STATEMENT OF HAMILTON HERMAN, ASSISTANT SECRETARY FOR SYSTEMS DEVELOPMENT AND TECHNOLOGY, DEPARTMENT OF TRANSPORTATION BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY SUBCOMMITTEE ON AVIATION AND TRANSPORTATION R&D, TUESDAY, JULY 20, 1976.

Mr. Chairman and Members of the Subcommittee:

I am pleased to appear before you today as you begin your review of the Department of Transportation's ground systems R&D activities. I shall try to provide you with an overview of those activities, and to demonstrate their relationships to overall Department policy objectives. In general, the Department performs R&D for three main purposes: to support its legislatively mandated regulatory and operational responsibilities, to improve the knowledge based upon which transportation policy decisions are made, and to contribute directly toward the solution of specific problems in order to improve the quality and availability of transportation.

While the Department is the ultimate "consumer" of a portion of its R&D outputs, particularly in those areas which support regulatory and operational activities, much of our R&D products will be used only if they are accepted by state and local government agencies and by firms and individuals in the private sector. With regard to this research, the Federal Government's

role is that of a catalyst helping in the evolution of a more perfect transportation system which will result primarily through the efforts of a motivated, competitive, and forward-looking private sector.

I would like to begin by presenting an overview of the Department's FY 77 budget request. Figure 1 shows the distribution by organizational elements within the Department. The R&D components range from about $30 million for the Office of the Secretary to $99 million for the Federal Aviation Administration. Note that in FY 77 R&D will account for nearly $368 million out of the Department's total budget request of $14 plus billion.

The Department's R&D activities can be categorized in several ways, each useful to illustrate one or another of its various facets. A significant point regarding the composition of the Department's program is shown in Figure 2. Approximately three-fourths of our total resources are in grants to others and less than one-quarter to operations, leaving a small slice of R&D. You will see that our socio-economic R&D accounts for a little over one-third of our R&D allocation and R&D relating to operating

responsibilities of the FAA and the USCG account for approximately one-third. The remaining one-third goes for advanced technical building block development which is used for providing technical opportunities and for establishing regulations. We allocate a large portion of our R&D effort toward socio-economic research in part to demonstrate the array of options which may meet transportation requirements, and to evaluate how well each will satisfy the public's transportation and other needs. In developing and operating systems to fulfill those needs, we must assure that the transportation R&D outputs will be acceptable to state and local transportation officials and to the general public.

Over one-third of our R&D effort must be devoted to prototype development, test and evaluation in order to carry our R&D effort through to the point where the public is educated, motivated, and willing to accept technological changes in transportation. In short, they want to "kick the tires." On the other end of the spectrum, our applied research, as that term is generally used, is approximately 1% of our total R&D budget. Exploratory development about 5%, advanced development 31%, and preliminary operational deployment and demonstration is 14%.

I would like to turn now to the objectives which guide the Department's R&D program. In general, the Department's mission, stated in the legislation establishing the Department of Transportation, is to provide for the "development of national transportation policies and programs conducive to the provision of fast, safe, efficient, and convenient transportation at the lowest cost..." "by private enterprise to the maximum extent feasible," and "the efficient utilization and conservation of the nation's resources." Historically, the Department has translated this broad mandate into the several R&D management objectives which appear on Figure 3. The objective structure noted has been taken from Secretary Coleman's Statement of National Transportation Policy issued in September 1975. The R&D objectives noted in our program analyses are clearly consistent with and supportive of the objectives outlined in that policy statement. The distribution of resources in percent of the total DOT R&D request is shown. You will note that more than 50% of the activity is aimed at improving the efficiency, service, quality, safety and security of the systems and are predominantly aimed at existing system investments. The knowledge base represents the resources with which

we look to future opportunities and to the techniques for sharing our technology with our constituents.

As an integral part of our R&D planning process, my staff and I regularly re-examine the Department's R&D programs with two basic thoughts in mind: First, how does the program relate to near term problems, and, secondly, how does it relate to the probable future. We have observed that increasingly our program to date has been oriented towards technical and operational evolutionary improvements of the present system. To complement this emphasis on near term research, my office has initiated several thrusts to assure that R&D results will be available in parallel with long-range evolving transportation system requirements. First, we are in the process of preparing an assessment of what the transportation system might look like over the next 25 years. Our purpose is to identify likely and potential technological and institutional advances which relate to existing transportation problems. With this perspective we hope to identify R&D opportunities which should be addressed now to facilitate both major changes and innovative incremental improvements. As a second initiative, we are now structuring an advanced transportation research program,

to be conducted at the Department's Transportation Systems Center, which will expand the long-range transportation system options available to future transportation policy-makers and planners. Needless to say, I would welcome the advice of this committee and its staff in carrying out these initiatives. Portions of the future assessment I mentioned have already been completed in draft form, and I would like to share with you some of the results and their R&D implications.

