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High Speed Ground Transportation

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THE CRISIS IN SPACE--TRANSPORTATION IN MEGALOPOLIS

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There has been much half-serious talk about its being easier to get to the moon from Washington than it is to get to Boston. This persiflage seldom raises the issue of whether it is as desirable to get to Boston as it is to get to the moon, although even in this new administration the Harvard-MIT traffic in bureaucrats--incoming as well as outgoing--suggests that it is. I would not, however, want to try a benefit cost analysis of the relative social values of the two terminal objectives; i.e., based on bureaucrats versus astronauts. Nor will I suggest that perhaps we might all gain if occasionally they changed places--if the bureaucrats became bureaunauts and the astronauts became astrocrats. I must admit I don't know very much about the problem of getting to the moon, but I do know a little--beyond personal reactions as a traveler--about getting to Boston, and so I shall retreat from further comparisons--envious or invidious--and concentrate on Boston.

As I am sure all of you are generally aware, productivity in long distance passenger transportation has increased phenomenally in the last 10 years. For hauls over 2000 miles, it is on the order of four fold; i.e., we get four times greater results in 1968 than we did in 1958. This increase, of course, results from increases in aircraft size, aircraft speed, mechanical efficiency and so on. The rise in productivity has been without question extraordinary and has given long distance travel a remarkable stimulus. Most of you have forgotten, if you ever knew, what it was like to go across the country in a DC-3.

For shorter distances too we've done very well at increasing productivity--at least where traffic flows are not too dense. The highway system has given great mobility of movement for all distances, but has been particularly suited to rural and suburban flows where any other form of transportation would be prohibitively expensive. I don't have to recite the benefits which have come from highway development.

With these great and far ranging improvements, there nevertheless has been an important sector of transportation that has lagged behind, and, unfortunately, the gap is increasing. Unfortunately, too, perhaps, the dimensions of the problem do not lend themselves at all well to private initiative and enterprise, nor do they in fact lend themselves to the kind of single focus, uncoordinated action we have had on the part of Government in the past. The problem is a public one and also one that involves the community at all levels--national, regional, and local, and in a very complex way. It lies primarily in the increasing concentration of the country's population in a relatively small number of "megalopolitan" regions, some of which have taken the form of "corridors" such as in the northeast. (The stretch from Jacksonville to Miami has many of the characteristics of the NEC although still on a smaller scale.)

In these regions the increase in population has engendered a congestion on the conventional modes of transportation which in the last decade actually reduced efficiency of movement. For example, it takes longer today to go between downtown Washington and downtown New York than it did fifteen years ago when we were emerging from the DC-3 era. It has been calculated that total elapsed time on the average in 1953 was 135 minutes; in 1968 it was more than 170 minutes. During some weekends of the year, for example Thanksgiving, the 4 to 5 hour drive between Washington and New York may stretch to 9 to 12 hours with a good part of the time spent standing still. While there may be economic advantages to centralizing location these advantages tend to be reduced by a clotting of the arteries of movement.

Clearly there is a social cost attached to these phenomena. If we come down the NEC toward Washington from Boston, through New York and Philadelphia we find that while the distance to Washington is roughly halved at each of these points the travel time by air remains largely constant; i.e., the travel time to Washington is the same from each of the three. This is of profound significance. It means that in the always delicate economic, locational balance as far as air transportation is concerned, Philadelphia, New York, and Boston are essentially equidistant from Washington. Put in another way, this means that the historic advantages of locational proximity are to an extent nullified. Over time this is very likely to have an adverse effect on the economies of some large metropolitan areas, and be an advantage to other large metropolitan areas.

Let me offer some additional figures which permit a better sense of the proportions of the problem.

Population in the Northeast Corridor in 1940 was 24 million, in 1960 it was 34 million, in 1970 it will be 41 million.

Density of population in the Corridor rose from 375 per square mile in 1940 to 531 in 1960 and it will be 632 in 1970. In the New York SMSA it rose from 4,138 per square mile in 1940, to 5,007 in 1960, and it will be 550 per square mile in 1970.

