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MASTER

**a technology assessment of
PRODUCTIVE CONSERVATION
IN URBAN TRANSPORTATION
project description**

ASSISTANT SECRETARY FOR ENVIRONMENT
OFFICE OF TECHNOLOGY IMPACTS
DIVISION OF TECHNOLOGY ASSESSMENT

december 1979

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MASTER

A TECHNOLOGY ASSESSMENT OF PRODUCTIVE CONSERVATION
IN URBAN TRANSPORTATION

PROJECT DESCRIPTION
FOR
FISCAL YEARS 1980, 1981

ASSISTANT SECRETARY FOR ENVIRONMENT
OFFICE OF TECHNOLOGY IMPACTS
TECHNOLOGY ASSESSMENTS DIVISION
WASHINGTON, D.C.

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Preface

The transportation sector directly consumes one quarter of the energy used in this country with auto passenger travel accounting for half of the transport sector's energy supply. Due to rapidly rising fuel prices and intermittent supply shortages, federal, state, and local government have begun to introduce various strategies (combinations of policies and technologies) designed to conserve urban transportation energy while maintaining a productive economy. The environmental consequences of many of the conservation strategies have not been adequately assessed.

Accordingly, the Assistant Secretary for Environment (ASEV) with the support and assistance of the Assistant Secretary for Conservation and Solar Energy (ASCS) within the Department of Energy (DOE) has initiated a Technology Assessment of Productive Conservation in Urban Transportation. The project will concentrate on the effects of alternative conservation strategies for the efficient movement of people in urban areas. The goal of the project are to provide:

- o a description of several alternative strategies promoting energy conservation in the urban passenger transportation sector;
- o a better understanding of the environmental impacts of such strategies;
- o an identification of the constraints to the implementation of such strategies.

This technology assessment project was developed by the Technology Assessments Division (TAD/ASEV), Argonne National Laboratory, and the Futures Group, Inc. For information concerning this technology assessment project, contact:

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I. INTRODUCTION

A. Background

The transportation sector is almost entirely dependent upon petroleum.^{1/} Transportation, consistently for the last thirty years, has accounted for over one-half of the petroleum use or one-fourth of the nation's total energy consumption. Passenger cars alone account for half of the energy used in the transport sector.

Intra-urban travel, that which occurs within an urban area, corresponds to about one-third of all person-miles traveled. In the absence of transportation controls (which to date have been strategies of reducing vehicle miles traveled (VMT) that were developed for air quality control plans), urban travel can be expected to increase in proportion to changes in population. Most forecasts assume the automobile will continue to be the dominant urban travel mode, since average income is projected to rise faster than the costs of owning and operating a car. Transit ridership, which has steadily declined since World War II, has leveled off and even shown slight increases since the oil embargo of 1973. However, under current policies, transit patronage, which accounts for about 2% of urban travel in most areas, is expected to achieve little if any growth.

To date the single most effective force in improving urban modal efficiency has been the Corporate Average Fuel Economy (CAFE) legislation in 1975. By 1985 total automobile fuel consumption should be less than that in 1975 due to improved vehicle efficiency. However, the continued increases in travel will eventually overcome this advantage so that by the year 2000 energy consumption will have surpassed the 1975 levels. Figure 1 illustrates both the range of projected increases in travel as well as selected forecasts of auto energy use. This graphically shows the consistency of the view that vehicle fuel efficiency improvements, at this time, have only a temporary effect on energy, and especially, gasoline, consumption.

^{1/} This discussion is developed from data contained in the Transportation Energy Conservation Data Book, 3rd ed., Oak Ridge National Laboratory, Feb. 1979, the National Transportation Policies Through the year 2000, NTPSC, June, 1979, and Projections of Direct Energy Consumption by Mode: 1975-2000 Baseline, Argonne National Laboratory, August 1979.

Figure 1. Selected Projections of Auto Energy & VMT.

Source: Projections on Direct Energy Consumption by Mode: 1975-2000 Baseline, Argonne National Laboratory, August, 1979

With the real cost of gasoline declining since the 1950's, except for this year and 1973 in which it rose slightly in real terms, there have not been any clear signals to the American motorist that conservation was either a desirable or necessary behavior. Intermittent interruptions in gasoline supplies, rather than price increases, have served as sharp reminders to the public of the vulnerability of our current transportation system. The response this summer has been a nearly insatiable demand for fuel efficient vehicles and at least a short term reduction in travel.

