PART F
Beyond the Present Planning Effort

INTRODUCTION

The time horizon of this planning effort must be considered to be relatively near term. Few transport facilities have effective lives of less than 20 years and may exceed 50 years. The planner's time frames must necessarily, therefore, take into account the expected lifetimes of such facilities. Indeed, their perspective must also accommodate the 10- to 20-year periods now common to take a major facility from conception to operation.

The 1990 capital investment time horizon employed in this document has both good and bad features. Among the good are:

- The short period brightens the likelihood that the demographic and economic assumptions used will be reasonably accurate.
- The imprint of the present will still be dominant 15 years hence.
- Current analytical tools can function reasonably well in a short-term forecasting situation.
- The imminence of the near-term focus works to ground the planning effort in more practical considerations.
- The timespan is long enough for many kinds of decisions and plans to be implemented.

Some of the shortcomings of a 1990 time horizon are:

- Most large-scale technological responses to expected needs could not be in place or in widespread operation in 15 years.
- Major resource problems may not be evident in so short a time frame.
- There is a human tendency to assume that such perceived problems, moreover, will be solved by technological advances.
- Alternative energy scenarios cannot fully develop within this time period.
- Most new policies and major new facilities proposed in such a plan would have their principal effects after the planning horizon year.

Part F attempts to respond, at least partially, to these shortcomings by looking briefly beyond 1990, recognizing that our vision grows increasingly imperfect, and that the observations that can be made about the more distant future must be more speculative and imprecise. Such an examination could help to assure, however, that no major changes lurk just over the horizon, which would require us to reconsider our evaluations.

Such informed speculation about the more distant future can also help us to understand better some of the implications of the various assumptions about the future employed in this planning effort. For example, some might find a basis for strong criticism of this planning approach in that its future is based very much on what could be characterized as a "more of the same, but better" view, and it does not reverse the expected trends sufficiently in light of the fact that liquid petroleum resources might well become short, or nonexistent during the span 1990 to 2010. In particular, those concerned about the degradation of our environment and the apparent exhaustion of many of our resources, particularly petroleum, might see a kind of blindness in so optimistic a view of our future. Consequently, alternative variations on the "future" planned for in this document are considered, and their effects on the prospective transportation system are reviewed. Significant contingencies are examined, and long-range technological opportunities are identified.

Finally, part F outlines a future course of action with respect to nationwide transportation planning.

CHAPTER XVI
Alternative Transportation Futures and Contingencies

The prospective transportation system reflects the assumption of vigorous economic growth for the foreseeable future. Nevertheless, it is recognized that the future is unknown and can unfold in many directions. It seems prudent to ask whether a transportation plan based on a vigorous growth, therefore, would also be suitable—or at least not have seriously adverse consequences—for plausible alternative futures. This section explores that issue.

Since there are an infinite number of possible futures, the first problem is to select some manageable number for analysis. It appears that three futures based on the dimensions of goals and success would comprehend most of the likely futures for the next several decades. These are:

- Traditional values successfully realized,
- Traditional values attempted but not realized owing to external causes,
- A major shift by the people of the United States away from their present traditional values.

These three futures, called by the shorthand terms of "success," "distress," and "transformation," bound uncertainty in that most futures considered likely for the balance of the century share the elements of these in different proportions. Thus, most likely futures should not exceed these extremes in ways critical to national transportation planning.

Figure XVI.1 illustrates how this technique can be used to study the planning implications of alternative futures. Plausible futures for the distress and transformation cases constitute the extremes examined. The success scenario reflects the OBERS projections. Although OBERS can certainly qualify as representing the successful realization of present traditional values, it does not constitute the maximization of those values that might be achieved (a condition designated as "super success" in the diagram). Hence, the success dot in the figure is placed within the circle of plausible limits for the future. Because the super success case would entail substantially the same transportation requirements as success, two separate scenarios are not needed. The shaded triangle represents the great number of fully plausible combinations of success, distress, and transformation futures that could occur.

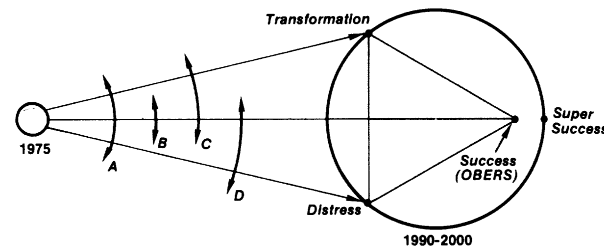

Figure XVI.1. Planning With Alternative Futures.

The prospective transportation system set forth in this document was designed with the success future in mind. One uses the alternative future to ask systematically how policies appropriate for success would work in the circumstances of distress and transformation. If a policy appears suitable for all the futures (indicated by arc A on the figure), it could be employed with significant confidence. If, however, it appears that an otherwise desirable policy would not be suitable for some alternative future (arcs B, C, or D), the options are: (a) abandonment or revision of the policy, or (b) preparation of a contingency plan to be put into effect if the success scenario appears to be veering in a direction where the policy would not serve appropriately, or (c) monitoring of indicators of future scenario development to permit timely policy reevaluation.

THREE SCENARIOS

Building Blocks

The three alternative futures of success, distress, and transformation were built up using internally consistent combinations of more than a score of elements thought to be significant in defining the future context of transportation in the United States up to the 1990-2000 period. About half the elements are quantitative, and about half are "softer" qualitative variables such as values and attitudes. Table XVI.1 lists these elements and indicates the assumption for each future. A single value for each assumption (based on a 1990 forecast) is provided for each scenario to facilitate their comparison and analysis. Uncertainty about when that value may be reached is indicated by the use of a 10-year range, from 1990 to 2000.

for high unemployment levels in the absence of strong economic growth.

- Continued growth of energy requirements from petroleum sources for transportation and other sectors is rapidly depleting known petroleum reserves. Assuming no spectacular new oil discoveries, will require (a) increasing reliance on other energy sources as the 1990–2000 period approaches, and (b) complete substitution of other fuel sources for petroleum by 2000 or soon after, depending on how fast petroleum reserves are exhausted.

Table XVI.1
Elements of Scenarios: 1990-2000

Element	Success	Distress	Transformation
Overall economic conditions	Prosperity	Depression	70% struggling prosperity, 30% frugality
Availability of raw materials	Ample	Severe shortage	Mild shortage
Energy trend (gas cost in 1975 dollars)	High growth (75¢/gallon)	No growth ($1.20/gallon)	Limited growth (80¢/gallon)
Weather/climate	Favorable	Unfavorable	Favorable
Labor force relative to 1975 (full-time equivalent)	22% higher	22% higher	9% higher (plus 13% underemployed or temporarily out of labor force)
Pattern of social values	Individual achievement	80% individual, 20% group achievement	70% achievement, 30% voluntary simplicity
Unemployment level	4%	20%	5% (but much underemployment)
Productivity relative to 1975	55% higher	5% lower	35% higher
Real GNP relative to 1975	90% higher	6% higher	44% higher
Inflation	Low (3%-4%)	Medium (6%-7%)	Very low (1%-2%)
Interest rates (long-term corporate bonds)	Low (6%-7%)	High (10%)	Low (5%)
Investment as percent of GNP	15%	8%	16%
Population (213 million in 1975)	246 million	240 million	246 million
Population distribution pattern	High urbanization	High urbanization	Ruralization and urban change
Concentration of business	Emphasis on central city revitalization	Continued slow dispersal to city fringes	Central city/suburban restructuring
Leisure and recreation	Moderate increase in time; large increase in spending	More idle time; less leisure; reduced spending	Much more leisure in voluntary simplicity sector; somewhat less in achievement group
Terrorism and crime relative to 1975	Low to moderate	Very high	Moderate and dropping
Emphasis of domestic politics	Conservative free enterprise	Socialistic inroads into free enterprise	Free enterprise/local autonomy
Support for environmentalism	Medium	Minimal	Strong but controversial
Type of education	Traditional	Traditional with group emphasis	Traditional, but more life-long, self-directed, and individualized
Emphasis of technology	High technology	Defensive, cost-governed R&D	Intermediate technology/automation split

Two fundamental facts influence all three scenarios.

