electric power from the utility industry instead of from the on-board heat engine. Alternative paths for power transmission from the heat engine to the vehicle drive wheels were considered along with the potential of regenerative braking to reduce vehicle energy consumption.

17. Key Words hybrid automotive vehicles, transportation energy consumption, automotive vehicle exhaust emissions, batteries, flywheels, motors, generators, heat engines, transmissions, regenerative braking		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-24 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle The potential for automobile weight reduction		5. Report Date
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) Frederick J. Hooven, Francis E. Kennedy		
9. Performing Organization Name and Address Thayer School of Engineering* Dartmouth College Hanover, NH 03755		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. DOT-TSC-996
		13. Type of Report and Period Covered Final report
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		14. Sponsoring Agency Code

15. Supplementary Notes

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Transportation Systems Center
Cambridge, MA 02142

16. Abstract

A study has been carried out to evaluate the potental for weight reduction of automobiles. It is concluded that automobiles of lighter weight than those current (1976 models) is the domestic market may be built in each of three size classes, 4, 5, and 6 passenger, and that this can be done within the limits of presently prevailing designs and materials. Detailed weight breakdowns are presented for a 4-passenger vehicle of 1987 lbs. curb weight, for a 5-passenger vehicle having a curb weight of 2551 lbs. and a 6-passenger vehicle of 3271 lbs. curb weight.

Since weight reduction is without significance unless product characteristics are well defined, detailed package dimensions are presented for each of the three size classes, and an improved roominess factor is proposed for the evaluation of effective roominess in cars. Other vehicle characteristics are discussed in detail and defined.

Detailed weight comparisons are presented between present and past designs of vehicles in each of the three size classes mentioned above.

The design process is outlined and illustrated by the making of design decisions for a new design of a 5-passenger vehicle. Finally, the potential for weight reduction by material substitution is examined.

17. Key Words Automobiles, weight, automotive engineering, automobile bodies, materials		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-25 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Study Design for a Method of Projecting Vehicle Miles of Travel		5. Report Date September 24, 1975
		6. Performing Organization Code
7. Author(s) F.T. Rabe		8. Performing Organization Report No.
9. Performing Organization Name and Address Environmental Impact Center, Inc.* 55 Chapel Street Newton, MA 02158		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. DOT-TSC-10596
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report
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15. Supplementary Notes

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16. Abstract

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

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

17. Key Words travel forecasts		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-26 U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Dynamic Models of the U.S. Automobile Fleet		5. Report Date July 18, 1975
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) F.T. Rabe		
9. Performing Organization Name and Address Environmental Impact Center, Inc.* 55 Chapel Street Newton, MA 02158		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No.
		13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		14. Sponsoring Agency Code

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16. Abstract

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

17. Key Words automotive fleet models		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-27.I U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle The Development of Performance Evaluation Criteria for Lean Operating Conventional Spark-Ignition Engines Volume I: Executive Summary		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) R.J. Tabaczynski and J.B. Heywood		8. Performing Organization Report No.
9. Performing Organization Name and Address Massachusetts Institute of Technology* 77 Massachusetts Avenue Cambridge, MA 02139		10. Work Unit No. (TRAIS) OS714/R7508
		11. Contract or Grant No. TSC-1034
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim report July 1975-June 1976
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15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

The work involved in developing a methodology for assessing lean burn engine concepts is discussed. An executive summary is given in Volume I and the detailed results of the first year's work are given is Volumes II through VI. Substantial progress has been made on the development and use of the combustion model. Through use of the combustion model, it is shown that cyclic variations in cylinder pressure are due to variations in the turbulent flow field on non-uniformities in the microscale that effect the ignition process. The laminar flame speed facility has been developed after an extensive review of existing data. Also, turbulent flame propagation experiments have been performed which give information on the turbulent entrainment speed and characteristic reaction times. This data is being used to improve the turbulent combustion model.

In addition to the experimental work, a cycle simulation program has been developed which can predict nitric oxide emissions and performance simultaneously. This cycle simulation can be used with the advanced combustion model to predict the effect cyclic variations have on engine performance and is an integral part of formulating a methodology for assessing lean burn concepts.

17. Key Words		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-27.II U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle The Development of Performance Evaluation Criteria for Lean Mixture Engines. Volume II: A Theoretical Investigation on the Effect of Mixture and Flow Non-uniformities on Spark-ignition Engine Combustion.		5. Report Date June 1976
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) C.R. Ferguson, J.C. Keck, and O. Oforah		
9. Performing Organization Name and Address Massachusetts Institute of Technology* 77 Massachusetts Avenue Cambridge, MA 02139		10. Work Unit No. (TRAIS) OS714 R7508
		11. Contract or Grant No. TSC-1034
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim report July 1975--June 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

A model describing turbulent combustion in a spark-ignition engine is presented. The model is based on an entrainment theory and features as parameters the entrainment theory and features as parameters the entrainment speed and characteristic reaction time. The model is used in a parametric study on the effects of mixture and flow non-uniformities. It was found that fluctuations which affect only the distribution of heat release in a given cycle yield families of pressure time diagrams with common expansion curves. Whereas fluctuations in the total heat release per cycle yielded familities of pressure-time diagrams with different expansion curves.