As indicated by changes in automobile purchase behavior and transit ridership, individuals are looking for solutions to the problem of remaining mobile while not greatly changing the amount of the time and money devoted to travel. Declining domestic petroleum production coupled with the current expectation of no major market penetrations of alternative fuels and vehicles before the year 2000 (even the cumulative effect of electric vehicles which may be introduced by 1985 are not expected to be major before 2000) leads directly to the heart of the problem - what can be done in the interim and what would be the effects of those actions?

The significance of this problem was recognized at the national level by the following words which served to introduce President Carter's Second Environmental Message of August 2, 1979:

"As national policies place greater emphasis on prudent conservation and management of the nation's resources, energy conservation and urban revitalization, transportation policies must be shifted accordingly."

The message to the 96th Congress reaffirmed the administration's fundamental environmental policies and announced new initiatives in twelve areas including transportation. Heading the list was the use of transportation funds to promote energy conservation in transportation.

More recently the new Secretary of Energy, Charles W. Duncan, was quoted by Business Week (October 1, 1979) as saying that conservation is "the most cost-effective" and "the most timely thing we can do" to decrease dependence on imported oil.

Within the Department of Energy, one of the responsibilities of the Assistant Secretary for Environment is the conduct of Technology Assessments (TA) identifying the environmental consequences of various energy policies. Technology Assessment is a form of policy study which systematically defines, explores, and evaluates both the direct and indirect economic, social, environmental, and institutional consequences of the introduction or expansion of new technologies or policies in our society. The need for a technology assessment in the transportation sector was apparent in mid-1979 and a literature analysis initiated to identify what was known about the problem.

B. Problem Refinement

An extensive literature analysis of transportation studies produced in recent years yielded data sources and identified issues where either the analysis was incomplete, of questionable quality, or the study has little effect on policy. The information gained from the literature analysis, when synthesized with current major issues in the transportation sector, provided an initial list of candidate technology assessment studies. In order to narrow this list, three major bounding decisions as illustrated in Figure 2, were applied:

1. The study had to be within DOE's purview of reducing dependency on foreign petroleum;
2. The study would emphasize demand reducing, rather than supply increasing, strategies; and
3. The study would take the more comprehensive market or transportation demand approach (as opposed to a single mode orientation). This approach groups travel modes according to usage, requiring consideration of mode shifts and relative modal advantages.

The candidate studies were then examined to determine if significant environmental impacts were anticipated to warrant the technology assessment.

At the conclusion of the problem refinement process, a technology assessment project was defined which would:

- o cover the urban passenger transportation sector;
- o emphasize conservation (reduction of foreign petroleum demand) strategies;
- o span the present-to-2000 time period;
- o use a market approach;
- o consider both policy and technology alternatives; and
- o focus on environmental (broadly defined) impacts.

From this definition, the specific objectives of the technology assessment project were developed.

Figure 2. Problem Refinement Process

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II. PROJECT OBJECTIVES

The technology assessment described in this document is designed to investigate the potential environmental, health and safety impacts of various alternative productive conservation strategies. Productive conservation strategies are defined as neither disruptive of the economy or of the American lifestyle but encouraging conservation in various sectors including transportation.^{2/} Since, by this definition, productive conservation promotes energy savings in a manner which is neither economically or socially disruptive, special attention will be paid to the unanticipated diffuse impacts of the studied strategies, a task well-suited to the technology assessment format.

This technology assessment is designed to meet several broad objectives. These include:

- (A) An identification of internally consistent (mutually reinforcing policy or technology elements following a specific theme) productive conservation strategies which will aid in the reduction of the United States' dependence upon petroleum in urban transportation;
- (B) A comparative analysis of the energy savings and environmental impacts of the various productive conservation strategies;
- (C) An analysis of the issues and the barriers which may constrain these productive conservation strategies from becoming effective.

A broader discussion of each objective follows:

A. Identification of Potential for Energy Conservation

The concept of productive conservation as applied to urban passenger travel can be partially defined as reducing energy consumption, especially consumption of petroleum based fuels, while maintaining social interaction. The potential for this is substantial simply because energy has never been an important factor in financing and operating urban transportation systems.

^{2/} Energy Futures, Report of the Energy Project at the Harvard Business School
Robert Stobaugh and Daniel Yergin, Editors (1979).