- The prospect of a 22-percent increase in the available labor supply by 1990, based on the population already born and on present patterns of female participation, compared with population growth of only 15.4 percent (for success and transformation) or 12.6 percent (for distress), creates the potential either for an unusually high rate of real economic growth or

Success Future. The success scenario assumes the fulfillment of traditional achievement values. Its quantitative elements are taken from the OBERS projections, including essentially full employment, average annual growth in productivity per man-hour of 2.9 percent, and resulting growth in real gross national product of about 90 percent between 1975 and 1990. Qualitative elements considered to be consistent with the quantitative factors were added to enrich the description and provide further contrasts with the other two futures.

Energy requirements for the success society will grow at 3 percent to 4 percent per year. A worldwide petroleum shortage predicted for the 1990's underscores the need for aggressive development of coal resources (including synthetic liquid oil and gas derivatives), shale oil, Outer Continental Shelf (OCS) oil and gas, nuclear energy, and other substitutes for liquid petroleum, along with continued large imports of foreign petroleum. Energy conservation efforts of the type advocated in national policy are assumed.

Distress Future. The distress scenario is the antithesis of success. Although the traditional values remain those of achievement, the goals achieved fall short of those attained in the success scenario because of the combined effects of such external factors as resource shortfalls, failure of technology to produce energy breakthroughs, and a major climatic change for the worse. The climatic change, toward colder and more variable weather than was characteristic of the unusually favorable 1960's, reduces crop production moderately and agricultural exports sharply. The lower export level, in turn, reduces the U.S. ability to purchase foreign products, including petroleum, at previous high levels.

Energy supply falls short primarily because of stretchout production policies of producing nations, the disappearance of U.S. foreign trade surpluses for use in petroleum purchases, and disappointments in: (a) developing improved nuclear plants, (b) finding domestic OCS reserves, (c) locating major new oil fields elsewhere in the world, and (d) a technological breakthrough that will provide a substitute for petroleum. Fuel prices are further forced sharply upward by the high cost of pollution controls over coal liquefaction and shale oil extraction, the high cost of scarce investment capital, increased fuel needs occasioned by adverse weather conditions, and anticipation that petroleum reserves will soon be exhausted.

The overall picture is that of a recession in the 1980's deepening into a severe depression in the 1990–2000 period. One inference is that the society is at a transition point—either conditions will improve or the society will be severely threatened in the post-2000 period.

Transformation Future. This scenario postulates a major transformation in traditional American goals and values toward a voluntarily more simple way of life. The transformation future is included because it seemed essential to include in the "planning cone" at least one alternative development path that would reflect a basic change in national aims. This assumption might not be academic because there is increasing evidence that so-called "voluntary simplicity" may be an emerging alternative lifestyle for persons of the United States. This lifestyle involves living simply and economically, with personal consumption goals significantly influenced by a desire oriented to conserve nonrenewable resources, reduce waste, and minimize pollution, so that permanent ecological balance can be achieved. Key values are frugality, simplicity, naturalism, use of personal effort to move around, and personal growth. In pursuit of these values, the "voluntary simplicity" sector prefers either (a) part-time or intermittent employment in the high-technology achievement sector to permit more time for pursuit of personal aims, or (b) employment in lower paying jobs utilizing intermediate technology and tending toward labor intensiveness rather than energy or capital intensiveness.

A society divided 30 to 70 percent between voluntary simplicity and present traditional achievement values was chosen because that seemed both a maximum plausible degree of change by 1990–2000 and a possible stable societal configuration.

Reduced energy consumption in this scenario by the voluntary simplicity sector combined with effective social pressures for widespread energy conservation allow energy needs to be satisfied by a relatively slow increase in domestic production of coal, oil shale, OCS oil and gas, and nuclear capacity at rates acceptable for environmental requirements (2 percent per year to 1985 and 1 percent per year or less thereafter). Much greater reliance is placed on renewable energy resources.

Cross-Impact Analysis

Array Formulation. The three scenarios described above were systematically studied for their implications for transportation policy by analyzing how major transportation variables might be affected in the future compared to the situation in 1975 as we know it.

In order to establish a macrostatistical perception of the effects of these scenarios, modeling techniques were applied based on 1990 parameters selected to coincide with the logic of the scenarios.

Cross-impact analyses were made for each future, each transportation function, each trend area, and each mode, with the results shown in figure XVI.2.

Transportation Functions, Trend Areas and Modes	Region and Alternative Scenarios: Interstate			Urban		
	Success	Distress	Transformation	Success	Distress	Transformation
Passenger Travel						
1. Demand						
Marine	●					
Air	●		●			
Auto	●	●	●	●		
Bus	●	●	●		●	●
Rail			●		●	●
Paratransit						
Private				●	●	●
Public				●	●	●
Co-op				●	●	●
Advanced systems				●	●	●
Pedestrian aids and bikeways				●	●	●
2. Energy efficiency						
Marine	●	●	●			
Air	●	●	●			
Auto	●	●	●	●	●	●
Other modes	●	●	●	●	●	●
3. Network and facilities						
Marine	●					
Air	●	●				
Highway mileage						
Interstate	●	●	●	●	●	●
Other roads	●	●	●	●	●	●
Bus			●	●		
Rail			●	●	●	●
Paratransit						
Private				●	●	●
Public						●
Co-op				●	●	●
Advanced systems				●	●	●
Pedestrian aids and bikeways					●	●
4. Cost reductions						
Marine	●		●			
Air	●		●			
Auto	●		●	●		●
Bus	●	●	●	●	●	●
Rail	●		●	●		●
Paratransit				●	●	●
Advanced systems				●	●	●
5. Reduced noise and pollution						
Airports	●	●	●			
Autos	●		●	●		●
Other modes	●		●	●		●
6. Safety						
Auto				●		●
Pedestrian aids				●	●	●
Other modes	●	●	●	●	●	●
7. Reduced incidence of crime and terrorism	●	●	●	●	●	●
8. Service to the disadvantaged						
Air	●	●	●			
Auto	●	●	●	●	●	
Bus	●	●	●	●	●	●
Rail	●	●	●	●	●	●
Paratransit				●	●	●
Advanced systems				●	●	●

Transportation Functions, Trend Areas, and Modes	Region and Alternative Scenarios: Interstate			Urban		
	Success	Distress	Transformation	Success	Distress	Transformation
Freight						
1. Demand						
Marine	●	●	●			
Air	●		●			
Waterway	●	●	●			
Rail	●		●			
Truck	●	●	●	●		●
Pipeline	●	●	●	●	●	●
Conveyor, tube				●	●	●
Elevator				●	●	●
Transit				●	●	●
Personal hauling		●	●		●	●
2. Energy efficiency						
Marine	●	●	●			
Air, waterway, rail	●	●	●			
Truck	●	●	●	●	●	●
Pipeline	●	●	●	●	●	
Conveyor, tube				●	●	●
Elevator				●	●	●
Transit				●	●	●
3. Network and facilities						
Marine	●		●			
Air	●		●			
Waterway	●		●			
Rail	●					
Truck	●	●	●	●	●	●
Pipeline	●	●	●	●	●	●
Conveyor, tube				●	●	
Elevator				●	●	●
Transit				●	●	●
4. Cost reductions						
Marine	●	●	●			
Air	●		●			
Waterway		●	●			
Rail	●					
Truck	●				●	●
Pipeline	●	●	●			
Conveyor, tube						
Elevator				●	●	●
Transit						●
5. Reduced noise and pollution						
Marine	●	●	●			
Air, waterway, rail	●	●	●			
Truck	●	●	●	●		
Pipeline	●	●	●	●	●	●
Conveyor, tube				●	●	●
Elevator				●	●	●
Transit				●	●	●
6. Safety	●	●	●	●	●	●
7. Reduced incidence of crime and terrorism	●	●	●	●	●	●

Legend:
- Major increase from 1975 levels.
- Increase from 1975 levels.
- No significant change from 1975 levels.
- Decrease from 1975 levels.
- Major decrease from 1975 levels.
- Mixed trends: some ups and some downs from 1975 levels.