17. Key Words	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.		
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-77-27.III U		

4. Title and Subtitle	5. Report Date
The Development of Performance Evaluation Criteria for Lean Mixture Engines. Vol. III: Study of Turbulence in a Steady Flow for an Engine Cylinder Geometry	June 1976
	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s) N. Nanopolous, D.P. Hoult, and R.J. Tabaczynski	
9. Performing Organization Name and Address Massachusetts Institute of Technology* 77 Massachusetts Avenue Cambridge, MA 02139	10. Work Unit No. (TRAIS) OS714 R7508
	11. Contract or Grant No. TSC-1034
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590	13. Type of Report and Period Covered Interim report July 1975-June 1976
	14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

A steady flow simulation is used to study the turbulent flow field produced during the intake process of a CFR engine. Measurements of turbulence parameters are made with a Hot-Wire Anemometer and a set of response equations is developed for the hot-wire, that accounts for the high level of turbulence intensity observed in the flow. Flow mappings are presented and estimates of the swirl rate are made for different valve configurations. Profiles of the mean velocity, fluctuating velocity, and turbulence intensity of the jet are also presented for different orientations of the hot-wire. A signal correlator is used to obtain the auto-correlation function of the fluctuating velocity component and hence the integral scale of the flow. The turbulent flow field was studied at various points in the flow for various valve lifts and for shrouded and unshrouded valve configurations. A qualitative discussion of the steady flow model is presented and some general conclusions on the nature of the turbulent flow are drawn. The most significant observation is the presence of a large turbulence intensity throughout the flow field, including the interior of the jet. This is contrary to the classical behavior of turbulent jets where turbulence intensities are of the order of ten per cent.

17. Key Words	18. Distribution Statement
turbulence in engines fluid mechanics combustion modelling	This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-27.IV U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle The Development of Performance Evaluation Criteria for Lean Mixture Engines. Vol. IV: Turbulence and Turbulent Combustion in Spark Ignition Engines		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) R.J. Tabaczynski		8. Performing Organization Report No.
9. Performing Organization Name and Address Massachusets Institute of Technology* 77 Massachusetts Avenue Cambridge, MA 02139		10. Work Unit No. (TRAIS) OS714 R7508
		11. Contract or Grant No. TSC-1034
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim report July 1975-June 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

Turbulent flow and turbulent combustion in spark ignition engines is reviewed. a basic characteristic of the turbulent flow field is its large relative turbulent flow field is its large relative turbulent intensity ($u'/\bar{U}<.2$). This fact makes analysis of engine turbulence difficult at best. Correlation for the integral and micro length scales are presented. These correlations are based on isotropic homogeneous turbulence theory and seem to correlate with engine data quite well. From these correlations it is deduced that the chamber height is the controlling physical dimension governing the integral scale of trubulence for chambers with low squish areas. Turbulent combustion for ignition to termination is reviewed. The important variables governing ignition and fully developed flame propagation are discussed. Also turbulent combustion models for spark ignition engines are discussed.

17. Key Words turbulence in engines fluid mechanics combustion modelling		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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1. Report No. DOT-TSC-OST-77-27.V U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle The Development of Performance Evaluation Criteria for Lean Mixture Engines. Vol. V: Simultaneous Performance and Emissions Modelling of a Conventional Spark-Ignition Engine.		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) R.J. Tabaczynski and J.B. Heywood		8. Performing Organization Report No.
9. Performing Organization Name and Address Massachusetts Institute of Technology* 77 Massachusetts Avenue Cambridge, MA02139		10. Work Unit No. (TRAIS) OS714 R7508
		11. Contract or Grant No. TSC-1034
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim report July 1975-June 1976
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15. Supplementary Notes

U.S. Department of Transportation
* under contract to: Transportation Systems Center
CAmbridge, MA 02142

16. Abstract

A performance model for the conventional spark-ignition engine is presented. The unique feature of this model is the treatment of the combustion process. The combustion zone is divided into three regions: an adiabatic burned zone, a boundart layer burned zone, and an unburned zone. This division of thermodynamic systems allows for accurate NO and performance predictions since heat transfer is accounted for and the NO is formed in the adiabatic core. A detailed description of the model is presented as well as a comparison of the model with experimantal data.

17. Key Words Cycle simulation emissions modelling combustion modelling	18. Distribution Statement This document is scheduled for publicatior in 1977, after which it will be available through the National Technical Informatior Service, Springfield, VA 22151.

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-27.VI U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle The Development of Performance Evaluation Criteria for Lean Operating Conventional Spark Ignition Engines Vol. VI: Laminar Falme Speed Measurements		5. Report Date June 1976
		6. Performing Organization Code
7. Author(s) J.C. Keck and M. Metghalchi		8. Performing Organization Report No.
9. Performing Organization Name and Address Massachusetts Institute of Technology* 77 Massachusetts Avenue Cambridge, MA 02139		10. Work Unit No. (TRAIS) OS714 R7508
		11. Contract or Grant No. TSC-1034
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Interim report July 1975-June 1976
		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation
Transportation Systems Center
Cambridge, MA 02142

16. Abstract

A spherical combustion bomb was constructed to perform laminar flame speed measurements for practical fuels. A thermodynamic analysis is used to calculate laminar flame speeds once a pressure-time trace of the combustion process is obtained. An equilibrium program is used to assure that the specific heats of the burned gases are obtained correctly. Ionization probes are used to assure that spherical symmetry exists. Initial tests indicate that this measurement technique is consistent with published data on methane.

17. Key Words	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151		
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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-28.I U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle An Analysis of the Automobile Market: Modeling of the Long-run Determinants of the Demand for Automobiles. Volume I: the Wharton E.F.A. Automobile Demand Model		5. Report Date February 1977
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) George R. Schink, Colin J. Loxley		
9. Performing Organization Name and Address Wharton Econometric Forecasting Associates, Inc.* 4025 Chestnut Street Philadelphia, PA 19104		10. Work Unit No. (TRAIS) OS715/R7508
		11. Contract or Grant No. DOT-TSC-1072
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report September 1975-March 1977
		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

An econometric model is developed which provedes 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.

17. Key Words automobiles, long-run forecasting, U.S. demand, annual stock, new sales, scrappage, fuel efficiency, auto costs		18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.	
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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-77-28. II U		

4. Title and Subtitle	5. Report Date
An Analysis of the Automobile Market: Modeling of the Long-run Determinants of the Demand for Automobiles. Volume II: Simulation Analysis Using the Wharton E.F.A. Automobile Demand Model	February 1977
	6. Performing Organization Code
7. Author(s) George R. Schink, Colin J. Loxley	8. Performing Organization Report No.
9. Performing Organization Name and Address Wharton Econometric Forecasting Associates, Inc.* 4025 Chestnut Street Philadelphia, PA 19104	10. Work Unit No. (TRAIS) OS715/R7508
	11. Contract or Grant No. DOT-TSC-1072
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590	13. Type of Report and Period Covered Final report September 1975-March 1977
	14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation Transportation Systems Center Cambridge, MA 02142

16. Abstract

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17. Key Words	18. Distribution Statement
automobiles, long-run forecasting, U.S. demand, annual stock, new sales, scrappage, fuel efficiency, auto costs	This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.