RAIL FREIGHT

In the rail freight industry, for examples, possible improvements to the freight network can be divided into several steps. The first is selective rehabilitation of the existing physical plant (guideway and terminals) plus operational changes facilitated by the freight car management system.

A second step is multimodal containerization, coupled with changes in operation of terminals. The yards would use more automated processes for containers; the loading and unloading would be done simultaneously on a number of cars so that stop times are minimized--and transfers would be accomplished between modes as appropriate. Shorter trains would increase frequency of service and decrease the impact on yard operations. Automation is the

key to many of these advances.

The next step is to a much higher speed network. The resulting higher productivity could more than outweigh higher equipment costs. Small lighter locomotives would produce less track damage. The network would emphasize medium/long haul container shipments and compatible operations with passenger service.

FRA's R&D program is now focused on solving current issues and problems and maintaining and improving the existing system, all of which is vitally needed. However, a simultaneous R&D effort is being initiated to consider advanced concepts and advancing technology to further enhance the existing system. Such activities will lay the framework for a future integrated intermodal freight system. This will require developments in container systems, increased automation of container transfers, cooperative multimodal terminals, etc. Not only must the physical systems be examined but the ability to implement and operate must be evaluated.

Urban Passenger Movement

Urban transportation improvements in response to the problems of congestion, poor mobility for the non-driver, and

energy uncertainty will be pushed by the Federal Government to improve urban life. One point seems abundantly clear: further expansion of the fixed route bus or rail systems typical of today's transit will not do the job alone over the long term. Fixed route bus, or transit, is very poor in low density communities where nearly half of the nation's population now lives.

The automobile will continue to be the primary mode of urban transportation, whether or not it is privately owned or shared. When the auto is shared or when it is operated as a service, it is classified as paratransit. In most cases, paratransit utilized current hardware technology and uses improved communication and flow management technology to increase its responsiveness.

The road to future change will be evolutionary in nature and conventional transit must adapt to ridership density variations, especially in the smaller cities. Effective low density service with line haul and intercity connections will be an increasing priority and a key factor.

The present program follows a three-pronged approach: (1) to produce near term improvements and payoffs for the existing conventional transit system, (2) to provide a spectrum of low density

system options which will allow cities and regions to select those systems which best fit their suburban character and environment, and (3) to provide a framework of areawide responsive systems so that cities may expand their system in a comprehensive and integrated regional network providing high access and connectivity to both low and high density areas. The Associate Administrator of the Urban Mass Transportation Administration will discuss these activities in much more detail.

Intercity Passenger Systems

Intercity passenger transportation is generally good. The private auto dominates, except at distances over 1,000 miles. At distances greater than 300 miles, air is clearly the most productive public transportation service. Bus and rail are small in overall statistics. Bus is important because it is the dominant public service to small-town America, and rail is vital in a few specific high volume corridors. There is substantial room for further improvement in two areas: first, in the intercity transportation at distances less than 300 miles and secondly in the integration of the intercity sector into the urban network.

There is an awkward gap at trip distances between 100 and 300 miles. Round trip by auto approaches a whole day. Rail is

only slightly better than auto or bus. Air suffers because too much of the trip is involved in airport access, terminal time, and air traffic circuitry. This short haul gap requires a system with a good cruise speed, (preferably approaching 300 mph) which loses very little time in stops and can operate at, say, 10¢/passenger-mile total costs at 5 million annual riders. The answer could be either a quiet helicopter-equivalent air system or a new kind of fixed guideway ground system (or both, serving different density characteristics). If the guideway can be shared with freight, either concurrently or compatibly off-hours, then, the difficulty in meeting the "low" ridership requirement with good economics is reduced. We have discussed previously our views on air service in your aviation hearings. My intention here is to only relate the air and surface roles and to emphasize the surface system developments.

With most of the interstate highway system already located, the major R&D activity is directed towards reducing maintenance and construction costs and improving the efficiency of the system by improving traffic flow and the quality and availability of motorist information.

Recent legislation is spearheading the refurbishment program in the current rail system which is intended to improve service and reduce operating costs.