These urban auto oriented systems are energy intensive as currently operated. The single occupant vehicles operated within these systems were most often designed for comfort and speed in an era of cheap energy. The fact that many proposals to reduce this energy intensity have been developed argues that reduction is possible even within the constraints of productive conservation. The matching of alternative strategies comprised of policy and technology elements to the distinct types of in-place systems (which can physically change only gradually during the time frame of the study) in various city classes promises to increase the potential for finding significant energy savings.

B. Comparison of Environmental, Health and Safety Impacts

The transportation energy conservation policies that will be studied are for the most part similar to those measures necessary to improve environmental quality. They are not, however, necessarily equally effective in achieving reductions of all undesired impacts. That is, there will be trade-offs between impacts on different environmental subsystems and, in some cases where energy conservation strategies will have negative environmental impacts, the design of mitigation strategies or redesign of the initial conservation strategy will be required. The TA will complete broad environmental impact analysis for each strategy, use the results of impact analyses to refine the strategy, and indicate where further mitigation of impacts might be required. Figure 3 illustrates that interaction between the transportation system and the environmental subsystems that will structure the TA's impact analysis tasks. A preliminary discussion is presented below on some of the possible environmental, health and safety consequences.

1. Physical environment concerns - Impacts will be assessed for five elements of the physical environment:

- (a) Air Quality - Transportation is a major contributor to urban air quality problems. On a national scale, highway transportation is the source of 70% of CO emissions, and the single largest source of HC and NOx emissions which are the precursors to photochemical smog. The amount of vehicle travel, measured in vehicle-miles traveled (VMT), and the speed of travel are the main determinants of the automotive pollutant load. Many of the policy elements contained in the strategies will have changes in VMT as their goal --

Figure 3. Relationship of Transportation Subsystems to Environmental Subsystems

reductions or increases in travel by particular classes of vehicles in different urban areas (e.g., shifts from large auto travel to small auto travel). Thus changes in air quality impacts are anticipated with each strategy. The nature of the impacts will vary, as not only the VMT by vehicle type will change but, for example, speed in certain areas such as the downtown might change in one strategy while total recreational VMT might decrease as the result of another. Although strategies to reduce auto energy consumption reduce pollutant production, in general, there could be some situations where this is not achieved.

(b) Water Quality - Water quality analysis will focus on urban runoff impacts, particularly if the particulate re-entrainment theory proves auto traffic to be a major determinant of both air and water total suspended particulate levels. The only other place water quality analysis enters in the TA is if a policy or technology element entails production and use of new vehicles; the production processes will be assessed for water quality impacts.

(c) Waste Disposal - The production and recycling or disposal of vehicles are the source of waste disposal impacts of highway transportation, rather than vehicle operation. Thus policy elements that promote the use of new vehicle technologies will be examined for impacts in this category. Recycling or disposal of electric vehicle batteries is one example of this type of impact.

(d) Noise- Transportation vehicles on land and in the air are major components of urban ambient noise levels. The type of motive power, stop-start characteristics, speed and vehicle mix all affect the noise generated by highway travel. Changes in the first three parameters are likely results of productive conservation policy elements, requiring analysis of noise impacts in urban areas. Many productive conservation policies are likely to improve the livability of urban areas by decreasing ambient noise levels through decreases in VMT and improvements in traffic flow patterns.

(e) Aesthetics - One of the dominant features of urban landscapes is the transportation system. Reduction in private vehicle travel requirements could reduce urban space devoted to that mode, such as highways and parking lots.

2. Ecosystems concerns - Ecosystem impacts focus on identifying pathways of pollutants or toxins through the aquatic and terrestrial ecosystems to humans. New combustion products, working fluids and battery electrolytes are examples of the kinds of substances of concern in the transportation system. Policy and technology elements will be analyzed for such substances and their potential pathways to the human population. Use of new engines, alternative fuels or engine modifications could give rise to these types of concerns.

