The Possibilities of Developing an Effective National Transport System in the 1970s

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March 1970
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This paper was prepared for presentation at the Univac Seminar for Writers and Editors at Shawnee on Delaware, Pennsylvania, October 8, 1969.
INTRODUCTION

I'll begin by thanking our hosts for the excellent handling of the transportation arrangements for the Univac Seminar -- I wish all transportation, now and in the future, could be handled so well.

There was a time not so long ago that the problem of getting from one place to another was not very difficult, mostly because so few people found it necessary to travel. Things are different today, and the task of providing adequate mobility for people and goods has become a major national issue. The very nature of today's society places a high value on mobility, whether it's concerned with travel within urban boundaries or on an intercontinental scale. We live in a go-go culture in more ways than one. And the objective of providing a means of escape from the poverty of the ghetto, or from the planet Earth itself -- has become a critical national goal. This tremendous drive to see new places, to be free of territorial restrictions, to enjoy maximum mobility may seem to be in conflict with man's basic need to stake out a place of his own. But I'm not here today to investigate the motivational justification for transportation research, but to talk about what the needs are now and might be in the 1970's and beyond. And, of course, to indicate what may be entailed in finding solutions to some of our transportation problems.

First, let's look at the history of today's transportation system and evaluate some of the factors important in the development of the present system as well as of the kind of transportation system that may evolve in the future. After that, I'll define some of the basic research programs that, it seems to me, are needed if we are going to plan for a really effective transportation network. The natural follow-up to that will be consideration of the possible nature of this future network.

One thing is clear: To assure any significant transportation improvements in the future we have to start planning right now. We need interdisciplinary analysis of our problems that will consider the impact of transportation on other domestic-policy issues of the future. Any really worthwhile improvement in transportation is going to require
massive capital investment plus widespread national planning. In addition to this massive capital investment, the long lead-time required for the development, construction, and implementation of these new transportation systems results in a situation that means a delayed return on investment from the private sector; consequently, it appears right now that significant government-subsidy is going to be needed for the development of national transportation on any widely improved scale.

The need for improved transportation is great, very great. But the financial risk is even greater, whether the money comes from governmental or private sources. In order to minimize this risk, we must have supportive analysis to ward off the possibility of failure. Failure of any wideranging improvements in transportation would be inherently costly, but even more costly would be the possible resulting catastrophic failure of development of the American economy.

GROWTH OF PRESENT TRANSPORTATION SYSTEM

All that's in the future. Now, let's return to the past which gave rise to our present transportation system. Once, we had fairly neat categories of transportation requirements. There were small, relatively concentrated urban centers separated by broad agricultural regions. Transportation problems differed in these two types of areas. As recently as fifty years ago, the principal method of travel within urban areas was public transportation of some sort: trolley cars, subway and El trains, buses, jitneys, taxicabs, or by foot. The long-distance transportation of passengers and goods was either by rail or, where nature provided it, by water. Fifty years ago, aviation was just beginning to demonstrate its potential for commercial use. Things are radically different today! Now intraurban transportation is largely by private car. With the exception of a few places such as New York, public transit makes little impact on the transportation scene.

The radius of use of the private car is increasing because of the flexibility of timing and route available to private conveyances as compared to rail and other mass transit. Also, there is inadequate public transport at the destination of any given trip by railroad. Today people don't board a train in Los Angeles for a trip to Las Vegas or San Diego;
they drive. If time is of the essence, they use commuter or short-haul aircraft, and when they arrive at the destination airport they rent a car. The railroads seem to have accepted this loss of passenger traffic as one of the facts of life, and have begun to concentrate almost entirely on the development of the freight market. An exception is the Northeast Corridor region where government subsidy has provided impetus and incentive for railroads to develop new technology.

Waterways as a mode of transportation are used to transport both people and cargo more than ever before, but they have little impact on the national scene. It is in international waters that this mode of transportation is becoming more and more important with the growth of container ships and super oil tankers.

