ENERGY FACTS
FOR
1975
TRANSPORTATION
DECISIONS

Published by

Texas Good Roads/Transportation Association

310 Vaughn Building
Austin, Texas 78701

Introduction

1975 will be a year in which individual citizens and public officials will be called upon to make decisions for providing adequate transportation facilities for Texas. Some of these decisions will be short term and will have an immediate effect. Others will not come to fruition for ten to twenty years.

Municipal and county officials, members of the Texas Legislature and other state officials, and members of the U. S. Congress will all be called upon to weigh the facts and chart the course for meeting our future transportation needs.

Energy efficiency of the various transportation modes must be considered in making the decisions. TGR/TA is publishing this information so the decisions can be made on the basis of fact.

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SUMMARY

Public officials and legislators called on to recommend transportation facilities for Texas must weigh the energy efficiency, costs and convenience of available modes. The habits and established preferences of the public are important considerations, but eventually the choice must be made and defended on a basis of factual information. The material presented herewith is considered reliable and authentic.

Texas is traditionally tuned to highway transportation. Urban congestion has so complicated highway traffic problems, however, that even highway people now grant that public transportation must be improved to maintain mobility. The traffic volume is already imposing problems on the highway system and threatens to be over four times as heavy by the year 2000.

Energy Efficiency

A recent study by Alan M. Voorhees & Associates, Inc., compared energy efficiencies for several basic types of transport modes, with emphasis on urban transportation. The article "Comparison of Efficiencies", reprinted from The Highway User Quarterly reports findings of Voorhees in terms of vehicle fuel economy, vehicle economy of the various urban modes, and passenger miles per gallon of gasoline considering vehicle occupancy. Voorhees found that the ordinary diesel-powered local bus is as energy efficient as America's most highly touted rapid rail systems in city operations -- and two to three times as efficient in the suburbs.

The logical conclusion, the Voorhees report says, is that improved modern buses "may provide the key to mass transit of the future." Even in New York (called "the exception to every transportation rule") city buses perform nearly as well as rail. (The Voorhees researchers point out that no other city even approaches New York's population density — which this study shows is one of the key factors in transportation systems, especially fixed rail.)

Factors Affecting Energy Demand

The Voorhees firm pinpointed a number of factors affecting transportation efficiency. The largest single factor was <u>weight</u> of the car.

Engine <u>design</u> was another major factor affecting fuel economy. (Electrically powered cars have the major advantage of conserving petroleum supplies and reducing emissions, and are often referred to as "the urban car of the future." Batteries that provide adequate driving range must be developed.)

<u>Changing speed</u> wastes up to 40% of energy in urban driving.

<u>Emission control</u> devices, air conditioning and automatic transmissions reduce fuel efficiency.

Better <u>driving habits</u> and vehicle maintenance can improve fuel usage.

Better roads save gasoline, Voorhees reports, thus verifying claims of The Road Information Program. On the otherhand, broken or patched pavement increases gasoline consumption by 20% for 30 mph traffic. Crowded freeways and streets are similarly costly; a congested downtown street can cause a 200% increase in fuel use.

Car users switching to mass transit would save less than 4% on fuel, even if present transit systems were used to their maximum capacity.

Highways Offer Fuel Savings

Improved new cars traveling at reduced speeds would provide the best way to save transportation fuel, according to an unpublished U.S. Department of Transportation report. Better engineered cars would cost the industry an estimated $10 billion over a 20-year period.

Carpooling offers a 13.9% energy saving within two years without adding appreciable cost. This approach, however, may not be realistic, as drivers tend to resist carpooling efforts. It would take "severe" travel restrictions to get more than a fourth of present "loners" to carpool.

The "ultimate" savings in energy from a switch of passengers from automobiles to urban transit (either rail or bus) is only 1.8%, according to the DOT report. More efficient automobiles operated at lower speed and coupled with carpooling would save 36.8%.

Shifting passengers and freight from automobiles, buses and trucks to trains and other mass transit would make a total saving of 8.1% at an investment cost of $29.2 billion over 15 years.

Travel Needs Best Met by Cars, Trucks

The Federal Bureau of the Census compiled statistics for the 125 largest metropolitan areas, to determine where people live in relation to their jobs. It was found that only 18% of the work force commute to jobs in the city from outlying residential areas.

These travel mode-use statistics coincide with U.S. Commerce Department figures showing that over 80% of all work trips are by passenger car or truck. According to the U.S. Department of Transportation figures, 91% of all trips made by Americans, to any destination for any purpose, are by private transportation.

Advantages of Bus Shown

A DOT report, "Evaluation of Rail Rapid Transit and Express Bus Service in the Urban Commuter Market" (done by a private firm), showed that transit trips mostly by rail cost more, pollute more and use more energy than those exclusively by bus.

Total trip costs were approximately twice as great for rail as for bus. The diesel bus was clearly superior to the combination of rail and bus-wagon (used as a collector) on pollution grounds.

The conclusion: "Based on our comparison of the full costs of rail and express bus systems, it seems difficult indeed to justify new rail systems."

'Trucks, Trains and Truth'

The Department of Research and Transport Economics of the American Trucking Associations, Inc., goes into elaborate details to "debunk the rail energy efficiency myth" raised by a U.S. DOT news release and "a clever bit of deception" in railroad advertising. The conclusion is that Shipper Surveys conducted by the U.S. Bureau of the Census. . ."show quite convincingly that intercity transportation is now rationally divided between trucks and railroads on the basis of size of shipment and length of haul." Shipments weighing less than 30,000 pounds and traveling less than 300 miles are predominately by truck; heavier shipments traveling longer distances go by rail 55% to 62% of the time.

"Optimum transportation energy efficiency will only be realized when each form of transport is allowed to improve the efficiency with which it performs those transportation services it can handle best," the statement concludes.

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The last three pages of this "Energy Facts" booklet reprint: Finding of the TGRA Urban Mass Transit Committee, as approved by the Executive Committee; a policy statement of the Better Roads & Transportation Council, of which TGRA's Gene Robbins is president, and an "Urban Transportation Perspective" discussing a new approach to the Dallas-Fort Worth Regional Airport.

It should be noted that out of the Urban Mass Transit Advisory Council report grew a Texas Good Roads membership action renaming that venerable group "the Texas Good Roads/Transportation Association." The approved statement recommended that TGRA "broaden its scope of interest" and support mass transportation as well as highways. Establishment of a state department responsible for the development of both modes "cooperatively and to their optimum potential" were also favored.

Contents

Comparison of Efficiencies

By John H. Jennrich
Writer/Editor
Highway Users Federation

One of the hottest topics in the past year has been energy—or, more appropriately, the lack of it.

Citizens throughout the nation have been asked to conserve energy—in their homes, offices and in one of the most vital factors of modern society: transportation.

Studies show that one of the major uses of energy is to move people. This is true now and will become increasingly important in the future.

Because of this, measurements and comparisons of alternative transportation systems are crucial to sound planning for the future. If system A costs the same as system B, but uses half as much energy, why not go with system A? Or, conversely, if the two (or more) systems are about the same in energy consumption, but one costs considerably less than the others, why not go with the less expensive system?

To provide the facts to answer some of these questions, researchers at Alan M. Voorhees & Associates, Inc. compared energy efficiencies for several basic types of transport modes. While the major emphasis was on urban transportation, efficiencies of intercity travel were also summarized for comparison.

COMPARISON MEASURES

Comparing energy sources—coal and gasoline, for example—is a little like comparing apples and oranges, until you realize that apples and oranges are compared everyday in terms of their calories or energy-producing units.

Same thing with coal and oil. Voorhees researchers converted coal and petroleum products into British Thermal Units (BTUs), then converted that back to an equivalent gallon of gasoline, which contains 125,000 BTUs. This allows vehicle efficiency to be expressed in terms of fuel economy, or miles per gallon of gasoline.

Besides gasoline, the two other energy sources commonly used for personal transportation are diesel fuel and electricity, more than 90 percent of which is produced by coal, oil or natural gas. For this study, diesel fuel, which has an energy content of 138,000 BTUs per gallon, was converted to equivalent gallons of gasoline by applying a factor of 1.11. Electrical power loses two-thirds of its energy in the conversion process and transmission lines, so a factor of 0.33 was applied to account for these losses in efficiency of the vehicle system.

But vehicle economy is only one part of the equation. The other part is actual use of the transportation system, which may be expressed in terms of passenger miles per vehicle mile.

Combining vehicle economy with system use produces a comparison measure expressed in terms of passenger miles per gallon (pm/g). This measure is the crux of the Voorhees study comparisons.

VEHICLE FUEL EFFICIENCY

One common assumption, the Voorhees researchers said, was that electrically powered vehicles are more energy efficient than gasoline or diesel powered vehicles.

Not so, they found out. The efficiencies in terms of propulsion per unit of energy consumed by these systems are about equal-approximately 15 percent. The principal difference is the point where energy losses occur.

For the automobile, energy losses occur within the engine; for electrically powered vehicles, most of the energy losses take place at the electrical generating plant and in electrical distribution lines.

With conventional ground vehicles, weight of the vehicle and operating conditions of the system, such as speed and frequency of stops, primarily de-

VEHICLE FUEL ECONOMY

	ANNUAL VEHICLE MILES (BILLIONS)	ANNUAL FUEL UNITS (BILLIONS)	ANNUAL EQUIVALENT GALLONS OF GAS (BILLIONS)	FUEL ECONOMY MILES/GALLON OF GASOLINE
PASSENGER CAR	986.4	73.12 gal gas	73.12	13.5
Urban	519.0		43.30	12.0
Rural	467.0		29.80	15.7
Standard				11.1
Compact				21.7
Standard, urban				9.9
Standard, rural				12.9
Compact, urban				19.3
Compact, rural				25.2
TAXI				9.0
DIAL-A-BUS				5.2
NYC SUBWAY	0.3727	2.062 KWH	0.171	2.2
TRANSIT BUS	1.47	0.314 gal diesel 0.030 gal gas	0.379	3.9
BART				5.5 KWH/Mi = 2.2 mpg
EXPRESS BUS				4.4 mpg (diesel) =4.0 mpg (gasoline)
VAN (POOL)				10.0
INTERCITY BUS	1.280	0.186 gal diesel 0.031 gal gas	0.237	5.4

Vehicle fuel economies were determined from basic operating data in terms of vehicle miles of travel and fuel consumption. Economies were estimated for new systems and those with incomplete data. Heavier vehicles are generally used for rail systems; therefore, rail vehicles are generally less efficient than buses in fuel used per seat mile.

termine vehicle efficiency. Because heavier vehicles are generally used for rail systems, rail vehicles are generally less efficient than buses in terms of energy consumed per seat mile.

VEHICLE OCCUPANCY

The Voorhees consultants found that if mass transit is going to be efficient, it must not only have efficient vehicles, but they must be heavily used. Vehicle usage is measured on the basis of passenger miles of travel divided by vehicle miles required to provide the service, including vehicle recirculation requirements. This recirculation —or deadheading—means that average transit occupancy, bus or rail, is only about one-fourth of what it appears to be at its peak usage. In spite of this, mass transit is at its most efficient during peak usage. Conversely, one characteristic of automobile use is that occupancy reaches its lowest levels during peak hour periods.

COMPARISON OF URBAN MODES

Bus and rail systems get about the same energy efficien-

VEHICLE OCCUPANCY
(Passenger Miles per Vehicle Mile)

MODE	Occupancy		
	ALL DAY AVERAGE	PEAK HOUR	PRACTICAL MAXIMUM
PASSENGER CAR	2.2	1.6	3.5
Work Trip		1.6	
Intercity Trip	2.9		
TAXI	1.0	2.0	3.0
DIAL-A-BUS (Haddonfield)	1.1	2.5	4.4
DIAL-A-BUS (Prototypical)	2.0	3.0	5.0
BUS TRANSIT[a]	9.0	18.0	25.0
300,000 population	6.0	12.0	20.0
3,000,000 population	12.0	24.0	30.0
NYC SUBWAY	23.5	50.0	60.0
CHICAGO SUBWAY	15.3	32.0	40.0
BART[b]	21.1	40.0	50.0
SHIRLEY HIGHWAY EXPRESS BUS	13.7	16.4	20.0
VAN POOL, 3M	n.a.	9.2	10.0
VAN POOL (Prototypical)	n.a.	7.0	10.0
INTERCITY BUS	20.0	n.a.	30.0

[a]Based upon review of published data and analysis of load count studies conducted by Alan M. Voorhees & Associates, Inc.

[b]Based upon 1975 projected ridership.

Unlike public transportation modes which achieve maximum occupancy during rush hours, automobile occupancy reaches its lowest value during the peak periods. This characteristic creates the need for public facilities.

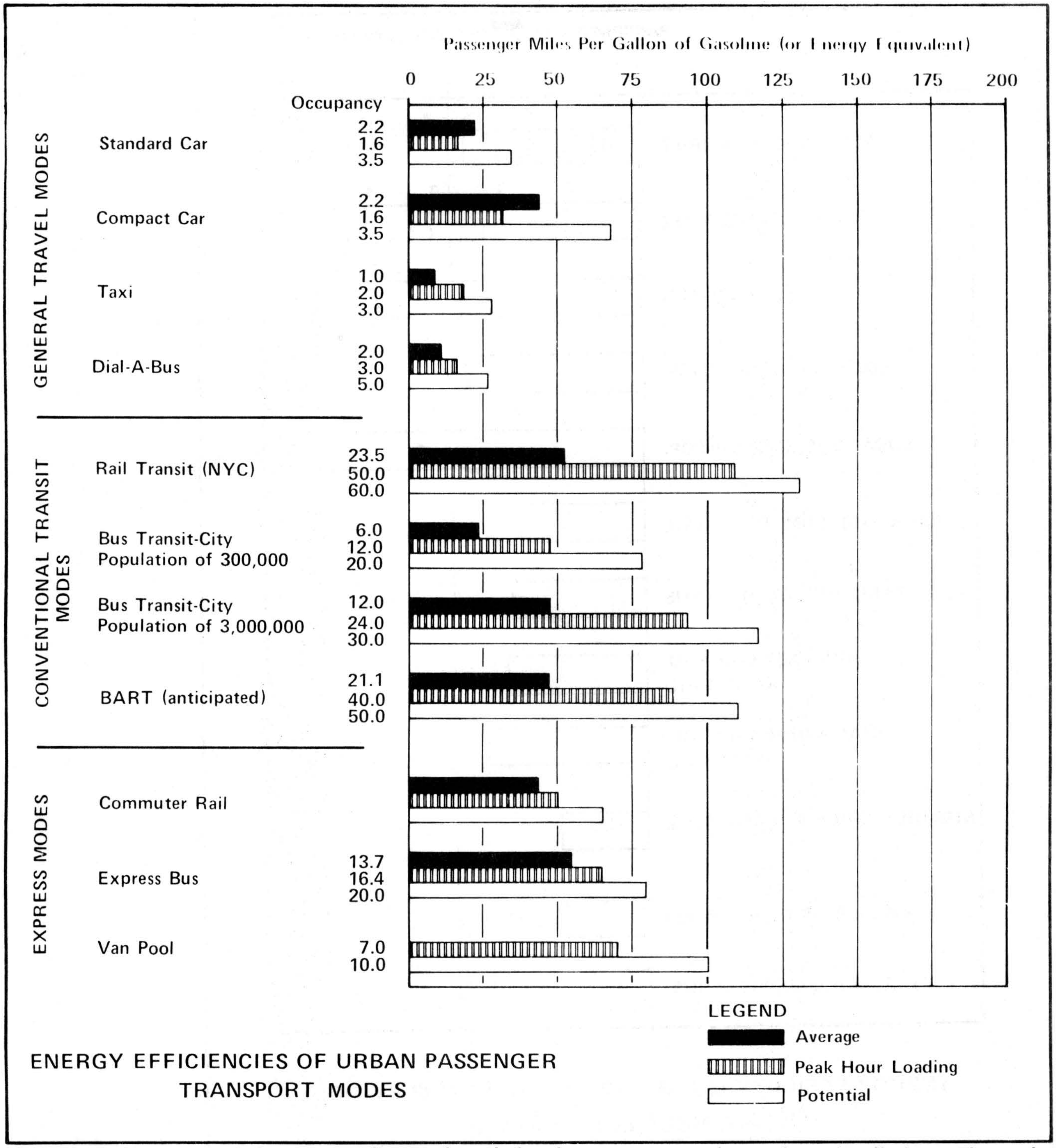
cies for major cities, the Voorhees researchers found. But transit efficiency goes down with reduced size and density of cities because of lower average occupancies. This affects bus transit only, of course, because smaller cities simply don't use rail transit.