Figure XVI.2
Ratings of Transportation System Characteristics for Alternative Scenarios in 1990-2000

Patterns Across Scenarios. Several interesting phenomena can be perceived from the outcomes of these analyses. For example, bulk commodities increase their share of total ton-miles from about 26 percent in 1975 to about 30 percent in 1990–2000 under all scenarios, a change that can be traced largely to greater coal movements. More significantly, total freight ton-miles rise about 88 percent for the 1990–2000 success scenario compared with 1975, whereas there is an only insignificant change in the distress scenario; the transformation scenario displays a ton-mile increase roughly in between the other two scenarios.

A roughly similar pattern exists for passenger transportation demand in the three scenarios, although the relative degree of change does differ between the passenger and freight sectors. In the success case, relative growth in passenger transport by all means including private auto is about the same as in freight. In the distress situation, freight growth is constrained more by the generally lower level of economic activity than is passenger travel. In the transformation future, passenger transport growth by all means including private auto is considerably higher than freight growth relative to the other scenarios.

There appears to be no market for new advanced intercity transportation systems in any of the three scenarios by 1990–2000, other than those that may be essential in overcoming massive changes in energy forms used. However, technological changes to improve the performance and reduce the energy consumption of present marine, air, rail, and truck systems will be widespread in both the success and transformation futures. These improvements and their associated cost savings would be greatly attenuated in the distress future because of lower capital investment and lower transportation demand.

The success scenario does produce a limited market for certain advanced urban transportation systems in special applications such as airports and in the downtown areas of two or three cities, but no such market is present in the distress scenario. The advanced urban systems market expands considerably in the transformation future, where a vigorous shift in emphasis to small-scale neighborhood planning occurs.

Summary of System Performance. The transportation system performs well under the success scenario, with most facilities and services growing significantly by 1990 to meet expanded demands for both passenger and freight movement, in and between cities and internationally. The intercity rail system, after pruning of socially and economically unviable routes is in good health. The major projected problem areas, remaining from earlier periods, would be high levels of traffic noise, congestion, and traffic-generated air pollution in and around many cities, and high highway-traffic-accident losses. The decreasing crashworthiness of the smaller private passenger car in accidents with trucks may lead to public sentiment against truck size increases or in favor of separate rights-of-way. Compared with the other two scenarios, liquid fuels will be more intensively used and will deplete faster.

Under distress conditions, the transportation system is not spared the deep economic troubles that will affect the rest of society. Many of the ills will be unavoidable—overcapacity, unamortized cost, and increasing specialization of many transport vehicles; undesirable side effects of government intervention in the transportation marketplace; continuing low-density surburban development ("urban sprawl"); automobile pollution control devices that depend on proper maintenance for efficient operation; and an increasing complexity and consequent rise in maintenance costs of automobiles.

Transportation in the transformation society performs generally well even at lower demand levels (especially for freight movement) and under more dispersed origins and destinations. This is due in part to the dominant success-oriented achievement sector of society, which maintains a high level of productivity and consumption, and in part to the "voluntary simplicity" sector, which encourages efficient and low-energy ways of moving people and goods. The only negative outcomes found for success-oriented policies in a transformation setting are the low level of Federal R & D and demonstration support for advanced systems responsive to transportation values, and the cost and maintenance complexity added to automobiles by safety and pollution control requirements.

For all scenarios, the transportation policies will continue; for economic and other reasons, the heavy dependence of the U.S. transportation system on liquid fuels can be expected to continue in the next 25 years. Inasmuch as a worldwide petroleum shortage, including exhaustion of economically recoverable reserves, is widely predicted for the 1990–2000 period or shortly thereafter, the *post-2000 period* will be particularly critical and success will depend heavily on economic and massive coal liquefaction and shale oil extraction for continued availability of liquid fuels. However, there is considerable uncertainty at present whether such sources can supply the liquid fuels in anywhere near the quantity needed to operate the transportation system expected in the post-2000 period. Hence, the scenarios share two common and potentially serious problems: (a) the possibility of a more rapid exhaustion of petroleum supplies (especially in the success future) than would be the case if transportation elements capable of utilizing electric power efficiently were promoted more intensively (e.g., railroads and electric-powered urban systems), and (b) the likelihood that the post-2000 period would be burdened by the legacy of a heavily liquid-fuel-dependent transportation system.

CONTINGENCY PLANNING

In addition to the kinds of alternative futures presented in the previous section, the planning process must consider the ability of the future transportation system to respond to emergency situations. Although there are many kinds of emergencies which might arise, particularly when hurricanes, earthquakes, and other natural disasters are considered, those of national scope are rare. The two events treated under this section are those for which the transportation system must be prepared to assure a responsible planning process.

The first of these is an energy supply emergency such as that suffered by the Nation in 1973–74. The second is a military emergency, for which one hypothetical case is reviewed. In each case only the broad-scale national effects on the transportation system are assessed.

Energy Supply Emergency

The 1973–74 embargo punctuated the dependency of the Nation's transportation system on petroleum. Previous discussion in this document confirms that this dependency will not change soon. In fact, our dependence on foreign sources will increase. Virtually all current transportation is operated on petroleum-based fuels, and it consumes half the national total. Thus, a prolonged embargo could substantially impact the transport sector.

The transport sector has shown considerable resilience in responding to shortages in the range of 10 percent. Shortages greater than that could not be readily absorbed in the existing system without considerably modifying the way the transport system functions. The American people have shown that they recognize the need to set priorities among potential fuel uses, and that essential services and more efficient services come first.

In addition, national programs are underway to provide for strategic petroleum reserves, and for emergency rationing of fuel in a major shortage.

The strategic reserve, to contain 150 million barrels of oil by 1978 and authorized to contain as much as 1 billion barrels by 1982, will provide a substantial buffer against future emergencies. Reserves will be distributed to assure balanced supply throughout the Country.

Emergency rationing plans are in the final stages of development. The plans recognize that the prime purpose of rationing is to assure an equitable distribution of available fuel. Rationing coupons would be provided to holders of drivers' licenses and to businesses based on history of previous use. Sale of coupons would be permitted on the open market and price will be determined by demand. Additional coupons would be available for special hardship situations. European experience has indicated that rationing plans are not effective until shortage levels reach 20-25 percent.

In other modes of transportation, fuel allocations would be based on procedures similar to those pertaining in the recent emergency. Firms would receive allocations based on historical use and priorities.

Finally, the United States has entered into agreements with other major consuming nations that would balance out supplies among consumers in the event of a major shortage.

Military Emergency

During military emergencies, the transportation system may be used more and quality of transportation service may fall. To examine this problem, the 1990 transportation system was tested with a scenario that calls for the U.S. forces to be engaged in a two-front conventional war. This action was selected as most likely to provide the greatest stress to all modes. Such an assumption merely recognizes that military support is one of the roles our transportation system must be prepared to play, and seeks to test the capacity of our system's future effectiveness.