Census of population counts are normally on the basis of residence. This can be misleading, however, since the daytime population of Manhattan for example is substantially higher than the figure for the residential population. Manhattan's residential population is 1.7 million; its daytime population is over 3 million. Washington, D. C. has a ratio of daytime to nighttime population of 1.40.

Land values in the NEC reflect the increased population and increased activity. The average cost of urban land taking for the interstate highway program is $40,000 per acre. Land values are difficult to obtain but it has been estimated that the cost per square foot of downtown land in the NEC ranges from $17 in Boston and Washington to $51 in New York City.

A study by the Federal Housing Administration shows that the cost of land for residential construction has risen an average 4% per year from 1946 to 1960.

Gross population figures give only a very partial view of the increase in demand for transportation. Clearly there has been a continuously rising propensity to travel, at least in the years since World War II. Add to this that the activity increase in the NEC has been along lines which have emphasized extensive personal contact and we find that transportation demand has gone up several times the population increase.

To be more specific, air passenger movement between Washington and New York in 1960 was 736,000. It was 1,842,000 in 1967. Rail declined somewhat in the same period but by nowhere near the increase in air traffic. Data for specific origins and destinations are difficult to obtain, but we estimate that highway movement between Washington and New York increased by 30% in the same period.

Our projections of future transportation demand in the NEC, based on the kind of facilities now present and planned, and at present costs to the traveller, are that by 1975 air demand will be 20 million passengers per year, rail 29 million, auto 300 million, and bus 30 million. This could be changed substantially either way by rising congestion or by the provision of a new system with sharply changed performance capabilities.

It is apparent now that the transportation facilities which will be in existence by 1975, unless new plans are made, will be insufficient to handle the demand and that as a result there will be sharp increases in user cost of transportation either through congestion or through increased fares and tolls. The imminence of these higher costs can already be seen in the higher aircraft landing fees which are beginning to spread throughout the Corridor. Higher transportation costs, whether born by the user or shared by the community, will adversely affect the economy of the Northeast Corridor. To the extent that demand outruns facilities in other megalopolitan regions of the country their economies will similarly be affected.

As I said earlier, it does not appear that private resources will be able in any conceivable way to meet the expanding transportation demand in the NEC. For example, the airlines can turn to higher capacity aircraft such as the Boeing 747 to deal with air congestion in the air, but they cannot, by themselves at least, assure that air travelers will be able to get to and from metropolitan airports, or that air travelers can even get through air terminals. The responsibility for these facilities is almost entirely public. The Government is, of course, pivotal in the case of highways. It is possible to imagine a somewhat improved rail system in the NEC under private aegis, but it is not possible, unless capital markets change radically, to visualize a new high speed ground system built with private resources.

This makes the problem of meeting expanding transportation demand a public issue.

The first question which ought to be raised about prospective public policy is whether it is desirable to improve transportation facilities in megalopolitan regions in a way which will stimulate their economic development. The answer straight off would seem to be an easy "yes". We can't imagine suppressing the growth of the NEC, the Cleveland, Detroit, Chicago complex, Los Angeles or any of the great regions to which population and activity have gravitated. I would point out, however, that the national governments of a number of advanced industrial countries have come down on the other side. New location in London, Paris, Tokyo and other major metropolitan areas outside the U. S. is firmly discouraged. Germany has long had a policy of decentralizing location. Even in the U.S., while location in metropolitan areas is not restrained in any sense, encouragement given by regional development programs such as in Appalachia tend to shift the balance in some degree.

The question of whether "megalopolis" should be encouraged has two important aspects which I want to touch on briefly. One is that decisions on this question ought to be made on some kind of rational grounds, such as the comparable economics of population concentrations of different size. The other aspect concerns the level of government at which basic decisions about regional growth ought to be made.