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Technical Report Documentation Page

1. Report No. DOT-TSC-OST-77-28.III U	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle An Analysis of the Automobile Market: Modeling of the Long-run Determinants of the Demand for Automobiles. Volume III: Appendices to the Wharton E.F.A. Automobile Demand Model		5. Report Date February 1977
		6. Performing Organization Code
7. Author(s) George R. Schink, Colin J. Loxley		8. Performing Organization Report No.
9. Performing Organization Name and Address Wharton Econometric Forecasting Associates, Inc.* 4025 Chestnut Street Philadelphia, PA 19104		10. Work Unit No. (TRAIS) OS715/R7508
		11. Contract or Grant No. DOT-TSC-1072
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Final report September 1975-March 1977
		14. Sponsoring Agency Code

15. Supplementary Notes

*under contract to: U.S. Department of Transportation, Transportation Systems Center, Cambridge, MA 02142

16. Abstract

An econometric model is developed which provedes 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.

17. Key Words automobiles, long-run forecasting, U.S. demand, annual stock, new sales, scrappage, fuel efficiency, auto costs	18. Distribution Statement This document is scheduled for publication in 1977, after which it will be available through the National Technical Information Service, Springfield, VA 22151.

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Improved fuel economy through reduced aerodynamic drag and rolling resistance		5. Report Date January 1975
		6. Performing Organization Code
7. Author(s) K. F. Kaiser		8. Performing Organization Report No. PM-T-22
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02143		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

An examination of the possible fuel savings that could be achieved through the reduction of aerodynamic drag and/or rolling resistance for automobiles and trucks is presented. This is followed by a survey of available techniques for reducing aerodynamic drag and rolling resistance.

A discussion of measurement techniques has been included from which the advantages and disadvantages of each become evident. The report concludes by identifying the existing government sponsored research programs in the field of vehicle aerodynamics.

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Roadway Classification Study		5. Report Date
		6. Performing Organization Code
7. Author(s) Joseph C. Sturm		8. Performing Organization Report No. PM-T-36
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS)
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12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Preliminary Memorandum
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Included in this paper are descriptions of the current roadway classification schemes utilized within the U.S. Four major types of classification are discussed: (1) regional; (2) functional (3) funding related; (4) administrative. A key factor in the classification of roadways is the administration of Federal funds; other factors include the overall planning of the highway system and assignment of jurisdiction. Some states employ efficient classification methods and techniques, whereas others use outmoded shcemes. Massachusetts has been chosen as the main source of material for this paper due to proximity. Included in the appendices are supportive documents dealing with roadway policies as practiced by Massachusetts. These include: (1) functional roadway classification; (2) roadway classification inventory; (3) current administrative roadway policy. The work itself consists of the selection and evaluation of potential data and data source areas relating to roadway classification, funding, and administration. What is desired is a consolidation of these mechanisms insofar as they relate to current federal/state/local funding practice.

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Technical Report Documentation Page

Report No.	2. Government Accession No.	3. Recipient's Catalog No.
Title and Subtitle REVIEW OF FUEL INDUCTION SYSTEMS AND XHAUST EMISSIONS FOR AUTOMOTIVE SPARK GNITION ENGINES		5. Report Date May 1975
		6. Performing Organization Code
Author(s) Eric M. Withjack		8. Performing Organization Report No. PM-T-37
Performing Organization Name and Address S. Department of Transportation ansportation Systems Center ndall Square mbridge, MA 02142		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
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		14. Sponsoring Agency Code

Supplementary Notes

Abstract

omotive fuel induction systems may be either carbureted or fuel in-
ted. Traditionally, carburetors have been used on mass produced
rican automobiles, while fuel injection has been used in special
h performance engines. For future use, the two systems must be
essed on the basis of attainable emission levels, fuel economy lev-
, cost competitiveness, performance, and maintenance characteris-
s. At this time, there is no emission test data or production cost
a on U.S. cars equipped with fuel injection. New model carburetors
t more, but require less maintenance than earlier models. Fuel
nomy improvement may be obtained through cut off fuel flow to the
ine during deceleration with fuel injection. Closed loop fuel
ection systems are being developed to meet the 1978 emission stan-
ds of 0.41 HC, 3.4 CO and 0.4 NOx (gm/mi), with three-way cata-
ic reactors. In 1975, several European manufacturers met
eral emission standards without catalytic converters.

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Technical Report Documentation P

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Impacts of fuel modifications on the petroleum refinery industry		5. Report Date October 1975 6. Performing Organization Code
7. Author(s) Jerry Horton		8. Performing Organization Report No. PM-T-39
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Preliminary Memorandum 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report is an initial attempt to examine impacts in the petroleum industry resulting from changes in the nature of automotive fuels. A survey has been made of available literature dealing with the effects of current and potential trends in automotive fuels in particular, and with the refining industry in general.

The studies reported in this document encompass four areas of motor gasoline modification: lead content reduction, octane rating improvement, volatility lowering, and sulfur content reduction. Fuel modifications in these directions have been examined individually, considering three refining criteria: additional capital investment, additional raw material requirements, and increase in manufacturing cost.

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle VEHICLE SPEED DISTRIBUTIONS		5. Report Date June 1975
		6. Performing Organization Code
7. Author(s) Joseph C. Sturm		8. Performing Organization Report No. PM-T-41
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS)
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15. Supplementary Notes

16. Abstract

This paper seeks to establish a framework for assessing the simulation capability and modelling accuracy of the driving schecules currently used by the EPA and by automobile manufacturers. The data are taken from both private and federal transportation research sectors. Specific data include statistical time series on roadways, and data gathered from research on automotive travel behavior and roadway use.