Final demand and total industry outputs were estimated by the Federal Preparedness Agency. In turn, using input-output analysis, these estimates were then used to develop transportation requirements. The results, shown in figure XVI.3, indicated that in this emergency scenario the entire economy would generate 4,380 billion ton-miles of intercity freight. This is 253 billion ton-miles (less than 6 percent) higher than the 4,127 billion ton-miles estimated under peacetime conditions. This result was compared with similar figures for 1944 when transportation for World War II was at its peak. It was assumed that if the years between 1940 and 1946 had been a period of peacetime conditions a proportionate change in ton-miles between the 2 years would have occurred. For 1944, the peacetime transportation would have equaled 809 billion ton-miles. This is 279 billion ton-miles (almost 35 percent less than the 1,088 billion ton-miles reported for that year). This finding indicates that the 1990 war scenario produces a transportation requirement of approximately the same magnitude as that of World War II. More importantly, it indicates that as transportation capacity continues to grow, the requirements of a military emergency become a smaller proportion of total transportation. The national transport system, particularly the railroads, however, would have to be in much better physical condition than in 1975. These planning forecasts assume it would be.

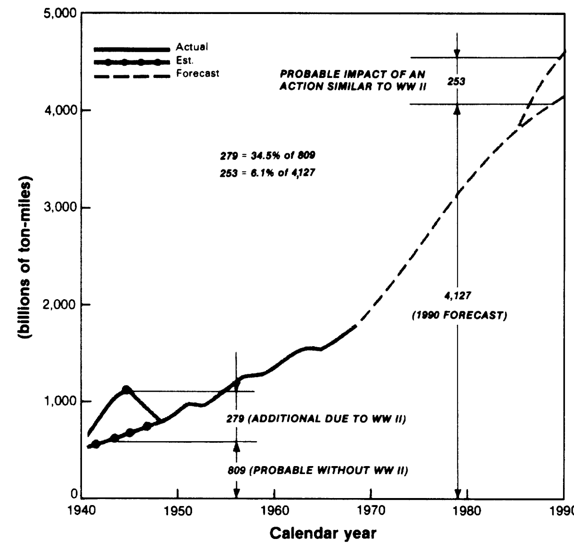

Figure XVI.3. Impact of a Conventional Military Action in 1990.

The estimated impacts by mode are given in table XVI.2. The 16-percent forecasted increase in air freight is well within expected capacity, particularly recognizing that passenger aircraft can easily be converted to air freight service. The heaviest impacts will be on the for-hire truck mode. This reflects the large quantities of high-value manufactured products produced for military purposes. It also reflects the expectations that, except for a serious energy shortage, such products will continue to be carried by truck as at present, rather than by rail as in the past. A more intelligent public policy, however, perhaps should shift this emphasis. The increase in water movements clearly reflects the increased demand for mineral resources, and the increases in pipeline movements reflect increases in fuel demand. Unless present patterns and policies change, however, only a minor increase in rail movements is expected for some raw products, steel and heavy equipment, and ordnance.

Obviously, military requirements would be given priority during a wartime situation, and particularly in the event of a serious energy shortage. A large assortment of civilian transportation demands would be available for assignment to lower priorities in favor of satisfying the needs of the emergency situation. It appears that the 1990 national system would have sufficient overall capacity even without such civilian cutbacks.

Table XVI.2
Intercity Transportation Impact of Conventional, Two-Front War in 1990
(Billions of ton-miles)

Mode	Without War	With War	Diff.	Percent
Rail	1,754	1,823	69	3.9
Water	829	894	65	7.8
For-hire truck	394	440	46	11.7
Private truck	273	279	6	2.2
Air	9	10	1	11.1
Pipelines	868	934	66	7.6
Total	4,127	4,380	253	6.1

CHAPTER XVII
Technological Possibilities

In the broadest and perhaps best sense of the meaning of the word, technology interacts with population, resources, and culture to form society and economy. In the United States, in this century, culture alone has been relatively stable. The other three forces have been highly volatile, and of these technology has changed most of all. In this generation, technology has acquired almost a frivolous reputation frequently associated with generating unneeded products for an uninterested public. In a more sinister garb, it has been blamed for most of the undesirable degradation of our environment. As a result, the belief that what technology has made a mess of, only technology can mend, is seriously questioned by many.

In the post-1990 period, when many of the products of current technology will be making their first pervasive impacts on society, the social and technological processes may be expected to have reached a stage of synergistic balance in which society directs technology rather than being propelled by it. The observation has been made that in the remainder of this century, we will not learn so much to do new things as to do well those things we now do rather poorly. In many areas, this will mean reducing the negative environmental and cultural effects of our technological society. In transportation, it will mean focusing on simplifying mobility, reducing both the technical and institutional complexities that have grown up around our transportation system. We have learned that it is not "progress" to double the speed of our aircraft and then waste hours getting to our terminals or waiting for baggage, or wasting motion because we lack adequate information and directions.

Consequently, a major focus for our technologies will be in easing modal transfers, providing better information, and producing more effective mobility in a door-to-door perspective. It also must deal with the ever-lurking problem that in the year 2000 petroleum reserves might be inadequate. In our goods-movement systems, we also will learn to simplify—reducing the complexity of our present systems, reducing in dramatic ways the real costs and the heavy obtrusiveness of our commodity flow networks. Finally, we will place technology in service to the society by emphasizing technologies that serve personal mobility and reduce dependence on vehicles for effective mobility. Fully integrated transport-spatial systems will produce meaningful freedom from transportation dependencies under which we presently operate, sometimes well, but that consume our time, our living space, and our resources.

If the Nation is to be making capital investments 20 years from now in technologies that are not already at least in their adolescence, it is not too early to have underway moderately small programs aimed at the explorations and advancement of these technologies. It is essential to think ahead in order to identify research we should be doing now to carry us in the directions currently perceived to be the most desirable and to provide contingencies for an always uncertain future.

Chapter XVI described several possible future scenarios. The "success" future assumed a sustained relatively high rate of economic growth. Two other scenarios, the "distress" and "transformation" futures assumed much lower and sporadic economic growth rates.

Considering first the success future, we start with the projected population curves of figure XVII.1.

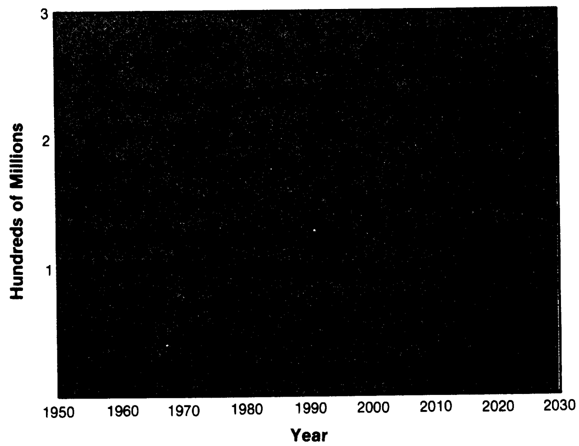

Figure XVII.1. U.S. Population Growth Based on Current Fertility Rates.

These trends become even more significant when the ratio of those in the working age group compared to those outside the working age group is considered. That ratio is increasing, reflecting a greater number of potential workers per person in the population.

The ratio of potential workers to potential retirees stays almost constant from now to the year 2000 at slightly over five potential workers per potential retiree. But the population is getting older. Somewhere around the year 2010, the retirement age population increases dramatically compared to the work force age group: in roughly 10 years the work force age group per potential retiree will drop from 5 workers to about 3.6.

What might we deduce from these population trends? If we have reasonably full employment, even with a slower rate of growth of labor productivity, real GNP per capita should rise until around the year 2000 because the potential work force per capita is rising. High employment levels are essential.

Post-2000, the shrinking work force and climbing retirement group could put an increasing premium on higher labor productivity. It also will probably encourage greater participation in the work force—more women, more part-time workers, and later retirement. It may result in changes in immigration quotas. Unless the drop in the ratio between producers and nonproducers is cushioned by a structural shift in the work force, the competition for the shares of national output could have serious social, political, and economic consequences. Savings are likely to be squeezed and capital investments curtailed during this period so that large new transportation investments would appear less likely in the period 2000–25 than between 1975 and 2000.