By far the most significant change in transportation during the past fifty years has been the growth of air transport. When the rails gave up their effort to attract and keep passengers, the air lines were ready and grabbed that market. At the same time, those elements of cargo which are time-dependent—newspapers, magazines, mail, perishable goods—were picked up by the air lines. The increased pace of our society has made it easy for the overseas airlines to cut themselves in on the ever-growing amount of travel, luring passengers away from the cruise ships. Also, ever-increasing surface-traffic congestion in heavily populated areas prompted the airlines to develop their commuter role in short-haul and even intraurban transport. Many of us here today have hopped from airport to center city by helicopter. In fact, it is safe to say that air transport meets the needs of some part of every segment of the travel market.

In addition to the changes which have been occurring in the various modes of travel there has been an overall change in the nature of the American scene—the development of the megalopolis. In the future we shall have broad stretches of contiguous communities you couldn't possibly drive across in a single day. This kind of development has been made possible by the increased mobility of the city dweller. No longer is it necessary, or even desirable, to live close to where you work. In fact, in the area with which I am most familiar—Southern California—it is rare to find someone living as close as a half-hour's drive to their work. I'm sure this is true on the East Coast too.
In transportation, technology guides the development of land-use patterns. And vice-versa. I turn to California for an example of this—the development and construction of the Palmdale Freeway. The Palmdale Freeway out of Los Angeles was planned as part of the state-wide interurban system. It was planned not to provide for intraurban transport but as a route for long distance trucks and the like. It was built because there was a great need for vehicle access to that particular part of the mid-California desert. But even though the Palmdale Freeway was built to meet that particular need, we find that large residential areas are developing along its length because people now have access to the metropolis by way of this road. What we do with all these cars when they get into the city is another problem. The Division of State Highways does not consider it to be their problem, but we in Los Angeles sure do.

The point I make here is that we cannot separate transportation planning and technology from the problem of land-use planning. If we consider them separately we ignore the influence of one on the other—the very heart of the urban and regional planning problem.

Transportation "improvements" at present consist of modifying and attempting to improve individual modes of transport designed to meet the needs of the past. We are not doing enough thinking about and planning for the future. We must keep in mind the division of the transportation "market" among the various modes of travel and the changes in character of that market that have taken place during the past ten years. Points of interchange between modes of transportation have become more crucial as they tend more and more to become bottlenecks. Nowadays, practically every trip involves at least one transfer from one mode of transportation to another. The transportation trends of our future society are rapidly becoming very clear. It is imperative that we begin now both regional and overall national and international transport planning.

We are lucky in that planning tools which already have proved invaluable in other industries can be readily adapted for use by the transport industry. Of course, I am thinking about systems analysis and computer simulation. But being willing to try to find new solutions to old problems is not enough—the nature of the problems has
changed and we are faced with completely new problems for which we had better find solutions soon. At the core of that need is the acceptance of the fact that we must consider the social and economic ramifications of transportation.

MAJOR FACTORS INFLUENCING FUTURE TRANSPORTATION SYSTEMS

I turn now, briefly, to some of the major factors already influencing what transportation systems of the future must be. I earlier pointed out as a characteristic of our present travel system the fact that people love the automobile. It has been demonstrated time and time again that the average man or woman considers the gain in privacy and flexibility of use worth what it costs to drive a car rather than to use public transportation. Where parallel systems of public rapid transit and automobile facilities have been developed there has been essentially no switch from automobile to rapid transit. There have been increases in total use but practically no switching. It seems no matter what we do in the way of adding to public transit systems we cannot make a dent in the volume of automobile traffic.

One certainly might conclude that people will switch to public transportation only when auto travel deteriorates to the point of being practically impossible. The automobile is going to continue to be the number one choice of short range travelers unless a change is forced by administrative decree or hopeless congestion. There will, of course, always be a hard core of non-drivers: mostly those too young, too old, or too infirm to be licensed. Public mass transportation must be provided for these non-drivers.