Commuter-oriented transit modes, because they're geared to the higher occupancy rates of peak-hour work trips, have relatively high energy efficiency rates. Commuter rail systems, which have for many years served suburban work trips to central cities in several of the larger metro areas, have an efficiency value of 43.6 pm/g. The Shirley Express Bus System going from Northern Virginia to

ENERGY EFFICIENCIES OF URBAN MODES

	VEHICLE FUEL ECONOMY (mpg)	Occupancy Passenger Miles/Vehicle Mile			Energy Efficiency Passenger Miles/Gallon		
		ALL DAY AVERAGE	PEAK HOUR	PRACTICAL MAXIMUM	ALL DAY AVERAGE	PEAK	PRACTICAL MAXIMUM
GENERAL TRAVEL MODES							
Passenger Car	12.00	2.2	1.6	3.5	26.4	19.2	42.0
Standard	9.86	2.2	1.6	3.5	21.7	15.8	34.5
Compact	19.31	2.2	1.6	3.5	42.5	30.9	67.6
Taxi	9.00	1.0	2.0	3.0	9.0	18.0	27.0
Dial-a-Bus	5.20	2.0	3.0	5.0	10.4	15.6	26.0
CONVENTIONAL TRANSIT MODES							
Bus Transit (U.S. average)	3.88	9.0	18.0	25.0	34.9	69.8	97.0
300.000 pop.	3.88	6.0	12.0	20.0	23.3	46.6	77.6
3,000,000 pop.	3.88	12.0	24.0	30.0	46.6	93.1	116.4
Rail Transit (NYC)	2.18	23.5	50.0	60.0	51.2	109.0	130.8
BART (anticipated)	2.20	21.1	40.0	50.0	46.4	88.0	110.0
Rail Transit (Chicago)	2.18	15.3	32.0	40.0	31.8	66.5	83.4
EXPRESS TRANSIT MODES							
Commuter Rail					43.6	50.0	65.0
Express Bus	3.95	13.7	16.4	20.0	54.2	64.9	79.2
Van Pool	10.00	n.a.	7.0	10.0	n.a.	70.0	100.0

This chart lists occupancy rates and energy efficiency rates for various urban travel modes according to all-day averages, peak hour performances and practical maximums. In larger cities, conventional bus and rail transit provide similar peak hour energy efficiencies. Lower occupancies reduce transit efficiency in smaller urban areas. Among express transit, the vanpool has an energy efficiency of 70, compared to 64.9 for express bus and 50 for commuter rail.

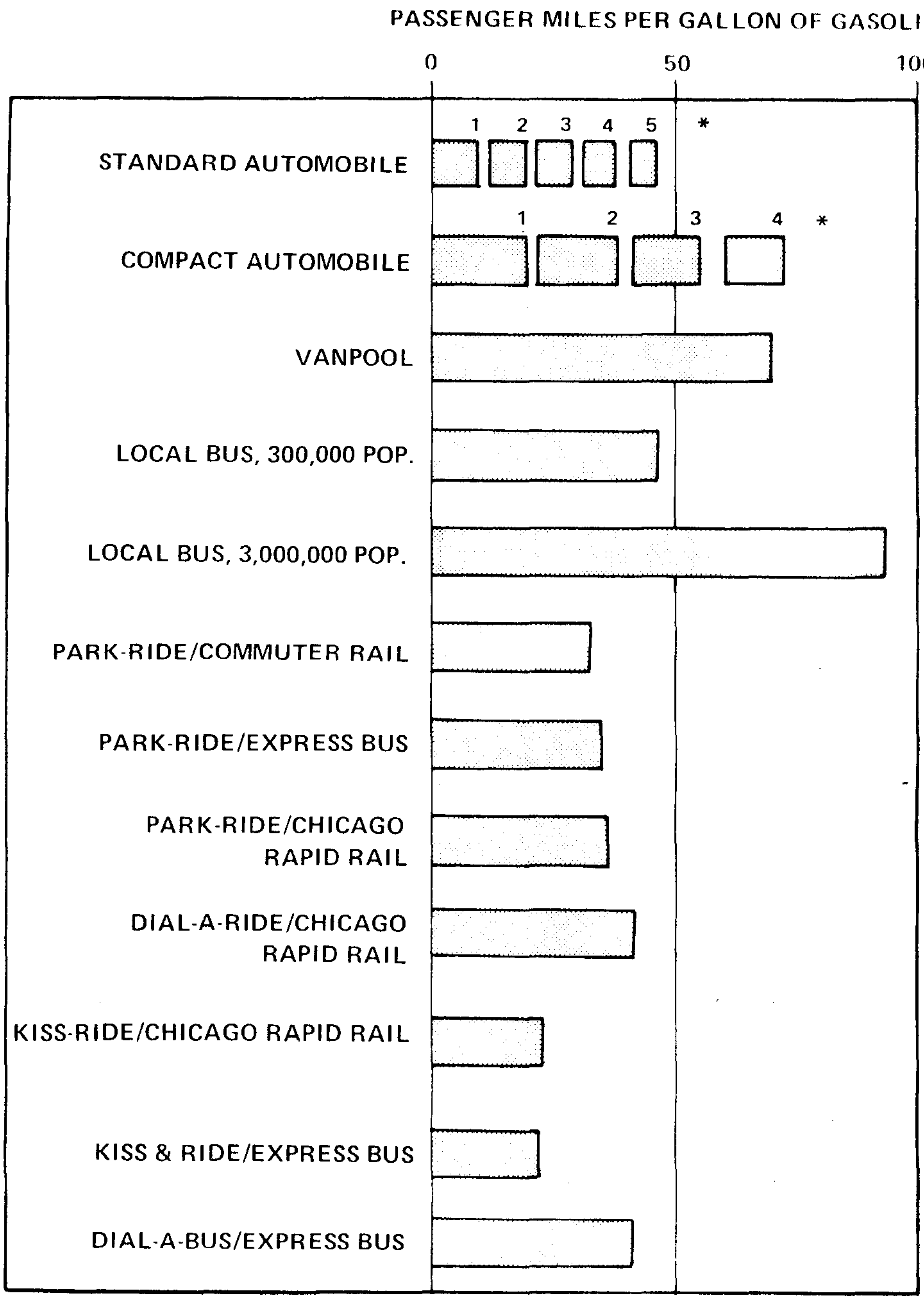


The energy efficiencies of alternative urban modes tabulated on page 14 are depicted graphically here. The modes are arranged to facilitate comparison of modes designed to provide similar services. Except for rail transit in New York City, bus transit in cities of 3 million population is the most efficient on average, peak and potential loadings.

Washington, D.C., has an efficiency value of more than 50.

Work trip pooling with automobiles can achieve energy efficiencies equivalent to those of express transit systems—up to 50 pm/g for a carpool of five occupants. But most carpools have two or three occupants, not five. For an average carpool occupancy of 2.5, the efficiency is only slightly better than that achieved for all purposes in an average automobile, which is 26.4. Vanpools, on the other hand, regularly achieve efficiencies in excess of 70 pm/g.

The importance of vehicle occupancy in determining efficiencies cannot be over-emphasized, the Voorhees consultants

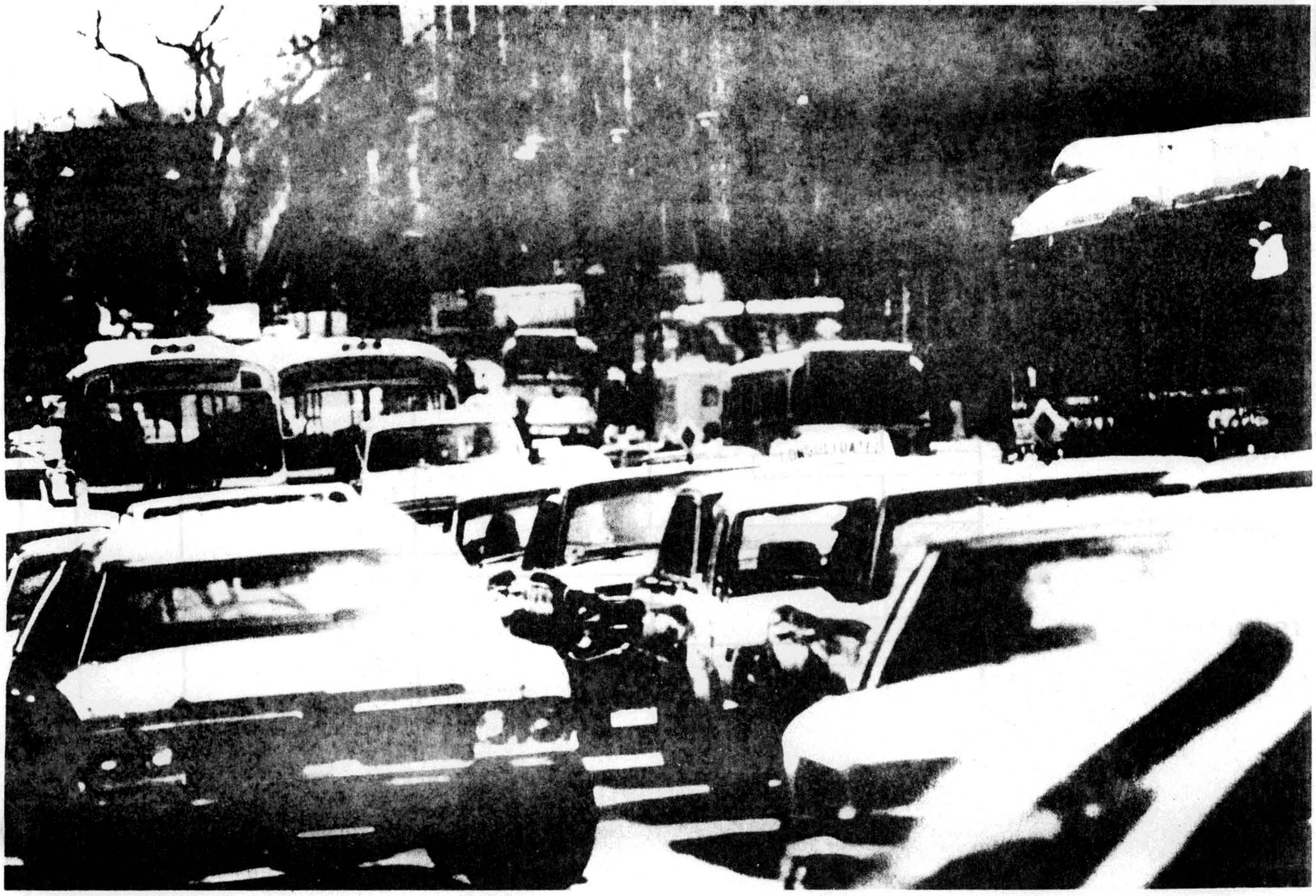


ENERGY EFFICIENCIES OF TYPICAL WORK TRIP BY MODE AND MODE COMBINATION

(10 Mile total trip length; 2 miles access distance to express transit and composite automobile for mode combination trips; peak hour occupancies.)

* Number of passengers

As shown in this bar graph of energy efficiencies for a 10-mile work trip, energy savings would result if workers decided to ride in carpools. The local bus in cities of three million population is by far the most energy efficient, exceeding all forms of rail and express bus. But the vanpool and compact car with four people are strong contenders.



The three types of personal trips are work trips, miscellaneous trips to shopping centers, schools or to the doctor, and pleasure rides or vacations. Work trips account for one-quarter of all trips. They are concentrated in congested areas along transportation corridors during limited periods of time, creating traffic flow and environmental problems.

said. But, they added, it "should be recognized that vehicle usage varies over a wide range, depending upon urban size and form, as well as travel attitudes, characteristics and patterns."

TYPICAL WORK TRIPS

There are three types of personal trips:

1. Work trips. Accounting for about one-quarter of all trips, they tend to be concentrated in centralized, highly developed areas and along transportation corridors. This intense concentration is one of the major transportation problems facing cities —peak hour traffic congestion and the environmental problems associated with this congestion. The Voorhees engineers consider this to be the most important category as far as comparisons and potential improvements are concerned.

2. Miscellaneous trips. These include shopping, personal business, medical trips and so forth. Generally about five miles in length, they have an unfocused, scattered pattern hard to serve by conventional mass transit except in areas of moderate to high density.

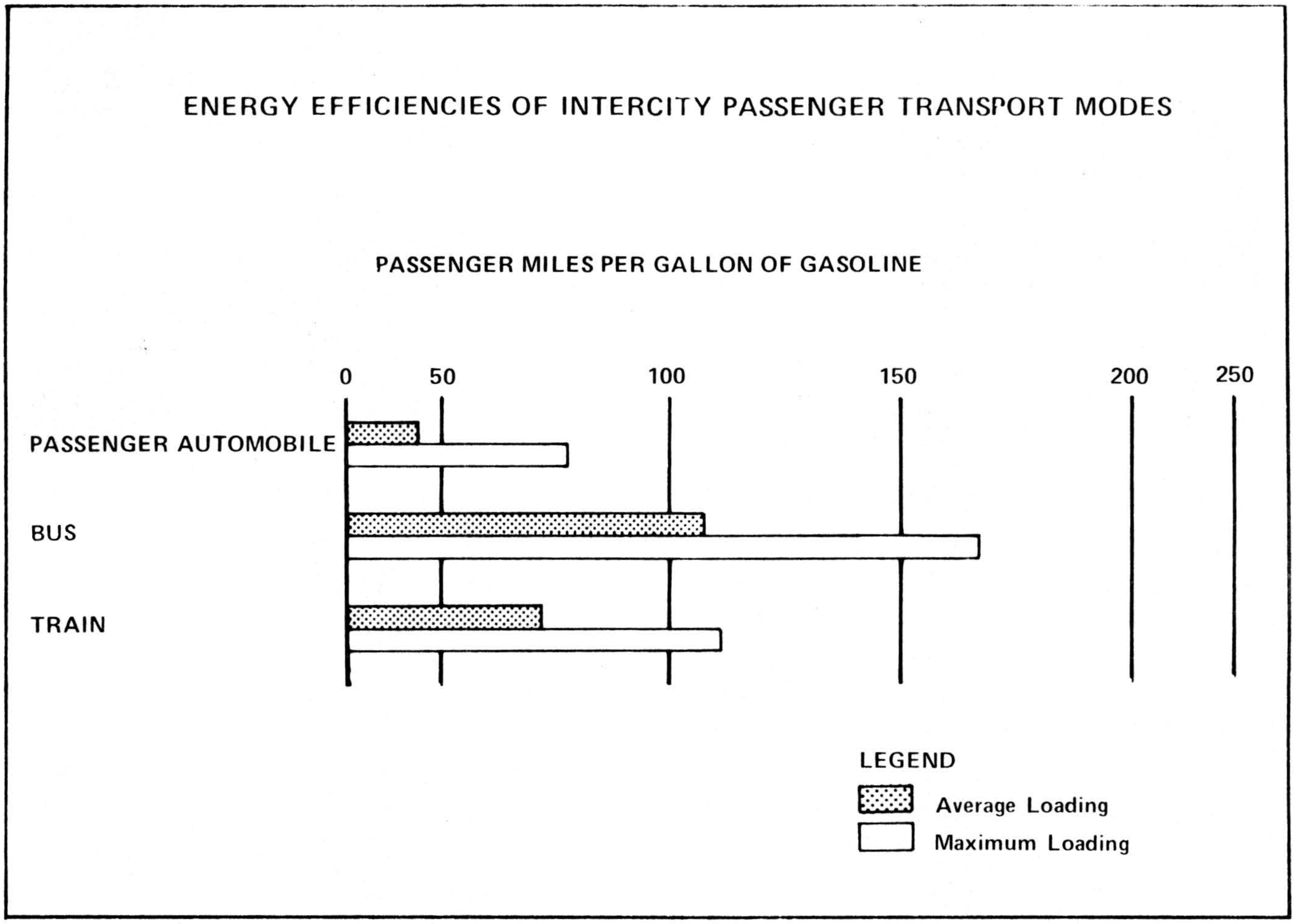
3. Pleasure rides and vacations. These depend on the convenient and inexpensive use of private automobiles and generally do not involve a choice among modes of transportation.

