

when I was put on my railroad job at the United States Railway Association. This is not a very glamorous subject, but it is pretty basic. Up until 1955 the railroads---and I am talking about railroad ties which are comparable to concrete in the highways and the surface under the concrete---up until about 1955 railroads had been putting 50 million new ties a year into the railroad system. Then the replacement rate started to go down, and it got down to about 15 to 20 million through almost 20 years, and I didn't pay any attention to that, and I don't think many others paid any attention to it. Now the tie replacement rate is going back up. It is up to 20 or 25 million ties a year, but the basic physical foundation of the railroad system, the ties, except for some railroads, has gone to rot. And now it is going to be replaced with 1977 prices, in which ties cost \$12, \$14 apiece, and if they had been properly replaced during all of those years, there wouldn't be so many to replace at today's inflated prices.

I think the same invisibility is happening in the highways and the bridges. In Minnesota, our highway department said we should spend \$100 million a year for the next 10 years just to repair bridges. The legislature gave them \$50 million. I believe it would be absolutely criminal if the physical condition of our highway system ends up the same way the railroads did. Remember that almost no one that I can recall during 1960, 1965, 1970, 1975, was really saying---look at railroad tie maintenance; they are not putting 50 million ties a year in, they are down to 15 million per year. You can probably defer that maintenance for a few years and it doesn't make much difference, but it happened for 20 years with the railroads. Is it also now happening with the highways?

There are a couple of books that I think you ought to get hold of, because as a shipper I think they contain more information on future transportation research than most other publications. One is a Transportation Research Board book of about two years ago that publishes all the papers at a Woods Hole conference in 1975. (Railroad Research Study, Background Papers, July 1965) There is a summary that is coming out, a condensation rewrite of all those papers. I think you ought to get ahold of the original book, the papers that were presented. It is oriented mostly to railroads but there are chapters on trucks and barges and economics, you name it, all subjects that relate to transportation. The bankers are talking about financing, labor is talking about labor, the professors are talking about education. It is all in there, and I think you ought to have that book.

Another book (that you probably can't get) pertaining to future transportation research is National Transportation Trends and Choices which the Democratic Administration doesn't like. They have banned this January 1977 Federal DOT book, but there are a few copies around. This book is not the end result, but it is a good first step to what might have been a fairly broad base planning effort in this country on transportation, but you can't get it right now.

So the shipper in transportation is very, very much interested in research programs oriented toward improving reliability of transportation modes which, in turn, permits improving the utilization of the modes, which in turn is better productivity, which in turn may help us not pay quite so much money, or give us a better transportation result, a better payback from transportation. And I think we recognize that data and costing weaknesses in this area are going to be detrimental to some of the decision making on what do we research and develop. And

finally, you all have a Transportation Research Board handout called the Ten Most Critical Issues in Transportation. (The Ten Most Critical Issues in Transportation are discussed in Carl Rappaport's paper in this circular.) I worked pretty hard on this one. There is a lot of stuff in here that I put in as a shipper. So if you want the broad brush thing on what one shipper thinks, there is a lot of it here, which is an Executive Committee publication. Thank you.

SOME SOCIAL, ECONOMIC, AND ENVIRONMENTAL  
RESEARCH NEEDS

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I would like to just raise a couple of propositions with the hope of opening a conversation with you about them. It is my thesis that we are at a turning point in the history of transportation developments in these decades. And I think we can identify at least four major shifts that seem to be long-term in character and that are probably going to be shaping our research and policy agendas through the 1980's. Let me just enumerate those four and then make a few comments about each of them.

First, despite the backlog in highway developments we have been hearing about, I think that job is nearly done. After a century-long effort to bridge this continent, we have now nearly finished the job. The big civil engineering projects to build initially a rail network and then a road network across the country has now connected every place to every other place, or nearly so. And so, having completed that job, we are now groping for ways of making that transportation network work better. Engineering styles of design and construction are having to be supplemented by other styles, and so we are seeing the introduction of new kinds of people into the transportation planning and management business---economists, lawyers, environmentalists, and sociologists, peculiar types.

Second, the concern for efficiency, which has dominated the transportation planning and management business for so long, is now being supplemented by a concern for equity. And we have been hearing some of the echoes of that in these last two comments.

Third, the powerful role that transport has always played in shaping land use patterns and in locating cities may now be ending. I will have more to say about that in a moment.

And fourth, the decline in public transit services is leaving a large gap, and we don't know quite how to fill it. We have been groping to find a successor to the old public transit systems, and we haven't known where it is. For awhile, we thought the successor was likely to be rail rapid transit systems, and so far at least the experiences in San Francisco and Washington are not encouraging. For awhile we thought it was going to be personal rapid transit (PRT) and/or dual mode. Now it looks as though PRT and dual mode are somewhere down the line sometime later. Some of us are optimistic about the prospects for paratransit, particularly for using automobiles as public transit vehicles, and some experiments are underway in those realms, as you know. Others are optimistic that pricing

systems of various kinds might be a way to better manage the system, and a little experimentation is going on there, but I think the Singapore experience is the most notable.