The second area of importance is very much similar to the issues. I have noted before, i.e., terminal, or transfer throughput. The integration of the intercity system into the urban network is increasingly important and will probably continue to be the toughest problem. There are institutional barriers similar to those in goods movement. Our vision is of a high speed ground network that ties distributed airports and other intercity terminals into a comprehensive urban network, and, in fact, becomes an integral part of both the urban and the intercity system.

The Road/Vehicle Evolution

The automobile and truck dominate urban and intercity travel and goods movement today, and will continue to do so into the foreseeable future. If we doubled the modal share of all other modes, autos would still account for 80% of all trips.

The trend toward a more energy efficient, safer, lower-polluting car will continue through the 1980s. We have just completed an interagency study dealing with automotive energy goals beyond 1980. This report will be released by the end of

the month in draft form to the Energy Resources Council. This report will contain objectives and recommendations relating to the operation of motor vehicles in the future. Studies and analyses will continue in the automotive energy area to ensure that in the future the automobile will be energy efficient, safe, and a good neighbor to the environment.

We are improving traffic flow control by having sensors detect traffic conditions and using the information to provide more efficient signals and information to the driver. The next step might be, through the broader application of micro electronics, to have some of these signals go directly to the car, simplifying the driver's function, and increasing flow and safety.

The ultimate step in such a trend would be to have all operating functions transferred from the human driver to an "auto-driver" that is programmed to respond to "signals" for all steering and vehicle operation. While there is considerable controversy as to how soon, if ever, this final step to a "driverless vehicle" could be feasibly accomplished, its implications are so far reaching and attractive that it deserves serious exploration: the rapid pace of technical advancements in electronics that increase

versatility and lower cost is continuing to shorten the list of things that can't be done.

Major emphasis to date in the R&D program has been on modification of the "roadway", involving vehicle sensing and traffic light control. More recent efforts are examining real-time sensing and signal control.

In the vehicle itself, electronics can augment driver steering, speed control, etc. Braking systems are being developed to provide skid-free stopping control. Most developments in vehicle electronics are currently aimed at improving internal vehicle functions such as fuel metering. Developments in this area are as yet very limited, compared to the potential that advances in microprocessing suggest.

Studies that relate to various aspects of future interactive road/vehicle systems, require considerable broadening to establish the necessary knowledge base and technology building blocks necessary. In order to lay the groundwork for the future system concept studies, highway automation/information systems, grade separation, and highway/vehicle interface studies will have to be initiated. This is truly an intermodal program that will require coordinated approach involving many elements of the Department of Transportation.

I believe this is a good point to describe the respective roles of the Office of the Secretary and the modal administrations in the conduct of the Department's R&D. Each modal administration within the Department receives separate appropriations and is responsible for planning, programming, and executing its own activities. The Office of the Secretary is required to coordinate these efforts to ensure optimal utilization of all DOT resources and to achieve a totally integrated, effective R&D program. The Office of the Secretary also focuses its R&D attention on policy formulation, long term transportation R&D requirements and on matters of multi-and intermodal nature which require integration and balancing of modal interests.

The Department's process for allocating R&D dollars begins with a review and analysis of the R&D management objectives and the strategic trends I have just described. The next steps are divided into a planning process, a budget cycle process and an execution process.

The planning process encompasses our enabling legislation and policy study results which are translated into R&D goals and objectives mode-by-mode. DOT goals are then the basis for administration R&D goals and objectives. When compromises are required, these are deliberated with the administrations.

The results of the above deliberations are the input for the first part of the budget cycle, the "Spring Preview," which begins some eighteen months prior to the start of the fiscal year. At that time, as a part of our total budget cycle preparation effort, we develop our R&D requirements. These in turn are meshed with the total budgetary requirements for the Department and are discussed with both the staff of the Office of the Secretary and the operating administrations. The results of these deliberations are forwarded to the Office of Management and Budget in the fall and are subsequently incorporated into the administration's appropriation proposal.

The results of the administration's appropriation proposal in the form of Congressional appropriations, are used to execute the R&D programs developed during the planning and budget cycle of the R&D management procedure.

My staff has transmitted to you the "Fiscal Year 1977 DOT Program Analysis Report," which includes resources for fiscal years 1975 and 1976, and presents an analysis, by some 40 separate categories. I will be glad to discuss it with you. It is my intention, however, only to summarize the Transportation Planning, Research, and Development appropriation which finances the Secretary's

responsibilities since detailed justification has been submitted in the budget. (Figure 4).