For the work trips, there are a large number of alternative modes of transportation and combinations of these modes. For a typical 10-mile commute, the worker may drive alone—as most commuters do—he may carpool or he may use a form of public transportation (bus or rail). Combinations are possible, such as driving to an all-day parking lot at an express bus station and riding the rest of the way with 50 other people.

A realistic comparison of energy efficiencies of typical work trips includes how passengers get to suburban stations if they choose to use express bus or rail for the main part of their trip.

In addition to information on these work trips and combinations provided by the Voorhees consultants, engineers at the Highway Users Federation have contributed data for a more complete look at all practicable urban modes of transportation.

The following is a comparison, in order of efficiencies, for a typical commute of 10 miles, including where applicable a house-to-transit station mini-trip of two miles followed by an eight-mile express run into the city:



The automobile has substantially higher efficiency for intercity travel than for urban travel because of improved fuel economy and higher passenger loadings. The intercity bus, with an energy efficiency of 108 pm/g for average loadings, is more efficient for intercity travel than train, which has efficiencies halfway between auto and bus.

MODE	PASS. MILES/GAL.
Walk-in/Rapid Rail (N.Y.C.)	109
Local Bus (3 mil. pop.)	93
Small Auto (4 occupants)	72
Vanpool	70
Walk-in/CTA (Chicago)	70
Small Auto (3 occupants)	55
Local Bus (300,000 pop.)	47
Standard Auto (5 occupants)	45
Park-Ride/Rail Rapid (NYC)	42
Dial-Bus-Express Bus	40
Park-Ride/BART (San Fran.)	39
Small Auto (2 occupants)	38
Standard Auto (4 occupants)	37
Park-Ride/CTA (Chicago)	36
Park-Ride/Express Bus	35
Park-Ride/Commuter Rail	31
Standard Auto (3 occupants)	28
Kiss-Ride/Rapid Rail (NYC)	25
Kiss-Ride/BART (San Fran.)	24
Kiss-Ride/CTA (Chicago)	22
Kiss-Ride/Commuter Rail	20
Kiss-Ride/Express Bus	22
Small Auto (1 occupant)	19
Standard Auto (2 occupants)	19
Standard Auto (1 occupant)	10

INTERCITY TRAVEL

The most efficient way to go from one city to the next by ground transportation is the intercity bus, which the Voorhees consultants found to get 108 pm/g. This was followed by compact automobile (73 pm/g), intercity train (72 pm/g) and standard automobile (37 pm/g).

CONCLUSION

Essentially what the Voorhees study points to is that the ordinary diesel-powered local bus is as energy efficient as America's most highly touted rapid rail systems in city operations.

And when the transit systems push out into the suburbs, as they are doing more and more, the local buses get two to three times as many passenger miles per gallon as do rail systems. Between cities, buses still outperform the trains.

In addition, of course, other studies have shown buses to be far less expensive and more flexible in routing than fixed rapid rail systems.

The logical conclusion is that improved, modern buses may provide the key to mass transit of the future. Even in New York City – the exception to every transportation rule – city buses do nearly as well as rail. But no other city even approaches New York City's population density, which Voorhees researchers have shown to be one of the key factors in transportation systems, particularly so for fixed rail.

Factors Affecting Demand

By Gerald M. Bastarache
Manager, Media Relations
Highway Users Federation

Public concern about gasoline consumption on our streets and roads may have waned since last winter's dramatic fuel crunch, but the experts continue to keep transportation energy demand under a powerful microscope.

The engineering consulting firm of Alan M. Voorhees was able to pin down a host of factors affecting transportation efficiency. The Voorhees specialists detailed the current and projected situation in automobile fuel use and what happens by shifting to other transportation modes.

The precision of the data is impressive. Culling the hard scientific evidence from the conventional wisdom, the following picture of automobile fuel economy emerges:

Weight of the car is the largest single factor affecting fuel consumption, according to Environmental Protection Agency research. A two-ton car gets about half the mileage of a 2,000-pound car, and the trend has been toward heavier cars. In 1962, the average car bought in this country weighed 3,431 pounds; 10 years later, the average new car tipped the scales at 3,666 pounds, a seven percent increase.

Voorhees engineers pointed out that safety benefits associated with larger cars may portend even less fuel economy if the 1975 and 1976 prototype vehicles are representative of future weight trends. The U.S. Department of Transportation's experimental safety cars weigh up to 5,900 pounds, for example.

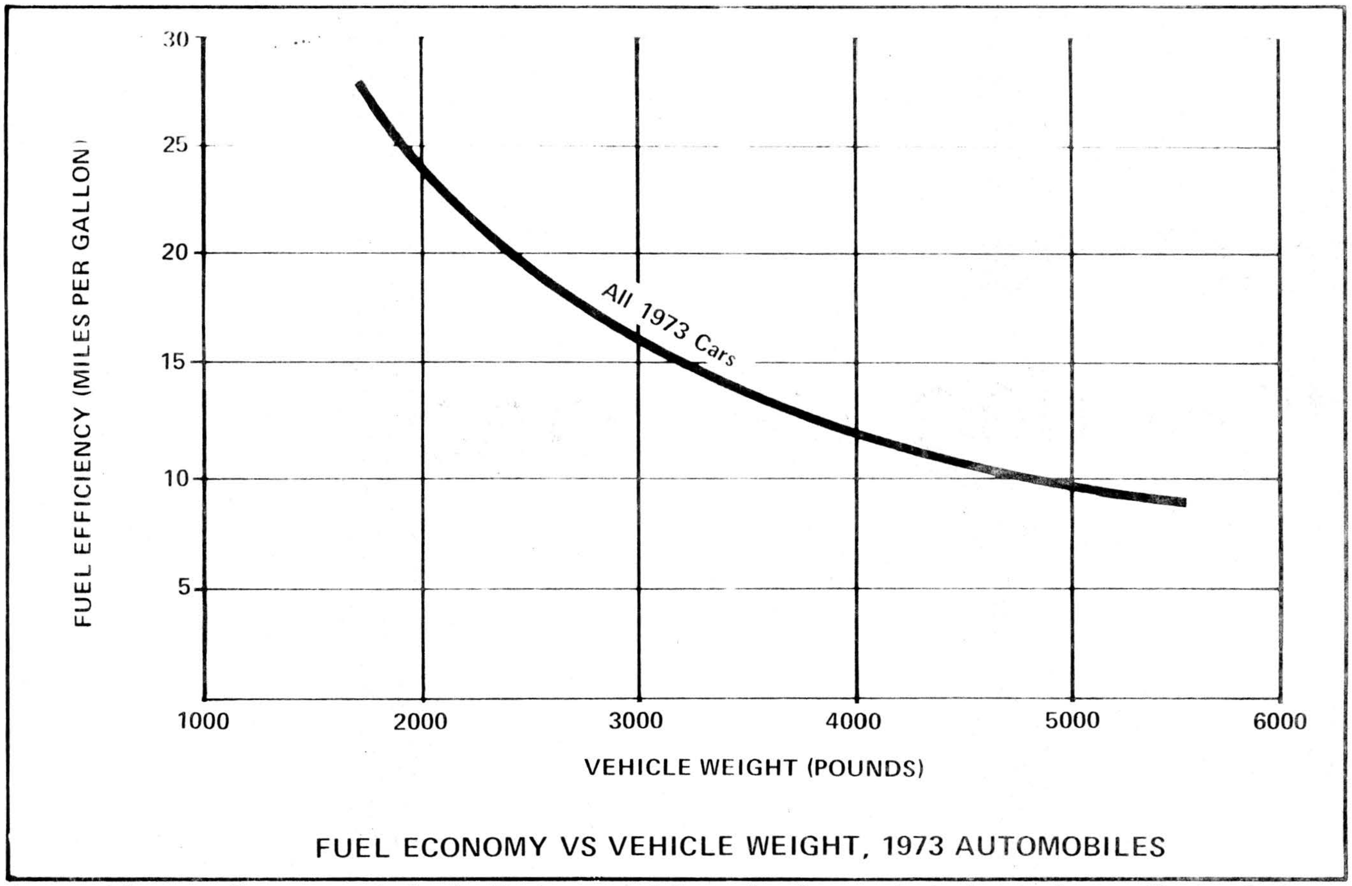
On the other hand, the report points out that recent trends in sales have seen compact and subcompact cars rising from a quarter of the new car market in 1971 to almost 40 percent in 1973.

"If new car sales of compacts and subcompacts continue at this rate," says the Voorhees report, "a significant reduction in fuel consumption will be achieved within five years."

Public transportation vehicles operate under the same weight-fuel consumption principle. The Standard Light Rail Vehicle (SLRV) developed by the U.S. Department of Transportation is about twice as efficient as conventional street cars of the type used in Boston, for example.

Engine design is pinpointed as another major factor affecting fuel economy:

- Conventional engines are highly developed and efficient at present, and even the largest can meet Federal emissions standards.
- Rotary combustion engines, available in smaller cars, are lighter weight than conventional engines and potentially cost saving, but have lower energy efficiency, less horsepower, and trouble meeting emission standards.
- The most popular passenger car diesel engine is less air polluting and uses less fuel than conventional engines, but is noisy, smelly, heavy and accelerates poorly.
- The stratified charge engine seems to offer a potential for less fuel use and air pollution at less tooling cost than other engine design options.
- The gas turbine engine would not save energy, but is an attractive alternative because of its low emission level and multi-fuel capability, although it will require additional development before commercial production.
- The steam engine has extremely low emissions, but is not as efficient as the conventional engine. Its operational problems and uncertain cost make it unattractive at present.
- Electrically powered cars have a major advantage of conserving limited petroleum supplies and reducing emissions, and are often suggested as the urban car of the future. Batteries providing adequate driving distance range must be developed, and the energy and environmental benefits will



Auto weight, according to a study by the Environmental Protection Agency, is the largest factor affecting fuel consumption. As indicated above, a 2,000-pound car was found to get about twice the mileage as a 4,000-pound car. Auto weights have increased in recent years, and Federal government experimental vehicles weigh up to 5,900 pounds.

depend largely on the efficiency of the electrical generating plants.

SPEED CHANGES COSTLY

The Voorhees study notes that as much as 40 percent of the energy waste in urban driving is caused by changes in speed. Using a "hybrid engine," which combines a heat engine with an energy storage system such as a battery, is cited as one way to reduce this problem.

Emission control devices, air conditioning and automatic transmissions also reduce fuel efficiency, according to the report. According to EPA, emission control devices reduce energy efficiency by almost eight percent in urban areas; air conditioning causes a nine percent fuel loss on a year-round average, rising to as much as 20 percent on a hot day. Automatic transmissions, used in combination with emission control devices, cut fuel economy by about two percent.

To be realistic, it's not at all likely that emission controls, air conditioning, and automatic transmissions are going to go. Nor does the report suggest such a thing. What it does suggest is that better engine design will ultimately achieve lower emissions without sacrificing fuel efficiency and that fuel could be saved if drivers used air conditioning only in hot weather.

Factors that the public can do something about fairly easily are also listed. Improperly inflated tires cause more fuel consumption because of the increased rolling friction. And belted radial tires are not just a rubber ad man's ploy, according to the Voorhees report: "Conversion to belted radial tires, a measure that could be fully implemented in two to three years, would reduce fuel consumption by five percent."

Better driving habits and vehicle maintenance by the motoring public could achieve "substantial improvements in fuel economy," and this is an area where everybody can pitch in. The report scores jack rabbit starts, rapid braking, high acceleration passing, and contends that "the extent to which driving habits can be improved is largely dependent upon the success of public education and driver education programs."

A lighter foot on the gas pedal is one of these "improved driving habits." The Voorhees researchers say that if you cut your car's speed from 70 to 50 mph, you cut fuel consumption by 24 percent; more, if you drive a small imported car.

The reason your car uses so

Poor streets and highways are major contributing factors to energy waste. Studies have shown that inadequate pavements impede traffic flow and create congestion, increasing gasoline consumption 20 percent at 30 miles per hour.

much more gas at 70: aerodynamic drag and inefficient gear ratios, says the Voorhees report. Improving the aerodynamic design of cars and installation of overdrive transmissions "could substantially reduce fuel consumption at high speeds."

POOR ROADS WASTE FUEL

The Highway Users Federation, The Road Information Program, and other organized groups who have long touted better highways as fuel-savers have their logic borne out by the Voorhees report, which flatly states that traffic and roadway conditions "have a major effect on fuel economy."

The Interstate Highway System, generally acknowledged as a fuel saver, will result in a 20 percent fuel savings when completed, compared to at-grade arterials, says the Voorhees report.

Less appreciated by the public is the fuel cost of badly broken or patched pavement. Far more than a simple driving nuisance, such deteriorated roads and streets increase gasoline consumption by 20 percent for 30 mph traffic.