3. Resource concerns - Most of consequences of the policy and technology elements relative to resource allocation are likely to be associated with changes in mineral allocation and changes in land use. However, depending on the technology, capital and labor availability may also be a significant concern. The introduction of new engines will require using minerals that may now be scarce and used for other purposes. Shifts in land uses will occur in urban areas as the result of modal changes or reductions in VMT. Existing land uses adjacent to highway rights-of-way in some corridors could be diverted to other land uses if new transit systems are introduced. Conversely, transit corridors may require land that is presently used for other purposes.
4. Socio-economic concerns - The impact of the policy elements in relationship to socio-economic effects will be an important concern during this study since productive conservation is defined as non-disruptive of the social and economic systems. Any change in transportation will affect base systems. A strategy which provides a smooth transition through those changes, in a way which seems parallel the evolutions of society and the natural economy, would be highly desirable. Areas of concern which require analysis include production, income and employment levels, industrial opportunities, national security, education levels, social amenities availability, mobility and accessibility and the effects of the transportation changes on institutional frameworks.
5. Health concerns - Health concerns from the transportation system stem from the air quality concerns discussed above and from the effects of any new, unregulated pollutants that may be produced by new vehicle engines or fuels. Analysis of impacts in this area will focus on the effects of any new pollutants that will accompany the use of new fuels or vehicles called for in a strategy. Promoting use of alcohol fuels is an example of one such policy element. Health concerns also include occupational and public health effects due to the fabrication of new urban transit hardware and fuel supplies, of exposures during non-routine situations (accidents), and of exposure to toxic materials transported through the ecosystem.

6. Safety concerns - Most of the safety consequences of the productive conservation strategies will be positive in nature. Decreases in VMT are generally associated with decreases in automobile related casualties, although safety analysis in the TA will examine more detailed effects on traffic safety including roadway type and vehicle mix. Annually there are over four million highway related injuries and 48,000 deaths. A decline in automobile VMT, achieved through a shift to transit or group travel, could reduce these statistics, since transit injuries and fatalities per passenger mile are much lower than for private autos.

C. Analysis of Barriers to Implementation

A study of the impacts of any proposed new policy or technology element must include some consideration of its feasibility. This TA will be concerned with the feasibility of implementation, but will not undertake any assessment of commercialization or a detailed barrier analysis. Instead, these issues and concerns will be incorporated in two places: development of the strategies and the environmental impact analysis. Cost and management or administration barriers will be considered in choosing policy elements for the productive conservation strategies. The DOE/ASEV definition of environmental impact assessment covers many of the issues often included on barrier analysis - institutional, social and economic impacts, and resource use. Questions of equity in tax-based policies, in labor union impacts, in safety on roads with smaller autos and large trucks, and in fuel economy and engine emissions trade-offs will all be addressed in the context of the environmental impact analysis. The state of society assumptions associated with the socio-economic impact analysis also provide a framework for evaluating the societal characterization or change that often affects the manner or rate of implementation of a technological development or change. These assumptions characterize a future society's economic and social systems, demographic make-up, institutional structure, as well as attitudes and values.

III. PROJECT PLAN

A. Project Methodology

The technology assessment will be conducted over a 24 month period. Figure 4 is a schematic presentation of the project methodology which is divided into four phases. Subsequent sections of this chapter provide descriptions of the major tasks that occur during each of the four phases.

1. Phase I

Figure 5 presents the tasks to be undertaken during Phase I. The major elements involve three activities: data collection; model assembly; and impact criteria definition. As one of the major tasks under the data collection activities, three scenarios of alternative conditions for the U.S. through the year 2000 will be defined. These scenarios will provide the framework within which the assessment will proceed. It should be noted that scenarios are not forecasts of the future, but rather consistent, hypothetical, and plausible sets of future conditions. The scenarios to be used in this technology assessment will be defined from those developed by the Energy Information Agency (EIA/DOE). The EIA has assembled a set of seven scenarios based on high, medium and low growth rates for three different energy price assumptions. The scenarios most likely to be used are the "mid-low growth, mid-mid growth, and lowest high growth".

The EIA scenarios are composed of social and economic indicators which are designed to reflect the general state of the U.S. economy. These scenarios are based upon factors such as the productive ability of the nation, the nature of energy supply, and the amount of government involvement in the economy. Part of the modification process will include the expansion and adjustment of the EIA scenarios so basic factors judged to be relevant to an analysis of productive conservation are included. For example, we may find it necessary to include a set of factors referring to changing attitudes and values (the state of society assumptions) developed for each scenario, so that the level of societal

Figure 5. Major Activities: Phase I

disruption caused by various strategies can be described. Major changes in the EIA scenarios are, however, not expected since it is beyond both the needs and the scope of this project to embark on a major scenario-building exercise.