OST PROGRAMS

The Office of the Secretary focuses its R&D attention largely on policy formulation, resource allocation, interagency and intradepartment coordination, evaluation of programs and on matters of an intermodal nature which require integration and balancing of modal interests. The Transportation, Planning, Research, and Development appropriation, which has four subdivisions, finances those research activities and studies which directly support the Secretary's responsibilities and which can more effectively or appropriately be conducted in the Office of the Secretary than by the operating administrations within the Department.

The Transportation Policy and Planning subdivision provides the foundation for development of transportation policy, coordination of National Level transportation planning, and dealing with such difficult issues as regulatory modernization, energy conservation, allocation of Federal resources in the transportation sector, and analysis of financially ailing transportation industries. Transportation problems and issues are assessed and policies developed on the

basis of empirical and systematic research. This R&D effort is primarily socio-economic oriented or "soft research" and is administered by the Office of the Assistant Secretary for Policy, Plans and International Affairs (TPI).

Two major program efforts under the broad OST R&D appropriation, University Research and Transportation Systems Development and Technology managed by my office (TST) are considered the "hard research or technological development" efforts of OST. The objective of the University Research Program is to assure that resources of the higher education community are effectively brought to bear on transportation problems. The Systems Development and Technology effort consists of project designed to complement research and development programs of the operating administrations and to stimulate industry efforts to advance transportation technology.

The last major R&D subdivision under this appropriation is called Special Programs consisting of projects which provide technical studies and other data in support of departmental effort in the areas of safety program coordination, hazardous materials and pipeline safety, transportation security, consumer and environmental affairs, and facilitation of passenger and freight

transportation. The projects within the Special Program effort are primarily administered either by the Office of the Assistant Secretary for Environment, Safety and Consumer Affairs (TES) or the newly created Materials Transportation Bureau (MTB).

In this brief outline, it is appropriate to view this program against the DOT Policy and RD&D Management Objectives framework previously noted. (Figure 5).

1. MODERNIZE REGULATION/LEGISLATION

TPI is directing a project called Problems of Economic Viability of the Transportation Industry in which systematic data analysis and evaluation attempts to develop sound policy recommendations dealing with the critical transportation industry issues. Special attention is paid to Federal policy and regulations (which may demand corrective action) to encourage continued resolution of transportation problems through private action.

2. INCREASE EFFICIENCY/SERVICE. The R&D program, directed toward this management objective, consists of the following major efforts: Research to Improve Service and Productivity (TPI) which identifies ways to make more effective use of existing transportation infrastructure and to improve overall service quality. It deals in

areas such as transit and traffic management, operational systems integration, improved evaluation techniques, airline activities, labor productivity, rural passenger service alternatives, etc. United States Cargo Data Interchange System (CARDIS) is a major TES/TST effort to develop the necessary standard codes and procedures to automate the flow of data concerning domestic and international cargo shipments.

Other projects in this management objective are: Improving Telecommunications (TST), 55-mph Awareness Programs (TPI) and Transportation of the Handicapped and Elderly (TES).

3. IMPROVE SAFETY AND SECURITY.

A major R&D effort by the Materials Transportation Bureau is in the area of Increased Material Transport Safety. The OST R&D projects managed by TES in this area are: Demonstrations and Technical Assistance, Advisory Standards Preparation, and Fire Safety Technology.

4. LESSEN UNFAVORABLE ENVIRONMENTAL IMPACTS.

Both TST and TES offices are involved in an overall effort to reduce adverse environmental effects of transportation-related systems and facilities on the public, user, and the natural environment.

The TST portion includes Surface Transportation Vehicle Noise Reduction which involves expansion of techniques for enforcement, improved noise reduction methods, and demonstrations; Noise Measurement, Information and Analysis consisting of adding to the data base of accurate measurement of various noise levels and modeling techniques; and Technology for Environmental Analysis which provides technological tools needed to support assessment and monitoring of environmental impacts of transportation systems/facilities.

The TES projects include Transportation Measures to Improve Air Quality, Technical Assessment of Environmental Impact, and Effects of Land Use and Coastal Zone Management Plans on Transportation Systems.

5. MINIMIZE ENERGY CONSTRAINTS. The significant thrust involves the Automotive Energy Efficiency Program (AEEP). This activity is the lead Federal Program to assess the automotive industry's capability to increase the fuel economy of their production cars, trucks, and buses in the coming years and to assess the probable effects upon the nation of introducing the modified vehicles into the future fleet.

TPI's R&D project in this area is a more general socio-

economic analysis called the Automobile--Benefits and Costs while the TES project deals with the Bicycle.