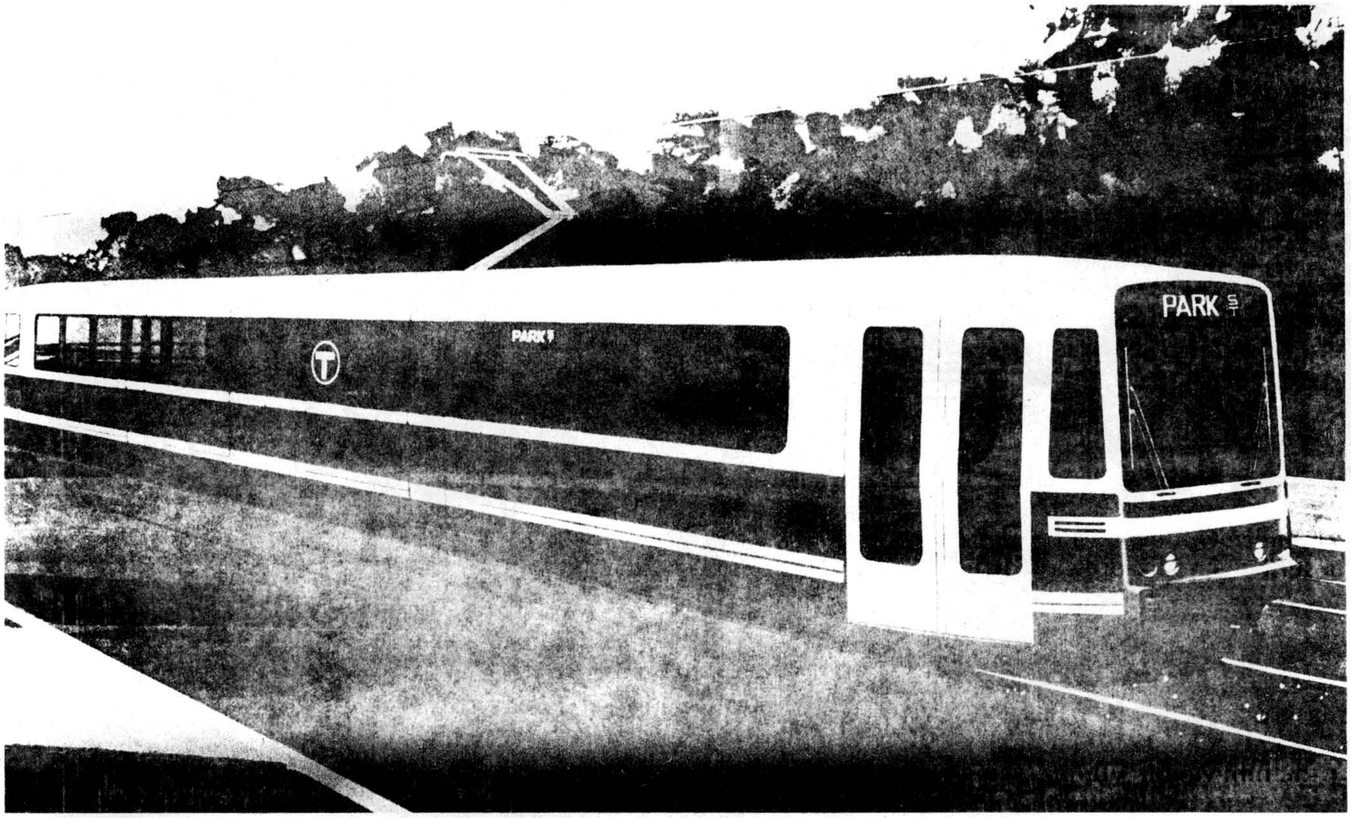
Freeways, if they are crowded, are no bargain either. Heavy traffic loads, even without traffic stoppages, can eat up 50 percent more fuel. Similar congestion on arterial streets gobbles up 60 percent more fuel, and a crowded downtown street causes a whopping 200 percent increase in fuel use.

Highway planners are well aware of the difficulties involved with major new construction in older urban areas. Costs have skyrocketed, and environmental considerations have become crucial. The Voorhees researchers point to low cost operational improvements as the way to save fuel in such areas.

For example, a study in Inglewood, Cal., found that by simply retiming traffic lights on a 60-intersection street system, a 71 percent reduction in vehicle delay would result, with a 13 percent reduction in stops and a jump in average speed from 22 to 30 mph. Fuel savings would amount to 19 percent during the 7 a.m. to 6 p.m. period studied.

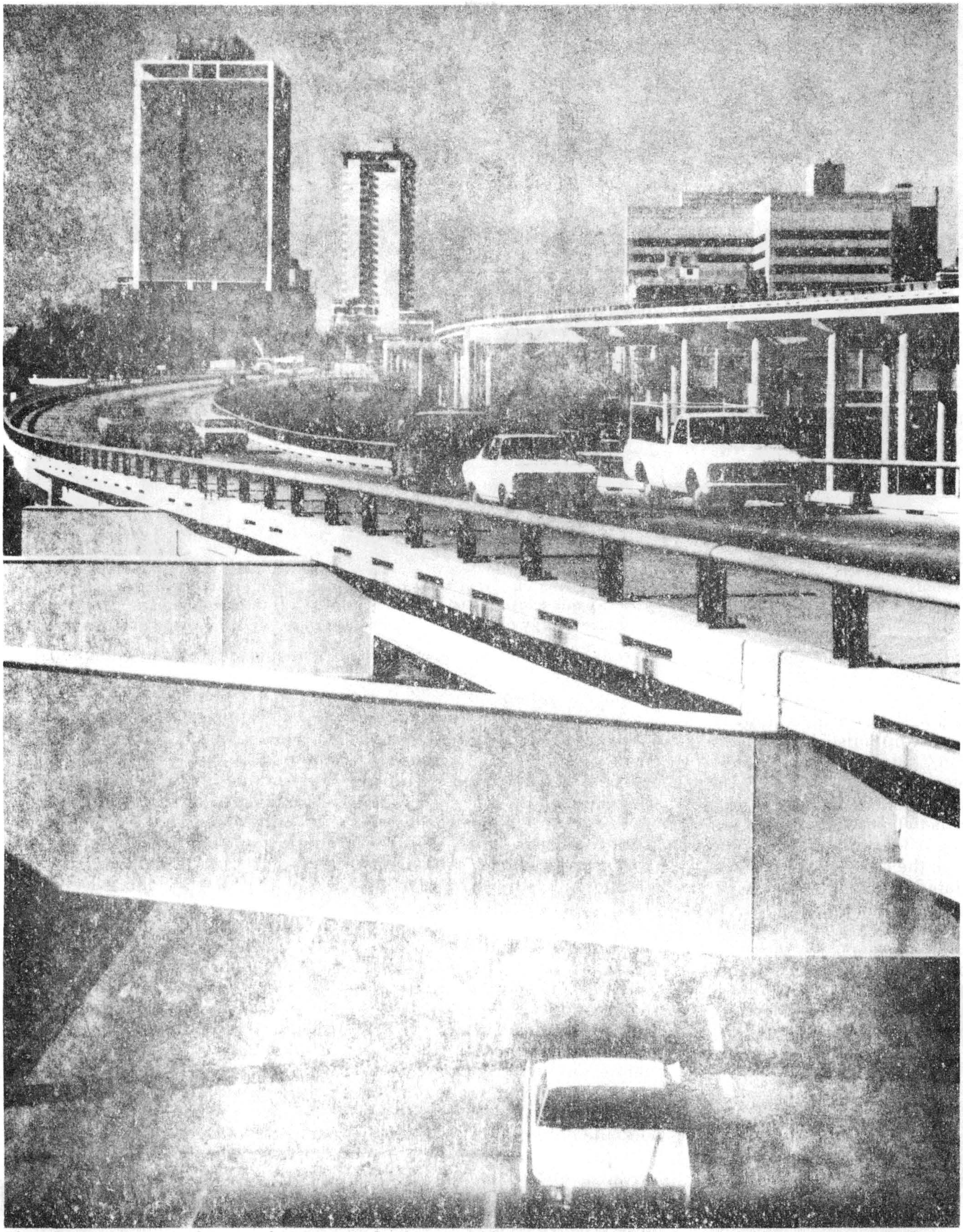
Intersection widening and channelization are also mentioned as ways to improve traffic flow and reduce delays and fuel consumption.

What would happen if people shifted from cars to transit? Voorhees researchers focus on the small capacity of our present transit system, which would result in a fuel savings of less than four percent even if it were



The potential impact of a commuter mode shift from auto to transit, such as the proposed U.S. Standard Light Rail Vehicle above, is limited because of the rather small capacity of the total transit system. Even if a way were found to increase use of existing transit to maximum practical capacity, a fuel savings of less than 4 percent would result.

The efficient movement of autos and buses over well-executed highway and street facilities produces immediate gains in the conservation of both time and energy and in improvement of the urban environment. Synchronized traffic signals, adequate lighting, pavement markings and channelized traffic are a few of the techniques available.



This elevated section of I-45 and U.S. 75 in downtown Houston is typical of the facilities that can reduce fuel consumption through elimination of slow down-speed up driving. Improvements in traffic operations provide the best opportunity for fuel economy because of their low cost and the virtual absence of negative environmental impacts.

Carpools are cited in the Voorhees report as an area of "great potential" in energy conservation. The energy efficiency of a compact automobile with four occupants exceeds that of all forms of rail transit and express bus. Only a local bus in areas of 3 million population is more energy efficient. Inducements are needed for carpooling, however.

used to its "maximum practical capacity."

As for expanding the transit system, the Voorhees study is vaguely optimistic. "For the long term," says the report, "the potential reduction in automobile travel which is possible by shifts to transit seems promising." But how many people leave the car at home is directly related to how attractive transit becomes, and the Voorhees report says that appeal depends on "changes in government policies, changes in attitudes with respect to transportation, and the integration of land use and transportation planning."

CARPOOL POTENTIAL

Carpools, actively promoted by the Highway Users Federation, governmental agencies, and thousands of private businesses and industries, are cited in the report as another area of "great potential" in fuel economy.

Stark realities intrude on the carpooling effort, however. The Voorhees report quotes a Los Angeles study showing that 76 percent of non-carpoolers on the Hollywood Freeway "would not be receptive to carpooling regardless of inducement." The researchers general estimate is that less than a quarter of all lone drivers would carpool unless severe travel restrictions were imposed, and such restrictions "are not likely to be applied except on a temporary, emergency basis as a result of severe fuel shortages."

There are no instant solutions in the Voorhees report to the problems caused by the transportation demand for energy, and the nature of the problem itself is not always clear.

But a central, fundamental impression is conveyed by the Voorhees analysis of automobile fuel consumption: facts are available, and they must be used to back up any decisions on transportation energy demand. Suppositions, guesses, and opinions have no place in the deliberations on how we get the biggest bang out of the smallest amount of fuel.

Another distinct impression is that there is no one big thing that any one person—or organization, or government agency—can do to improve automobile fuel economy. But there are many, many little conservation practices that individuals and organized groups can do. A combination of small actions, from improved driver behavior to watching the setting on a car's air conditioning, can save fuel.

True, more research is needed. It also is true that more action plans are needed. But, in the meantime, there is sufficient data to point the way to successful programs for making our roads and streets "savers," and not guzzlers, of our precious fuel supplies.

Study Says Highways Offer Best Fuel Saving Measures

Improved engineering of new cars and an increase in carpooling —with all motor vehicles traveling at reduced speeds—would provide the best way to save transportation fuel, according to a still unpublished report prepared for the U.S. Department of Transportation.

In contrast, the report discloses that the transfer of passengers from automobiles to urban transit facilities would result in a much smaller energy savings at a much greater additional investment.

The report, prepared by four researchers at the U.S. DOT's Transportation Systems Center (TSC) in Cambridge, Mass., characterizes as fallacious many claims that large amounts of energy and money could be saved by shifting passengers and freight from rubber-tired vehicles on highways to railways and other rail transit facilities.

Entitled "Transportation Energy Conservation Options," the report was completed last October by David Rubin, John K. Pollard, David Hiatt and Chris Hornig. The study which led to the report involved an examination of nine energy conservation options in terms of how much can be achieved in energy savings within various time periods, and the cost of each possible achievement.

The document carries an introduction stating that the study results comprise working papers of the authors which have not yet been approved by DOT officials.

The energy conservation options are ranked in terms of "ultimate" savings as a percent of the total fuel energy used in transportation by all modes of travel.

Increased automobile efficiency through better engineering of new cars stands as the best way to save fuel, with a more than 20 percent savings in total energy used for transportation in a maximum time of 20 years at a cost of an added $10 billion.

Carpooling is in second place, with a 13.9 percent energy savings within two years at a negative cost.

Adding in speed reduction at a 2.9 percent savings and a cost of $20 million brings possible overall fuel savings to almost 37 percent at a total long-term cost of about $10 billion.

The "ultimate" savings in energy possible through a switch of passengers from automobiles to urban transit (either rail or bus) is only 1.8 percent, according to the report. And this would require 10 years and an investment of $6.2 billion.

A switch of passengers fron autos to intercity trains and buse would save an additional 2.9 per cent, with a cost of $6 billion ove 15 years.

A possible shift from auto mobiles to bicycles and walkin was also considered by the study team. This would save an addi tional 1.8 percent of fuel at a cos of $2 billion over 10 years.

The energy savings from all o these automobile alternative would be 6.5 percent at a cost o $14.2 billion in new investmen over 15 years.

This contrasts with the alterna tive of more efficient automobile operated at slower speeds couple with carpooling, which would save 36.8 percent in energy at an addi tional investment of $10 billion in about the same time span.

The TSC report produces

(Continued on page 4)

Report Says Highways Offer Fuel Savings

(Continued from page 1)

similar findings related to freight shipment.

Increasing the operating efficiency of trucks can save 6.3 percent of the total fuel energy used in transportation within 15 years at an additional cost of $3 billion.

Increasing allowable truck loads could save another 3.2 percent of energy fuels within 10 years, and at a negative cost.

Therefore, improved trucking efficiency, in terms of operations and allowable loads, can save a total of 9.5 percent of energy within 15 years, at a total investment cost of less than $3 billion.

Again by contrast, the TSC report shows that a shift of freight from trucks to rails would save 1.6 percent of available energy at an investment of $15 billion over 15 years.

The report states that the grand total savings by going the highway route in energy savings would be 46.3 percent of total energy consumed by all transportation at an additional investment cost of about $13 billion over 20 years.

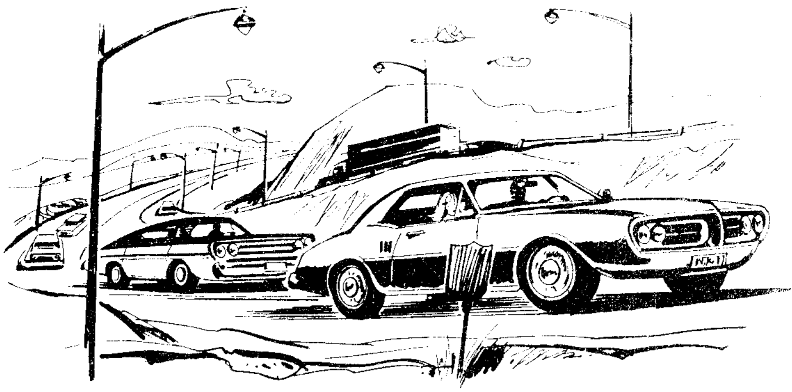
The energy savings that could be obtained by shifting passengers and freight from automobiles, buses and trucks to trains and other mass transit would total only 8.1 percent at an investment cost of $29.2 billion over 15 years, according to the study results.

Transportation Energy Conservation Options

ACTION	"Ultimate" Savings as Percent of Energy		Year to Achieve Maximum Savings		Additional Investment (billion $)	
Passenger Transport						
Increase Auto Efficiency	20.0+%		20 yrs.		$10.00	
Carpooling	13.9%		2+ yrs.		neg.	
Reduce Speeds	2.9%		3 yrs.		$ 0.02	
(Using Motor Vehicles)		36.8+%		20 yrs.		$10.02-
Shift from Autos to Urban Transit	1.8%		10 yrs.		$ 6.20	
Shift from Autos to Intercity Bus and Rail	2.9%		15 yrs.		$ 6.00	
Shift from Autos to Bicycles and Walking	1.8%		10 yrs.		$ 2.00	
(Using Rails, Transit, Cycles)		6.5%		15 yrs.		$14.20
Freight Transport						
Increase Truck Efficiency	6.3%		15 yrs.		$ 3.00	
Increase Allowable Truck Loads	3.2%		10 yrs		neg.	
(Using Trucks)		9.5%		15 yrs.		$ 3.00-
Shift from Trucks to Rails	1.6%		15 yrs.		$15.00	
(Using Rails)		1.6%		15 yrs.		$15.00
Grand Total Savings—Highways		46.3+%		20 yrs.		under $13.02
Grand Total Savings—Rail/Transit		8.1%		15 yrs.		$29.20

This chart shows the results of a study for the U.S. Department of Transportation of nine different methods for conserving fuel consumed in transportation. Each of the possible energy conservation measures is analyzed according to the potential energy savings, the time required to achieve the savings, and the additional investment required.

