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Testimony of Alan S. Boyd, Secretary of Transportation,  
Before the Subcommittee on Intergovernmental Operations  
of the Senate Committee on Government Operations  
on S. Res. 68

April 6, 1967

Mr. Chairman and Members of the Committee:

It is a pleasure to appear before this Committee to discuss the resolution proposing a Select Committee on Technology and the Human Environment. I believe that the object of this resolution is worthy of the highest consideration. Technology has always affected men's lives. But in this era of rapidly advancing progress, the side effects as well as the direct effects of technology are creating new problems for society along with new opportunities. The great challenge confronting us now is finding out how to anticipate and control the unwanted effects so as to achieve a net gain in our total environment. Unless we carefully and continuously examine how we use our great technological capability we may invite social setbacks as severe as the lack of technology imposed on man in the past.

I would like to discuss with you today the Department of Transportation's involvement in this important area; this involvement includes some of the effects that transportation has had on the human environment, some of the problems we believe it will pose, and the steps that are now under consideration to deal with certain of these problems.

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Let me start by making the observation that in this last half of the 20th century we are suffering from an embarrassment of technological riches. Our capability is so great that we can now modify the natural environment limited only by the basic physical laws of nature. However, this capacity is very recent, and it is well to remember that prior to this century man suffered from technological poverty. His technology, the tools by which he exerted control over the environment, was marginal indeed. The benefits of any innovation so outweighed its possible negative consequences that man put the innovations into use as quickly as their value could be seen.

This history is nowhere more clearly seen than in the history of transportation. Water transportation has served as routes of exploration and settlement of the Nation. Many water carriers have linked communities and served centers of population, commercial distribution, and industrial production. Today, these courses continue to insure prosperity. At the present time, however, we are becoming more and more involved with such consequences as the costs of navigation features of water resource projects and water pollution resulting both from industrial and transportation sources.

The benefits of the railroad as a means of opening a continent to economic exploitation were so obvious that financial, inventive, and political resources were brought to bear to insure that the device would

be used to link together all major centers of commerce and resources. No detailed analysis was made of the long range consequences of this development, its effects on the environment, or the changes to which its limitations might lead. They were of negligible concern in the face of the need to open the continent.

Let me take another example. The invention of the automobile provided a technology for meeting a whole class of travel needs. It was so much more efficient than anything then available that its benefits soon were obvious. The benefits were so great that every level of government <sup>in</sup> cooperated/providing the capital and the facilities for its expansion. Today this one transportation technology accounts for 85 percent of vehicle miles of travel in the country.

Who gave any thought to its side effects? Who had examined pollutant emission from the internal combustion engine? Who had examined the conditions of its use to tell when it would generate hydrocarbons and oxides of nitrogen in amounts sufficient to become a hazard to health? Who was examining the volume, speed and flow characteristics that interact to generate so many accidents? Until recently, of course, hardly anyone. The automobile-highway system was so much better than anything available and the society needed the transportation so badly that it either tolerated or overlooked these consequences, or the effects were so small as to be unmeasurable at the time.

In essence, transportation technology came so dear that to meet our needs as a society it was exploited to the fullest. Two things have happened, however, in the last half of this century that require us to change this pattern of exploitation. Initially, society has become so complex and interrelated that any changes which may take place now or in the future will have ramifications that we do not yet know how to measure. Secondly, the power of our technology to modify the human environment has become greater than was ever conceived.

The fact is that man has, in the last half of the 20th century, all but won his struggle to gain control over a hostile environment. His problem now is to use that power to preserve, enhance, and expand the quality of human life. It is clear to us in the Department of Transportation that detailed analysis of the consequences of transportation technology, existing or proposed, is an essential part of our mission. It is one of the Department's basic responsibilities to: 1) determine where and how transportation interacts with and modifies the human environment, 2) define the magnitude of these effects, and 3) develop specifications for technology that will most effectively provide needed transportation services and at the same time will minimize any negative effects. The Department of Transportation is already engaged in a variety of such efforts. Our motor vehicle safety standards, aircraft certification program, and our High Speed Ground Transportation project are examples.