The availability of investment capital is a problem now, and while there is controversy about the long-term trends, there are factors that suggest we will need a higher ratio of national savings (investment) to consumption in the future. There are several reasons: (a) the objectives of capital investment have broadened beyond those of increasing labor productivity to include environmental and safety protection, (b) conversion of energy systems will divert substantial capital, and (c) the number of new people entering the work force require capital to create new jobs.

Capital may, therefore, be a continuing problem, but it is not an immovable obstacle to attracting innovation, given a reasonably healthy economy that can generate the investment mood for major innovation. This is unlikely to occur in an energy-scarce world; economic health requires high productivity and productivity requires energy. Although there is debate as to the degree to which national output must suffer as a consequence of higher energy prices, it is difficult to envision abundant output with severely restricted inputs.

There are tremendous "ifs" in these kinds of projections and in drawing conclusions from them. All the variables (work participation, working and retirement ages, average workweeks, rates of capital accumulation, national priorities and attitudes, international events and influences, and technological capabilities) contain uncertainty. But they do have the advantage of giving us a point of departure.

If we accept these conjectures at face value, what implications do they have for the development and implementation of future systems?

The first is a continuing pressure for labor productivity improvements in transportation; gains in some sectors of the economy generally will escalate labor costs in the others. This will drive up labor costs in transportation, creating a continuing pressure for equivalent productivity improvements in that sector. The population trends hypothesized would indicate a strong intensification of that pressure around the year 2010. If higher productivity is to be achieved through the route of more automated, fixed-guideway systems, then the pressure for deployment of such systems will grow more or less continuously but with an acceleration around 1990, leading to a substantial infrastructure in place around 2010. Benefits might accrue from placing this infrastructure in place earlier, but this raises the question of whether people would devote a considerable part of the national budget to such expenditures when the problem lies still 20 years ahead.

This timing of circa 1990 for a takeoff point for new fixed-guideway systems appearing in appreciable numbers is thus the result of the combined considerations of: when automated systems are likely to be most needed to improve labor productivity; the availability of capital, given the pressing need of other uses; energy conversion; rail freight improvements; and the maturation time of a deliberately paced technology development program; and the political judgment of when the society would support such expenditures. These systems could phase into both the urban passenger/freight systems as well as intercity passenger/freight systems.

The uncertainty of the energy picture continues to loom large in all considerations of the future. As noted, we would not generally associate our success future scenario with constrained or very expensive energy. Under this extreme, the more energy-efficient existing systems will get increasing emphasis, and we will trade energy efficiency for performance. New systems that require substantial new capital are unlikely in a sluggish economy. To hedge against this eventuality, it is imperative to understand the technical and operational options in the context of this kind of environment, and to have carried these options far enough so that they can be drawn upon when necessary.

Another consideration is illustrated by the middle option of figure XVII.2. If energy is relatively cheaper in the form of electricity rather than in the form of petroleum or synthetic petroleum, then fixed-guideway systems are favored relative to highway and air systems; the technical advances required to permit use of electric highway vehicles with adequate performance are substantially greater than for fixed-guideway systems.

With more electrified high-speed ground systems for short trips replacing short-haul air, air would be used more exclusively for long-distance travel. The urban electric auto would become a favored alternative. The natural bias for long-haul freight movement by rail or some new fixed guideway instead of highway would be strengthened.

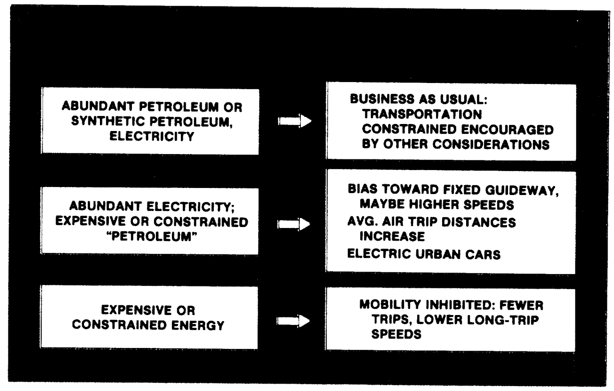

Figure XVII.2. Energy Scenarios.

One important aspect for transportation, whether we have a reasonably affluent world or a materially austere one, is the impact it has on personal values. A prerequisite for any new system is that it meet the standards for the environment in which it is to operate. These standards are likely to evolve in the direction of increasing stringency if one can afford to meet more stringent standards. Only if there is substantial decline in the economy are we likely to place less value on environmental protection.

THE AUTOMOBILE

Under any serious scenario, the automobile will continue to dominate passenger travel as well as most shopping trips unless we get a tremendous shift in present traditional values and an absolute end of petroleum without adequate available substitutes. If the modal share of all other modes were to double—which is not an unrealistic possibility—autos would still account for 80 percent of all trips.

The car is getting more socially responsible. The current trend toward a more energy-efficient, safer, lower polluting car should continue through the 1980's. By 1990, further improvements could begin to occur through the application of microelectronics and sensors to the road/car system.

Compared to other alternatives, the automobile is at its best where trip densities are low and destinations are diffuse; i.e., where aggregation is difficult; this is the typical situation in our still-growing suburbs and in rural areas. For long intercity trips, the auto wins on the basis of economy when multiple passengers are traveling together, or when trip time is less important than convenience and flexibility. The auto loses its comparative advantage over other modes only when there is an opportunity to aggregate a large number of trips, making larger vehicles more attractive, or when distances are long so that higher speeds reflect substantial reductions in total travel time.

The auto is not efficient in its use of street space, and congestion puts it at its worst when travel densities are high, such as in our central business districts and the arterials leading to them. Here more space-efficient modes, such as automated guideway transit systems (AGT's), may be preferred.

The automobile is adaptable, both technically and operationally. If required, new vehicles can be made to be very energy efficient by favoring fuel consumption in the tradeoff with size, performance, emissions, and safety. Even with existing cars, the per passenger efficiency can be made highly competitive with other modes by carpooling and other forms of trip consolidation.

The auto also plays a dominant role even under the most optimistic kind of scenario for new transportation innovations—abundant energy, a vigorous economy, and a high degree of technical progress. In fact, the automobile itself might well be the most dramatic beneficiary of such conditions.

Vehicle traffic flow control is already being improved by having sensors detect traffic conditions and by using the information to provide more efficient signals as well as information to the driver. By the late 1980's, it should be possible to have some of these signals go directly to the car on a routine basis to assist the driver and further reduce congestion while improving safety. The ultimate step in such a development would be to have all operating functions except route choice transferred from the human driver to an "auto-driver" that responds directly to signals from the road flow control system for all steering and vehicle operation. While there is considerable controversy as to how soon, if ever, this final step to the essentially driverless car (the true "automobile") 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 and sensors that increase versatility and lower cost is continuing to shorten the list of things that can't be done.

With or without this last step, the current efforts to understand better the tradeoffs between the various automobile characteristics and to find better ways to build, maintain, and upgrade the infrastructure are entirely appropriate—some variant of the car will remain an essential component of our future transportation system.

URBAN TRANSPORTATION EVOLUTION: AN ADAPTIVE SYSTEM STRATEGY

As described in greater detail in earlier chapters, the population density of most of our central cities has been declining for many decades as increasing numbers of people have opted for suburban living. The exceptions are those cities that grew up around the automobile, and thus never reached the very high densities that once were typical of our older cities. Our urbanized areas have also become more multinucleated as the people have been followed to the suburbs by retail outlets, jobs, and other activities. More than half our metropolitan population now lives in the suburban rings, and about half of them work there.