TRAVEL NEEDS BEST MET BY PRIVATE CARS, TRUCKS



The government has released new data on travel patterns of America's urban workers which help explain why the automobile is the most widely used method of commuting.

The Federal Bureau of the Census recently compiled statistics for the 125 largest metropolitan areas in the nation (those with populations of 250,000 or more) to determine where people live in relation to their jobs. The travel patterns discovered were so diverse that they dispel the theory that most people commute to jobs downtown.

SUBURBS REACH PARITY WITH CITIES

Essentially, the picture that emerges reveals that about as many people live and work in the suburbs as live and work in the central city. Of the entire work force, only 18 percent commute to jobs in the city from outlying residential areas.

For all of the Standard Metropolitan Statistical Areas (SMSAs) surveyed, the commuting patterns showed that:

° 36 percent of the people both live and work in the central cities;
° 34 percent both live and work in the suburbs;
° 7 percent live in the city but work in the suburbs;
° 5 percent live in the metropolitan area (encompassing both the central city and its suburbs) but work outside of it.

DATA FOR BIGGEST CITIES SHOWN

For the ten largest SMSAs, the commuting patterns show an even greater suburban focus:

° 29 percent both live and work in the central cities;
° 47 percent both live and work in the suburbs;
° 17 percent live in the suburbs but work in the city;
° 7 percent live in the city but work in the suburbs.

Thus, for the ten largest population centers in the nation (New York, Los Angeles, Chicago, Philadelphia, Detroit, San Francisco, Washington, D.C., Boston, Pittsburgh, and St. Louis) more than half of the jobs are outside the central city while little more than a third of the work force resides in the city itself. Thus, the statistics refute the contention that suburbanites predominantly commute to jobs in the central city.

NEW YORK FOUND ATYPICAL

The top ten list—omitting New York, which has the greatest number of workers who both live and work in the central city—shows an even more pronounced suburban focus. The proportion of people who live and work in the suburbs increases to 50 percent, while the percentage of persons living and working in the city drops to 25 percent.

Data for suburban residents only for the ten largest SMSAs shows that:

° 27 percent work in the central city;
° 73 percent work in the suburbs.

CARS MOST PREVALENT MODE

Additional data from the study show how the trip demands for all 125 SMSA's were met:

° 68 percent drive their own passenger cars or trucks;
° 12 percent are passengers in private vehicles;
° 6 percent travel by bus or streetcar;
° 2 percent use subways;
° 1 percent use railroads;
° 8 percent walk;
° 3 percent use taxis or other conveyance.

These travel mode-use statistics coincide with U.S. Commerce Department figures which show that over 80 percent of all work trips are by passenger car or truck. According to the U.S. Department of Transportation's Nationwide Personal Transportation Study, 91 percent of all trips made by Americans—to any destination, for any reason—are by private transportation.

"LOST" GOVERNMENT REPORT

WASHINGTON, D.C. – A transportation report from the federal government shows that transit trips mostly by rail cost more, pollute more and use more energy than those exclusively by bus.

Additionally, the report raps its own sponsor, the Department of Transportation and DOT's Urban Mass Transportation Administration (UMTA), for perpetuating a transit system that limits the efficient utilization of low-cost alternatives.

The report, "Evaluation of Rail Rapid Transit and Express Bus Service in the Urban Commuter Market," was done by a private firm, Institute for Defense Analyses, for the DOT's Office of Transportation Planning Analysis. Date of the report is October 1973 but it was not generally known about until earlier this year.

For the study, IDA set up a hypothetical but typical 13-mile commuter trip composed of passenger collection in residential areas, an express run into the city and passenger distribution in the central business district (CBD).

Considerations are the amount of energy used; pollutants emitted; cost of building, maintaining and operating the system; and the value of time spent in commuting by each passenger.

ALTERNATIVES

The bus-only alternative used a typical 50-passenger diesel-fueled bus that traveled the entire length of a trip from residential collection to CBD distribution. Two kinds of routes were considered: one over arterial streets and the other on exclusive express bus lanes.

The second alternative was rail rapid transit for the express run, fed by conventional rubber-tired vehicles such as buses and jitneys that did the residential collecting. Because rail requires collector services, several feeder vehicles were considered, including five-passenger jitney (automobile), eight-passenger bus-wagon or van, 19-passenger minibus and 50-passenger bus.

The fastest, most cost-effective vehicle was the bus-wagon.

COSTS

Total trip costs are approximately twice as great for rail as for bus.

Cost per passenger for a bus using an arterial street is $1.53. Using an exclusive busway, it drops to $1.40. Rail with the most cost-effective feeder service totals $2.97, nearly double the per passenger cost of the local bus.

Also, rail costs are increasing at a faster pace than bus costs. Over the past decade, bus operating costs have risen 1.03 percent a year. But rail transit operating costs have increased at a 2.66 percent rate.

"Rail transit supplier costs are much higher than those of buses," the IDA reports. For example, "The annual capital cost for a rail transit car is $44,480 per year ($563 per seat) compared with $6,810 ($136 per seat) for expressway buses."

FUEL CONSUMPTION

IDA takes into account the energy output of various fuels and the energy consumption of various vehicles. It compares the most cost-effective combinations of the two alternatives, considering full loads for the 13-mile trip. Buses on exclusive busways use .064 gallon per passenger for the trip. The rail alternative uses .192 gallon.

The study notes that "It is difficult to compare the fuel consumption of the two systems because different types of fuel are used. However, a rough comparison can be made by comparing the gallons of diesel fuel used by the bus with the combined sum of the gallons of gasoline used by the bus-wagon and the heating oil used by rail transit."

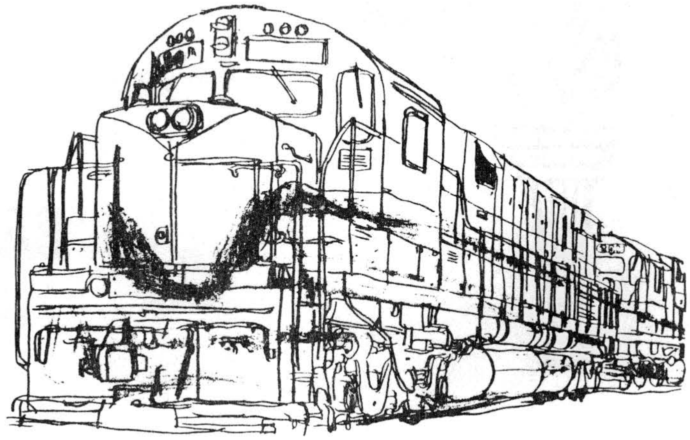
Conclusion: Three times as many gallons are used by the rail/bus-wagon combination as by the bus.

EMISSIONS

The figures show that the diesel bus is clearly superior on pollution grounds to the rail/bus-wagon alternative.

IDA states: "For the total trip, all three emissions are higher for the rail/bus-wagon alternative – seven times as high for carbon monoxide (CO), almost twice as high for nitrogen oxides (NOx) and eight times as high for hydrocarbons (HC)."

Most of the carbon monoxide and hydrocarbon pollutants come from the bus-wagon feeder, while most of the nitrogen oxides come from the electrical generating plants for the rail system.



SHOWS ADVANTAGES OF BUS

It is possible to eliminate almost all of the bus-wagon disadvantage on the first two by substituting a slower, more expensive 50-passenger diesel-powered bus for residential collection to feed the rail line. But the report shows that abandoning the optimum vehicle, the bus-wagon, would result in a significant, negative trade-off in time and money.

In any case, nitrogen oxides would remain a factor.

THE POLITICS OF REGULATIONS

The DOT-sponsored IDA report shows that low-cost mass transit alternatives are inhibited by the government.

It says that "institutional and political forces" at all levels of government are excluding low-cost alternatives that would emerge "as the result of market forces" and are inhibiting "the efficient utilization of the limited range of permitted alternatives."

IDA raps federal subsidy programs such as the UMTA Capital Grant Program which, it says, tends "to perpetuate the present organization of the industry."

NEED FOR RAIL TRANSIT?

Transit spokesmen, says the report, claim a need for transit that is independent of public willingness to pay for such service. One popular rationale for both public subsidies and the exclusion of transit competition is to improve mobility "for those disadvantaged persons who do not or cannot drive their own automobiles."

But the report quotes a study by the Massachusetts Institute of Technology showing "that private automobile and transit are close substitutes even for those who do not drive." The MIT report shows that "nonschool trips per capita by unlicensed individuals are quite constant across cities, independent of the level of transit service. Where transit service is poor, there are many private auto trips made for the benefit of passengers rather than the driver."

Conclusion: "Proponents of rail transit believe that rail transit is the only technology capable of offering high-quality service. This study has presented evidence and analysis to the contrary."

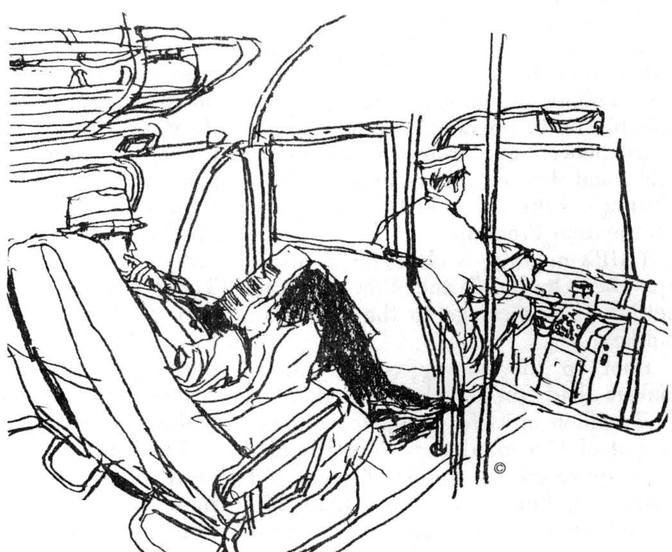
That evidence includes both automobile use and bus services that offer approximately equal user time cost at far lower supplier cost.

FEDERAL ROLE

"Federal transit subsidy programs," the IDA reports, "perpetuate the existing institutional organization of the industry. The UMTA Capital Grant Program has the added disadvantage of promoting uneconomical substitution of capital for labor. Buses are scrapped sooner than they should be . . ."

"The question remains, how might Federal policy help achieve greater rationality in the choice among urban transportation capital alternatives?"

Conclusion: "Based on our comparison of the full costs of rail and express bus systems, it seems difficult indeed to justify new rail systems. Bus systems could serve commuters at approximately equal user time cost and far lower supplier cost. Little institutional innovation would be required for the Department of Transportation to shift Federal support from rail to express bus systems."



ENERGY

BAD ROADS ARE GAS GUZZLERS

How many times in the past few years have you read here in HIGHWAY BUILDER and other construction industry publications that the mass transit advocates use and issue any circumstantial happening that is remotely detrimental to the "Highway Issues" to further their cause?

Of course, the biggest culmination of events for them to exploit has been the fuel shortage. Very quickly, their cries of concern became loud and they let it be known to the American public that the culprit of the situation was not the *Arab's, but the automobile;* that gas gulping monster that was using sixty percent of all fuel reserves, creating air and noise pollution and of course, taking fuel away from industry and from home heating purposes. Why didn't they constructively devote their time and news releases to a situation that would have an immediate effect in helping conserve fuel; and that is to initiate a program of modernizing our present road system. Instead, they proposed more transit systems that would cost billions of dollars and couldn't possibly be in operation for five to ten years hence. The true story is being told, and by an organization that is getting results . . . TRIP, The Road Information Program.

TRIP's message is clear, "Bad Roads are Gas Guzzlers" and they are out getting their message to the American public.

Prior to the energy crunch, automakers had predicted production of 11.7 million units for 1974, the highest output of U.S. producers since the first auto appeared on the road scene 80 years ago. Since then more than 250 million cars, trucks, and buses have been produced in America. Startling is the fact that these American vehicles log an average of 25 billion miles per week on 3.7 million miles of roadway, ONLY HALF OF WHICH IS PAVED. And even then much of the paved portions may cause trouble for motorists as some 700,000 miles of U.S. roads are inadequate for existing traffic loads and 89,000 bridges are critically deficient. Add to this the fact that 15,000 new vehicles are being added to the traffic flow everyday. Figure at that rate, when the auto is 100 years old in 1993, America will have 93 percent more vehicles on a road system less than one percent larger than the present system. At the present time, 82 percent of all working Americans commute to their jobs by automobile. This means that on an average workday there are some 50 million commuter cars traveling our highways.

TRIP says many existing roads were designed to handle the vehicle loads of 50 years ago and need to be modernized to improve traffic flow. Improve traffic flow and we start a chain reaction of beneficial economic, environmental, and fuel saving results.

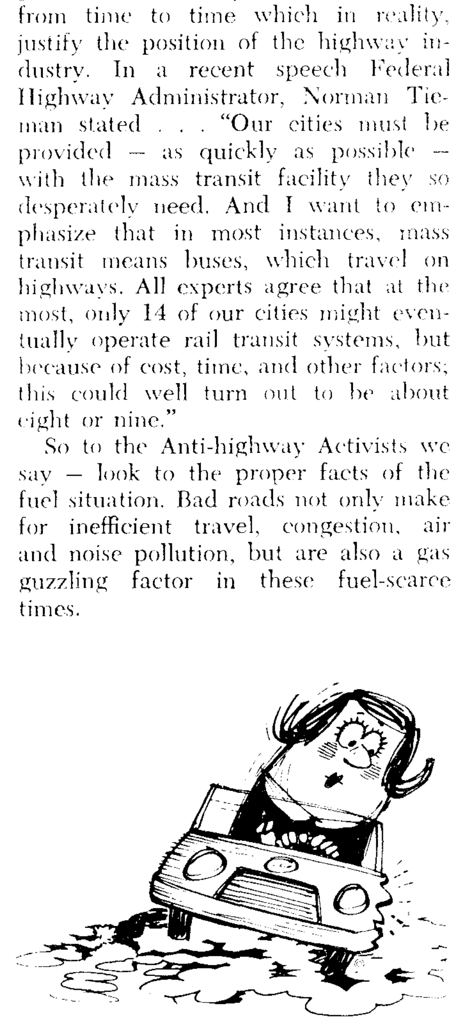
According to TRIP, the outmoded road may be the biggest gas guzzler of all. Bad roads can be modernized to reduce or eliminate traffic jams, which probably waste more fuel than excessive speeds. Most certainly, certain types of road improvement can save individual motorists as much as 20 percent of the fuel consumed on trips. These improvements include construction of overpasses or underpasses to ease congestion at jammed intersections, installation of left turn lanes, building acceleration lanes onto major highways, and adding extra lanes.

TRIP maintains that America doesn't need miles and miles of new roads right now, but certainly could profit from modernizing roads in many areas so that drivers can get around communities without wasting fuel in local traffic tie-ups.

To date, road repairs and maintenance programs have been left up to the state, and this includes finding their own source of funding. It stands to reason that pot-holes, unsafe narrow bridges and just plain bad roads cause traffic tie-ups and impede traffic flow, thus using more fuel. Why not start our corrective actions where it will do the most good!

The present Federal Administration stand is definitely geared to mass transportation. Yet, they make statements from time to time which in reality, justify the position of the highway industry. In a recent speech Federal Highway Administrator, Norman Tieman stated . . . "Our cities must be provided — as quickly as possible — with the mass transit facility they so desperately need. And I want to emphasize that in most instances, mass transit means buses, which travel on highways. All experts agree that at the most, only 14 of our cities might eventually operate rail transit systems, but because of cost, time, and other factors; this could well turn out to be about eight or nine."