6. INCREASE KNOWLEDGE BASE.

This represents a long term management objective which receives a relatively high proportion of OST's R&D effort. Because of its nature, it involves all the various OST offices concerned with R&D (TPI, TES, and TST). The TPI effort in this area involves various socio-economic research projects for necessary data and analysis techniques in National Planning, Forecasting, Intermodal Relationships, National System Assessment, National Transportation Data Base, etc.

The TES effort in this area while smaller than TPI's includes Transportation Safety Information Systems, Cargo Loss Data Collection/Analysis/Estimation, and Consumer Education. TST has various projects in this area.

In this category is Advanced Research Projects with its principal objective the development of a knowledge base in critical, multimodal core technologies that have high potential payoff. Another project called Transportation Systems Technology Payoff/ RD&D Program Balance is directed to improve transportation R&D resource allocation, program focus, and effectiveness through

development of alternative future scenarios and timely identification of technological implications.

Another major TST R&D effort is in The Transportation Construction Program with the goal of significant cost reduction in future modal projects involving underground, surface, and aerial structures. The project Technology and Knowledge Sharing is a key R&D project which attempts to assure maximum distribution of DOT research and development products to the state and local governments. It consists of multimodal coordination, information service development, and technical program development.

The last program area in the management objective category of increasing the knowledge base is University Research. The University Research program, within the purview of my office, is structures to assure that resources of the higher eduction community are effectively brought to bear on transportation problems and that active involvement of universities and colleges with the Department, state and local governments and the transportation industry takes place. Through this process we avail ourselves of some of the most important of our applied research. This area is the most fundamental of the research activities sponsored by the

Department. In the past three years, the program has received excellent responses from the university community. Over 300 graduate students have performed research under the direction of outstanding and expert principal investigators working closely with program monitors from every element of the Department. The purpose of that relationship is to assure the basic objectives of the program will be accomplished.

The Department is fortunate to have several highly competent R&D facilities to perform its in-house R&D. The Department's Transportation Systems Center, located in Cambridge, Massachusetts, is an unique institution which performs technical, economic and social science research in all modes of transportation for the Office of the Secretary and for the modal administrations. Because it carriers on research relating to all transportation modes, the Center, or TSC as we refer to it, is in a unique position to aid in the transfer of R&D results from one mode to another, and to address problems common to several modes. Right now TSC is constructing an extensive dynomometer laboratory to aid in implementing the automotive fuel economy regulatory program mandated by the Energy Policy and Conservation Act.

Several of the Department's administrations have their own research labs which support their modal research activities. This may will summarize the various facilities and give you an idea of their location. (Figure 6).

The witnesses from the modal administrations will provide some detail on the facilities in their respective organizations.

Conclusion and Key Issues

1. Delivery of R&D

One thing that becomes quickly apparent when entering the transportation field is that there is no shortage of ideas on how to improve things.

The literature is full of potential new technologies and operational concepts, and many of these have been taken to the proof of concept or technical feasibility stage either by Government programs or by private funds. Stil more need to be examined.

Proof of technology alone is not sufficient. Acceptance in the marketplace is a prerequisite and there is a great reluctance to be first with untried systems particularly when huge capital outlays are required and very often provided largely by public funds. In a declining market, most efforts have been concerned with sheer survival and in this environment, change, even if it

promises greater efficiencies, is difficult to institute where uncertainties exist. Technology sharing is our process--but credibility is the qualifier--much more realworld information is needed.

2. Institutional Problems

Mobility in this country is higher than anywhere else in the world and this has come about largely by the competitive market and usually along directly modal lines.

Government funding and regulation has also generally followed this same pattern.

However, many of the methods, by which efficiency, convenience, service and cost can be improved, cross the lines of conventional thinking and organizational structure.

For example, standardization in the rail transit industry is difficult to achieve because existing infrastructure such as stations, tracks, tunnels and signalling does not allow for it. The introduction of urban transportation systems requires the advice and consent of a multitude of diverse concerns and may significantly affect land use and the structure of the city. Labor practices vary significantly from mode to mode and are often incompatible with each other. Cooperative behavior between modes is often

precluded by regulation or past practice.

It is clear, then, that the introduction of change into these monolithic structures is difficult at best and will require our continuing attention and investigative efforts.

3. Systems Integration and Evaluation

One thing has become clear in our efforts to understand and facilitate the continued improvement of our national transportation system.

