Future Concepts of Urban Mass Transportation—An Overview

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•THIS paper presents an overview of the general concepts of future urban mass transportation. It is part of the general report, given at the Highway Research Board Annual Meeting, in which the six papers published in this RECORD were abstracted and presented for discussion. Since these six papers are given here in their entirety, only comments on relevant parts are being included in this overview.

"Future concepts" of any form of transportation is a rather elusive subject. Some think of it as new gimmicks for cars; others see in it the return to mass transit. Some think people should move back to the city, and others visualize longer and faster movement in personal capsules that move swiftly and cheaply in three dimensions through space. The generality of the topic covers all these ideas, but it also makes it difficult to focus sharply and critically on the real possibilities of the future.

PURPOSE AND GOAL

In the past very few years, it was good enough to make people think about new ideas in transportation. Transportation had been stagnant for so many years that even the idea of change itself was novel. By now transportation innovation has become a household word and our news media are flooded with new technology, the "catchier" the better. We must now move on to the next step in innovation, in which we will begin to assess in some detail the value of new ideas in relation to the needs for transportation. At this state of the art, we hope that our current discussion will not merely contribute more new ideas, but will also bring them into perspective in relation to their usefulness for real improvements in the future.

When considering future concepts in urban transportation, one often expects a preoccupation with or a juxtaposition between expressways and rail rapid transit. In order to reverse this somewhat traditional trend, the papers given under this topic were intended to focus on the broad, future spectrum of urban mass transportation. It is quite clear that urban transportation can involve more than just expressways or rapid transit, or a combination of the two. Other forms of transportation must be seriously considered, and still others may have to be developed from existing modes or recognizable needs.

While much of our present concern stems from today's immediate problems, we do not wish to be overwhelmed by them alone. Additional, formidable problems will arise and we must attempt to foresee them. It is important that as new concepts are forming, we plan not only for their appropriate use tomorrow, but also for their appropriate use throughout their useful lives, whether they be a few years or a few decades. In this set of papers then, we are concerned with any contribution to future concepts of urban mass transportation, be they existing modes or new systems, new software ideas, or new approaches to current problems.

THE BASIC NEED

To make a success of urban transportation we need more than token improvement; we need a new system which eliminates the current problems and failures. We need a large improvement. Maybe we need new technology; maybe we need new operating

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policies. People will not want to pay more for transportation in the future so our solutions must be economical. What we need to know is what people really want and need.

I, for one, like my car. If you want me to use a transit vehicle, it will have to be made a lot more attractive than it presently is; it will have to come much closer to my residence, and I will have to be notified as to when that transit vehicle is running and where it is going, and it will have to take me to my destination as fast as my car would.

While I desire much better public transit, I also want improved facilities for ordinary auto driving. I would like to be able to travel without congestion and strain, to park closer to work or shopping, and also to stop acting as chauffeur for the rest of my family.

Neither transit nor the automobile gives me all that I want. Either system would require great improvements to be able to offer me what I think I would want from a good transportation system. Yet we still may not know exactly how to define "improvement." Learning this is one of our most important objectives.

For the last fifty years or so, the transport user has consistently chosen the automobile when given a choice. I suspect that many of the people who are proposing new transit systems do not plan to use them themselves, but rather want to remove some of the other people from the highway so they will have a little more room for their own cars. But this is not a very realistic way to solve the problem. As a matter of fact, this approach perpetuates the problem with a sizable expenditure of funds. The basic difficulty with this unfortunately very common approach to today's traffic problems is the difference between individual goals and social goals. As an individual transport user, one pursues his own individual goals independent of his perception of the societal goal; i.e., car for him, transit for all others, regardless of the willingness of all others, society, to individually accept these social goals. We readily disregard that social achievements in a free society such as ours are by definition an average, or summary of individual goals. As each individual decides on his best solution he also contributes to a social solution, whether or not it is generally acceptable.

We can identify some approaches toward improving both auto and transit to make them more attractive, either socially for the car or individually for transit. Transit must be attractive to individuals or no one will use it. We have to give it greater speed in order to make it consistently capable of speeds equal to or greater than those of the automobile. Door-to-door service is another must. The automobile provides it, and I consider it extremely important, even if I have to walk half a mile from the parking lot. This walk is preferable to one to and from a bus station because it leads directly to the car and to the start of the trip, without the probability of a long wait for a bus. I want service at my convenience, not at the time the transit scheduler has chosen. I also want privacy, comfort and convenience—economically. This is a pretty big order for improving transit service, and to attain these goals requires a lot of work before all or even a good number of them are satisfied. On the other hand, driving in rush-hour congestion is distasteful to most people and parking in remote lots at substantial cost can become a strong deterrent to automobile use in dense areas. A resolution of these problems of the private car would improve the attractiveness of the car immensely.