In order to provide for future transportation, one of our primary concerns is to define the range of effects of transportation technology on the environment. This is a necessary prerequisite to making modifications in any particular mode or in developing completely new transportation systems. The effects that I would like to talk about fall roughly into two classes. One involves changes imposed on the environment because of the nature of transportation technology. The second reflects derived effects arising out of the operation of that technology.

The first group is fairly obvious. Whenever a transportation system is installed or operated, we have historically had to modify the physical environment in order to make it operate effectively. The Interstate Highway System is a good example. In this vast construction project, more earth is being moved and more natural materials of construction are being used than in any other single civil engineering project in this history of man. We have to make these modifications in the environment because the safe and efficient performance of the automobile required this kind of construction. In essence, the design of the vehicle, the mode of its operation, and the rapid growth of its use have dictated highway design. The same, of course, may be observed about airport runways and landing approach patterns, and to railroad track and right of way. The fact is that, however reasonable, these changes in the environment are frequently irreversible and, hence, an option for use of some limited part of the environment is lost.

The other class of effects of transportation is far more subtle and far more difficult to separate and define clearly. The development of transportation technology has literally changed the ways in which we live. Some of these changes clearly improve the quality of life while others may seriously limit that quality. One way to get a grasp of the complexity of some of these indirect consequences of transportation is to examine them on the basis of dominant environmental impact. These may be broken down into four classes: effects on the individual, social effects, economic consequences, and physical effects. I will discuss just a few of the major consequences, both positive and negative, in each category to give you a feeling for the complexities with which we are trying to deal in the Department of Transportation.

#### Effects of Transportation on the Individual

The availability of efficient and economic transportation has permitted a significant proportion of our population to enjoy a whole class of opportunities never before open to them. Mobility itself exposes the individual to aspects of his physical environment, culture, and history that were not possible previously. Hence, there is a degree of communication among people that has leveled many of the provincial differences in our society.

Educational services have been radically improved by the growth in transportation services; they have permitted consolidation of facilities and

staffs. Health services have been subject to the same effects. The concept of regional medical centers for providing highly specialized services presupposes transportation capability within the region adequate to bring the people to those centers quickly, conveniently, and safely. The same consequences have accrued for police and fire services which help make the individual more secure in outlying areas. In essence, the mobility provided by modern transportation has given a mass of people a sense of independence and individuality that no group has known in all of human history.

This transportation capability, however, has had negative and disruptive effects. Accidents are an obvious one, and I need not repeat the depressing toll that has been the price for our mobility. It is an inescapable fact that accidents in all forms of transportation have caused human and property losses that have been staggering.

There are also more subtle effects whose short and long term physiological and psychological consequences are not clearly understood. What are the long term effects of moderate levels of noise, shock, and vibration? We already know that they are significant annoyances and that they can generate stress. Yet we know too little about human tolerances, particularly when subjected to repeated, random exposure. This is one reason why the Federal Aviation Administration has developed a sophisticated noise measuring capability and carries out continuing studies

of noise levels near aircraft flight paths and why it is involved so intimately in sonic boom studies. Certainly, as we pursue the development of high speed surface transportation, the problems of shock, vibration, and noise caused by vehicles traveling at speeds of 150-300 m.p.h. become significant indeed. This is one of several reasons why we are studying improvements in tunnelling techniques which have the potential for eliminating these adverse effects on the environment.

Air pollutants and their effects on human health have been amply documented, and I need not repeat them here. It is also clear that transportation systems which use organic fuel as energy sources are sources of contamination. This is true to a significant extent of automobiles and to a lesser extent of aircraft and the locomotive. It is for these reasons that the Department of Transportation is and will continue to work with the Department of Health, Education, and Welfare and its programs under the Clean Air Act. The Department of Transportation will also continue to cooperate fully in other aspects of HEW endeavor to improve the problems of the environment. For example, our many constituent elements have provided assistance to Secretary Gardner's Task Force on Environmental Health and Related Problems.