The differentiation of both the appropriateness and effects of policy and technology elements on urban areas of various sizes is an important aspect of this TA. Thus the classification of urban travel by city type is one of the first scheduled tasks. This effort will examine the most recent data available on total population, residential density, average trip length, mode split by trip length, mode split by trip purpose, household size, vehicle ownership, and any other variables deemed useful for evidence of differences in travel habits and modal usage.

One method of classifying cities has been to group them using the Standard Metropolitan Statistical Area (SMSA) populations as a surrogate for travel characteristics. For instance, one approach groups those over three million persons (8 SMSAs), those from one to three million (28 SMSAs), and those under one million (220 SMSAs). This roughly divides the total SMSA populations into thirds, as well as characterizes, although not perfectly, the potential transportation systems of heavy rail, light rail-bus, and bus only transit systems.

The two remaining tasks under the data collection activity are: (a) the definition of the "in-place" strategy (policies and technologies) based on the National Transportation Policy Study Commission report summary of which policies now exist regarding the urban transportation market; and (b) the technical description of the operating characteristics of developing technologies which could be utilized in that market.

Model assembly, the second activity in Phase I, involves the evaluation, acquisition, linkage, and validation of the analytical models to be used in the transportation demand and impact analyses. These models will be exercised in Phase II with the in-place strategy and again in Phase III with the alternative strategies. Both analyses are described in the Phase III section of this Chapter.

The third activity to be undertaken in Phase I is the further refinement and definition of the variables measuring the impact of the strategies as discussed in Chapter II. Part of this activity will include the identification of the various interest groups likely to be affected by changes in the impact variables.

2. Phase II

The second phase involves the application of the transportation demand models to the data characterizing the in-place strategy and an analysis of the subsequent impacts. These analytic processes which are also used in Phase III, will be described in the following section. In the same time frame, alternative transportation conservation policy and technology elements are identified screened, and grouped into alternative strategies.

The criteria which will be used in identifying the productive conservation elements are: reduction of our dependence on petroleum resources in urban transportation; and minimal disruption of both society in general and the transportation sector in particular, as defined by changes in mobility and accessibility. It is understood that any change requires some adjustment and one or another interest group is bound to feel that a given element affects its interest more than any other's. A resultant strategy should, however, spread the burden, thereby reducing societal discontent and extent of change necessary for any one group to bear.

The term "minimal disruption" implies the impacts of the policy would not involve large employment shifts over a short period of time, significant reductions in personal mobility, excessive restrictions on freedom of choice, large negative impacts on a given sector of the economy as defined by region or industry, or other examples of excessive burdens falling upon specific interest groups. In other words, by equalizing the effects of conserving energy among segments of society, public acceptance and support should be enhanced.

Once the set of productive conservation policy and technology elements has been identified, they will be grouped into three alternative strategies. Each of the alternative strategies will have a central theme. Several themes are possible for developing the strategies: only elements specific to DOE programs; enhancing group travel, individual travel or both; specific targets for conserving transportation energy (10, 20, or 30%); or reductions in the number of trips, length of trips, or the energy intensity of trips by changing travel mode. All of these themes are promising; the final selection will depend on insights gained in the Phase I activities, the Phase II Analyses, and the recommendations of the project review panel. Whichever theme is selected, however, would group policy/technology elements that reinforce each other in promoting energy conservation in the urban travel market.

As an example of the application of an alternative strategy theme (reducing trips), communication technologies may be major technology elements which would maintain accessibility while mobility declines. Communication technology is increasing in speed, functions and affordability and may make it possible to have not only personal computers but also home offices in full communication with headquarters. This would allow individuals to be productive without leaving their homes or remote work centers. Although controversy surrounds the telecommunication/transportation tradeoff, it may be reasonable to expect that transportation demand would be reduced rather than induced in metropolitan areas where face-to-face meetings are frequent and often unnecessary. Through the analysis, it could be found that this technology element is the key to staggered work hours for peak shaving because of the buffered storage characteristics of computer conferencing. In addition, communication technology may have a profound impact on shopping and school trips. By investigating all opportunities for substitution, an internally consistent strategy could be defined based on these communication technology advances.

An actual strategy would of course, contain many more elements, but the above is an example of how a particular theme would serve to define a strategy.

Figure 6. Transportation Demand Analysis

3. Phase III

In the third phase, the transportation demand and impact analysis are applied to the alternative strategies. Comparisons of impacts are made between each of the alternative strategies and the in-place (current use) strategy. Issues such as interest group impacts, potential mitigating actions, and barriers to implementation are identified.