It would seem then, that if we could combine the advantages of the individual transportation system (the auto) with those of a mass transit system, a viable solution for the future might result. To reach this long-range solution we might in the meantime provide partial improvements which would in some appropriate cases, like downtown, attract people to transit and away from their automobiles. In areas such as the suburbs, we might improve automobile service to offer better access to the nondriver.

In each case, it will take more than a marginal improvement to attract and hold new patrons. Otherwise, any subsequent improvements in another mode might just attract them back to that mode in a vicious, competitive seesaw. For instance, substantial improvement in transit service, where that is advantageous, must be better than what patrons can get or could even expect to obtain from the automobile. This does not mean stamping out the automobile altogether. It means developing the automobile and its improvements in those areas it serves best, and transit in the other areas. As we do this, we should also provide ample opportunity for these two major urban transport systems to interact effectively now and even to merge into one eventually.

PAPER REVIEW

Let me now relate the ideas given in the papers presented in this RECORD to the goals and direction towards future urban mass transportation. I should like to begin the discussion of the papers by outlining one we do not have: one on the user's demand for transportation services. When the materials on the problems of urban mass transportation were being assembled, both a study of basic transport demand and the social questions of what people require in a transit system were unavailable. We mention this omission to point out a relevant and important area in which much work still needs to be done, and in which some very interesting results can probably be obtained with relative ease.

A special problem of demand analysis is the modal split of transport users between automobile and transit. The paper by Zupan discusses this and offers methods for predicting transit usage. The paper's main characteristic is that the prediction is done entirely on a theoretical basis using census data alone, and requires none of the costly and cumbersome field data collection procedures. It demonstrates the magnitude of undertaking such an analysis and the difficulty of identifying the basic parameters that underlie the choice of a transportation mode on an aggregate basis. I challenge each reader to give a precise analysis of his decision-process when he chooses between a car or transit. I guess that most of our urban commuters are ruled out because they do not even consider transit as a serious, possible alternative, but even the few who have the choice of using transit would probably be hard put to specify just what goes on in their minds when they choose transit over the automobile. This may be a good mental exercise for any transport planner the next time he has a choice.

The result of Zupan's work should become a major contribution not only in modal split forecasting itself, but more importantly in the ongoing quest to find simpler, cheaper, and yet more reliable methods for quantitative analysis of transport problems. In this respect, the paper represents an important example of a rather new approach to the theoretical understanding of transportation, and in particular, future transportation.

Moving on from software to hardware, we have a paper by Zworykin which deals with transit technology. Anyone who says that nothing new has been invented since the steel wheel on steel rail should take a good, hard look at this paper. It presents ideas about transit which might eliminate or reduce waiting times through the automation of transit operations on an exclusive right-of-way and under very stringent control conditions.

Zworykin, who is the co-inventor of television and an electronics expert, explains the need for highly improved transit service which stimulated him to attack this problem. He then proceeds to demonstrate that highly attractive systems with many innovative features can be designed. He proposes fully automated operation of individual cars, operating at minimum spacing or whenever there is demand by a patron. Cars would be stored on circular tracks under stations consisting of slowly revolving platforms which would provide continuous service and quick access. It would, of course, be possible to run these trains on conventional steel wheels on steel rails, or, as Zworykin proposes, on air cushions. Power for them might be provided by linear motors. This proposal, explained in detail in the paper, clearly demonstrates that there is ample room for imagination and innovation in mass transportation and that there are indeed other possibilities for mass transit than the present form of the rail system.

The paper by Heathington, Miller, Knox, Hoff, and Bruggeman entitled "Computer Simulation of a Demand-Scheduled Bus System Offering Door-to-Door Service" features the development of an algorithm for providing bus service from any particular point in a network to any other point. The simulation uses a process where simulated passengers call in and specify their origins and destinations. The computer then searches for a vehicle in the system which can service each particular call. It first analyzes whether the people already on a particular bus would be inconvenienced beyond tolerable limits if the call were serviced. If a bus is available and its change in routing is considered acceptable, it is sent to the caller. If it is not available, the next nearest bus is rerouted, and if no presently running buses are available, a new one is dispatched. This kind of operation can provide substantially improved service, particularly in low-density

areas, for social trips, for trips between widely separated residential areas, for relatively infrequent shopping trips to smaller neighborhood centers, and even for trips into the downtown area from major terminals.