On the first aspect, I would suggest that we have altogether too little information. Much has been said in recent years to the effect that New York City is incapable of being governed, or that it is not "viable" as a social and economic entity. Somehow we have the uneasy feeling that New York City has gone over the edge and that it cannot really be made to work. This may be true, but it is clearly true also that we have no solid knowledge upon which to pass judgement on the desirable, the optimum, or the maximum viable size to which we should allow or encourage metropolitan areas to grow. In the absence of this kind of knowledge it would seem difficult to formulate national policy as to the desired location and direction of economic growth; i.e., as a regional matter. In that case, one would hesitate to suggest that the Federal Government can decide how much or how little growth transportation regions such as the NEC ought to have.

This leads to the second aspect of the question of regional growth; namely, the level of Government at which basic decisions on matters such as transportation facility investment ought

to be made. If the Federal Government cannot, for lack of any rational schema, make the big decisions about growth and investment in metropolitan regions then we are perforce driven back to the next level of government in the U.S.; namely, the states. But this is likely to be unsatisfactory because of the regional nature of transportation networks. It is for this reason that various proposals have been made for regional transportation authorities. Senator Claiborne Pell of Rhode Island has, for example, proposed that an interstate compact be established among the eight states of the Northeast Corridor for the operation of a high speed rail system. Nowhere in the U.S., however, beyond strictly local government special district arrangements, has an approach been taken which has cut across the traditional lines of political jurisdiction.

These fundamental questions of public policy are going to have to be dealt with before we can go very far in changing the present pattern of transportation--regardless of the technology available.

Let us assume for purposes of the rest of this paper that our objective generally is to satisfy the expected transportation demand in the Northeast Corridor for the next two decades without raising the cost of transportation vis-a-vis other social costs. I will not go into the more esoteric aspects of this objective. Adopting it simply provides us with a general framework in which we can suggest the most productive areas of exploitation, such as for example in research and development. As stated earlier, it is reasonably clear that if we continue the directions of transportation investment we have followed in recent years we will increase substantially the social costs of transportation in densely populated regions such as the Northeast Corridor. This results from the combination of the high volume of traffic flow and rising land costs.

It has been said that a simple projection of highway traffic between northern New Jersey and Manhattan will by 1980 require 40 new lanes. Forty new lanes would cost in the neighborhood of $2 billion and would raise the vehicle mile facility cost from an approximate one half cent for private automobiles today to two cents in 1980.

A new airport in the New York area seems absolutely necessary, if projected air traffic is to be accommodated. Assuming that the new airport is built within 25 miles of downtown Manhattan, its cost will be at least $600 million. This will make the landing cost per aircraft about $75 as compared to the present average of about $50 for the New York Port Authority airports.

Costs cannot be reckoned in economic, dollar terms alone. This has been shown in the strong resistance to the building of freeways which has flared up in a number of cities such as Washington, D. C.. Here the objection is only partly economic; it is also based on unwillingness to relocate, to have neighborhoods broken up, and to have barriers erected to lateral flows in the city. Other costs, of course, are those frequently pointed to--noise, pollution, accidents and so on.

It is probable that transportation costs will rise unless we turn to different systems from those we have encouraged in recent years. We need systems which will be low in land requirements, low in noise, low in pollution, and low in accident rate. Such systems with sufficiently high performance capability to attract patronage in competition with conventional air and highway do not exist.

Present rail systems, if improved with new equipment such as is now operating between Washington and New York, can probably meet some of the need for improved capability. But the railroads have neither the capacity nor the performance characteristics to meet transportation needs in the NEC beyond the immediate future. For example the existing main line of the Penn Central Railroad between Washington and New York must be used for increasing freight movements as well as passenger.

It is likely that for the future in regions such as the NEC we are going to need three basic types of high performance transportation systems. One will move passengers between points of high population concentration at speeds up to 200 to 500 miles per hour. This system will operate on the ground on fixed rights of way. The second system will provide at high speeds much of the flexibility achieved today by private automobile. It will depend on the next generation of helicopters, and on STOL and VTOL craft. Generally, these short haul aircraft will operate between low density points in the suburbs of metropolitan areas. The third system will attempt to improve the utilization of highway by increasing average speeds and reducing headways. Presumably this system will accommodate automobiles not unlike those presently in use.

What are the prospects that such systems can be in operation in the next 20 to 30 years? Let me speak now to the developments which may bring them about. First the high speed ground system.