Many of the solutions involve novel institutional arrangements, as well as technologies. General acceptance and valid testing frequently can only be obtained by installation and evaluation in an operational environment.

The Department has used the process of demonstration both in passenger and freight systems. Examples of these are the Haddenfield dial-a-ride experiment and the automation of the Chicago rail terminal freight information system.

This technique can only be successful when it is carried out in close cooperation with the local authority or user especially as we wish to preserve the ability for decisions to be made at that level.

4. Critical Mass of R&D

I began this summary by mentioning the paucity of R&D in the transportation industry in recent years.

In general, it must be expected that the industry, given the opportunity to be profitable, must itself be the prime mover in innovation and change, for in the long run, it is the competitive marketplace which will produce the best ideas and continuing improvements in service.

The industry, however, has not been profitable and there has been little incentive to try to place new systems and techniques into the market. Some have tried with disasterous results.

The Department has played a significant role in the reversal of this trend but the level of R&D in the industry is extremely low and time is short to make the determinations which will be persuasive in the face of significant new investments.

Mr. Chairman, this concludes my prepared remarks. I hope that this statement begins to give you background on the Department's R&D activities. I welcome any questions you may have.

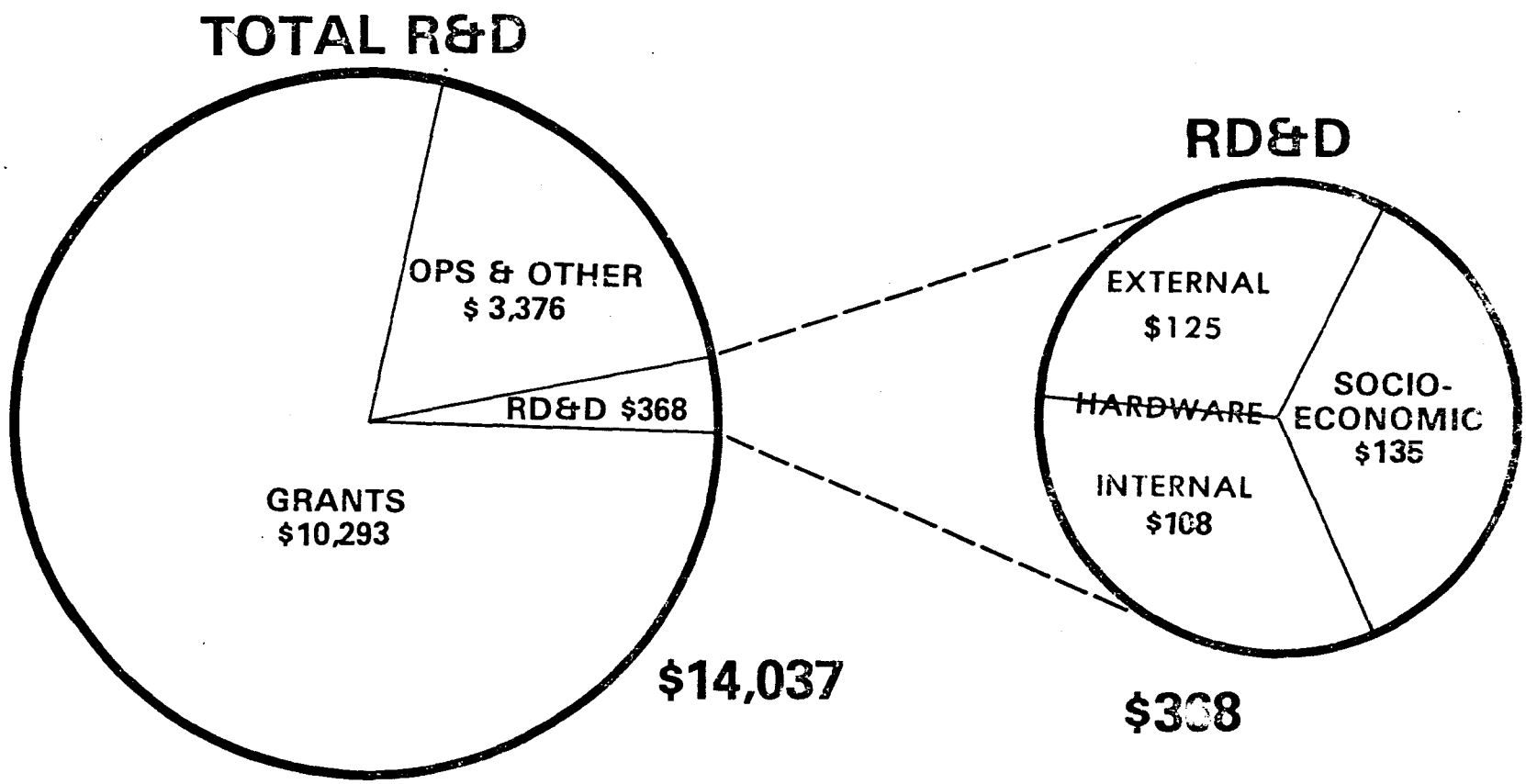
Department of Transportation
FY 1977 Budget Request
(Millions of Dollars)