Conventional transit is not well suited to serving these growing low-density suburbs. It is a characteristic of transit systems that as the number of riders per mile decreases, the average cost per rider rises, other things equal. In the light of this, the observed decline of transit is not only understandable but appears to have been almost inevitable in the absence of a tremendous shift in present traditional values.

The auto, which was undoubtedly an important factor in suburbanization, is on the other hand considerably less than ideal downtown and in areas of high activity or population density; it takes up too much space and, therefore, contributes heavily to congestion and energy inefficiency, and it pollutes.

In spite of rapid suburban growth our downtowns have not gone away and are assuming new roles and new density patterns. Where there has been a net outmigration of population, offices and other activity generators have substituted for dwelling space. While traffic in and out of central business districts (CBD's) has declined in terms of percent of all trips, in absolute terms it remains high. In these high-density areas and along the arterials leading to them, systems that are more space efficient than automobiles are a necessity in our larger cities. Where congestion and air pollution are severe, there appears to be increasing acceptance of the idea of restricting private autos downtown, concomitantly with improving public transportation service.

Thus the evolving pattern of our cities, aided by a highly automobile-oriented population, has diminished the role of conventional transit outside the downtown CBD. This increased dependence on autos has brought increased attention to automobile alternatives that can more effectively serve the suburban carless.

The problem we face today stems from the fact that no single mode or vehicle type can serve well the needs of a mixed-density, multinucleated city. It seems unlikely that this situation will change in the foreseeable future. Except perhaps for a few semiexperimental new towns, the longevity of the existing infrastructure—houses, roads, and buildings—will insure it.

Further, there is no unanimity of tastes and preferences as to what cities should look like. Some cities may work to revitalize and encourage high-density growth; some may work to shrink their central business districts and encourage the growth of suburban activity centers; and some may leave development patterns entirely to market forces. Change will come slowly because of the huge investment already expended in existing infrastructure.

Thus, we will continue to need systems that can provide circulation within our downtown areas; systems that provide good arterial flow for peak-hour commutation, both CBD- and non-CBD-oriented; systems that can offer an alternative to the car in our low-density suburbs and our small communities; and, last, systems that accommodate the automobile, which will continue to dominate the urban system (except in high-density areas or on major arterials during peak hours).

Today, our downtown circulation is provided by a combination of conventional transit—fixed route bus or rail and the taxi. Transit also serves commutation (predominantly into and out of the CBD), which is an increasingly small proportion of total trips. Given a future in which we can afford it, these systems will probably be partially replaced by new kinds of downtown people-mover systems. The Department of Transportation is now sponsoring a series of demonstrations of such systems. They could become available for large-scale commercial use in the mid- to late 1980's.

For lower density regions the user-operated automobile is expected to remain the mode—for those who can use it. For those who can't—the young, some elderly and handicapped, and other nondrivers—traditional assistance has come in the past from the helpful driver acting as chauffeur, or from the taxi. Over the past few years there has been an increasing effort to devise new and hopefully cheaper options—the dial-a-ride bus and van systems and other flexible and combination flexible fixed-route variants.

To date, these low-density systems have been disappointingly expensive, although they are considerably cheaper for this application than conventional transit. But as long as we have suburbs and people within them for whom the car is not satisfactory transportation, there will continue to be a need for low-density alternatives to the car. If such low-density service is to be provided, the taxi or the dial-a-ride variant systems appear to be the best way we know of to satisfy this demand. Current efforts to improve their productivity through better vehicle dispatching and management should help lower costs.

By 2000, the driverless car may become a viable possibility, but in the short- and medium-range future the personal car will continue to be supplemented by either ride-sharing or some variant of the taxi/dial-a-ride approach.

Given these ingredients for our overall urban transportation systems, how might we expect the urban transportation system to evolve?

Once again, the many possibilities may best be characterized by examining extremes. An energy-constrained world would probably encourage higher density growth, with sharper gradients in both population density and land value around job- and activity-center nuclei. This favors conventional transit. It also favors various pooling schemes. If the economy were concomitantly sluggish, we would be slower to abandon existing housing infrastructure for new construction, which would be a countervailing force to continued low-density development. It would also be an inhibitor to capital-intensive new fixed-guideway systems, and a pressure against greater operating subsidies.

At the other end of the scale, with a vigorous economy and available, though perhaps higher priced, energy, the economic pressure for higher density, close-to-work living would be alleviated. This is the climate for more liberal development with larger investments in new types of automated, fixed-guideway systems, some integrated into building structures providing downtown circulation, and some providing high-speed connections between the multiple nuclei in the urban region as well as with intercity transportation terminals.

Along any path of evolution in which our cities retain their mixed-density, multinucleated character, the basic transportation functions remain the same: circulation within high-density regions where the auto is too space hungry, high-density arterial flows, and low-density suburban and community transportation to supplement the car. The levels of service offered and the techniques for providing it may be different given different scenarios.

The important point is that the ultimate urban system need not be planned now; the need is for an evolutionary strategy that permits the different elements of the system to adapt to the changing character and needs of our urban regions. This implies that we develop those technological and operational options that appear desirable and reasonable, even though we cannot say now in what combinations and proportions they may be needed.

INTERCITY PASSENGER SYSTEMS EVOLUTION: OPTIONS AND POSSIBILITIES

With the Interstate Highway System nearly complete and with the world's best air service, today's intercity passenger system must be considered reasonably good. Under an energy-constrained, sluggish-economy scenario there is no obvious reason to project more than incremental change to the current system. Highway capacity additions are possible. Air growth would slow. Intercity bus service could be improved, but the pressure for more dramatic improvement is likely to be too low to attract the needed resources. Innovation is likely to be restricted to improvements of system energy efficiency including possible rail conversion to electricity and to the already planned improvements to facilities.

Another scenario toward the other end of the spectrum of possibilities might be a duplication of the 1950–75 GNP per capita growth and a nation that works its way over the hump of the energy problem. By the end of the century, these assumptions would imply an older and much more affluent population with 122 million people over 37 years of age compared to 82 million today. These are adults who are rapidly becoming independent of growing children. There will be fewer households with children, and these smaller families tend to decrease the economic advantages of the car relative to public modes.

Under these more optimistic circumstances it would seem reasonable to expect a very high rate of growth in demand for intercity travel and that trip time would grow in importance relative to cost as a determinant of both trip length and mode choice. More money would permit longer trips, and concern about trip time favors faster modes. This would portend a resurgence of air growth. An increase in multinational corporations in a reasonably healthy world economy would further spur international business travel. Given technical solutions for environmental problems, including lower noise and emission levels, and improved operating costs, an SST could find application in this scenario.

Another future market opportunity is the awkward distance between about 100 to 200 miles that is too short to fly and too far to drive; a round trip by auto requires 4 to 8 hours. In a scenario of reasonable economic growth and with energy not severely constrained, a higher speed system with good access at both ends could sensibly fit in this stage length, which today accounts for roughly 40 percent of all trips over 100 miles. There are three options:

- For low- to medium-density links a quiet short takeoff or vertical takeoff and landing (S/VTOL) air vehicle is a candidate system; the vertical takeoff implies a low-noise footprint for compatibility with urban locations, and little time lost at the terminal to give high vehicle productivity. The primary inhibitors today are high operating costs, incompatible air traffic control, and environmental questions.
- The Loran C navigation system may provide the basis for safe all-weather operation, and technological advancements can lower operating costs while improving community acceptability. This option could be available for extensive use beginning in the late 1980's.
- In medium- to high-density corridors, a new high-speed ground system has the best potential, preferably sharing the same infrastructure with freight as is discussed later. This could either be an advanced rail system, or some new type of guideway carrying smaller, faster, and lighter vehicles than rail is designed for. The inhibitor today is inadequate ridership to justify the high guideway costs. Higher future demand and improved guideway/vehicle technology could reverse the current assessment of system economics. Because of the substantial capital and right-of-way acquisition requirements of this option, it is unlikely that this alternative would be available for extensive deployment before the year 2000.