So to the Anti-highway Activists we say — look to the proper facts of the fuel situation. Bad roads not only make for inefficient travel, congestion, air and noise pollution, but are also a gas guzzling factor in these fuel-scarce times.



TRUCKS, TRAINS AND TRUTH —

Debunking the Rail Energy Efficiency Myth

Would you believe . . . .

. . . That a car is twice as "energy efficient" when it carries four 200-pound men as when it carries four 100-pound women?

. . . That a truck combination is more "energy efficient" when it carries steel than when it carries lettuce?

. . . That the steel industry is more "energy efficient" than the clothing industry because it produces more tons per unit of energy?

You'd probably recognize that all of these suggested conclusions are based upon irrelevant comparisons. Yet one of the most persistent and dangerous propaganda pitches now being used to brainwash the public in these days of the energy shortage is based upon comparisons of this type. An advertisement that has been widely circulated puts it this way.

> Southern Pacific trains move 238 tons per mile per gallon. 4 times that of trucking. 125 times that of air.

The effectiveness of this clever bit of deception is unquestionable. Although the ad doesn't say so, millions of people actually believe that because trains move more tons per gallon of fuel they are more efficient than trucks or planes. Even worse, some highly placed public officials have used this argument to promote regulations and legislation designed to shift freight from trucks to trains as a means of saving energy.

As an indication of how far things have gone the table below has been reproduced from a news release put out by the U.S. Department of Transportation. It purports to show the approximate energy efficiencies of different forms of transport in 1973. It accompanied a speech delivered by Secretary Claude S. Brinegar to the Scientific American Energy Conservation in Transportation Round Table Conference, which was held in Washington, D.C. earlier this year.

ENERGY USAGE AND APPROXIMATE EFFICIENCIES (1973)

Passenger Mode	Fuel Usage 1,000 B/D*	Passenger Miles Per Gallon of Fuel
Rail	10	100 150
Bus	70	75-150
Automobile		
Non-Urban	2,000	35
Urban	3,000	25
Air	700	15

Freight Mode	Fuel Usage 1,000 B/D	Freight Ton Miles Per Gallon of Fuel
Water	300	300
Rail	300	180
Truck	1,500	50

Note: Various miscellaneous uses (international carriers, non-freight trucks, recreational) use about 1.3 million B/D.

* B/D Barrels per day

Although the Secretary's remarks were highly qualified, as to the relative efficiency of trucks and trains, the clear implication of the table is that trains are more than three times as efficient as trucks (180 ton-miles per gallon of fuel for rails compared to 50 ton-miles per gallon for trucks). It has subsequently been used by others without the Secretary's qualifying language.

This is not only ridiculous, it is dangerous, as a few examples will quickly show. It would be funny if it weren't so serious. The truth is that without a good deal more information, neither the economic value nor the energy required to move different kinds of freight between different points can be determined by either the number of tons that are moved, the distance each ton is moved or the product of the two, which is ton-miles.

Gross Weight and Carried Load

The amount of fuel required to move a given load, all other things being equal, varies with the total or gross weight to be moved rather than with the carried load alone. In other words, energy is expended to move both the cargo carried and the vehicle that carries it. This can result in an improvement in apparent fuel efficiency while real fuel efficiency actually declines.

To illustrate, if the car in the question posed at the opening of this article weighed 3,600 pounds empty, the carried load would be 400 pounds and the gross weight 4,000 pounds with the four women. With the men the carried load would be 800 pounds and the gross weight 4,400 pounds. The carried load would be twice as much with the men as with the women but the gross weight would be only 10 percent higher. Under these conditions, if the car obtained 10 miles per gallon with women and 9 miles per gallon with the men, the relative fuel efficiency based on the carried load would be 2 ton-miles per gallon when hauling women and 3.6 ton-miles per gallon when hauling men. There would be an actual increase in fuel consumption of 10 percent when the men were carried -- assuming that fuel consumption went up in direct proportion to the gross weight of the loaded vehicle, which it would not -- but an apparent increase in energy efficiency of 80 percent in ton-miles per gallon of fuel based on the carried load. The same would be true, of course, if the comparison involved thin and fat people.

Obviously, the importance of moving people cannot be determined on the basis of their weight. Neither can efficiency. Based upon the kind of reasoning used in assuming that ton-miles per gallon of fuel is a proper basis for determining energy efficiency, fuel could be saved, or efficiency increased, by moving the men rather than the women. Even more ridiculous, under this concept, the apparent fuel efficiency of a carpool could be increased and actual efficiency decreased by having its members gain weight.

The same principle applies to the movement of freight. A flat bed truck combination carrying steel would have an empty weight of about 13.5 tons and a carried load of about 23 tons, for a gross weight of 36.5 tons. A refrigerated combination carrying Boston lettuce would have an empty weight of about 15.5 tons and a carried load of about 10.5 tons for a total of 26.0 tons. Thus the gross weight, the weight that influences fuel consumption — all other things being equal — of the combination loaded with steel would be only 40 percent greater than the one carrying lettuce but its carried load would be 120 percent greater.

Since, as pointed out earlier, fuel consumption would not increase in direct proportion to the increase in the carried load, the relative number of ton-miles that could be obtained between the same points per gallon of fuel when hauling steel would greatly exceed that which could be obtained when hauling lettuce. Under the theory that freight should be shifted to the most efficient use as determined by ton-miles per gallon of fuel, this would dictate that fuel be used to haul steel rather than lettuce. But a steel salad might be hard to digest.

One final example, the comparison of different kinds of transportation service in purely physical terms, such as ton-miles, is no different than comparisons of different kinds of goods in such terms. How can a ton of steel be compared with a ton of clothing? Or a bushel of potatoes be compared to a bushel of corn. Under this theory the steel industry would be more energy efficient than the clothing industry because it produces more tons per gallon of fuel, or other unit of energy.

There are a number of other reasons why ton-miles per gallon of fuel should not be used to determine relative transportation efficiency. One is that fuel consumption per ton-mile varies with the gross weight involved not the carried load — **all other things being equal.** There's the rub. In transportation things are rarely equal. Among the things that are seldom equal are the terrain over which shipments move, the mileage between given points by different carriers and forms of transport, shipping weight as compared to commodity weight, the volume of freight moving between given points at one time and over time, the distance that goods move, the completeness of the service and the speed at which freight moves.

What Goes Down Must Come Up

The effect of the terrain over which freight moves on fuel consumption per ton-mile is pronounced, for obviously it requires more fuel to move a load uphill than down. Under the ton-mile per gallon of fuel principle, downhill movements should be favored over uphill. This leads to some interesting speculations.

It requires less fuel per ton-mile by any mode of transport to move the same freight from Denver to Omaha than from Omaha to Denver. Thus, under this theory, transportation from Denver to Omaha should be encouraged while that from Omaha to Denver should be discouraged.

Each year millions of tons of coal are moved from mines in the mountains of Pennsylvania, Virginia and West Virginia to ports in the Hampton Roads, Virginia area. The cars used to haul the coal to the ports are returned to the mines empty. Since it requires fuel to haul the empty-cars up the mountain when no freight is being hauled, think of the increase in efficiency that could be realized if the return of the empty cars was discontinued.

When Is A Mile Not A Mile?

Routes of different railroads between the same points are rarely the same. If two railroads operate between two identical points and Railroad A operates over a route that is 20 percent longer than that of Railroad B, the number of miles when multiplied by the weight of the shipment will result in 20 percent more ton-miles by Railroad A to move the same freight between these points. Railroad A would actually use more fuel, but its rate of fuel consumption per ton-mile could and probably would be lower because fuel consumption per ton-mile tends to be lower on longer hauls.

When railway movements are compared to movements by truck between the same points the effect of circuity is even more significant. Railway routes between the same points are generally longer than highway routes. In some instances, the rail mileage is more than double the highway distance. Thus, on the same shipment between these points, rail ton-miles will be double truck ton-miles.

Obviously this difference in ton-miles will materially affect both the actual fuel consumed in performing a given transport service and the rate of fuel consumption per ton-mile, increasing the former and decreasing the latter.

Shipping Weights Vary for Some Goods Depending Upon Mode

The weight of a shipment includes the packing and bracing materials necessary to permit it to move without damage. In most cases shipments must be given greater protective packing and bracing to move by rail as compared to truck. A good illustration involves household goods which must be crated for rail movements but not for movement by truck. Thus the same goods often weigh more when moving by rail than by truck. This increases the number of ton-miles performed by rail compared to truck.

Volume Over Time

The volume of goods to be moved at a given time, as well as that to be moved in a given period, is particularly important when considering the relative fuel consumption per ton-mile of trucks and trains.

Generally speaking railroads can move large quantities of heavy goods, moving in large volume between fixed points located relatively long distances apart, at greater fuel efficiency than can trucks. On the other hand, trucks can handle all commodities moving short distances, light and bulky articles and smaller shipments moving all distances between numerous points more efficiently than can rails.

To illustrate, trains can move large quantities of coal between mines and generating plants and other limited points such as ports, with less expenditure of fuel than can trucks. Trucks, however, can move smaller quantities of coal, single carload quantities, for example, short distances between mines and small consumers with less fuel than would be required to perform the same movement by rail.

The relative efficiency of railroads declines sharply as the shipment size, or the quantity to be moved between given points at a given time declines. This can probably be illustrated best by an example involving passengers. If 1000 persons want to travel between two points and all can leave at the same time, they could probably be handled most efficiently by train. If the number that could leave at one time dropped to 500, the fuel efficiency of trains in terms of either passenger miles or ton-miles per gallon of fuel would drop sharply. If the number that could leave at the same time fell to 50, buses would probably be more energy efficient.

In the case of freight movements, the same principle applies. Just because railroads can carry dense commodities — those that have high weights per cubic foot — moving relatively long distances at the same time and in heavy volume over time at relatively low energy consumption per ton-mile does not mean that they can move lighter loads and smaller volumes at the same efficiency.

This is one of the reasons for the railroad branch line problem. Both the fuel required and the cost to move small amounts of freight at a given time by rail are prohibitive. A switch engine pulling a few cars up a branch line uses much more fuel than would be required to move the same freight by truck.

Complete Movements Not Compared

Another reason that ton-miles by railroad are not directly comparable with ton-miles by truck is that the former frequently do not include necessary transportation to and from the rail facilities. These movements, usually by truck, consume fuel not included in the railroad total. The ton-miles per gallon of fuel for these pick-up and delivery movements is usually low in relation to over-the-road truck movements.

Since rail movements must be made between rail terminals, the number of ton-miles required to move goods between points intermediate to rail terminals can be considerably greater than if the shipment moved entirely by truck. This is particularly important on shipments moving relatively short distances. On a movement between two points 80 miles apart by highway and located intermediate to two railroad terminals located 100 miles apart the difference would be substantial. To move the shipment by railroad would require 120 miles — 20 by highway and 100 by rail — whereas the highway movement would require only 80 miles. Under the method used to compile rail statistics the fuel consumed in moving the shipment to and from the rail facility would not be included in the rail fuel consumption data and neither would the ton-miles.

Density and Loadability

The ratio of carried load to gross load for various commodities is affected by two factors, density and loadability. Density is the weight of a commodity in relation to the space it occupies.

It is expressed in pounds per cubic foot. Loadability is the amount of freight that can be loaded into a given space due to the size and shape, as well as other characteristics, of the freight (such as fragility). Density and loadability determine how much freight, in terms of weight, can be loaded into a given freight car, truck or trailer. These factors have an important bearing on fuel consumption per ton-mile.

A box car or truck trailer has a fixed weight and cubic capacity. Either may limit the amount of goods that can be loaded in them. Thus if a trailer can haul 50,000 pounds and its cubic capacity is 2,500 feet its optimum density is said to be 20 pounds per cubic foot (50,000 ÷ 2,500). This means that freight that can be loaded to 20 pounds per cubic feet will fill both the cubic and weight capacity of the trailer. Any freight that cannot be loaded to 20 pounds per cubic foot will reduce the weight that can be loaded in the trailer. Household refrigerators, for example, have an average density of about 8 pounds per cubic foot. Since, however, they cannot be stacked one on top of the other, their loadability is only 5.6 pounds per cubic foot and a 40 foot trailer with 2,500 cubic foot capacity can only be loaded to 14,000 pounds or 7 tons. As shown earlier, this would mean that refrigerators would yield very low ton-miles per gallon of fuel and their movement would have low energy efficiency.

Quality of Service

Efforts to determine the relative energy efficiency of different types of transportation by comparing ton-miles per gallon of fuel ignores important differences in the "quality" of transportation services. Among the factors that make some transportation services more costly and valuable than others are speed, flexibility, frequency and completeness.

A service that provides overnight delivery is usually more attractive to those who buy transportation (shippers) than one that requires a week to effect delivery. One that offers daily service is usually preferred to one that offers it two or three times a week. Door-to-door service is usually more desirable than a service that requires pick up and delivery from and to a carrier facility. These higher quality services also usually require greater expenditure of effort per ton-mile including fuel.

Technological Feasibility

Each mode of transport has certain technological characteristics that give it a decided advantage in efficiency over the other modes for certain types of traffic. Pipelines can handle large quantities of liquids moving in large and steady volume between fixed points, with maximum efficiency. Railroads and water carriers can handle efficiently large quantities of freight moving in large shipments between fixed points. The speed of air carriers between distant points is unmatchable by other modes. Trucks are unexcelled for movements of all types of freight for short distances and for distribution involving small and medium size shipments moving all distances between many points of origin and distination.

Pipelines can obviously only move flowable commodities while water carriers can only serve points that are accessible by water. Not so obvious is the fact the railroads can only serve points located on tracks without truck assistance. The distance that the shipment moves and a number of other factors have a decided bearing on whether or not a given freight movement can be handled more efficiently by trucks, rails, or a combination of the two.

The Average Fuel Consumption Per Ton-Mile by Mode

The comparisons of relative energy consumption per ton-mile of trains and trucks, used to "prove" that the former are more efficient, are, of course, based upon averages for the two modes.

This is perhaps the most glaring of the errors in this whole exercise.

There is no disputing the fact that railroads can move large quantities of dense commodities in heavy volume between fixed points with a lower consumption of fuel per ton-mile than can trucks. On the other hand there should be no disputing the fact that trucks can handle short haul movements of most commodities and long haul movements of low density commodities and those moving in small or medium size loads with less energy per ton-mile than if they were and could be moved by trains.

The comparison of average train and truck fuel consumption per ton-mile is as meaningful as the comparison of average fuel consumption uphill and down. For all practical purposes, one cannot be substituted for the other.

What About Piggyback?

It is generally conceded that railroads can usually perform line haul transportation — movement of freight between fixed points with less fuel per ton-mile and that trucks can handle assembly and distribution services, including single carload lots and smaller shipments more efficiently. Because of these facts and because trucks can handle traffic between points not on rail lines it is often suggested that a combination of rail and truck service would be desirable.

There is some merit to this idea and the growth of piggyback service over the years indicates that this is recognized. Experience has shown, however that no arbitrary decision based on mileage or other factors can determine where and when it should be used to achieve maximum efficiency. Where speed and quality of service are concerned movements entirely by truck can frequently provide superior performance between specific points with lower expenditure of fuel than can piggyback service.

How Should Transportation Energy Efficiency Be Determined?

The argument that ton-miles per gallon of fuel is a proper criterion for judging transportation energy efficiency is obviously without merit and should be dismissed. How then should transportation energy efficiency be determined? This question might best be answered by comparing transportation to other facets of our economy.