There is no obvious successor to transit, and it looks as though the old forms, the pre-automobile forms, are not working very well either. So in respect to all four of these developments, we seem not to have answers, and we are obviously groping---sometimes intelligently. Let me elaborate on these themes briefly.

During the 1950's and then into the 1960's, the transportation planning task, particularly the urban transportation planning task, got fixed into something of a formula. You all know it well because you have all been practitioners of it. This task was to predict population and employment, predict land use patterns or lay out desired land use patterns, generate traffic, assign it to a network, and then build the roads that would carry the expected demand. And then, faced with the backlog of highway construction, we undertook the job to put those roads in place, connecting suburbs to their center cities, connecting metropolitan areas to each other. And that, as I said before, calls for civil engineering knowledge and public works construction skills.

Essentially, the key to the transportation planning task of that time was predicting latent demand and then building facilities that would satisfy it. That task, I am suggesting, is nearly done. Virtually every spot on the continent is now connected to every other spot by roads and airways. In turn, we have built a tremendous fleet of vehicles to operate on those roadways and equipped the population with cars and driving skills. Unfortunately not quite all, everyone in the population is so equipped, but those who do have highways, automobiles, and driving skills are being very well served. Americans enjoy levels of accessibility that are unprecedented, and they enjoy degrees of personal freedom that are unmatched elsewhere.

And yet, now that we have just about completed the job of linking everyone or every place at least, we seem to be unhappy about that. A vocal new lobby has arisen which is overtly anti-automobile. Initially there was a wave of concern in the late 1960's about high accident rates on the highways and a concern for vehicle safety. That spread over the continent and into the Congress, and we have now been doing something about that. Within the past few years, the nation has become concerned about the cumulative environmental effects of automobile use and highway construction, and we have been hearing about that, particularly of course, about air pollution. Others, more recently when it has become fashionable, have been concerned about energy consumption. We will be hearing more about that one, no doubt. Still others are concerned about the fact that automobility has, in fact, meant the decline of the public transit services. Others, I suspect, have joined the anti-auto crusade for the same reasons that have already encouraged people to join crusades. With a strange perversity, because the automobile highway system has become the mass transportation system, it has come under attack in the name of mass transportation.

These recent criticisms have already generated a wave of engineering changes that are surely going to improve the auto highway system appreciably. Both the roadways and the vehicles are being considerably improved, and they are far safer than they were before, and certainly more changes are forthcoming in vehicle design. Fuel efficiency is being improved dramatically and will continue to be.

Exhaust emissions are being cut even more dramatically and some knowledgeable engineers are predicting that the air pollution problem produced by automobiles will be gone in 10 years, or rather as soon as we can replace the fleet, so it may be a little bit longer. But it is a solvable problem. In a sense, these three problems, safety, fuel, and emissions, have yielded to straightforward regulation and to engineering techniques.

But some other problems remain, and they are far more intransigent. The most serious of these problems, I believe, is that the accessibility afforded by automobiles is not available to everyone. That those who remain carless, either because they can't afford cars or because they can't drive them, have been positively hurt by the rise of the highway auto system, just as others have been positively helped. That seems to me to be our major dilemma.

Insofar as cars have induced a decline in public transit service and a reorganization of metropolitan spatial structure, they have also constrained life opportunities for those who are poor and/or black, or for those who, because of age or infirmity, cannot drive. It strikes me that the major, perhaps the only fundamental problem of the auto highway system, lies here in its equity effects, that everyone does not have the equivalent of auto-like accessibility. I suggest that the proper response to that persistent problem is not to ban the car, or to put additional constraints on its use, or to stop highway construction. Rather it is to invent additional means of supplying transport services to those who are carless so that they can enjoy equivalent accessibility.

There has been a lot of discussion of some of the potential means---I mentioned a few. Perhaps one of the more optimistic ones is more effective use of transit services---the old sort, but somehow modified, as, for example, using the old bus in express mode, perhaps with exclusive right of way, or perhaps with preferential treatment. There is a lot of experimentation around the world in that respect.

Small vehicle transit services of various kinds are prospects, and paratransit modes using automobiles as public transit vehicles seem to me to be among the more likely prospects. Perhaps some of the new vehicle types of the Morgantown sort (personal rapid transit) or its successors hold promise. Perhaps it is more equitable taxing and subsidy arrangements that assign the costs more fairly than has been our habit. Perhaps charging full costs of transportation services to all users---automobile users and transit users---is the right way. We have tended to try to use transport services as a medium for income redistribution, and that is a pretty inefficient way to redistribute income. I would suggest that we ought to be exploring the prospects of charging everybody what it really costs. And then if we seek to supplement incomes, that we do so via the income tax. That would solve many of your financing problems, incidentally.