An important step between defining any of the study's strategies and the impact analysis is determining the demand for travel in each city class and under each scenario. This demand must be balanced with the supply of transportation services. Figure 6 illustrates this process.

The data collection and forecasting processes provide input to transportation demand models. The input takes the form of economic and demographic data of the city classes, transportation system data such as modal availability and accessibility, travel times and costs, and the characterization of the strategy to be evaluated, including the state of society assumptions that are applicable for each scenario. The models, which of necessity must be capable of providing quick estimations (through demand elasticities) of travel demand fluctuation due to the policy and technology elements, provide as output passenger-miles of travel (PMT) and vehicle-miles of travel (VMT) by mode. Additional stratifications by interest groups and trip purpose will be necessary to evaluate secondary and tertiary impacts as well as to identify barriers to implementation.

Two major feedback loops exist before the results are passed to the impact analysis stage. The first, lettered "A", balances supply-side physical constraints on the number of new types of vehicles that can be produced and facilities that can be constructed. This loop normally feeds back to the input parameters. Excessive demand could indicate the need to increase user cost by reducing modal frequency in the models. The second feedback loop is used if the impacts produced by the strategy for energy consumption and air quality are unacceptable. Here

again the strategy may need readjustment. It is expected that loop "A" would be entered several times to arrive at a demand/supply equilibrium. Loop "B" may be used in parallel or series with loop "A" to adjust the direct impacts of the strategy.

At the end of the iterative process, the output of the refined strategy is ready for the impact analysis process and another strategy enters the transportation demand analysis.

The analysis of the environmental impacts will occur during Phase II and III as shown in Figure 4. The analysis of environmental impacts of the strategies will proceed at two levels - the first, aimed at screening for major quantitative impacts; and the second, to fully detail all expected impacts of a strategy, documenting interrelationships and magnitudes.

The first level analysis will be part of the process of developing the productive conservation strategies. An example of the difference between the two levels is the air quality impact analysis. First level analysis will consist of computation of the changes in the emission loads for CO, HC and NOx for the areas affected by the policy/technology element. Decisions on whether to keep the element in the strategy will be made using this information. The second level analysis will translate the emission loads into air quality forecasts, using any of several modeling techniques available (e.g., rollback, dispersion) as appropriate to highlight the key impacts. A health effects analysis can then proceed based on the air quality assessment. In some cases quantitative estimates of population exposures and health damage are possible, e.g., carbon monoxide, lead, particulates. The range of uncertainty will be considered explicitly. However, many potential health concerns are not sufficiently understood to allow quantitative health damage estimates. In these cases areas of concern will be noted and problems discussed qualitatively.

Two categories of inputs are needed for the impact analysis process as illustrated in Figure 7. First, impact criteria must be identified and second, data that characterizes the transportation system of each strategy must be generated. The initial impact criteria task is the

Figure 7. Impact Analysis

identification of the interest groups which will be affected by the strategy under study; important not only for the analysis of impacts, but also because these groups often possess the means of affecting the policy/technology elements. An analysis of their positions and values must therefore be undertaken.

The state of society assumptions, the next impact criteria input, should be examined to aid in formulating the expected future positions and values of the various interest groups. During the identification of interest groups a relevance tree may be utilized to aid not only in the identification of the interest groups but also in the definition of particular impact areas in which they are involved. These assumptions address societal characteristics which often affect the manner and rate of a technological development or change. The understanding of these assumptions is critical to the identification of the unanticipated impacts of the strategies.

The third impact criteria is the definition of the variables which will be used to ensure the productive conservation nature of each strategy. The limits may change from scenario to scenario based upon both the state of society assumptions and the scenario assumptions.

As described in the previous section, the transportation demand models produce information on the passenger and vehicle miles traveled by mode which characterizes the use of the transportation system. The demand and supply data are input variables to the environmental impact analysis, which is the heart of this technology assessment. Environment is defined here in its broadest sense - both the physical and social environments. It is expected that interviews, cost/effectiveness analysis and cross-impact analysis, three techniques already used in long-range regional transportation studies, will be utilized to assist the environmental analysis. (The discussion of the analysis of barriers to the implementation of the strategies was presented in Chapter II).

4. Phase IV

The last Phase is the production and review of the draft and final reports which document the process and findings of the technology assessment.