Our Gross National Product (GNP) is not measured in tons but in dollars. Thus all of the goods and services produced by our economy, including transportation, are aggregated in terms of their dollar value. This is the missing ingredient in any physical measurement. While these physical measurements are helpful and necessary in determining quantities and relative values they are meaningless otherwise. Goods come in a wide range of values per ton. Thus while a ton of gravel is equal to a ton of bread in weight their values differ widely. Values, of course, are based upon the price consumers will pay for a given quantity of a given good. While apples and oranges cannot be compared physically, their prices per pound can be compared and the aggregate value of apples can be compared to that of oranges.

The same principle that applies to goods also applies to service including transportation. Just as goods come in a wide range of prices per pound, gallon, bushel or ton, transportation comes in a wide range of prices per ton-mile. The prices per ton-mile for transportation reflect the value that those who buy transportation service (shippers) place on them. This value reflects the consumers judgement of relative quality.

Since transportation consumers have a free choice among different modes of transport at a variety of prices, which largely reflect the cost of those services including fuel costs, it must be assumed that they choose a particular service because it best meets their needs all things being considered.

The use of price per ton-mile rather than ton-miles alone automatically eliminates the distortions that result from comparing purely physical units. In the examples of the effect of terrain on fuel consumption, where ton-miles per gallon of fuel are greater going downhill than up, the use of value would eliminate this problem because all of the pertinent factors would be reflected in the price. Competing railroads, for example, would have the same cost factors in each direction and so would truck lines.

Looking at transportation from the same viewpoint as we look at the rest of our economy, we find that the average price paid for railroad service is less than 2 cents per ton-mile while the average price paid for intercity truck service is about 10 cents per ton-mile. Thus the average price of truck service per ton-mile is 5 times that of rail service. Since it is obvious that shippers would not pay 10 cents for something they could get for 2 cents, it is clear that the ton-miles produced by railroads are inferior to those produced by trucks.

In the DOT table reproduced near the beginning of this report, rails are said to produce 180 ton-miles per gallon of fuel while trucks produce 50. Applying relative values to the physical units we find that railroads produce \$3.60 worth of transportation service per gallon of fuel while trucks produce \$5.00 worth.

Summary and Conclusion

Attempts to determine the relative energy efficiency of different types of transportation by the simple process of comparing the number of tons hauled per mile per gallon of fuel is both foolish and foolhardy. It is a simplistic approach to a complex problem and is dangerously misleading because it appears to be scientific.

The basic question posed by the energy shortage is how can we meet our National transportation requirements with the least expenditure of energy, which in the case of trucks and trains is petroleum fuel. This demands that the energy requirements to perform given services be compared on a realistic basis. This cannot be done by the simplistic method of comparing ton-miles per gallon of fuel.

While it is possible to compute the number of tons that could be moved per mile per gallon of fuel by various modes of transportation under specific conditions, it is not proper to generalize energy requirements for different kinds of movement. Thus, if the number of tons of specific kinds of freight that can be moved between specific points at a given time are known, the amount of fuel that would be required can be calculated for each mode.

In other words, if it were known that 10,000 tons of coal were to be transported from a mine to a generating plant at a given time and the terrain to be traversed was known, the amount of fuel that would be required to move it by each mode of transportation, railroads, trucks, barges, pipelines or even conveyor belt, could be determined with some degree of precision. Also, if it were known that 10,000 tons of merchandise of different kinds and characteristics were to be moved from 1,000 known points of origin to 1,000 known destination points, in a given period of time, it would be possible to compute the fuel requirements by mode of transport. In either case, the number of ton-miles per gallon of fuel could be determined but these data would be largely irrelevant since they could not be compared properly.

If, in the example above, it was found that 400 tons of coal could be moved per mile per gallon of fuel by railroad, and that was the most efficient mode in this instance, and if it was found that only 40 tons of merchandise could be moved per mile per gallon of fuel by truck, and that trucks were the most efficient mode for that freight, these would be the pertinent facts. That is, they would tell which mode could move each kind of freight with the smallest consumption of fuel. The fact that the railroads could produce 400 ton-miles per gallon of fuel when moving the coal would not mean that they could produce ton-miles per gallon at the same rate when moving the merchandise. Comparison of the ton-miles per gallon, or gallons per ton-mile, required to move coal efficiently with ton-miles per gallon required to move merchandise by the most efficent mode would, therefore, not only be irrelevant, but it would be highly improper and misleading. Yet, this is precisely what is done when average ton-miles per gallon of fuel for railroads is compared to average ton-miles per gallon of fuel for trucks.

The truth is that the types of traffic being handled by each mode of transport today reflect the economic efficiency of each mode, including its energy efficiency. For the most part pipelines are moving bulk liquids in heavy volume between fixed points. Water carriers are moving long haul bulk commodities in large shipment sizes between points on navigable waterways. Railroads are moving heavy dense commodities in large volume in medium to large shipment sizes between points on their lines. Air carriers are moving high volume small shipments of a priority nature, while trucks move virtually everything that moves in local or urban areas and that intercity freight which moves in small lots or that demand prompt delivery, or special handling which can only be performed by trucks. Trucks also participate in the movement of virtually all intercity freight moved by the other modes originating and/or terminating at points not directly served by those modes.

The so-called Shipper Surveys conducted by the U.S. Bureau of the Census[1], although they cover only intercity transportation of certain classes of manufacturers, show quite convincingly that intercity transportation is now rationally divided between trucks and railroads on the basis of size of shipment and length of haul. Small sized shipments, and those moving short and medium distances are predominantly carried by truck. Heavy, long-haul movements, on the other hand are predominantly by rail. It should be noted that purely local freight movements, and movements of some classes of manufactured goods, were excluded from the Shipper Surveys.

Specific data on rail and trucks movements, from the Census tabulations, show:

Shipments weighing less than 30,000 pounds	— 12 percent by rail — 87 percent by truck
Shipments weighing 30,000 pounds or more	— 55 percent by rail — 39 percent by truck
Shipments traveling less than 300 miles	— 33 percent by rail — 64 percent by truck
Shipments traveling 300 miles or more	— 62 percent by rail — 32 percent by truck.

(residual percentages represent "other modes")

Any shifts in the modal freight patterns shown above — from truck to rail for small and/or up to medium range shipments — would probably require more rather than less fuel than under current conditions.

Finally, if maximum energy efficiency is to be achieved in transportation, it must be accomplished on realistic terms, which include the quality as well as the quantity of the service involved. This can best be determined by the cost of the service and what those who use it can and will pay for it. A service, no matter how low its cost or fuel consumption, that is not responsive to shippers' needs is worthless. This is no different than any other phase of our economy, a product for which there is no market has no value.

Optimum transportation energy efficiency will only be realized when each form of transport is allowed to improve the efficiency with which it performs those transportation services it can handle best.

[1] U. S. Bureau of the Census, Department of Commerce; 1967 Census of Transportation, Commodity Transportation Survey — Shipper Groups.

DEPARTMENT OF RESEARCH and TRANSPORT ECONOMICS

AMERICAN TRUCKING ASSOCIATIONS, INC. WASHINGTON, D.C. 20036

AUGUST 1974

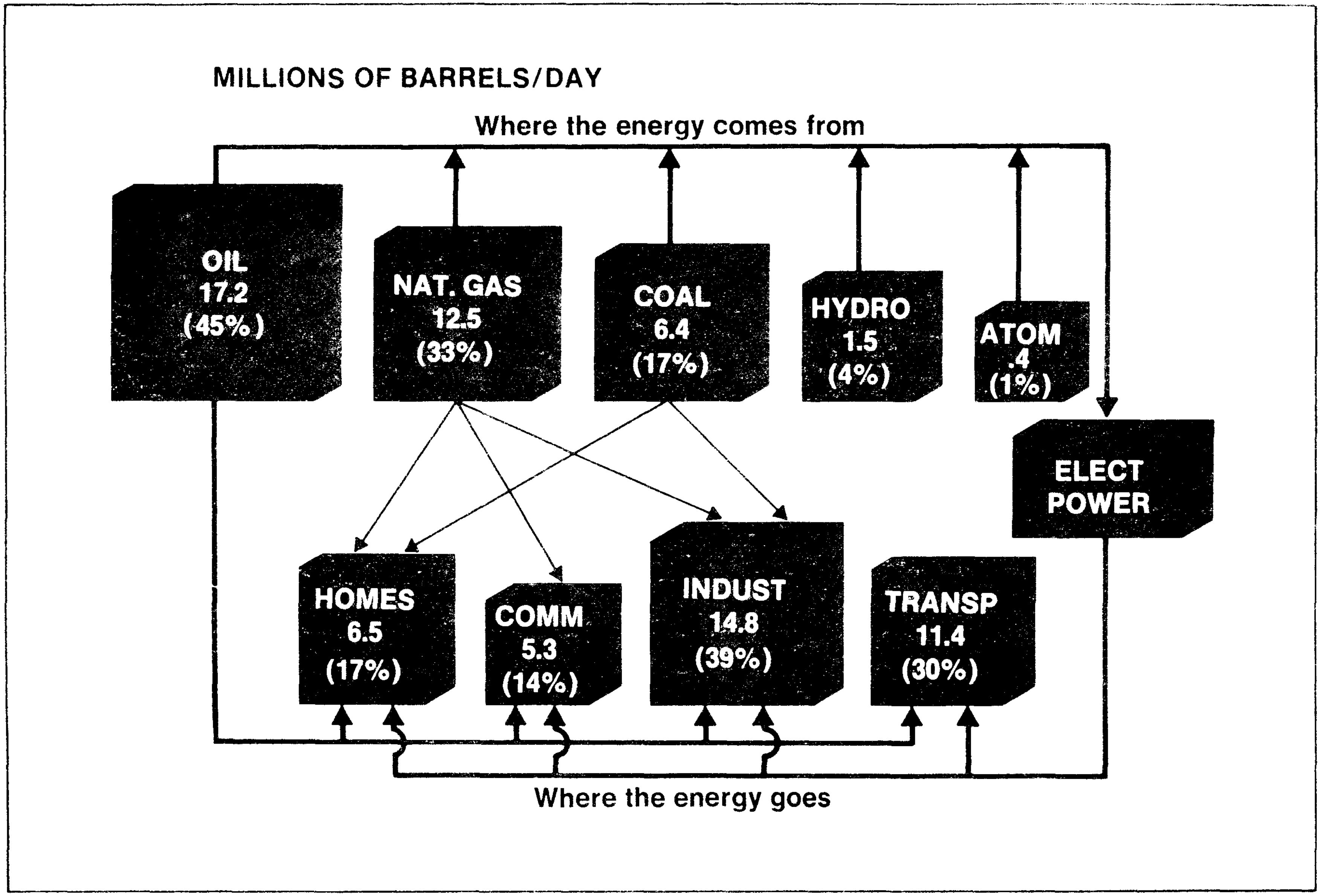
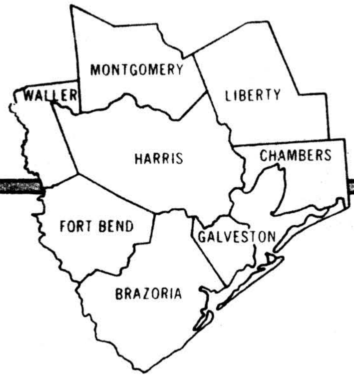


Figure 1—U. S. energy flow

Our energy consumption normally amounts to the equivalent of 38 million barrels of oil per day. The largest single source is oil, which accounts for 45% of the total!



H-GRTS

Newsletter

HOUSTON — GALVESTON Regional Transportation Study

Sponsored by the Cities of Houston, Pasadena, Galveston, Baytown, and Texas City; the Eight Counties, and the Texas Highway Department; in cooperation with the Federal Highway Administration, in coordination with the Houston - Galveston Area Council

VOLUME 4 NUMBER 4 OCTOBER , 1974

TRAFFIC VOLUMES UP AGAIN .... ARE WE FORGETTING TO CONSERVE ENERGY?

Comparing this year's traffic volumes on freeway and major highway systems with those of the same month last year, traffic in the H-GRTS Area showed a decrease early this year but it has been up again since the month of April. One main reason for the traffic rebound probably was the return of a more plentiful gasoline supply since the end of the oil embargo and the abatement of energy conservation measures which were imposed voluntarily on the public at the height of the energy crisis.

Is the energy crisis really over? Will the U. S. oil production be enough and in time to meet the increasing demand now and in the future? How much can other types of energy sources, such as coal, natural gas, nuclear, solar, geothermal or even garbage help? If promising, can these types of energy be readily converted for transportation use?

Not everyone agrees that the crisis is over, of course. In fact, many scientists, industrialists, congressmen and government officials are continuously voicing warnings that the nation's energy crisis has just begun. Energy sources, other than oil and gas, are promising but it will take a long time and great expenditures before they will be available for extensive use, especially for transportation purposes.

Narrowing down on transportation as an energy user, researchers point out that: (1) transportation has been responsible for about 1/4 of the nation's energy consumption, and a similar demand is expected to continue through 1990; (2) 96% of transportation energy is provided by petroleum, and almost 60% of U. S. petroleum goes for generating energy for transportation use; (3) passenger movement accounts for about 59% of the total energy used for transportation, and energy consumption for personal travel has increased by 40% as compared to a 20% increase in population in the past 15 years.

To illustrate these figures in simple facts: (1) transportation relies upon petroleum very heavily; (2) the efficiency of transportation vehicles is getting lower because of heavier weight, fancier equipment, and devices for safety and pollution reduction; (3) automobile ownership has increased and the number of passengers using a vehicle is reduced; (4) urban transit is less efficient because of low patronage. On the other hand, a slow turnaround trend has recently started toward smaller vehicles and less fuel consuming air pollution control devices.

automotive information

Motor Vehicle Manufacturers Association of the United States, Inc., 320 New Center Building, Detroit, Michigan 48202

VOL. III, No.1 AUGUST-SEPTEMBER, 1974

Cars Found More Energy Efficient Than Mass Transit

More efficient use of automobiles and car pool commuting are the greatest transportation energy-savers, according to a recent U.S. Government report. Combined with reduced travel speeds and more efficient truck use, private transportation can conserve some 37 percent of the projected nationwide energy consumption over the next 15 years, it said.

The conclusions were included in a study conducted by the U.S. Department of Transportation. The DOT report also revealed that a switch from passenger cars and trucks to public transportation would save only 1.8 percent in energy use, would take 10 years to accomplish, and require a $6.2 billion investment with a several-fold increase in the level of capital expenditure.

Modes Compared

The DOT study found that overall, the efficiency of cars and trucks would result in a combined energy saving of 46.3 percent in 20 years at a cost of $13 billion. On the other hand, a massive shift to rail and bus transit would save only 8.1 percent in fuel over a 15-year period and cost $29.2 billion.

Prepared by the Massachusetts Transportation Systems Center of DOT, the study singled out increased car efficiency as having the highest potential for conserving fuel — more than 20 percent. Car pools were ranked a strong second, with an ultimate savings of 10 percent.

Greater truck efficiency could conserve 5.4 percent, while reducing highway speeds would save 2.9 percent, the report showed. By increasing the allowable truck loads — an action Congress is currently considering — a further energy savings of 4.4 percent could be realized.

Transit Savings Marginal

Of three mass transit alternatives considered, DOT reported that a shift from autos to intercity buses and rail systems would effect only a 2.9 percent savings. If automobile riders changed over to urban transit, encompassing all public transportation modes, about 1.8 percent of anticipated fuel consumption could be saved.

Diverting freight movement from trucks to rails would produce only a 1.6 percent savings in fuel, the report said.

Better utilization of automobiles, buses, and trucks offer the best potential energy savings because it would take the least amount of public investment, according to the report. It noted that the 10 percent reduction in energy through more prevalent use of car pools would require virtually no financial outlays.