FREIGHT SYSTEM EVOLUTION: OPPORTUNITIES

Our interest is in the total freight system, but the primary focus is on the rail system—the immediate problem of maintaining adequate rail service is perceived to be the most pressing and this is where the greatest potential for improvement through operational and technological innovation is identified. There are numerous other areas in the overall freight system where technical innovation, such as more versatile pipelines, is likely, but none that has such large-scale implications as the potential changes in rail. Moreover, it should constantly be recognized that these other improvements could adversely affect rail, which as far as it can be seen, would be the only method for shipment of heavy and bulky goods to points not served by water.

Improvements to rail will likely have an important impact on the future evolution of trucking and inland waterways. A change in comparative advantage would shift the market shares of each, and it could make multimodal truck-rail-truck movements more attractive for longer distance hauls. This summary will focus primarily on rail and truck.

There is widespread agreement that the immediate problems of the railroads are not technical; the first order of business is to remove the institutional barriers to more rational and efficient operational practices. Some sense of the directions of institutional and regulatory change needed to motivate the desired system — optimizing behavior instead of sub-optimizing behavior — has recently emerged; these directions are at least partially reflected in the Railroad Revitalization and Regulatory Reform Act of 1976.

Even partial success in bringing about more efficient operational practices should create a better climate for technological innovation. It is, therefore, very appropriate for us to develop a better perspective on the relative merits of alternative paths of technical evolution. Substantial capital will be invested in long-life-cycle equipment as a part of rail revitalization, and it is essential, insofar as possible, that these investments move us in directions that are consistent with the most desirable directions for long-run technical evolution of the system.

We will characterize the spectrum of possible futures in a different way than in the prior discussion by contrasting a scenario that requires no major change to rail with one that hypothesizes a new rail system.

The first is a continuation of current trends. Long-haul trucking becomes increasingly preferred to rail, and trucking continues to expand its market, both in size and diversity. This implies more trucks and a continuing pressure for larger ones. The tradeoffs involved are the improved truck productivity due to larger size against the impact on highway maintenance, capacity, and construction costs, and the safety problems (either real or perceived) of mixed large-truck, small-car traffic, and the adverse effect on rail. One possible outcome of this could well be highways dedicated to truck use, so that in major corridors car and truck traffic are separated.

One might conjecture further. Once the decision is made to build a dedicated facility, it makes sense to optimize it for the purpose. For example, with electronic guidance it may be possible to permit higher speeds and more trailers, evolving toward high-speed "trains" on the dedicated-highway links. Short-haul trucks on the regular highway system could feed the transfer terminals where the high-speed-system trains are assembled.

Functionally, a new hypothetical highway train system on a dedicated highway has many features in common with a grade-separated high-speed rail link. Given the decision to have a dedicated system, the central issue then becomes the relative technical and economic merits of rubber tires on concrete versus steel wheels on rail, or combinations thereof.

The results of such an analysis are not now known but we can broadly describe the alternative scenario of rail improvement and give some feeling for its potential.

A major problem with rail today is the inordinate time most freight cars spend in intermediate yards, stops that must be made by the typical train to drop off some of its freight cars and pick up others. The obvious alleviation would be to have more through trains, on which all cars are going from the same origin to the same destination so that there is no need for such intermediate yardings. With today's typical train sizes of from 40 to over 100 cars per train, this implies very large shipments and is thus a relatively rare occurrence.

The number of through trains could be greatly increased by going to very much smaller trains, say 5 to 15 cars each. This would drastically cut the average number of intermediate yardings, thereby reducing both the time each car loses waiting in yards as well as the volume of traffic the yards must handle. Yard costs should decrease. It would also increase frequency of service and, therefore, reliability of service. The problem is that without other changes, reducing train size would require a substantial increase in the number of crews, and, therefore, line-haul costs. This could be alleviated by reducing crew size, substituting a higher degree of automation of crew functions.

With load and unload times at terminals reduced, higher speed could further decrease costs by increasing the productivity of the equipment, i.e., more train-miles generated per day. It also could further increase the incentive for multimodal shipments.

Given these changes, containerization becomes a more attractive alternative. It is the key to a truly effective intermodal network in which rail, truck, ship, or air can each be used to its maximum efficiency, uncompromised as it is today by the need to offer service outside the "window" of its optimal performance. It is usually easier today to use a single mode, sometimes nonoptimally, than to bother with a slow and expensive intermodal transfer. If each mode were used optimally, most long-haul shipments might shift from truck to high-speed rail, modifying the current trend to more and larger trucks on the highway system. Trucking would continue to grow and serve urban and short-haul movements.

It would also appear to be natural and economically desirable to use the same high-speed network for intercity passenger movement; this is awkward today because heavy trains wear down the track impeding high-speed passenger service, and speed differentials make passenger movements too slow.

While the tradeoffs would need to be investigated in detail, the new high-speed, small trains might be designed for lighter axle loads to reduce track maintenance expense.

Waterborne transportation will see continued technological development, on the domestic inland, Great Lakes, coastal waterways, and on the open seas. On the inland system, increasingly sophisticated terminal facilities will handle both containerized freight and bulk cargoes with increasing speed. The use of "unit" barge tows of a single commodity to a single destination will increase. Radio and telecommunication plus nationwide LORAN will improve control and scheduling of tows. Seagoing tows with very large barges and form-fitting tugs will enter the coastal trade.

Space will be at a premium at coastal ports and the rail marshalling yards are likely to move inland with good rail and highway connection to link the waterfront with these backup terminals. Real-time computer systems will track shipments to minimize shipping time, as well as pilferage and incorrect routing.

Extensive undersea mining and oil recovery will require bulk raw-material movement. Large cargo-carrying submarines are likely for liquid or slurry materials to provide a capability for very efficient movement and for loading and unloading away from wave action. Offshore deepwater ports may have both surface and subsurface hookup facilities with materials piped across the ocean floor. Coastal land is likely to be preserved for ecological and recreational reasons so that pumpable cargoes will move via undersea pipeline to inland storage and processing plants. All cargo vessels are likely to increase in size and level of automation.

Small, high-speed, highly maneuverable ships will service the many offshore facilities and marine farming operations. Surface-effect vessels, both hovercraft types and sidewall types as well as hydrofoil, will see limited service in special passenger applications. Hovercraft capable of traversing iced-over rivers may come into use in Alaska and other far-north locations.

The first task is to do the conceptual design work and evaluate the economic advantages and disadvantages of different levels of technical performance change; this effort is now ongoing.

CHAPTER XVIII
The Future of the Planning Effort

A plan cannot be a static document. Rather, it must evolve and develop. Effective plans will depend on the development of a comprehensive planning process over time, a process that is responsive to changing needs and conditions.

The planning process which produced this document has much growing and evolving to do because it is a first effort, because of the opportunities for appreciable input from others, and because of the large potential for expanding the scope of the present effort. There are three ways for the planning process to evolve:

- Through an iterative process of review and revision with industry, other levels of government, and the general public, based on this first effort;
- By improvements in our information and methods, and improved insight into the shape of the future as emerging phenomena and trends are clarified;
- By extension of the planning focus into significant areas left untreated in this document.

Each of these will be discussed in turn below, not as alternatives but as a synergistic set in which it is recognized that all three will be taking place in unison over time.

PUBLIC REVIEW AND REVISION

Of the three paths, the first is the most important. This planning document has been prepared without any direct input from the public, although estimates of future requirements were produced by local governments in many cases. Were it in any way to be claimed to be a final document, lack of full public participation would be, appropriately, a reason for strong criticism. But the purpose of this document is to *initiate* a dialogue, not to conclude it.