Not all is resolved in this simulation, however. More pages are devoted to what needs to be done than to what has been achieved so far. Another factor which is characteristic of this kind of simulation study is that as one attempts to resolve problems related to the development of this kind of transportation service, two new problems seem to arise for every one solved. In this case, the concept is basically relatively simple, but the execution presents serious problems. However, this is a concept in urban mass transportation that could be implemented almost immediately if we were willing to do some earnest thinking and experimenting. We could develop a progressively more sophisticated process with time, all the while improving transit services between the downtown and the relatively low-density suburban areas. In its convenience, this type of service would be second only to the automobile, and would certainly be a big improvement over conventional buses.

Two papers in this assortment deal with new concepts of individualized, public transportation, the suggested marriage of the advantages of auto and transit. Curiously enough, the titles of these two papers stress this marriage: "Small Car Automatic Transit" by Fichter and "Supra-Car" by Haikalis. They each deal with a transportation system for the city and are most profitably considered together. They utilize small individual cars on separate guideways whose control systems are fully automated. They provide not only what transit provides today, but also a flexibility which is very similar to that of the automobile.

Fitcher's system consists primarily of one-way elevated guideways with somewhat elaborate loops for switching from one main line to another. An interesting concept is the possibility of providing intersections at grade for those links whose capacities are relatively low. An analysis is given of expected capacities with single cars operating by themselves, single cars which could intersect at grades, and also several cars coupled together as single units. Fichter has given considerable thought to this particular concept, but it deserves still more as many questions still need answering: Are we going to direct our energies towards the problem of high capacity on the main links or are we aiming for a low-density distribution system at a reasonable cost? Are we thinking of individual vehicles or buses? Will we provide a pleasant visual experience for the occupant? Should we provide the possibility for individual routing that allows for a change of mind in midstream, or a system that immutably obeys one initial destination command? These are only a few of the questions which must be answered.

Haikalis has stressed another facet of the system by proposing a combination of vertical as well as horizontal service. In his system, capsules moving on an elevated guideway switch over to a vertical column and descend to the base of the column for loading and unloading of passengers. But why not make the columns into vertical elevators and extend the horizontal system into a vertical system? The system could be adapted to the movement of goods as well as people. If we had such an automated three dimensional access system, we might extend its capability to provide other kinds of services for houses and offices, e. g., water, sewage, and power.

Some intriguing numbers are manipulated by Haikalis. They are certainly very thought-provoking and should give readers some incentive for reflection on the future of transportation. Eight billion dollars are being spent every year by New Yorkers on urban transportation. With that huge sum an elaborate guideway system could be supported and could probably offer substantially better service than what now exists. Even while the calculations are very cursory, they clearly indicate once again that automated guideways are not an unrealistically expensive dream.

The remaining paper would seem to close the spectrum by addressing itself to the visual experience in transportation. Chermayeff, an architect with the firm of Cambridge Seven, did designing for Expo '67 and for some transportation facilities. His paper deals with visual orientation in a transit system, by identifying and structuring nonexistent or confusing information. At present, passengers who wish to transfer quickly and easily towards their destinations or to other transport modes remain disoriented, confused,

and frustrated. Anyone who has tried to grope his way through an unfamiliar transit system will appreciate that this kind of problem exists almost everywhere. Ironically, many of the principles of good orientation and information can be applied with relative ease and at low cost. Perhaps they will begin to receive higher priority if their purpose, applicability, and implications can be better understood.

Chermayeff explains the various types of orientation that should be provided in the urban transportation system. First the system must be identified so people know it does exist and where to find it. Next, route information is needed, then station information, and finally vehicle direction. One must also be able to easily find connections throughout the system, and means for getting to them, not to mention a way to return to the outside world when the trip has been completed. Orientation is often in conflict with other information such as advertising. These conflicting types of information should also be recognized as such and treated accordingly.

This paper is significant in that it presents not only concepts, but actual results of designs that have actually been implemented in Boston. It opens the door, we hope, for much more substantive investigations into human reactions to the transportation systems and their information problems.

In conclusion, these papers give something of a state-of-the-art review of urban mass transportation. We probably cannot really expect very sudden major breakthroughs, but the good, hard engineering and analysis going into this problem may soon begin to provide some substantial improvements in urban mass transportation in the next few years.