When we consider the mass transit needs of the megalopolis, it is obvious that great flexibility of routing and pick-up will be imperative for the collection and distribution portions of any trip. High speed transit will be required for travel between points separated by long distances.

We have no simple equations to answer the questions posed by these factors. To assure effective study of these problems will require substantial tax support. And to get this money we shall have to convince the taxpayer that there is something in it for him--that there will be
definite improvement in his own personal life-quality if he supports, with his tax money, the kind of study and the kind of transport development proposed.

PRINCIPAL ISSUES IN TRANSPORTATION RESEARCH

I turn now to some of the principal issues in transportation research. I confine my comments here to those factors considered to be the basic needs for an adequate national transportation complex. My list is not complete by any means; but it does represent a spectrum of the kinds of studies that will be needed. The first group of research programs I should like to see funded are those which can be classed as basic tools. To date we have been "improving" our transportation systems by stop-gap measures. When a problem arises, we look to past history of that portion of the industry and figure the best way to fix whatever is causing the problem. That's why the present system represents something that grew like Topsy. We can make no significant improvements with that kind of modification, especially when transportation has such a broad effect on the community served. We need analytic tools and supportive analysis which will provide the mechanisms for applying innovative systems analysis to the solution of our problems.

Data Collection

One of the most helpful of these tools would be adequate data collection, evaluation, and storage. It is amazing to me that so little has been done in this area. Actually, we have remarkably little information on the way things and people are moved these days. We need a data bank, a national data bank. I was pleased to learn that the Department of Transportation is asking Congress to provide thirty-five million dollars for a 5-year study program aimed at collecting national transportation data. That sounds like an awful lot of money for just collecting transportation data. But when you talk to these people, review their proposal, and realize the extent of the data that would become available to transportation planners you see that they're talking about a bargain, especially as compared to the present collection of data on urban transportation alone which is costing some twenty-two million dollars annually.
You're sure to ask: "What's happening to all this local data now being collected? Why can't we get a look at it?" The reason is, before you start collecting data on any regional basis, you have to decide what data you want and what you're going to use it for--you have to develop proper sampling techniques and you must provide storage and retrieval facilities for the data collected. So far, this hasn't been done--at least not often enough.

Traffic Forecasting

The second needed basic tool for the study of transportation problems is development of methodology for really meaningful traffic forecasting. We need long range multimode forecasts. We must relate the demands we forecast to capacity increases and technological advances as we see them coming in the future.

A striking example of the lack of consistency in traffic forecasting is found in today's aviation industry. At one of our large-hub airports the airport management is forecasting a volume of operations--takeoffs and landings--of some 500,000 for the year 1980. But the Air Transport Association, representing the airlines, is forecasting a traffic volume for that same airport in the same year--1980--of over 900,000 takeoffs and landings. That's close to double the airport's forecast! The difference in itself is bad enough, but think what this could mean in the future. On one hand you have the airport management planning facilities to meet the requirements of 500,000 takeoffs and landings in 1980; on the other hand, you have the airlines basing their aircraft acquisition program on almost twice the number of operations that particular airport will accommodate. Compounding the confusion is the fact that traditionally the airlines divide the predicted total market in a way that usually adds up to more than 100% because each airline is optimistic in projecting its own part of the market. If the airport and the airlines implement their individual plans using such disparate figures the congestion mess at that airport will be...I have no words for it! I salute that airport and the airlines for their long-range planning, but hope they realize they had better get together and come up with more consistent projections.
We have to accept the fact that always there will be irreducible uncertainties in traffic forecasting, but there is reason to believe that we can apply analytic methods that take these uncertainties into account. We need flexibility to accommodate technological innovation—forecasts of demand and airport capacity should attempt to anticipate these innovations to some degree. (Right now the aircraft industry has some evidence that we should be able to double the capacity of existing airports with improvements in air-traffic control.) But we must face the fact that the methodology for accurate traffic forecasting cannot be developed immediately—we must constantly improve the accuracy of our forecasting and come a little closer each time by an iterative process that eventually will lead to really successful forecasting in the field of air traffic. But we have to get started now—the longer we procrastinate the worse the problem becomes.