#### Social Effects of Transportation

Turning to the social effects of transportation it is obvious that modern transportation has radically changed the character of the social



environment. The rapid urbanization that has occurred in the post war era has been, to a significant extent, a product of our investment in transportation, mainly in highways. The real growth of population has not come in the center city but in the suburbs surrounding them. What has emerged is a complex social structure which we classify as the metropolitan area. Ill-defined communities have developed with looser associations among groups than society has ever known. Participation in a variety of social institutions has broadened and generally enhanced the number and variety of contacts among members. What has also developed has been a large increase in informal or voluntary groups for meeting a range of social and personal goals that could not exist without our transportation capabilities. Hence, transportation has provided a means by which a variety of social institutions could flourish and provide opportunities for masses of people to experience the largest range of cultural activities any society has ever known.

On the negative side, mobility has decreased the durability of groups. Institutions, stable and constant for years, change character rapidly today. This occurs in part simply because transportation causes a decrease in continuity of membership. People free to move and who do move on the average of five years develop different ties; their social institutions take on a different meaning. Family structure and friendship relations have changed significantly and the sense of stability and

permanence in our culture has decreased. Again, transportation technology has played a significant part in initiating these changes, but the degree and ultimate effects on our social environment are not adequately understood.

Negative social effects of transportation are most clearly seen in the cities themselves. Increased mobility and the outward migration it has supported have caused a significant loss in intellectual leadership as well as in the tax base that cities must have to meet their current problems. One result involves a de facto segregation of the urban poor from the more affluent suburbs. The loss of revenue from individual and industrial sources further compromises the capacity of the city to provide necessary services.

Yet as the major cities have lost their industrial base, they have retained and expanded their communication, command, and control functions. These largely "people" functions require large masses now located in the suburbs to converge in a wave on the city center. This has led inevitably to a new group of congestion, parking, and pollution problems. Improved transportation technology is one cause of those dilemmas, and we have just begun to deal with them.

#### Economic Effects of Transportation

Let me turn next to economic effects that derive from transportation technology. It is clear that the mass economy which is enjoyed in this country today was made possible in significant part by innovations in

transportation technology. Speaking chronologically, waterways, next railroads, then highways, and in recent years pipelines and air transport have brought about the expansion in the range of products available by sharply reducing the costs of movements of goods. Each mode has, in turn, advanced its own state of the transportation art. The location of industry has always been heavily dependent upon transportation facilities, and improvements made in transportation technology have markedly increased the flexibility in plant location.

The mobility now given to labor has permitted a diffusion of skills, and hence, extended economic opportunity over a much broader area. This, of course, has been some of the reasoning behind the highway construction parts of the Appalachian program. By employing our transportation technology we provide a basic infrastructure needed to develop the economy of an isolated area. This has been a consistent finding of economic impact studies. Land values around highways and new airports have all risen and appropriate business activity has been highly profitable. Certainly residential housing has clearly followed the growth and improvement in highway facilities. The mobility provided by these facilities has made large areas accessible and attractive for living which home builders have been quick to exploit.

There have been negative economic effects also. One, of course, is resource utilization. Fossil fuels are a very convenient source of

energy, but they are also the source of most of our synthetic chemicals.

Within known reserves is this the best allocation of this resource?

The locations of transportation facilities generally stimulate economic activity, but they do tend to change it somewhat. Highway bypass studies, for example, indicate that businesses adversely affected by the change in transportation facility are those which catered directly to the highway user. Similarly, although land values in the area of an airport rise, the kinds of economic activities that it can support has been frequently determined by characteristics of aircraft activity.

#### Physical Effects of Transportation

In addition to the individual, social, and economic effects that derive from transportation there are also significant physical consequences that arise. Whenever a highway, airport, or railroad is built, the local ecology is changed. The construction of ways can change the hydrologic properties of streams and watersheds. Changes in the rate and direction of water flow has subtle effects on stream characteristics as well as erosion. As these balances are changed, there are ultimate effects on man and his environment through the complex chain by which all life is united.

The location and operation of transportation adds also to our pollution problem. Air pollution has been mentioned but there is also water and soil pollution deriving from the construction and operation of

transportation systems. In some places, highway construction has led to the silting of streams which affects their purity as well as affecting fish population. The Bureau of Public Roads in the Federal-Aid Highway program now works closely with conservationists to minimize problems such as these.

