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CHARLES ZWICK was born in Plantsville, Connecticut, and received his doctoral degree from Harvard University. He was a member of the Harvard faculty for 2 years after receiving his degree.

In 1956 he joined the Rand Corporation as head of the logistics department, and in 1963 became a member of the Research Council.

His public service began in Washington in 1965 when he became assistant director of the U.S. Bureau of the Budget. After serving in this capacity for 3 years, he was appointed director in 1968.

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The charge given to me as a panel member was to look at transportation developments as one of the broad issues facing the nation and to answer questions such as, What part will transportation play vis-à-vis national defense, housing, the attack on poverty and crime, and other national issues? Should and will transportation continue to account for roughly 20 percent of the Gross National Product and why? This charge is obviously so broad that whatever I say can be fairly included within it. I will attempt to answer some of the questions but obviously not all. As an economist by training, I like to look at the demand and supply aspects of a problem. Therefore, I will first comment on the demand, or requirement side, and then on the supply, or the constraint side, of transportation growth during the next 2 decades.

As our nation continues to grow and become more wealthy, there will inevitably be a corresponding increase in the demand for transportation services. I cannot present here a complete theory of development, but the trends, I think, are clear and, in fact, dominant. With regard to goods and materiel movement, simple observation confirms that we will continue to integrate spatially our productive activities. In economic terms, we will continue to substitute a relatively cheap factor of production, transportation, for other more expensive factors. The rapid growth of international organizations carrying out production in many places throughout this world, I would argue, is only the top of an iceberg underlying a broad-based reorganization of the world's productive activities. This trend will continue during the next 2 decades. I forecast this trend with high confidence even though we are now going through a period in which the specter of increased protectionism is raising its ugly head. In the end, the iceberg is too big and too fundamental to be subverted by a few who find that their private, comfortable positions are threatened.

With regard to the movement of people, I see the same growth in demand. Mobility is a highly desired commodity. As people become wealthier (and they will become weal-

thier at an impressive rate over the next 2 decades) they will demand increased mobility and, equally important, a higher quality of transportation services because it is also true that privacy, safety, comfort, and flexibility are also income-elastic commodities. In brief, people will have more time available and higher incomes; they will, therefore, demand increased quantities of transportation services. The mix of personal transportation services will continue to evolve in the direction of higher quality services.

The first set of constraints is the technological potential. There will be real and important technological advancements, but I do not foresee that great breakthrough that is going to bring us into a new era of dramatically increased mobility. The underlying laws of physics are too immutable to expect that, notwithstanding futuristic drawings or our most fond wishes. It takes energy to cause movement, and the transformation of energy, as we were taught in Physics I, has side effects that get us rapidly into dollar costs, on the one hand, and various potentials for pollution, on the other. In the end, there will always be a question of choice. Are we willing to pay the price in terms of dollars and side effects for a given transportation service? We were also taught this simple principle in one of our first courses, Economics I.

We will continue during the next 2 decades to make progress on individual transportation components, but I feel that the really significant advancements will come from new combinations of power and control systems with containers, rights-of-way, and storage facilities. In short, by using new combinations of existing transportation components, we can increase utilization of existing facilities and thereby free resources and make money available to help solve problems of side effects.

Technology, while continuing to make progress, will also continue to be a real restraint on the growth of transportation during the next 2 decades. I commend to you the area of system integration as one which holds great promise. Better utilization of rights-of-way and more innovative and flexible combinations of containers and power systems could make significant improvements. The transportation system has high, fixed costs, and anything we can do to better utilize the system reduces average cost or makes the system more efficient.

A second constraining set of forces is what I call a side-effects problem. I believe it is obvious that any activity as big and as pervasive as is the current and prospective transportation system of this country will have major impacts on the environment and social order. It is also obvious that, because this is so, transportation systems will be alternately blamed as being the source of all the problems of the late twentieth century society or praised as being a solution to any problem, be it balance of payments deficit or the role of the family as a moral force in an affluent society.

Both views are, of course, absurd. Between these two extremes, however, there is a lot of room for blame and praise. An important first principle, I believe, is to be realistic and accept this fact. The days have gone when those involved in the transportation activities of the nation can casually say that their job is to provide transportation systems, and it is someone else's responsibility to deal with the amorphous and pervasive side effects. Review any major newspaper in a metropolitan area, and chances are that you will find several important political debates concerning transportation issues. In Congress, it is the SST, in Washington it is the Three Sisters Bridge, and in Miami it is the jetport.

It is clear that in the future more attention will have to be paid to muting or eliminating some of the undesirable side effects of transportation systems. It is also clear that we cannot eliminate the problem of side effects by simply prohibiting transportation systems or by eliminating economic growth as some of my more extreme friends would argue. Economic growth and increased mobility give us the potential to do so many socially desirable things; to argue that we should stop their development is, to me, the height of poor judgment.

Once we recognize that there are benefits and costs in any important decision, and this is clearly the case in most transportation decisions, we are in a position to start working toward an acceptable solution. These solutions will not be easy, and the first step will require all individuals on all sides to give up their unnegotiable demands. In the end, a modern society can and will blend competing objectives into an overall public policy posture. We have solved tougher problems in the past, and I am enough of an optimist to believe that there is no lack of intellectual ability to solve these problems.