Regulatory Aspect of Transport Growth

A third basic tool is that of government regulation, the proper use of which is important to the growth of all modes of transportation. The legal and jurisdictional problems of transport are incredibly complex—from the Department of Transportation of the Federal government right on down to the smallest municipal traffic bureau. We are hampered by a conflict between the desire for home rule and the admitted need for regional planning, plus a secondary conflict arising from the fact that planning functions in most governmental agencies are in the hands of a group different from that which has financial control. What's more, the problem of long lead-time and delayed return on investment in the development of any significant improvements in transportation means that few industries can handle such improvements on their own. An important need, therefore, is a study of the proper division of developmental expense among government, manufacturers, the transport industry, and eventually the users. A small but pretty radical step has been taken in that direction on the funding of the proposed SST program.

A factor of importance in consideration of the regulatory aspects of transit planning is the role of the labor unions. The impact of the unions on the operation of any eventual improved transport network must
be acknowledged during the planning stage, not handled as an afterthought. We must have the cooperation of the labor unions, and they must be convinced during the planning stage that an improved system means benefits for them.

Modal Split Considerations

Now we come to the fourth of the basic tools I’m talking about—the modal-split consideration. If we don’t have accurate demand forecasts of rider volume on a new or improved link of our transport network we just won’t be able to build a truly effective system. We must understand the factors which are at work when there is a choice between competing modes. If there is no public transit between two points on a given stretch, people are going to have to travel by car. But if a railroad as well as a highway connects these two points it is a question of how many travelers can be persuaded to switch from automobile to rail travel. But let’s suppose there’s only the highway and you’re going to design a brand-new rail system to serve the two points: how do you optimize use of the rail line so the maximum economic return can be assured? Putting it more bluntly, how can you exploit human psychology to vary the modal-split pattern?

As an example of this problem, let’s consider one of the projects underway in the Los Angeles area right now. Recently, HUD announced approval of a plan to build an exclusive bus-lane on the San Bernardino Freeway, one of the most congested freeways in the area. I applaud this attempt to do something about highway congestion. I think this experimental demonstration program is a great idea and I’m glad that we finally are going to get some data on just how many people will ride buses if you provide a high-speed express route. However, I’m sure motorists watching the buses whiz by as they stew in a mile-long parking lot that so often crops up on our expressways will be pretty annoyed because they cannot swing into the almost empty bus lane. You’re sure to hear a lot of screaming about the inefficient use of this bus lane. I have been told that the State Highway Division is going to try to load this express lane with buses nose-to-tail so motorists creeping along in other lanes will not be upset because they
have to stay out of the bus lane. I don't believe they are going to get the riders for this kind of volume. I just don't think this tactic will work. A smarter idea, I think—and this has been proposed many times by others far wiser and more experienced—would be to have a priority bus on-ramp to the freeway. Perhaps you know that in Southern California we are experimenting with monitored on-ramps. They work this way: When congestion on the freeway gets to the point where traffic is being appreciably slowed, motorists are held up at the ramp till traffic eases up; then, a few cars are let on at a time till traffic movement is back to what is considered normal. If you were held up at such a ramp adjacent to an exclusive bus on-ramp for forty-five minutes or so you would be more likely to envy the people in the buses going by—and decide you should try it yourself—rather than complain about inefficient use of the facility.

Tied into the possible effectiveness of this technique is the need for an efficient distribution system in the downtown areas, something Los Angeles doesn't have. These problems cannot be considered independently—we must consider ways for evaluating the critical parameters when we tackle the problems of modal-split.