The analytical thrust of this framework is the generation of a family of curves similar in nature to those from the driving schedules. The data base includes current and past vehicle miles traveled, as well as data on average traveled speed. Additional data characterizing urban/rural travel behavior have been interfaced with data on roadway use.

Specifically, the driving schedule output is: percentage of distance travelled by the test vehicle at various speed levels and within various speed ranges. Output of the proposed model is: percentage of total national urban/rural VMT generated at various speed levels and within various speed ranges. These two measures are similar in nature, and lend themselves to direct comparison on a curve-by-curve basis.

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Technical Report Documentation P

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle REVIEW OF DIESEL ENGINE TECHNOLOGY FOR AUTOMOBILE APPLICATION		5. Report Date February 1975 6. Performing Organization Code
7. Author(s) Thomas J. Trella		8. Performing Organization Report No. PM-T-45
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Preliminary Memorandum 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This survey finds that currently produced diesel automobiles show a fuel economy advantage of 10 to 80% over gasoline powered automobiles in the same weight class. The advantage varies depending upon how normalized. The most favorable figures are on a miles per gallon basis. The advantage quickly deteriorates when normalization accounting for horsepower to weight ratio, BTU per gallon, and highwa driving cycles are applied. Diesel powered automobiles currently mee emission levels of 0.41 HC, 3.4 CO and 2.0 NO_x grams per mile. Lower NO_x values are attainable only at expense of fuel economy. Super-charging promises significantly increasing the low horsepower to weight ratio. Improved fuel injection systems for direct injection diesel engines are also under development. The undesirable attribute of the diesel engine--smoke, odor and idle noise--can be controlled with current technology.

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle ANALYSIS OF MATERIALS IN AUTOMOBILES		5. Report Date October 1975
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No. PM-T-46
9. Performing Organization Name and Address H.H. Aerospace Design Company		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. DOT-TSC-1028
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Preliminary Memorandum
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15. Supplementary Notes

16. Abstract

The material composition for 14 different production automobiles manufactured between 1963 and 1975, as well as for several calculated composites, is presented in this report. Compact, intermediate, standard and luxury cars are included in the sample. An automobile is mainly made up of ferrous material (77.4% by weight), combined with 5.3% nonferrous metals and 4.4% each rubber, fluids and lubricants. There is also about 2.4% glass, 1.9% soft trim, 1.9% plastics, 1.7% sound deadener, 0.7% paint, and on the latest models, 0.1% ceramics. Cars made in the past few years contain significantly more plastic materials than cars made in the early 1960's. In general, however, it appears than the materials mix for U.S. automobiles has remained roughly constant over the past 20 years.

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle A REVIEW OF LEAN MIXTURE ENGINE TECHNOLOGY AND CURRENT DEVELOPMENTS		5. Report Date October 1975
		6. Performing Organization Code
7. Author(s) Michael Koplow		8. Performing Organization Report No. PM-T-47
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Preliminary Memorandum
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Lean mixture engines are spark-ignition internal combustion engines designed to burn fuel/gas mixtures containing appreciable amounts of excess air or other non-combustible gas. They offer fuel economy and reduced emissions over the traditional automotive engines. Lean mixture technology is compatible with the basic design of existing engines, and with oxidation catalysts. It will not, however reduce emissions enough to meet the hydrocarbon standard alone. Further improvements in lean mixture engines can be expected to include redesign of combustion chambers to promote efficient burning, and changes in induction systems, ignition systems and engine control The potential of these changes is further reduction in NO_x emissions and modest increases in fuel economy.

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Report No.	2. Government Accession No.	3. Recipient's Catalog No.
Title and Subtitle rocessing and Display Programsfor Steady State ngine Test Data		5. Report Date December 1975
		6. Performing Organization Code
Author(s) alph G. Colello		8. Performing Organization Report No. PM-T-51
Performing Organization Name and Address .S. Department of Transportation ransportation Systems Center endall Square ambridge, MA 02142		10. Work Unit No. (TRAIS)
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Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Preliminary Memorandum
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Supplementary Notes

Abstract

rocessing and display programs have been developed to accept engine ynamometer test data and to provide engine maps for visual display, for se in engineering calculations, and for input to vehicle simulation pro-rams. The programs process about 4000 items of raw test data acquired rom a single steady state engine test and yield engine maps of fourteen ey engine parameters.

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Technical Report Documentation Pa

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Fuel economy/emissions impact study.		5. Report Date November 1975
		6. Performing Organization Code
7. Author(s) Ernest T. Kendall		8. Performing Organization Report No. 425-75-02
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02143		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Working paper
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15. Supplementary Notes

16. Abstract

This study estimates the near-term impacts of fuel economy goals and emission standards upon aggregate automotive gasoline consumption and new car sales. Concentrating on the 1975-1985 time period, the analysis evaluates the effects of (1) a 19.6 and a 21 mile-per-gallon fuel economy goal in 1980, and (2) a 28 mile-per-gallon goal in 1985. The analysis is carried out for the several sets of emission standards which are currently under consideration. It is assumed that fuel economy goals and emission standards will be met solely through extensions of existing technology. The analyses are based upon an approach which combines automotive technology assessment with econometric projections.