I would like to see some further exploration in new organizational forms for redistributing services, for organizing the industry to make it easier for people to use automobiles and transit services of various kinds and thereby perhaps also inducing some innovation in pricing.

Now let me say just a few things about the effect the automobile has been having on land use patterns. It has been charged, as you know, with having created the low-density suburbs, for having induced central city decline, and for having encouraged sprawled metropolitan development patterns. Those who prefer high densities and traditional city forms have in turn condemned roads and automobiles

because they have been so effective. Their condemnation has been so enthusiastic that they have succeeded in stopping many of the highway construction projects around the country, as we have been hearing here. But if that is their purpose---somehow to shape land use patterns---I think their efforts are too late.

I am guessing that we have now passed the historic threshold and that for the first time in all history transport is no longer the determinant of land use patterns. It is true that highways have traditionally opened metropolitan hinterlands to suburban development. It is true that earlier the railroads opened up the west and indeed located the cities of the west, placing them at railheads or rail junctions. It is true that earlier than that the canals, the sea ports, and the crossroads did the same. But those days are passed. Now that every place is directly connected by roadway to every place, now that most industries are locationally freed from their natural resource sites, now that knowledge is the major input to industrial development and industrial processes and not raw materials, now that most industries and most households are footloose, they can locate anywhere. We now enjoy locational freedoms that are unprecedented. Each metropolitan area is now so internally well served by a ubiquitous network of roads that any additional improvements to accessibility are unlikely to make much difference. (That is the main reason, I am guessing, why BART has had so little effect on land use patterns in the San Francisco area.) It looks as though it is now too late to shape land-use patterns deliberately through installation of transport systems.

So, even though the highway auto system has induced suburban sprawl and metropolitan spatial reorganization to low density patterns, it is too late to use transport to change that. Moreover, I think, those who are unhappy with that pattern are stuck with it. I think we have had an irreversible history working here, inducing lower and lower densities, and we can't go back. American cities are low density and they are likely to remain so whether we like it or not. That has some implications, to be sure, for fuel consumption. People are going to be traveling long distances in this country, longer than elsewhere. And although some of the critics have been hoping that the rise in gasoline prices would induce a reduction in auto use and then an increase in density, my guess is that they are going to be disappointed, because the demands for auto use are so inelastic with respect to price---people are willing to pay very high prices. If you doubt that, look at the experience of other countries where gasoline is now up over \$2 per gallon and where per capita incomes are far lower than those in the United States. Even so, automobile ownership and use curves are rising---in Japan, Brazil, France, for example.

And then, by the time prices get high enough to make much difference---say, on the order of \$5 or \$10 a gallon; I don't know how high it has to go to make a difference in people's use patterns---by that time, we are likely to have a workable electric automobile. I understand the industry is really being very optimistic about new battery developments, and they are talking about producing electric powered cars within a few years. If they succeed, that fear will be mitigated.

Some have predicted that we are going to be developing old-fashioned city centers again, because they are expecting that rising fuel prices and demographic shifts are going to be moving the middle class back to the central city. Bill Alonso's scenario reinforces that view. He notes that the

number of childless households is increasing very dramatically. In fact, the number of households with only adults, whether married or unmarried or all male or all female or mixed, is increasing. Female labor force participation rates are rising far faster than anybody ever predicted. With two or three or four adults working, a center city location is far more amenable than a distant suburban location for job finding and commuting. That might induce moving back. So, too, would childlessness induce moving back. That might happen to some appreciable degree, but not enough to make an overall dramatic change in metropolitan spatial structure, I am guessing.

One byproduct of that potential scenario would be that middle class folks might then be pushing poor blacks out the central city, and the next liberal war may be to save the central city for the poor. But if they do move out to the suburbs, and if birth rates among the poor remain at their high levels, we will have simply a shift in racial composition and a similar spatial structure with perhaps those suburban schools put back in business again.

With that, I am guessing that we are at a crossroads in this period in 1970's and then into the 1980's. We are groping for a style of transport planning which we have not yet found. A style that is not oriented to road building per se, whether highways or transit guideways. A style that is sensitive to the distribution of benefits and burdens among different population groups that are affected by transport developments. A style that can exploit the new technologies and can develop new styles of regulation which are less constraining, that open opportunity, that induce change rather than constrain change. And above all, a style that seeks to increase accessibility, to extend personal freedom, and especially for those for whom the automobile has tended to reduce accessibility and freedom.