Finally, the Department of Transportation, along with the Environmental Science Services Administration, is involved in the study of weather modification. In order to improve all-weather operation for air transport, methods for dispersing fog or reducing snowfall become attractive. Cloud seeding and other weather modification techniques might well provide significant improvement in air terminal and air traffic control operation. Yet, the effects of any weather modification may extend far beyond the local air space intended. Hence, a very clear understanding of its consequences must be had before large scale operations may be undertaken.

In enumerating this list of environmental effects of transportation technology, the diversity of the interactions is clear. It is becoming increasingly obvious/<sup>that</sup> before we add new, or markedly modify existing, transportation technology the full range of these interactions must be explored. This is a basic responsibility of the Department of Transportation and one which I can assure you is being, and will continue to be, pursued vigorously.

The fact is that transportation technology can no longer be viewed in isolation, either among the modes themselves or in the total environment of which they are a part. Transportation is itself merely a means to achieve our goals as individuals and as a Nation. We must learn to tailor our technology to meet those goals and not allow it to dictate what they shall be. The fact is, however, that we have not had this capacity. Certain goals have had to be compromised because available transportation technology was inadequate or actually prevented them from being met. It is one of the main long range goals of the Department of Transportation to define the transportation technology needed to serve national goals and to enhance the quality of the total human environment.

To achieve this end requires a level of systems thinking that has been all too infrequent. Transportation, after all, is a subsystem within a larger set of social, economic, and political goals; and this subsystem must be designed and developed with a clear understanding of these goals. The Department of Transportation alone cannot do its job of providing the optimum design of integrated transportation systems unless the real goals are stated and their ramifications examined in detail. We will shortly begin a close working relationship with the Department of Housing and Urban Development on urban transportation problems just for this reason. We will continue to work with other departments, with you in Congress, as well as with State and local governments, with management, and with

labor. Ultimately, our task is to provide transportation systems adapted to the emerging and changing needs of the Nation; transportation that is designed as an integrated part of the total environment and whose consequences will be known and predictable. The Department of Transportation will need and will use all scientific and technological resources to achieve this end.

Let me turn finally into the question of technological change. There is propensity to try to predict technological innovation. Prophecy in this area has been notoriously poor and in our time has become an irrelevancy. The essential feature of the technological revolution that began after World War II is that we are in a position to generate innovations according to need. This does not mean isolated devices but rather integrated systems tailored to specific sets of requirements. The emerging disciplines of systems engineering bespeaks this capacity.

It is important for us all to recognize that we no longer have to stand aside and wait for technology to emerge. We now can directly choose what shall be developed based upon our ability to set requirements, provide the resources, and specify target dates. Of these, the first is crucial since technological solutions are not possible unless goals are explicitly stated. Inescapably then, technological innovation is largely determined by those of us who are responsible for determining goals, the national needs. If we wish to know what technology we shall have 10 or 50

years from now, we must ask not scientists or engineers. We must ask ourselves: What are our goals and our priorities? In the transportation field that is what the Department of Transportation is attempting to do. We will act fully cognizant of Congressional directives for Congress, to its great credit, has explicitly recognized the effects of transportation technology on the human environment. In the Department of Transportation Act you expressed your concern with the beauty of the landscape, with urban life and its amenities, and with the effect of noise on the environment. In organizing the Department of Transportation, these concerns were given special recognition. An Office of Noise Abatement will be established in the Office of the Secretary of Transportation. This Office will coordinate noise abatement activities with the research and development program of the Department and with other federal agencies. There will also be established an Office of Resources Conservation to deal with impacts of transportation projects on the environment on natural beauty and on the prevention of water and air pollution. The Office of the Secretary of Transportation will also be concerned intimately with the effects of its programs on comprehensive planning for urban regions. These then will be some of our new significant activities in this important area. I have touched upon others in ongoing programs. We will move forward; on that you may rest assured.



Let me conclude by stating that we will proceed fully aware of our basic responsibilities to define the requirements which are the key to innovation in transportation: systems that in their area optimize the quality of our human environment. To this end, technology must be the servant of progress, not its master.