ADMINISTRATION	TOTAL	R&D
OFFICE OF THE SECRETARY	67.8	29.9
COAST GUARD	1,209.6	19.0
FEDERAL AVIATION ADMINISTRATION	2,403.6	99.3
FEDERAL HIGHWAY ADMINISTRATION	6,914.3	44.0
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	177.0	58.0
FEDERAL RAIL ADMINISTRATION	774.2	47.5
URBAN MASS TRANSPORTATION ADMINISTRATION	2483.6	70.0
ST. LAWRENCE SEAWAY DEVELOPMENT CORPORATION	6.6	-0-
TOTAL	14,036.7	367.7

Figure 1

DOT Resource Allocations FY 1977

(Millions of Dollars)



RD&D INCLUDES DEMO'S NOT REPORTED IN A-11 BASELINE

Figure 2

DOT Policy Objectives

NEAR TERM

- REMOVE INSTITUTIONAL BARRIERS
- INCREASE PRODUCTIVITY AND SERVICE
- PROMOTE THE QUALITY OF LIFE
- FOSTER MULTIMODAL TERMINALS
- SHORE UP WEAK ELEMENTS
- MAINTAIN EMPLOYMENT

LONG TERM

- MULTIMODISM
- COMPREHENSIVE COMPATIBLE SYSTEM
- HIGH ACCEPTIBILITY & UTILITY

R&D MANAGEMENT OBJECTIVES

MODERNISE REG/LEG	0.3
INCREASE EFFICIENCY & SERVICE	35.8
IMPROVE SAFETY & SECURITY	20.7
LESSEN ADVERSE ENVIRONMENTAL EFFECTS	4.9
MINIMIZE ENERGY CONSTRAINTS	2.6
INCREASE KNOWLEDGE BASE	35.7
	100.0%

Figure 3

TRANSPORTATION PLANNING, RESEARCH AND DEVELOPMENT

FY 1977 Request by Budget Activity and Major Program

($ in Thousands)

I.	Transportation Policy and Planning	$11,800
	A. Transportation Planning	1,100
	B. Transportation Policy Development	4,000
	C. Policy and Planning Information Base	3,100
	D. Administrative Costs	3,600
II.	University Research	3,500
III.	Transportation Systems Development and Technology	12,400
	A. Protect Environment and Conserve Energy	6,700
	B. Multi- and Inter-Modal Systems and Technology	2,589
	C. Noise Abatement	1,000
	D. Technology and Knowledge Sharing	500
	E. R&D Management, Planning and Support	800
	F. Administrative Costs	811
IV.	Special Programs	2,100
	A. Safety Affairs	135
	B. Consumer Affairs	140
	C. Facilitation Affairs	315
	D. Transportation Security	150
	E. Environmental Affairs	460
	F. Material Transportation	775
	G. Administrative Costs	125
	Total Appropriation	$29,800

Figure 4

FY '77 OST Program

DOT MANAGEMENT OBJECTIVES	AIMED AT	$ (000's)
MODERNIZE REGULATION/ LEGISLATION	UPDATING ECONOMIC REGULATIONS, ELIMINATING INTERMODAL RESTRICTIONS, DEVELOPING PROCESS FOR RESOLVING ISSUES.	950
INCREASE EFFICIENCY/SERVICE	IMPROVING TRAFFIC FLOWS - INCREASING ACCEPTANCE - MINIMIZING CONGESTION, REDUCING COSTS (Fixed and Operating).	2505
IMPROVE SAFETY/SECURITY	PROTECTION OF SYSTEM, OPERATING PERSONNEL, PASSENGERS, AND FREIGHT FROM HARM OR LOSS.	360
LESSEN UNFAVORABLE ENVIRONMENTAL EFFECTS	REDUCING DELETERIOUS EFFECTS OF TRANSPORTATION ON THE PUBLIC, USER, AND NATURAL ENVIRONMENT (Noise, Air Pollution, and Land/ Water Contamination).	1500
MINIMIZE ENERGY CONSTRAINTS	PRIMARILY ENERGY CONSERVATION OF AUTOMOBILE AND OTHER HIGHWAY EQUIPMENT (AEEP).	7160
INCREASE KNOWLEDGE BASE	FORECASTING NEEDS - PROJECTING AND EVALUATING APPROACHES TO NEW SYSTEMS - THE DOT UNIVERSITY RESEARCH PROGRAM, ETC.	16825
TOTAL		29800