Traffic Flow Limitations

Traffic-flow limitation is the fifth basic tool in my kit. It is obvious that you can optimize the use of existing links by reducing the headway between vehicles of any given mode and opening up the bottlenecks that exist. But you can go only so far in this direction. No mode of transportation has infinite capacity. In the Southern California freeway network the basic rule-of-thumb has been to provide freeways on a four-mile grid so that no one has farther than two miles to drive to get onto a high-speed limited-access road. There are areas in Los Angeles where this four-mile grid has been completed. It's already congested! In fact, practically every freeway in Los Angeles has been used to capacity on the first day it opened!

Now let's look forward to the time when we have this four-mile grid completed over the entire Southern California region. It's all operating at capacity. It's all congested with those mile-long parking
lots around five o'clock in the evening of every working day. What now? Do you try two-mile grids? Double decking? Triple decking? Let's face it—there is a limit to what you can do in the matter of automotive transit and road development, a limit to what can be done in each of the principal modes of travel. So you have to go back and take a look at these principal modes in terms of their ultimate capacity. You have to consider the potential for improvement in the foreseeable future. You have to look at the mean traffic and the peak-hour traffic and relate this ultimate capacity to what you foresee as the ultimate demand for that region.

This kind of consideration could lead to some basic changes in our social sector. We may find we must control the degree of mobility allowed in an urban center, which will affect the land-use considerations I mentioned earlier. This kind of thinking may lead to a return of the "cottage-industry" concept: instead of workers traveling an hour on the freeway to get to the job, the work might be delivered to their homes for processing. Personally, I wouldn't mind that, as nice as I find the working conditions at Rand. Another theory calls for going back to "company housing" with people given subsidies for living within a given region. Industries would pay these subsidies in order to reduce the taxes they might otherwise have to pay for the development of transportation systems, which might or might not prove effective. I am not recommending these approaches, although they may be worth studying. I'm just speculating on the kind of things that we might have to come to.

MAJOR PROBLEM AREAS

I have outlined for you five basic tools which are essential for our efforts to meet the transportation needs of the future; now, let's consider some of the major problems where we can make use of these tools. Again, this list is not comprehensive, but each item is a necessary component of any comprehensive list.

Adequacy of Service

The first problem is adequacy-of-service in transport. If you don't schedule public transportation for the times the travelers want
it you'll never develop the anticipated potential market. An example is the concept of "use it or lose it" proposed by the Civil Aeronautics Board some years back. This, as you probably remember, was a regulation that permitted an airline to drop service offered a community unless more than five passengers per day on an average made use of a given schedule. An airline was not required to serve a community which would not respond with this stated minimum of traffic. Many of the airlines did petition to drop service on the basis of failure of a community to use the service offered. The communities reacted by claiming that the airlines deliberately scheduled their flights in the middle of the night so that it was not practical to use the service as often as was required for continuance. Many times, there were valid arguments from both sides. There is no question about the need for accurate traffic forecasts if we are to solve this adequacy-of-service question, but we cannot come up with anything approaching a right answer unless we have thorough knowledge of operator and user economics. The adequacy-of-service factor would be used to evaluate present schedules and to determine also the impact of planned improvements in traffic scheduling. This applies to all modes of transportation.

Preferred Markets of Component Transport Modes

A second problem at which we should take a good look is that of a preferred market for a component transport-mode as part of our overall transit network. This is most important where there is competition between modes of transport—the automobile versus bus lines for example, or bus lines versus rail lines. If you have competition, especially between two commercial modes, you are apt to have development of excess capacity to the detriment of the regional transport picture as a whole. A broad approach to the problem is imperative. You must take a good look at things such as what is best in the way of schedules and facilities for a large area like the Northeast Corridor. We must find the answer to such questions as: Should we build more roads or more airports? Should we have more deep-sea ports, and where? How many SST schedules—not aircraft, but flight schedules—could the market of the eastern seaboard support? The answer to this last question will
lead to determination of the number of airports actually needed and how they should be spaced, and help solve the problem of connecting intercontinental SST airports with the communities that are the ultimate destination of travelers. And it helps with the solution of the problem of the best locations for inter-modal transportation centers. Just how do you divide the market among all the modes of transportation for the most efficient and economical operation? One answer might be a combination of distance-speed factors for the different modes.