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Technical Report Documentation Page

Report No.	2. Government Accession No.	3. Recipient's Catalog No.
Title and Subtitle ederal incentives to technology nplementation: a bibliography		5. Report Date November 1, 1976
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uthor(s) Jeanne Horrigan		8. Performing Organization Report No. DOT-TSC-OS14-WP-76-3
erforming Organization Name and Address ytheon Service Company* endall Square ambridge, MA 02142		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
ponsoring Agency Name and Address Department of Transportation e of the Secretary e of the Asst. Sec. for Syst. Dev. and Tech. e of Systems Engineering ington DC 20590		13. Type of Report and Period Covered Working paper
		14. Sponsoring Agency Code

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Cambridge, MA 02142

bstract

is annotated bibliography was compiled as part of the tomotive Technology Implementation Study. The problem posed is: identify the ways in which the Federal government can effectively teract with the automobile manufacturers to encourage the intro- ction of socially desirable features in motor vehicles. The terature search covers ten years of technical literature and vernment hearings.

ey Words	18. Distribution Statement THIS DOCUMENT CONTAINS PRELIMINARY INFORMATION SUBJECT TO CHANGE. IT IS CONSIDERED AN INTERNAL TSC WORKING PAPER WITH A SELECT DISTRIBUTION. IT IS NOT A FORMAL REFERABLE REPORT. DISTRIBUTION IS EFFECTED BY AND IS THE RESPONSIBILITY OF THE TSC PROJECT MANAGER.		
ecurity Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

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Technical Report Documentation Pa

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Steady state fuel economy investigation of Mobil 1 lubricating oil		5. Report Date December 16, 1976
		6. Performing Organization Code
7. Author(s) J.S. Boziuk III		8. Performing Organization Report No. DOT-TSC-OS714-PM-76-14
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Project Memorandum
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The tests discussed in this memorandum compared the contribution to fuel economy of Mobil 1 and Kendall (10W-40) lubricating oils during steady-state operation of a spark ignition engine. The data indicated that within normal engine variability there is essentially no difference in fuel economy between the two oils for a fully warmed up engine. A slight fuel economy benefit is indicated at idle. This test did not compare low temperature operation. Further testing is recommended.

17. Key Words	18. Distribution Statement This document contains preliminary information subject to change. It is considered an internal working paper with select distribution. It is not a formal referable report. Distribution is effected by and is the responsibility of the author.		
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Results of 1975 4-cylinder engine tuning sensitivity pilot study		5. Report Date January 25, 1977
		6. Performing Organization Code
7. Author(s) L.F. Simeone		8. Performing Organization Report No. DOT-TSC-OS714-PM-77-1
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address .S. Department of Transportation ffice of the Secretary ffice of the Asst. Sec. for Syst. Dev. and Tech. ffice of Systems Engineering ashington DC 20590		13. Type of Report and Period Covered Project memorandum
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This study investigated the effect of engine tuning malfunctions and maladjectments on the fuel consumption characteristics of a four cylinder, spark ignition engine. The assortment of tuning malfunctions looked at in this study was by no means exhaustive, but those chosen did cover, or at least, simulated a significant portion of the malfunctions that would be found in the field. This study was able to show that major tuning malfunctions result in significant excessive fuel usage; minor tuning malfunction engine data was generally inconclusive, although definite trends were discernable.

17. Key Words	18. Distribution Statement This document contains preliminary information subject to change. It is considered an internal working paper with select distribution. It is not a formal referable report. Distribution is effected by and is the responsibility of the author.		
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

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Technical Report Documentation Pa

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AUTOMOTIVE FUEL ECONOMY POTENTIAL FOR 1981 THROUGH 1984		5. Report Date July 1976
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s)		
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA 02142		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address		13. Type of Report and Period Covered Working Paper
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Title III of the Energy Policy and Conservation Act establishes a Federal program to regulate the fuel economy of passenger automobiles. The Act sets average fuel economy standards for each manufacturer's fleet of new cars sold in the United States beginning with the 1978 model year. While specific standards are enumerated for the 1978, 1979, 1980, and 1985 model years, the Secretary of Transportation has responsibility for issuing standards for the 1981-1984 model years. These intermediate standards must require maximum feasible average fuel economy levels and must result in steady fuel economy improvements toward the 1985 goal.

To assist in establishing such standards, this report evaluates potential fuel economy improvements during the 1980-1985 time period. After assessing alternative technological and design approaches, a general production implementation scedule was specified for the domestic automobile industry. Based on this schedule, hypothetical rates of introduction and market penetration for specific new designs and technology were established and possible values of fleet average fuel economy for all domestic producers were calculated.

17. Key Words	18. Distribution Statement This document contains p liminary information subject to change. It is an informal technical document for comm ication and dissemination of preliminary i formation at the working level. Distributi of this work is the responsibility of the Project Manager, Automotive Energy Efficie Project.
19. Security Classif. (of this report)	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Test report on a 318 CID engine powered Plymouth Valiant equipped with an experimental multi-mode automatic transmission		5. Report Date November 1976
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address Arthur D. Little, Inc. Cambridge, MA 02140		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. DOT-TSC-1046
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Asst. Sec. for Syst. Dev. and Tech. Office of Systems Engineering Washington DC 20590		13. Type of Report and Period Covered Progress report
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report is part of the "Study and test to confirm automobile drivetrain components to improve fuel economy." A Plymouth Valiant powered by a 318 cubic inch V-8 engine was equipped with an experimental automatie transmission and tested for fuel economy and emissions in accordance with the 1975 EPA test procedures. The test results indicate that the fuel economy of this vehicle can be improved by as much as 14% (composite cycle) without oushing emissions beyond the realm of control. This fuel economy gain was concurrent with a decrease in NOx emissions of 11%.

Key Words automobile, transmission, fuel economy, emissions		18. Distribution Statement THIS DOCUMENT CONTAINS PRELIMINARY INFORMATION SUBJECT TO CHANGE. IT IS CONSIDERED AN INTERNAL TSC WORKING PAPER WITH A SELECT DISTRIBUTION. IT IS NOT A FORMAL REFERABLE REPORT. DISTRIBUTION IS EFFECTED BY AND IS THE RESPONSIBILITY OF THE TSC PROJECT MANAGER.	
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REPORTS TO THE CONGRESS

Reports to which the DOT Transportation Systems Center, Automotive Energy Efficiency Project made substantial contributions. These reports, however, are not solely the work of TSC.