Industry Investment Needed

While the projected savings of over 20 percent through increased auto efficiency was cited as the greatest possible energy-saver, the report indicated that it could not be done without an additional investment by motor vehicle manufacturers. The DOT recommended that vehicle producers design cars for greater fuel economy and calculated that such an added in-

(Continued on Page 2)

MVMA offers this newsletter to present factual information, views and comments on motor-vehicle related issues of current interest. Content may be reproduced or quoted with or without credit. Requests for copies should be addressed to **Public Relations Department, Motor Vehicle Manufacturers Association, 320 New Center Building, Detroit, Michigan 48202.**

Cars Found More Energy Efficient Than Mass Transit (Cont. from page 1)

vestment may cost the industry $10 billion over a 20-year period.

Improving the operating efficiency of trucks, the study said, would cost about $3 billion over a 15-year span. But, it said, the energy savings would amount to 6.3 percent. If truck loads were increased from the present maximum legal limits, an additional 3.2 percent fuel saving could be made over a decade's time with no further financial outlays needed.

According to the DOT report, the highest capital investments were anticipated for mass transit systems. A switch from passenger cars to rail and bus transit for longer trips would conserve 2.9 percent of expected fuel requirements, but at a cost of $6 billion over 15 years. Although a similar changeover for commuting within cities would save 1.8 percent in energy, the investment over a 10-year time span would total $6.2 billion.

National Energy Policy, Coordinated Regulation Needed

The nation should develop a balanced national energy policy to meet the energy crisis; a program that strikes a balance between energy needs and environmental concerns, and between domestic self-sufficiency and reliance on foreign sources.

Such a policy must build upon and employ the free market system in developing our resources, with the government providing coordination, support where needed, and regulation as is necessary — according to MVMA president Franklin M. Kreml.

Kreml urged development and implementation of such a program in a wide-ranging, major address to the 72nd annual meeting of the American Automobile Association (AAA). Other nationwide transportation problems that demand effective solutions, he said, include highway traffic safety, overly-stringent automobile emission standards, conflicts between Federal motor vehicle and emission regulations, and potential impairment of the nation's mobility.

FEA Leadership Vital

He told the AAA delegates that the newly-created Federal Energy Administration must lead in the development of an effective national energy policy and coordinate acquiring and usage of the country's fuel resources.

"Regulation, when invoked, must be such that it does not upset the market balance as it did so disastrously in underpricing oil and natural gas," he cautioned, and only as much as may be necessary to rekindle free market forces, he said, noting that motor vehicle manufacturers are increasingly producing products which are progressively giving better fuel economy.

"The government's most critical task," he added, "is support of research and development of new sources of energy."

Auto Disincentives Criticized

Kreml took issue with two other speakers at the session, Russell E. Train, administrator of the Environmental Protection Agency and John G. Sawhill, administrator of the Federal Energy Administration, who said that the way to encourage use of mass transit is to impose significant "disincentives" on automobile usage in dense urban areas. While such disincentives may achieve some increase in mass transit use, Kreml said they will also operate to discourage many people from coming into cities altogether.

"It would be wiser and more productive to develop positive incentives to use motor vehicles more efficiently," he stated.

Kreml also called for continuance of the Highway Trust Fund to maintain road quality in order to avoid "erosion of our mobility, increased traffice fatalities, further economic distress to our cities, and a depressed general economy.

"It is imperative," he asserted, "that Trust Fund monies be available to restore to an acceptable level of maintenance the tens of thousands of miles of the U.S. system which are in their most serious state of disrepair since World War II, if for no other reason than to meet the requirements of highway safety."

Balanced Program Urged

Reductions in traffic injuries and deaths, Kreml said, must begin with a balanced highway safety program focused equally on the highway, driver, and vehicle. He stressed that the role of the Federal Government should be one of leadership, coordination, and support rather than directing a total national-state-municipal effort.

The MVMA President questioned the 77 Federal safety and damageability standards issued since 1966 which, in his words, "have proved unjustified in terms of cost/benefits in most cases, and frequently have proved to be counter-productive."

Nor is there conclusive evidence that the stringency of Federal automotive emission control standards is justified, he said. The recently released National Academy of Sciences study on the cost/benefits of the Clean Air Act amendments, according to Kreml, "emphasizes the inadequacies of the existing scientific base from which decisions have been made, and urges expanded research to strengthen the scientific and information base to reduce many existing uncertainties."

Kreml summed up by saying that attempts to meet safety, damageability, and emission standards—and concurrently improve fuel economy—result in mandates from several concerned official agencies that tend to conflict.

"As a result, we have urged that an integrating function be set up within one of the existing Cabinet-level departments to examine all proposed actions affecting motor vehicles for the purpose of determining the degree to which they conflict with conservation objectives, and with each other," Kreml said.

MVMA Supports 55 MPH Speed Limit Extension

The Motor Vehicle Manufacturers Association has urged Congress to extend, rather than make permanent, the nationwide 55 mile per-hour speed limit.

Citing the need for time to gather and evaluate data on the effects of decreased speeds and travel on traffic fatalities, MVMA said an extension would have the same interim effect as making the limitation permanent, without discouraging programs to further reduce highway injuries and deaths.

The present law — effective in all states since March, is due to expire on July 1 of next year. Congress is currently considering legislation which will extend the 55 mph speed limit.

Accident Exposure Drops

While the present maximum speed limit has been cited as a major cause for the decrease in traffic injuries and deaths, there are indications that decreased exposure to accident situations has had an even greater effect.

Several safety officials have cited the decline in travel as having a significant effect on the saving of lives.

According to Joseph Kauffman, research and development director of the Northwestern University Traffic Institute, there is no conclusive research to show that the 55 mph speed limit is the prime factor in reducing highway deaths.

"The energy shortage, less time spent on the highways, and fewer miles traveled are probably as important," he said. "Almost any accident is a combination of several factors and there really hasn't been a lot of good research to judge the importance of each."

(Continued on Page 4)

MVMA Supports 55 MPH Speed Limit Extension (Continued from page 3)

Low Speed Crashes Prevail

Lee N. Hames, director of safety education for the American Medical Association, has noted that most highway accidents occur at speeds under 55 miles per hour.

"We believe that the savings in lives cannot honestly be attributed to any great extent to the reduction in the speed limit," he said. Hames said he believes that the energy shortage, with car pooling and the use of other methods of transportation, reduced the number of miles being driven by motorists which significantly affected the number and severity of crashes. He also said the drop in fatalities is due to increased use of safety belts, particularly in newer cars.

National Safety Council President Vincent Tofany says the 55 mph speed limit was a major factor in saving lives, but that economic factors may also have played a part in the fatality reduction.

New Study Released

The Safety Council recently released a report on the factors influencing the 24 percent traffic death reduction recorded in the first four months of 1974, when compared to a similar period last year. The study summarized the effects of the factors as follows:

Reduction in speed	-11%
Reduction in travel	-05%
Reduction in occupancy	-03%
Reduction in night driving	-02%
Switch in roads	-01%
Greater use of Safety Belts	-01%
Other (unexplained)	-02%
Age, small cars, motorcycles, pedalcycles	+01%
Total	-24%

While 11 percent of the reduction was attributed to lower speeds, the Safety Council said that "driving speeds dropped not just on high speed highways, but also on roads with speed limits below 55 miles per hour."

The Council said another contributor to the fatality reduction was lowered speeds in accident occurrances that reduced many potential deaths to injuries. It added that slower speeds gave drivers more reaction time to respond to hazards and required less braking distance to come to a stop or slow to a speed low enough for accident avoidance maneuvers.

"Increased accident avoidance capability," the Council stated, "was probably an important factor in reducing the number of pedestrian fatalities in the first four months of the year."

Reduced travel was also singled out as a significant factor. The Council pointed out that travel on urban highways was down nearly six percent while travel on rural roads decreased about four percent.

'76 Cars May Be Heavier, Test Shows

The improved fuel economy of 1975 model cars — estimated by the EPA to be 13.5 percent better than on comparable '74 models — may be largely canceled out next year when a series of stricter government safety, damageability, and emissions standards go into effect.

One U.S. motor vehicle manufacturer estimates that existing, or proposed, vehicle regulations for the 1976 model year will necessitate significant weight additions to cars. Based on a trial program, a weight increase of 18 percent is anticipated for small automobiles, with a resulting fuel penalty of 14 percent.

The manufacturer conducted a test, using one of its current subcompact models weighing 1670 pounds, and determined that compliance with '76 standards will add 315 pounds to the vehicle. Included in the additions were 73 pounds for a new bumper system, 26 pounds for emissions hardware, and 126 pounds for body additions (head restraints, seat belts, door beams, brakes, fuel and electrical systems). The necessity of a larger displacement engine would add 90 more pounds. The addition of an air cushion restraint system would add another 55 pounds over and above the 315 pound increase.

The subcompact, modified to meet '76 standards, was tested under a combination of city/suburban driving conditions and used 14 percent more fuel than a comparable 1975 model. Such a fuel penalty, the manufacturer said, would be inflationary and would aggravate the energy crisis.

Powering Transportation	24.8%		
Driving Cars	13.2%	Driving farm & off road vehicles	1.2%
Driving trucks & buses	5.5%	Fueling ships & boats, including ocean going vessels	1.0%
Flying planes	3.2%		
Fueling trains	0.7%		

Source: "Where America's Energy Goes", Chase Manhattan Bank.

TGRA Urban Mass Transportation Advisory Council Recommendations as Amended and Approved by the Executive Committee

Austin, Texas
June 19, 1974

A. Recommend to the TGRA Executive Committee that TGRA broaden its scope of interest and support to include mass transportation as well as highways.

B. Further recommend that TGRA support establishment of a state department responsible for administration of highway and mass transportation programs, recognizing the need for development of these modes cooperatively and to their optimum potential.

1. Support the creation of a separate regenerative state mass transportation fund on a basis which will not compete with the established State Highway Fund.

2. Support enabling legislation to permit the state to assist cities, counties, and transit authorities in planning, designing, financing, and constructing mass transportation facilities.

3. Support coordinated planning for all transportation modes by local, state and federal agencies.

4. Support coordination of efforts of state agencies through the Interagency Transportation Council.

5. Support studies of Texas transportation needs to establish practical goals and to define respective roles of city, county, state and federal governments.

6. Support the principle that the operation and control of mass transportation systems is a local responsibility.

7. Support the use of highway funds for improved public transportation through fringe parking, exclusive or preferential bus lanes, electronic controls, bus turnouts and other appropriate improvements on public roadways where mutually determined by local governments and the State.

8. Support selected research to develop new technology needed to serve the transportation needs of Texas.

9. Support projects to test new transportation systems in Texas cities.

10. Support the release of highway and urban mass transit funds appropriated by Congress but impounded by administrative action.

11. Support public information programs to promote public support of transportation needs.

12. Support programs such as carpools to encourage greater transportation energy conservation.

13. Support the development of urban transportation management curricula in Texas educational institutions.

14. Support changing the name of TGRA to reflect the expanded scope of the Association.

BETTER ROADS AND

TRANSPORTATION COUNCIL

Policy Statement

Adopted
Nashville, Tennessee
July 31, 1974

1. Complete the Interstate system as soon as possible to bring its proven economic and life-saving benefits to bear on the constantly growing transportation needs of urban and rural areas. Present funding levels are inadequate to accomplish this goal. Interstate authorizations should be at least $4 billion per year. States exercising initiative in the completion of Interstate mileage should be encouraged to do so.

2. Increase substantially the rural primary and secondary program authorizations to amounts no less than the totals for urban highways and mass transportation assistance. It is the long-neglected primary and secondary roads which are in the least satisfactory condition for safe and efficient movement of people, goods and farm production -- and this is where the highest accident, fatality and injury rates are experienced.

3. Provide a funding level of at least $2 billion annually from general revenue for mass transportation. Establish an equitable formula for distribution of the funds to the states.

4. Launch an intensive program to bring substantial early relief to urban traffic congestion. Such a program should include improved management of transportation facilities; completion of planned freeways, ring roads, and improvement of arterial streets; greater use of public transportation and carpools; and use of highway funds for bus lanes on freeways, passenger shelters, parking areas and electronic controls.

5. Provide for continuity of funding in highway and mass transportation programs. The full amount of funds authorized by Congress should be made available to the states without administrative impoundment. Red tape should be eliminated. Categories should be reduced and the states should be given maximum flexibility in the application of funds to meet their respective needs.

6. The Highway Trust Fund should be continued beyond the 1977 expiration date on the following conditions:

a. total authorizations for highway improvements are increased to fully utilize revenues generated by highway user taxes.

b. an equitable apportionment formula is established to guarantee each state a minimum return of 85% of motor vehicle related taxes collected and attributable to each state.

7. Increase funds available for replacement of obsolete and hazardous bridges and for elimination of highway-rail crossings at grade.

8. A national transportation policy should be established for the cooperative development of all transportation modes to their optimum potential. The Federal government should be involved only in programs of national significance. A broader responsibility for state and local governments and private enterprise should be encouraged.

9. Highway and transportation programs should be translated into human needs. The primary goal should always be to improve the quality of life of the American people. With the completion of the Interstate system, consideration should be given to two other major programs:

a. economic development roads to create new jobs and support dispersal of population.

b. parkways and scenic roads to provide for the recreational needs of a growing population.

10. Highway and transportation programs should support energy conservation and environmental goals.

URBAN TRANSPORTATION *Perspective*

A Publication of the Texas Good Roads Association
302 Vaughn Building
Austin, Texas 78701

TEXANS WORKING TOGETHER FOR BETTER TRANSPORTATION

December - 1973

ON APPROACHING THE BIG AIRPORT

IH 635 is an offshoot of IH 35E that describes a concrete half-circle around East and North Dallas and winds up back at the parent highway just below Farmers Branch. From that interchange you can look due west and almost literally see the new Dallas-Fort Worth Regional Airport, only 13 miles away.

Dallas County and the Texas Highway Department want to make a freeway connecting the two, SH 635. Laying aside for the moment traffic not generated by the airport: The Dallas-Fort Worth transportation study indicates that the airport will attract about 8,000 trips a day from the North Dallas-Farmers Branch-Richardson-Garland area when it is opened -- and 54,000 a day by 1990.

If SH 635 is not constructed, most of that traffic will take one of two alternate routes: (1) Down 35E to Spur 348 and on to SH 183 (15.76 miles) or (2) IH 35E-Spur 348 to SH 114 (16.83 miles). Both are freeways, or will be.

Figuring an average of 12 miles to the gallon of gasoline, the Federal Highway Administration's 1971 figure (it's less now with the new emission controls), the proposed SH 635 route would consume 3,163,330 gallons in 1975.

The route winding up on SH 183 (south entrance) would use 3,834,930 gallons.

The SH 114 route (north entrance) would take 4,095,300 gallons.

By these estimates, the two alternate routes would use 671,600 and 931,970 more gallons of fuel per year. By 1990 the saving will increase to approximately 4.5 million gallons for the southern and 6.3 million for the northern route. That's per year. (To get a comparison, of course, choose one or the other alternate.)

It would take a lot of fuel to build the SH 635 facility -- the Highway Department estimates about one million gallons of gasoline and diesel fuel per year during the 2 1/2-year construction phase.

By then (say, early 1977) the traffic from Dallas would be starting to pinch and another route would be most welcome.

Now about that non-airport traffic: The total average daily travel for SH 635 is 30,000 vehicles in 1975 -- and 80,000 by 1990. (These are transportation study figures.)

SOME CONSTRUCTION ACTUALLY SAVES FUEL IN THE LONG RUN

In summary: Stopping all highway construction unquestionably would "save" gasoline; however, what we're trying to do is to use what we've got wisely. Often a few miles of new highway or improvements on an obsolescent road will shorten travel distances and improve free-flow traffic movement. IH 635 is a good example.

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