Figure 5

DOT R&D FACILITIES

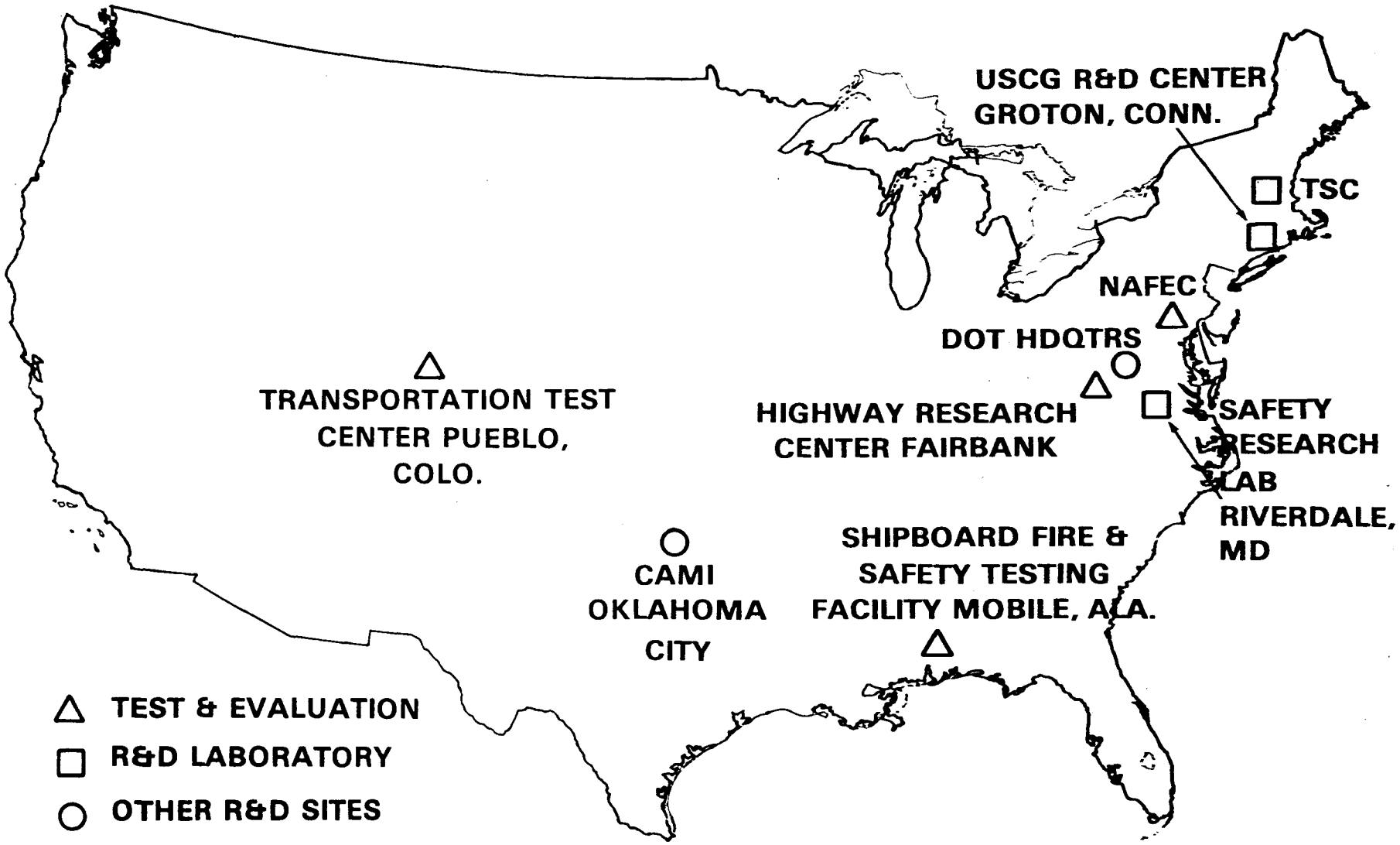


Figure 6