The Department of Transportation has embarked on this long-term planning process in what it believes can be a highly productive fashion, by setting down in a document as clearly and comprehensively as possible, its view of a probable future transportation system for the Nation, assuming a continuation of present traditional values. This statement, it is hoped, will make subsequent public discussion both tangible and productive.

The Department of Transportation considers this document the first step in the process of development of a national plan. The steps to follow will be equally important. For the next year, a comprehensive review and comments process will be undertaken to obtain recommendations from all interested groups or individuals. This process will help to shape the Department's future efforts in updating and revising this first effort.

The first months following publication will be devoted to formal briefings and hearings. This will be accomplished in two ways. First, all major national organizations wishing to participate in the review will be briefed by the Department's headquarters staff. Second, the Federal regional councils in the 10 standard Federal regions throughout the Country will work with the Department of Transportation's Secretarial representatives to brief the major Government organizations and their staffs about this planning effort.

Following these formal briefings the remainder of the year will include regional hearings held in 11 cities. These cities are: Atlanta, Boston, Chicago, Denver, Fort Worth, Kansas City, New York City, Philadelphia, San Francisco, Seattle, and Washington, D.C. During this period, the Department would also invite direct written responses by all interested citizens or groups.

This yearlong review process is extremely important to the Department in order to make an evaluation as to what changes and adjustments will be necessary in the development of a plan. All interested citizens are urged to participate in this review.

With this public input the process of revision will begin, culminating in publication of a revised planning document for further public consideration in the following year.

TECHNICAL IMPROVEMENTS

This first planning document is the result of a decision by Secretary William T. Coleman, Jr., that a planning process be initiated by the Federal Department of Transportation. In many respects, that decision found existing departmental and Federal resources falling far short in the information, methods, and institutional processes requisite to such an undertaking. One important product of this effort has been the identification of these gaps, and the initiation of corrective measures.

Future iterations of a plan should benefit from this expansion of our technical capacity to do planning. Moreover, as time passes, many concerns just now emerging should be clarified. Energy availability is one example, and shifts in population migration patterns is another. The process should benefit from our improved view of the future as our forecasting capacity strengthens. The process would also benefit from a national discussion of our present traditional values and what changes, if any, our society wishes, or what changes, if any, are going to be brought about because of resource or fiscal scarcities, if any, which cannot be overcome.

Among the major technical deficiencies to be improved are:

- *Current information* — Information regarding actual transport flows is inadequate, sometimes nonexistent, particularly for all the highway-oriented modes.
- *Forecasting* — Greater range and precision in socioeconomic forecasting is essential to meaningful future transportation planning. Newly emerging trends in population distribution and urban-rural settlement patterns, and highly volatile birth-rate conditions are large uncertainties. More comprehensive research seeking to clarify the likely trends beyond 1990 will enhance this capability.
- *Modeling* — Current capability to employ models comprehensively at the national scale is extremely limited. Transport models that, given future commodity production and consumption, can estimate regional flows and estimate modal shares based on descriptions of modal characteristics are essential to the planning process.
- *Impact analysis* — Fully comprehensive assessment of the impact of planning decisions is not feasible at present. However, such a capability is essential for alternatives' evaluation as well as for overall planning analysis. Of particular concern is the present inability to treat land-use transportation relationships fully.

EXTENSION OF THE PLANNING PERSPECTIVE

This current planning document has taken a relatively broad view of transport planning concerns. However, a far more comprehensive view is potentially attainable.

As described in the Foreword, the intent of this document was to address all forms of transportation, seeking to identify what overall system was most probable for the Nation. In taking this first step, the traditional Federal view has been considerably expanded. Omitted from this perspective, however, were two elements which future elaboration of a plan could comprehend:

- This planning document specifically focused on what needed to be done for the future. A possible scenario evolving from this approach would include:

  a. Identifying what is to be done,

  b. Seeking a broad political consensus on parts of a plan as national goals,

  c. Seeking a broad political consensus on what changes, if any, might occur in our present traditional values,

  d. Identifying who would play which roles, and

  e. Programmatic development.

  Thus, future evolution of a plan could consider the public-private factors in implementing such a plan, and within the public sector, what levels of government would bear different responsibilities for implementation.

- Extensive cost-benefit analyses were excluded from this first effort. Future development of the process could permit more extensive cost-benefit analyses to be performed as part of the plan development process, and presentation for public review and comparison to other transport and nontransport programs.

Finally, the planning perspective needs to be more effectively sensitive to the ways in which transportation is interwoven into the society's well-being. It must seek to become comprehensive in its recognition of transport's role in contributing to our society's goals.

TOMORROW'S CHOICES

Throughout this document trends have been described and public choices identified. In the future, these choices will often take the form of a public decision to intervene in expected trends to achieve perceived public benefits. Such intervention would seek to divert trends into directions deemed more conducive to national goals.

Many such decision points have been touched on in the pages of this document. Hopefully, issues surrounding some of these decision points have been clarified by their treatment here. Some have been treated only briefly and far more consideration and discussion is necessary before public decision. As the public discussion evinced by this document expands, these issues will receive fuller treatment and new issues will surface. The whole process of raising these questions to the level of conscious explicit decision-making, with full recognition of the consequences of particular choices, has been the goal of this document.

Among the major questions and issues expected to be on the public agenda in the future are the following:

- How should a democratic society allocate its available resources between present needs and long term prospective problems? Within this general question, several specific transportation issues arise.

Issue 1 — To what extent should present investment be diverted to provide solutions to future expected energy shortfalls?

Issue 2 — To what extent should services and capacity that are presently uneconomic, such as Amtrak and certain components of the rail system be retained against a potential future need brought about by failure to meet our liquid energy needs?

Issue 3 — To what extent, and in what ways should public policies seek to reinforce trends toward urban density patterns deemed more energy efficient, or otherwise more desirable.

- When is it appropriate for the public to intervene in marketplace decisions? What mechanisms are appropriate? Many of our major future decisions lie in this area. Among them are:

Issue 4 — To what extent should public policies favor and support rail traffic over alternative modes when it is deemed that the public interest is better served by a stronger rail system?

Issue 5 — To what extent should public policies restrict automobile use and otherwise support public transit over private modes when it is deemed that the public interest is better served by increased use of transit modes?

Issue 6 — How can public transit costs be equitably allocated between those users who benefit directly and the general public, and between disadvantaged riders and the affluent user diverted from his automobile?

Issue 7 — To what extent should public policy require investment by the consumer in devices for his own safety and protection, beyond that which he would make in the open marketplace?

- How can government best institute orderly procedures to make necessary changes in public policies with due consideration for the persons and institutions affected by the changes? In many instances institutions, industries, and livelihoods have developed around previous policy. Among issues in this area are:

Issue 8 — How can waterway user charges be instituted over time to assure public benefit without undue harm to an industry that has grown up around the present practices?

Issue 9 — How can general aviation users pay the costs of public expenditures that benefit them without undue harm to the industries involved and with assured maintenance of aviation safety?

Issue 10 — How can the economic efficiency benefits of increased truck sizes, and perhaps weights, be obtained without detriment to other public interests such as a strong viable rail system, and safe, environmentally desirable highways?

Issue 11 — To what extent is the public responsible for providing equivalent access to public transport facilities for the elderly and handicapped beyond meeting their mobility needs by alternative means?

CONCLUSION

With all its limitations, some recognized and others no doubt overlooked, this document is submitted to the public, including governmental leaders at all levels, for consideration, criticism, and discussion. It is my considered judgment that the valuable data developed and gathered together here for the first time in one place should be made public even if there might be no consensus on its interpretation and the judgmental factors employed to reach certain tentative conclusions.

Respectfully submitted

William T. Coleman, Jr.
Secretary of Transportation

Dated: January 5, 1977
Washington, D.C.