Cargo Transport

The third problem in this series is that of efficient cargo transport. We actually know little about present patterns of cargo movement—I'm pleased that the need for a study of the movement of cargo as well as people is highlighted in the transport information program of the Department of Transportation. We must have these data! And we must develop some kind of minimum-cost cargo transport system to guide the industry in the development of facilities to provide needed service. These data could be used also in planning for multi-payload (passenger and cargo) facilities.

A total picture of cargo operations, including manufacturing and distribution of goods, is needed. The cost of inventories and warehousing has to be balanced against the possible increased cost of transport. Suppose a ship breaks down in the Red Sea. The steamship line might find it more economical to air-ship the needed part rather than send it by the far cheaper means of using one of its own ships headed that way. They have to balance the savings in transport against the cost of having the ship out of service while the wages of the crew keep mounting, or against the possible loss of a perishable cargo. These are important considerations—the economics of the total operation in terms of cargo transport must be determined.

Traffic Flow Control Systems; Modal Interfaces

We move on to the fourth problem—traffic-flow control systems and the modal interfaces that might exist. Obviously, if you are able
to control separation—distance between vehicles, their speed, the traffic
mix, and entries and departures from the system, you are going to be able
to increase the flow-rate of the traffic. We are familiar with the basic
concepts of such a control system, but unfortunately no such completely
planned system exists outside science fiction. In air transport parti-
cularly a major overhaul of flow-control mechanisms is long overdue.

Turning to rail transport, we find that improved signalling methods
and road-bed improvements could double traffic capacity by reduction
of headways between trains. And, of course, we always have the auto-
mobile. Automated highways for the use of private cars are old hat—
in theory—but I have yet to see one.

As long distance travel increases, the need for inter-modal trans-
fer points for people, baggage, and cargo becomes more and more impor-
ant. Minimizing delay at these transfer points not only calls for de-
velopment of new facilities and expedited transfer but also requires
education so that the public will use them efficiently. You know what
I mean if you ever have watched passengers straggle up an aircraft
boarding ramp one at a time when there was ample room for two or three
abreast loading; this needless delay adds to turn-around time, decreases
aircraft utilization, and increases operating cost. Some means must
be found to induce travellers to move quickly through intermodal trans-
fer facilities; perhaps prepackaged "people-pods" are the answer.

**Noise Pollution**

Noise pollution is the fifth problem that has to be solved. All
modes of transportation suffer from this problem in some degree, just
as all contribute in some measure to the various forms of pollution.
We all know about the automobile's contribution to smog. We're fa-
miliar with the pollution of coastal waters at Santa Barbara, California,
because of a leak during off-shore drilling for oil. Harbors are polluted
by shipping. Particulate pollution of the air by planes is an increasing
source of complaint. But when it comes to noise pollution, air transport,
particularly jets, brings the most frequent complaints.

Any high-speed, high-power vehicle is going to produce noise. This
is recognized by the transport industry, especially air transport. And
they know that it is in their interest to try to do something about noise. Damage suits over noise pending right now in Los Angeles total about three billion dollars. Just think what's going to happen when the sonic boom of the SST rips the skies.

It might be well to think about that SST sonic boom for a minute. We are told it's not going to be a problem in areas where the SST craft will be taking off and landing—they will take off at subsonic speed and be about 150 miles from the airport and the community before they reach sufficient altitude to go supersonic. If this is true, cities such as Los Angeles and New York are not going to be hit by the sonic booms they are now worrying about; no en-route air traffic control system would be programmed to route the supersonic jets over a large community. But what are you going to do about routine maintenance and check-outs at these origin airports? Maintenance noise is responsible for a great number of the complaints coming from residents of Los Angeles. Let's face facts: an aircraft scheduled to take off at seven in the morning has to be checked out during the early morning hours. And jet engines running at full power—not reduced power but full power needed for supersonic flight—for about three minutes, you'll have a lot of people living within hearing distances of the airport screaming about being awakened at four in the morning. Believe me, three minutes of that kind of noise is one of the longest three minutes you'll ever experience.