Technical Report Documentation Page

1. Report No. DOT-TSC-OST-75-9	2. Government Accession No. PB 241 770	3. Recipient's Catalog No.
4. Title and Subtitle POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT: Report to the Congress		5. Report Date October 1974
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No. DOT-TSC-OST-75-9
9. Performing Organization Name and Address U.S. Department of Transportation 400 7th St. S.W. Washington DC 20590 / U.S. Environmental Protection Agency 401 M St. S.W. Washington DC 20460		10. Work Unit No. (TRAIS) OS514/R5515
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Senate Committee on Commerce Washington DC 20510 / U.S. House of Representatives House Interstate and Foreign Commerce Committee Washington DC 20515		13. Type of Report and Period Covered Special Congressional Report June-October 1974
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report, prepared in compliance with Section 10 of the Energy Supply and Environmental Coordination Act of 1974, P.L. 93-319 (the Act), addresses the potential for fuel economy improvement for new motor vehicles. The Act directed the Administrator of the Environmental Protection Agency (EPA) and the Secretary of the Department of Transportation (DOT) to conduct jointly a study and report on the practicability of a fuel economy improvement standard of 20% for new motor vehicles in the 1980 time frame.

As required by Section 10 of the Act, the information on fuel economy improvement potential presented in this report includes an assessment of the technological problems of meeting any such standard, including lead times involved, the test procedures required to determine compliance, the economic costs and benefits, the enforcement means, the effect on energy and other resources, and the relationship of safety and emission standards.

17. Key Words Fuel Economy Improvement Technology Advanced to Improve Fuel Economy Fuel Economy Standards	18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-10	PB-241 771	

4. Title and Subtitle	5. Report Date
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT: Policy Assessment Panel Report	January 1975
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No. DOT-TSC-OST-75-10
9. Performing Organization Name and Address US Department of Transportation 400 7th St. SW Washington, DC 20590 US Environmental Protection Agency 401 M St. SW Washington, DC 20460	10. Work Unit No. (TRAIS) OS514/R5515
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address US Senate Committee of Commerce Washington, DC 20510 US House of Representatives House Interstate and Foreign Commerce Committee Washington, DC 20515	13. Type of Report and Period Covered Special Congressional Report June-October 1974
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Policy Assessment Panel Report is Report Number One (1) of seven (7) panel reports prepared by special panels of a task force established under joint chairmanship of the US Dept. of Transportation and the US Environmental Protection Agency to conduct a study of the practicability of a 20% fuel economy improvement for new motor vehicles in the 1980 time frame. Materials developed by the various study panels were used in preparing the Report to the Congress entitled "Potential for Motor Vehicle Fuel Economy Improvement" dated 24 October 1974 (second printing 18 November 1974).

This panel report selects eight specific fuel economy improvement strategies which fall into the broad categories of new car fuel economy labeling, government established and enforced fuel economy standards and vehicle taxation to dissuade purchases of new automobiles with poor fuel econlmy. The strategies are evaluated on the basis of their impact on consumers, producers and government administration. The report concludes that none of the strategies is clearly preferable over all the others. Each has its strength and weakness.

17. Key Words	18. Distribution Statement
Automobile Fuel Economy Policy Automobile Fuel Economy Labeling Automobile Fuel Economy Standards Automobile Fuel Economy Taxation	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	96	$5.00

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-11	PB-241 772	

4. Title and Subtitle	5. Report Date
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT: Safety Implications Panel Report	January 1975
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No. DOT-TSC-OST-75-11
9. Performing Organization Name and Address US Department of Transportation 400 7th St. SW Washington, DC 20590 US Environmental Protection Agency 401 M St. SW Washington, DC 20460	10. Work Unit No. (TRAIS) OS514/R5515
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address US Senate Committee on Commerce Washington DC 20510 US House of Representatives House Interstate and Foreign Commerce Committee Washington, DC 20515	13. Type of Report and Period Covered Special Congressional Report June-October 1974
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Safety Implications Panel Report is Number Two (2) of a group of seven(7) prepared by special panels of the Task Force established under the joint chairmanship of DOT and EPA to conduct a study of the practicability of a fuel economy improvement standard of 20% for new motor vehicles produced in the 1980 time frame.

This panel report contains four individual analyses related to the safety impact of increased small car usage and automobile weight reductions to improve fuel economy.

1. Fuel economy as a function of weight, performance, and driving schedule.

2. Traffic control for safety and fuel economy.

3. Weight versus safety.

4. Effects of speed limits on fuel economy and safety.

17. Key Words	18. Distribution Statement
Fuel Economy vs. Safety Safety Impact of Increased Small Car Usage	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		

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-12	PB-241 773	

4. Title and Subtitle	5. Report Date
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT: Air Quality and Emissions Panel Report	January 1975
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No. DOT-TSC-OST-75-12
9. Performing Organization Name and Address US Department of Transportation 400 7th St. SW Washington, DC 20590 US Environmental Protection Agency 401 M St. SW Washington, DC 20460	10. Work Unit No. (TRAIS) OS514/R5515 11. Contract or Grant No.
12. Sponsoring Agency Name and Address US Senate Committee on Commerce Washington, DC 20510 US House of Representatives House Interstate and Foreign Commerce Committee Washington, DC 20515	13. Type of Report and Period Covered Special Congressional Report June-October 1974 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Air Quality and Emissions Panel Report is No. 3 of a group of seven (7) prepared by special panels of the Task Force established under the joint chairmanship of DOT and EPA to conduct a study of the practicability of a fuel economy improvement standard of 20% for new motor vehicles produced in the 1980 time frame.

The report describes the factors which affect air quality, i.e., number and kind of stationary emission sources, the motor vehicle fleet mix and number of vehicle miles traveled by each class of vehicle, etc., and then by using a simple methodology described in the text, draws some conclusions on the effect various fuel economy strategies will have on air quality.