My prediction in this complex and important area, then, is that side-effect problems resulting from the movement of goods and services will become more important, more complex, and more central to the work of those involved in transportation.

A third restraint is the money needed to pay for these increased transportation services and where it will come from. Let me start this discussion with a point that is as basic as the physical laws that prohibit one grand technological solution to our transportation problem: You and I are going to pay for these new and grand transportation systems, either directly or indirectly through governmental expenditures. The only way to avoid this harsh reality is to try to shift the burden to someone else. Much of the debate on transportation financing goes to this issue of who is going to pay. Because we know that it is going to involve a great amount of money, we expend a great deal of effort attempting to shift the burden to someone else—anyone else.

I will defer, for a moment, the question of public expenditures and focus on private expenditures by individuals. Here, budget studies confirm what we expect from our own personal experience. As income goes up, there seems to be a proportionate increase in expenditures on transportation services. Will this continue in the future? My forecast is that it will. Let me elaborate on this point. First, transportation expenditures will not become an increasing proportion of one's budget as one's income goes up. There are just too many other claimants on the increase to make that a realistic option. In economic jargon, the income elasticity is close to one.

Second, and implicit in my earlier remarks, is that some of the costs now transferred or shifted to others will be directly charged to the users of transportation services so that, in a real sense, a doubling of transportation expenditures will not lead to a doubling of consumption of transportation services. Therefore, as a consumer, do not look for relief from the transportation portion of your budget as your income goes up. If you spend 20 percent of your income on transportation now, you will probably still be spending 20 percent of it on transportation services 10 or 20 years from now.

Notwithstanding this forecast, however, you will not necessarily share proportionately in these expenditures as income grows. Some of the increased expenditure is going to be absorbed in muting or eliminating some of the undesirable side effects of transportation systems. Today, these costs either have not been faced or have been shifted to some other expenditure category.

Since the mid-1950's, the federal expenditures on transportation have kept pace with the growth in Gross National Product and also the growth of the federal budget. The issue is whether this trend will continue during the next 2 decades. My forecast is that it will, but, again, this forecast is subject to several important qualifications.

First, the reclassification issue that I mentioned earlier will be involved. More and more of the expenditures to mute or eliminate the side effects of transportation systems will be borne by federal programs labeled as transportation programs. Therefore, even if transportation programs maintain their proportion of the total federal budget, as I believe they will, it does not mean that federal expenditures on transportation services as we now define them will double when the budget of the federal government is doubled.

Is this reclassification desirable? To the extent that the costs are directly related to transportation function, I believe it is. To the extent that transportation programs are used to accomplish other objectives, I question it. For example, should the transportation function be used to provide subsidy payments to particular elements in so-

ciety, such as the old and the poor? I think our analysis of public policy and the resulting programs undertaken would be more clear-headed, more rational, and more productive if these subsidy payments to particular segments of the population were clearly identified as such. It might then be possible to think of alternative techniques such as direct income supplements to accomplish the same objective more directly and efficiently. On balance, I would guess that more charges will be made to the transportation component of the budget than will be subtracted from it. Although the transportation proportion of the federal budget will remain a relatively constant percentage of the total, it will, in fact, not represent a proportionate increase in transportation expenditures as we understand them today.

A second qualification pertains to an uneasiness I feel about my forecast and concerns the increased costs and competition for scarce federal funds. This increased competition has been intensified over the last decade, and I forecast that it will continue to intensify during the next 2 decades. The nation's desire for increased public services has run ahead of the current tax system's ability to generate revenues. This imbalance between the desire for services and the ability to pay has led and will continue to lead to a more intense debate among the advocates of the particular programs. We have created a group of clients who will be effective opponents to the transportation interests for any increase in the federal budget.

In the late 1950's and early 1960's, the main concern was about fiscal drag (that is, a tendency for the federal tax system to generate more revenue than we could find useful public programs for); now the situation is completely reversed. Therefore, my forecast is that increased expenditures for transportation by the federal government will face stiffer competition than they have in the past. I still believe that the growth in expenditures will occur but with greater difficulty than it did in the past.

Let me summarize with four points. First, the future growth in the demand for transportation services looks very large indeed. Both underlying production considerations and the desires for mobility of the increasingly wealthy society underpin this forecast.

Second, any force as big, as pervasive, and as important as transportation is and promises to continue to be cannot escape responsibility for the side effects of its activities. In the future, these considerations will become more central whether we like it or not.

Third, an important area for growth in transportation systems is innovative combinations of transportation components that increase the utilization of the existing facilities. Transportation systems have high fixed-costs, and anything we can do to increase utilization will lower average cost and, therefore, be an important contribution.

Fourth, in regard to this question of utilization, perhaps one of the most important things all of us can do is to work for reform in the current regulatory environment of this country. If you look at the regulatory environment as we approach the end of the twentieth century, you find first, that, it was conceived in the nineteenth century and, second, that, it is one of the major inhibiting forces to proper utilization of transportation facilities. This, I think, is recognized generally but not publicly discussed because it is politically unattractive. I live in a regulated industry, and one does not talk about one's own regulators. However, I think the time has come when all of us, if we are going to be serious about improved utilization of transportation resources, must face up to this problem. Perhaps the best way to say it is that, if we can get into the twenty-first century without a nineteenth century regulatory system, we will have made important progress.