So air-transport planners do have to worry about the impact of supersonic aircraft on residential communities. This kind of noise is going to be one of the biggest problems in the Palmdale area even though the Department of Airports in Los Angeles has insisted that 17,000 acres be acquired for the Palmdale Airport to provide a bufferzone against noise. Again we have the problem of land-use, this time in terms of noise pollution. We're going to have to find ways to reduce the costs of air-easement and land acquisition by using land surrounding airports for activities not sensitive to noise. And this means we'll have to consider the effect on the community of sterilizing a relatively large part of it as far as conventional development is concerned.
The process of regulating aircraft noise is already under way. Limits will be established and there will be government aid for efforts to reduce the impact of aircraft noise on the community. This, I feel, is going to lead to limits being set in residential areas for all kinds of noise originating from our transportation systems and industrial plants. It is clear that both the social and economic costs of noise are important to planning.

Socioeconomic Aspects of Multimodal Transport Systems

The last major problem about which I'll talk today is the lack of definite information about the social and economic aspects of the development of multi-modal transport systems. In a simpler phrase: "What's it going to do to the community?"

Let's suppose you're going to design a transportation system for a city which doesn't yet exist. You would have to forecast its population growth pattern. You would need a pretty good idea of the level of education and income of those who would people this new city, and how they would be divided into age groups. You would have to know what was planned as far as physical development is concerned: What portions of the area were being set aside for residential, commercial, and industrial use. What about recreational, health, and educational facilities? What about the proximity of military installations and the like? And, when it came to the study of industrial activities in this projected community, you would have to gather all the facts about the need for specific raw materials and about the methods for distributing the products of industry.

Actually, the things we must know for intelligent planning of a transportation system for a brand-new community are the same things we must know for effective improvement of present systems in existing cities. Urban development both follows and leads transport planning. You can see this in the degradation of areas along rail lines and the growth of industry and commercial enterprises around airports and major highway hubs. And the modal-split definitely relates to demographic groupings. One group is content to ride subway trains and buses; another
group insists on using automobiles. We have to characterize the demo-
graphic groupings of any community to get an idea of what use residents
will make of planned transit facilities. These modal-split factors are
most important as we move into new technologies such as the Hovercraft,
or the Sky Lounge concept we hear about in Los Angeles, or the Metro-
liners already running between New York and Washington in the Northeast
Corridor. Will the public ride the projected new service? More import-
ant, how will the new service affect the health, education, employment
of the members of the community? How will it affect public order?

You must look at the overall impact on the character and economic
aspects of the community—of all the major problems I have mentioned,
I feel this is the most important, the one most ignored in the past.
Transport is a key element in community development because there is
no aspect of urban living that is not vitally affected by transportation.
An understanding of the various ways the community is affected is vital
to the success of any planning.

A LOOK TO THE FUTURE

Now, let's take a quick look at how I see the future of transpor-
tation and what a transportation system in the late 70's will look like.
I predicate my projections here on the assumption that the government
and the public will accept the need for the kind of research I have
been talking about—and be willing to pay for it. If they don't and
it becomes impossible to conduct this kind of research, all I can pic-
ture is a grossly degraded version of the system we've got today.
That can happen—if the degradation occurs gradually enough.