17. Key Words	18. Distribution Statement
Air Quality Automobile Emissions Emission Standards	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22151

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

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-13	PB 241 774	

4. Title and Subtitle	5. Report Date
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT: Technology Panel Report	January 1975
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No. DOT-TSC-OST-75-13
9. Performing Organization Name and Address U.S. Department of Transportation, 400 7th St. S.W., Washington DC 20590 U.S. Environmental Protection Agency, 401 M St. S.W., Washington DC 20460	10. Work Unit No. OS514/R5515 11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Senate, Committee of Commerce, Washington DC 20510 U.S. House of Representatives, House Interstate and Foreign Commerce Committee, Washington DC 20515	13. Type of Report and Period Covered Special Congressional Report June - October 1974 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Technology Panel Report is report Number Four (4) of seven (7) panel reports prepared by special panels of a task force established under joint chairmanship of the U.S. Dept. of Transportation and the U.S. Environmental Protection Agency to conduct a study of the practicability of a 20% fuel economy improvement for new motor vehicles in the 1980 time frame. Materials developed by the various study panels were used in preparing the Report to Congress entitled "Potential for Motor Vehicle Fuel Economy Improvement" dated 24 October 1974 (second printing 18 November 1974).

The authors evaluate individual technologies which could produce improved automobile fuel economy in the areas of vehicle improvement (reduced weight and aerodynamic drag), transmission improvement, engine improvements and reduced performance acceleration. Potential 1980 fuel savings are estimated for each of these technologies. The more promising of these technologies are then combined in several different configurations to produce estimates of potential automobile fuel savings possible by 1980.

The authors conclude that the domestic automobile manufacturers could increase their sales weighted automobile fuel economy by more than 30% by 1980. The manufacturers of foreign imports which are more fuel efficient than domestic automobiles could meet a 20% improvement but could not meet a 30% improvement goal by 1980.

17. Key Words	18. Distribution Statement
1980 Automobile Fuel Economy Technologies for Improved Auto Fuel Economy	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.
Unclassified	Unclassified	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-14	PB-241 775	

4. Title and Subtitle	5. Report Date
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT: Economics Panel Report	January 1975
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No. DOT-TSC-OST-75-14
9. Performing Organization Name and Address US Department of Transportation 400 7th St. SW Washington, DC 20590 US Environmental Protection Agency 401 M St. SW Washington, DC 20460	10. Work Unit No. (TRAIS) OS514/R5515 11. Contract or Grant No.
12. Sponsoring Agency Name and Address US Senate Committee on Commerce Washington, DC 20510 US House of Representatives House Interstate and Foreign Commerce Committee Washington, DC 20515	13. Type of Report and Period Covered Special Congressional Report June-October 1974 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Economics Panel Report is Number Five (5) of a group of seven (7) prepared by special panels of the Task Force established under the joint chairmanship of DOT and EPA to conduct a study of the practicability of a fuel economy improvement standard of 20% for new motor vehicles produced in the 1980 time frame.

This report analyses the economic effects automobile fuel economy improvement will have on the automobile industry, the American consumer, and the US economy in general. Some specific conclusions are that

1. Consumers will generally experience savings on fuel and maintenance expenditures which more than offest the increases in car prices due to the fuel economy improvements.

2. Automobile sales are expected to increase in the 1970's and 1980's although the rate of increase is expected to be slower than in the past, with a shift back towards standard-size cars.

3. Petroleum savings could range from 0.9 to 1.5 million bbl/day by 1980, from 1.6 to 3.0 by 1985 and from 1.9 to 4.0 by 1990.

17. Key Words	18. Distribution Statement
Economic Impacts of Fuel Economy Improvements Automobile Industry Impacts	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	37	$4.00

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
OT-TSC-OST-75-15	PB-241 776	

4. Title and Subtitle	5. Report Date
TUDY POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY MPROVEMENT: Fuel Economy Test Procedures Panel Report	January 1975
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No. DOT-TSC-OST-75-15
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
S Department of Transportation 00 7th St. SW ashington, DC 20590 US Environmental Protection Agency 401 M St. SW Washington, DC 20460	OS514/R5515
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
S Senate ommittee on Commerce ashington DC 20510 US House of Representatives House Interstate and Foreign Commerce Committee Washington, DC 20515	Special Congressional Report June-October 1974
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Fuel Economy and Test Procedures Panel Report is No. 6 of a group of seven 7) prepared by special panels of the Task Force established under the joint hairmanship of DOT and EPA to conduct a study of the practicability of a fuel conomy improvement standard of 20% for new motor vehicles produced in the 1980 time rame.

This report presents the test procedures recommended for insuring compliance with uel economy regulations. Discussions included are: (a) driving variables pertinent o the establishment of a meaningful, reproducible test methodology; (b) test and easurement methods which are applicable to fuel economy certification tests; (c) urrent test procedures in use by industry and the federal governemtn, and (d) ecommendations for a standardized Federal Test Procedure.

The recommendation is that federally conducted fuel economy tests for labeling nd/or certification be performed on a chassis dynamometer using two driving chedules - city and highway.

17. Key Words	18. Distribution Statement
uel Economy Test Procedures riving Schedules uel Consumption Measurement	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
nclassified	Unclassified		

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Technical Report Documentation Pag

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-75-16	PB-241 777	

4. Title and Subtitle	5. Report Date
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT: Truck and Bus Panel Report	January 1975
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No. DOT-TSC-OST-75-16
9. Performing Organization Name and Address US Department of Transportation 400 7th St. SW Washington, DC 20590 US Environmental Protection Agency 401 M St. SW Washington, DC 20515	10. Work Unit No. (TRAIS) OS514/R5515 11. Contract or Grant No.
12. Sponsoring Agency Name and Address US Senate Committee on Commerce Washington, DC 20510 US House of Representatives House Interstate and Foreign Commerce Committee Washington, DC 20515	13. Type of Report and Period Covered Special Congressional Report June-October 1974 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Truck and Bus Panel Report is Number Seven (7) of a group of seven (7) prepared by special panels of the Task Force established under the joint chairmanship of DOT and EPA to conduct a study of the practibility of a fuel economy improvement standard of 20% for new motor vehicles produced in the 1980 time frame.