The Japanese with their New Tokaido Line have set a standard for railroad passenger operation which has brought a tremendous response in patronage. It is without doubt the most profitable rail passenger operation to be found anywhere. Moreover, as it is extended, speeds will be increased to 150 miles per hour. A similar system is without question a candidate for the NEC. Its capital cost between Washington and Boston would be on the order of $3 to $5 billion. A good deal of the system would probably have to be underground.

The only alternative high speed ground system which has been worked out technologically is tracked air cushioned vehicles. As you may know a full scale TACV will be in operation in France in about a year. As we see it, TACV's can offer high speed transportation at ground level up to speeds of 250 to 300 mph. Beyond these speeds aerodynamic drag is likely to drive costs to unacceptable levels.

TACV's offer a number of advantages for high-volume high-speed intercity movement. Construction costs are likely to be lower than for high speed rail because of better weight distribution of the vehicle. Operated in conjunction with linear electric motors, TACV's will minimize noise and pollution. Safety of operation would be much higher than on any present mode of transportation. The short-coming of the TACV is that because of the problem of aerodynamic drag it cannot operate at high speeds in tunnels. This clearly makes TACV's less useful for operation in high density areas. It is probable that for special purpose applications such as airport access TACV's can be very effective and can be operational in 4 to 5 years.

Higher speed ground systems are not likely to come for some time. Going into a controlled atmosphere is a necessity to reduce aerodynamic drag, but this too brings many problems. A completely new suspension system will be needed and the prospects are that it will be magnetic. Much research and development, however, lies between now and the realization of such a system.

The second system has been talked about for some years, but has been slow in coming, largely because of the high cost of helicopter operations. The larger manufacturers of helicopters all have craft ready to produce in the next couple of years which should considerably reduce these costs while at the same time improving performance. If the emphasis on helicopters for defense is lessened, the manufacturers may push the commercial versions more strongly, thus shortening the time before we have economically efficient aircraft. Compound helicopters with 90 to 100 passenger capacity will have seat mile costs between 3 and 6 cents, and with fares at that level, will attract a great deal of patronage. As I said earlier, they will meet a great need for inter-suburban movement. I do not believe they will be permitted to operate in or near downtown, because of noise and other traits.

A recent study completed by contract with my office has shown that in the Washington, D.C.-Baltimore area not more than 30% of air traveler movements originate or terminate downtown. This would suggest the need for a decentralized pattern of V/STOL service. It doesn't make sense to bring travelers in from the suburbs to downtown and then out again to ultimate destination.

The third system toward which we are moving is some form of automated highway. No means of transportation will be built for a long time to come which will surpass the private automobile in convenience and flexibility. Its only shortcoming other than pollution, noise, and safety, is a veracious consumption of space. What needs to be done is to achieve a much higher flow rate when autos come together in high concentrations, particularly for long distance travel. This undoubtedly can be done by some control device which will synchronize the speed of a number of autos on a highway. No one knows yet whether it will be done mechanically or electrically. Regardless of which means is used, control devices over the individual vehicle suffer from the very serious shortcoming that if one vehicle breaks down, or runs amuck, the system becomes extremely unsafe for other vehicles. A way of overcoming this hazard would be to put automobiles aboard some sort of pallet device. This would assure much greater reliability and probably permit higher speeds.

My office has attempted to encourage experimentation with auto-on-train service between Washington, D. C. and Jacksonville, Florida. The response of the public to such a service would provide an indication of the attractiveness of automobile carrying devices. So far, however, no private firm has been willing to go ahead with the idea, and appropriations have not been available from the Congress. Nevertheless, there is little doubt in my mind that in the next 15 years we will develop systems which will greatly improve the efficiency of travel by auto.

These are the prospects which lie ahead. Anyone who can hold the seat mile cost of travel in the Northeast Corridor constant will have at least as good a source of wealth as Florida real estate, and anyone who can reduce it by a cent will be worth a good part of the oil in Texas. This, I think, should constitute a challenge, even to those who have fired away at the moon at speeds up to 25,000 miles per hour.