B. Management Structure

1. Responsibilities

The overall management of the project is the responsibility of the Project Direct, Technology Assessments Division (TAD/OTI). Support and assistance are provided by the Office of Transportation Programs (OTP-ASCS) in the transportation demand modeling and strategy determination activities of the TA. Management and technical support for all phases of the study will be shared by The Futures Group (TFG), a private consulting firm, and Argonne National Laboratory (ANL). Technical support will also be provided by Management of Resources and the Environment (MRE), Lawrence Livermore Laboratory (LLL), Oak Ridge National Laboratory (ORNL), and Brookhaven National Laboratory (BNL). Figure 8 depicts the management structure for the technology assessment.

TFG and ANL, with assistance from TAD project director, will collaborate on the following specific tasks:

- o determination of the strategy themes and resultant alternative strategies by screening the conservation policy and technology elements (with support and assistance of OTP/ASCS).
- o technical review of all of the impact analysis,
- o identification of issues relating from the implementation of each of the strategies, including supply constraints, adverse environmental impacts, the potential of mitigating actions, and barriers to implementation which would limit the feasibility of the conservation actions, and
- o production of the draft and final reports of the in-place strategy, strategy alternatives, and the technology assessment.

In addition to the shared responsibilities, each of the principal organizations have separate assigned tasks. TFG is responsible for:

- o definition of economic and demographic characteristics of the scenarios, adopted from the work conducted by the Energy Information Administration (EIA) and the National Transportation Policy Study Commission (NTPSC),
- o description of the in-place strategy, from the NTPSC, that would constitute the basis for status quo forecasts within the scenarios and include a state-of-society analysis,
- o refining of the state of society assumptions under the various scenarios and strategies,

Figure 8. T.A. Management Structure

- o identification of interest groups affected by the policy packages: both the market orientation and those who are helped and hurt by the implementation of the strategies,
- o socioeconomic (social, economic, institutional) impact analysis,
- o coordination of the impact analyses, at both the screening and detail levels, of the ecosystem (terrestrial, aquatic, and human/animal pathways) and the physical environment (air and water quality, waste disposal, noise pollution, and aesthetic degradation), which will be performed by MRE, and
- o organizing and conducting the project review panel meetings.

In the role designated as lead laboratory, ANL will be responsible for coordinating the inter-laboratory activities as well as these specific tasks:

- o production of an early report that described the setting for productive conservation in the context of urban transportation,
- o assist ORNL and LLL in forecasting tasks under guidelines developed by ANL and TFG to insure consistency with the scenarios,
- o acquiring and exercising the transportation demand models suitable for quick estimates of the effects of policy and technology elements on the demand for transportation by mode (with support and assistance of OTP/ASCS),
- o defining the criteria to be used in each of the categories of the impact analysis, and
- o impact analysis of resources (mineral, natural land and water, and capital/labor) and safety (occupational and public).

In coordination with ANL, Lawrence Livermore Laboratory will define the present and twenty year transportation technology characteristics; Oak Ridge National Laboratory will be responsible for city class definition, transportation data collection, and forecasting; and Brookhaven National Laboratory will conduct the health impact analysis (occupational and public).

In coordination with TFG, LLL will assist in the ecosystem impact analysis and ORNL will assist in the socioeconomic impact analysis.

The project review panel is composed of individuals whose professional work enables them to provide commentary on the organization and direction of the technology assessment. Some members also represent organizations for which the implementation of the strategies would be a function of their agency. It is intended that their periodic review of the progress of the study will lead to a reduction in both bias and omission of pertinent information and will provide new information sources and valuable perspectives. As indicated in Figure 4, the views of project review panel will be incorporated into the technology assessment during each of the Phases.

2. Reports

A final report will be published at the end of 1981. In addition, a number of specific reports are scheduled including:

<u>REPORT</u>	<u>PHASE</u>	<u>PROJECTED TARGET DATE</u>
Literature Abstracts	I	1 Qtr Fiscal Year 1980
Productive Conservation Setting	I	1 Qtr Fiscal Year 1980
Draft Report on In-Place Strategy	II	3 Qtr Fiscal Year 1980
Final Report on In-Place Strategy	II	4 Qtr Fiscal Year 1980
Draft Reports of Alternative Strategies Analysis	III	1-3 Qtr Fiscal Year 1981
Final Report on Strategies and Comparison to In-Place Strategy	III	3 Qtr Fiscal Year 1981
Draft Final Report	IV	4 Qtr Fiscal Year 1981