Special consideration is given in this report to the potential improvement of truck and bus fuel economy implementable by the 1980 production year. Vehicles considered in the section are those with gross vehicle weight ratings of 10,000 pounds or more. This group of vehicles presently consumes an estimated 18% of all highway fuel, but the technologies and production facilities involved in efforts to improve the fuel consumption of this category of vehicles are quite different from those of the automobile.

Analyses of available data indicate fuel economy improvements for some individual trucks can be as great as 41% by the 1980 production year. Assessment of such technology applied without cost or production capacity restraint would yield an aggregate reduction of 25% in the fuel consumed by the new trucks and buses manufactured in 1980.

17. Key Words	18. Distribution Statement
Truck Fuel Economy Bus Fuel Economy Fuel Economy; Technology Assessment	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
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Automotive Energy Efficiency Program Status Report: a report to the Appropriations Committee of the House of Representatives		5. Report Date December 31, 1974
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. House of Representatives. Committee on Appropriations Washington, D.C.		13. Type of Report and Period Covered
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report on the Automotive Energy Efficiency Program (AEEP) of the Department of Transportation (DOT) summarizes the direction, progress, results, and application fo studies completed or underway and the future plans of the program. AEEP is the Federal Government's principal program to assess the capability of the automotive industry to increase significantly the fuel economy of their production vehicles over the coming years and to assess the national effects of modification of the vehicle fleet in terms of safety, costs, emissions, and energy usage. It supports the Department's goal of improving the energy efficiency of the national transportation systems while meeting the mobility needs of the people. It does so by providing factual data and objective analyses relevant to fuel economy. Under AEEP the Department has established significant expertise on the characteristics of potential fuel saving vehicular components, on the effects on vehicular components of the use of fuel saving components, on fuel economy measurement procedures, on automotive manufacturing processes and capacity for change, on the economic, emissions, and safety effects of vehicles with improved fuel economy, and on the demand for automobiles of various kinds. The main application of the results of the AEEP is in the concust of policy analyses and development of positions on aspects of the motor vehicle fuel economy issue by the Department and by other agencies and groups.

17. Key Words	18. Distribution Statement		
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Report by the Federal Task Force on Motor Vehicle Goals beyond 1980.		5. Report Date September 2, 1976 6. Performing Organization Code
7. Author(s) Hamilton Herman, task force manager		8. Performing Organization Report No.
9. Performing Organization Name and Address U.S. Department of Transportation U.S. Environmental Protection Agency U.S. Energy Research and Development Administration U.S. Federal Energy Administration*		10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Energy Resources Council		13. Type of Report and Period Covered Report to the Energy Resources Council. DRAFT 14. Sponsoring Agency Code

15. Supplementary Notes

* and U.S. National Science Foundation

16. Abstract

In view of the Nation's long range need to conserve energy nad the fact that the motor vehicle fleet is the largest single user of our decreasing petroleum supplies, the Energy Resources Council established a Federal Task Force to study motor vehicle fuel economy goals beyond 1980. These goals were to be compatible with environmental, safety, and economic objectives.

Relative to a baseline of 1975 automobile characteristics (new car size mix, fuel economy, safety, and emissions, etc) projected without change into the future and accounting for the expected growth in vehicle miles traveled, the Task Force concluded that, with substantial industry effort, investment, and risk, coupled with a reasonable approach to government regulation, the United States can acheive the following reasonable goals:

1. 40-50% reduction in projected automobile fuel consumption by 1995
2. 80-100% improvement in new-car fleet fuel economy with the current automobile of 4, 5, and 6 passenger cars.
3. Substantial reductions in auto deaths and injuries
4. Continuing improvement in ambient air quality
5. Savings in the cost of automotive transportation
6. Substantial savings in material resources

The value of the potential auto fuel savings exceeds the cost of the capital investment necessary to obtain these savings.

17. Key Words	18. Distribution Statement
automobiles, fuel economy, emissions	Draft available for public comment.

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

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Automotive Design Analysis: report of a panel of the Interagency Task Force on Motor Vehicle Goals Beyond 1980		5. Report Date August 1976 6. Performing Organization Code
7. Author(s) R.L. Strombotne, chairman		8. Performing Organization Report No.
9. Performing Organization Name and Address Interagency Task Force on Motor Vehicle Goals Beyond 1980. Automotive Design Analysis Panel		10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Energy Research and Development Administration, Environmental Protection Agency, Department of Transportation, Federal Energy Administration, and National Science Foundation		13. Type of Report and Period Covered Interim report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report deals with the technological and engineering aspects of automobile design. The analysis relates the user-established requirements of auto size/roominess and performance/acceleration, the federally-established emission and safety requirements, and representative technological options available to automobile manufaturers, to automobile weight, materials and fuel economy potentially achievable in the 1980's. The anticipated results of continued research are projected for that time. It analyses the complex interactions of these attributes and discusses automobile design characteristics necessary to meet the user and federally mandated requirements.

The panel concludes that, within an uncertainty band of a few miles per gallon due to the impact of still unsettled emission and safety requirements, the new car fleet average fuel economy can be increased by up to 100 per cent from current levels without changes in current fleet mix and without changes in the passenger or baggage volume, given sufficient time and efforts to accomplish the necessary development.

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16. Abstract

This is the report of the Automotive Manufacturing and Maintenence Panel whose task was to develop an understanding of the U.S. automotive manufacturing industry in terms of its methods of operation, its methods of manufacturing, its manufacturing capacities, its capital requirements, its costs, and its limitations In addition, the Panel made analyses to determine the labor, materials, energy content, leadtime, capital requirements and the manufacturing and maintenence costs of selected vehicle configurations. The vehicle configurations are provided by the Automotive Design Panel and are selected on the basis of specific fuel efficiency, safety, damageability, noise, and emissions characteristics. Panel outputs in terms of automotive manufacturing and maintenence costs and resource requirements(i.e., labor, materials, and capital) are submitted to other appropriate panels to enable them to perform their tasks.

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CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

REPORT NUMBER INDEX

SUBJECT INDEX