If I were to say the public might be willing to accept travel by
private car across the island of Manhattan at the rate of three miles
an hour—that's slower than a brisk walk—I think everyone would throw
up his hands and say: "That's ridiculous!" But already it's down to
six miles per hour. Would you think anyone would have accepted that
kind of transportation? But let's be optimistic. If we can put a man
on the moon, we can adapt the engines used in the Apollo program to
travel between New York and Los Angeles in 10 minutes. If we progress
that far, I hope we may also have solved the problem of getting from
the airport to mid-town in less than an hour.

What will be the characteristics of the transportation system of
the future? First, the system must be based on inter-modal planning,
with integration of services to optimize economic operation. Second,
it is likely that it will be necessary to have inter-industry subsidies:
higher fares where they can be justified by marginal cost pricing con-
siderations, and even zero fares in other types of transportation where
this is needed to minimize the total cost to the community. By this
I mean such things as providing free transportaion so that people in
the ghetto can travel to where jobs are available. This could help
get a lot of people off the welfare rolls. Third, there will be major
technological improvements in transport that I have not touched on to-
day because I'm sure most of you are familiar with them. But to sum-
marize briefly some things that will be seen: in high-density, high-
activity centers such as shopping plazas, airports, and large industrial
complexes, I'll mention moving sidewalks and mini-buses. These repre-
sent high-density, low-speed transport systems. Low-density outlying
areas will be served by the Dial-a-Bus, a computerized door-to-door rout-
ing and scheduling system feeding into major transport networks. A rapid
transit development we are almost sure to see if it can be done economic-
ally would make use of a string of individual capsules instead of the
large-capacity passenger cars now used on commuter trains. These cap-
sules would provide the privacy for which people now look to the auto-
mobile. These capsule trains will, I hope, have push-button routing
controlled by individual users living or working along a guideway net-
work. This guideway might be a railway or make use of air-cushion ve-
hicles or some adaptation of the vacuum tube system used in department
stores and the like.

Now we come to number four--developments in the field of personal
vehicles. One of the most interesting possibilities is dual-mode per-
sonal vehicles that could be used on the streets and roads or on auto-
mated travel networks, switching from one mode to the other as necessary.
These vehicles will not be powered by internal combustion engines--unless
we can make such engines completely smogfree.
Considering all these points together, we come up with a picture of future transport something like this: We'll have public transit, traveling at 100 miles per hour or more, connecting the outlying regions of a megalopolis and serving airports as well as other major transfer points. The vehicles used probably will be automated air-cushion vehicles traveling freeways or existing rail rights-of-way. This concept can be extended to the short-haul interurban market. I believe interurban travel of some 500 miles or so will be served primarily by V/STOL aircraft which in the future probably will have a capacity of 100 passengers and operate over an independent airway system with independent air-traffic control so as not to compete for the facilities used by conventional aircraft.

Conventional aircraft including SST will continue to be the principal mode of travel on interurban and intercontinental trips of over 500 miles. A major technological improvement I predict for this type of travel will be off-shore airports with connection to land by either hovercraft or underwater tubes.

Now for a prediction which you may consider a contradiction of all I have said before: I believe that before the end of the 1970's we shall see a sharp drop in the growth of demand for transportation. Certainly it will continue to grow but not at as high a rate as it is growing these days. Why? Because of technological advances in our communications systems. The introduction of the video phone would make it unnecessary for me to come all the way across the country to address a meeting such as this. I'm glad this meeting was not scheduled for 1980, because I'm enjoying every minute of my visit here.

A final thought: The public certainly is not yet ready for rocket-propelled commercial aircraft even though they are feasible right now, but we must think and plan in terms of space age methods. We can begin by considering the proper philosophical approach to transport problems, in the project-definition phase. We would have to consider why conventional methods of transport planning do not seem to work. I can think of three reasons: First, we do not have adequate incentive to develop really effective improvements in transport; second, we do not yet, because we lack government-funding for demonstration programs, have any
means of demonstrating the potential of the new technologies available to us; and third, we still fall far short of educating the public and industry to the point they understand the importance of what we're trying to do. These are the factors critically important to the success of any future developments in transportation research.