Issues in New Transportation Systems and Technology

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These remarks represent a personal view of some of the broader issues that arise in the context of new transportation systems and technology. They may sound somewhat critical, but are not meant to be. They are meant rather to be an attempt to provide a glimpse into the thinking of someone in the program-decision stream who, although not technically trained, believes in the promise of new technology and wants to be sure that it will be in a position to rise to the challenge that confronts it now and in the future.

There are, of course, various levels of transportation technology development. Some time ago, research and development in transportation consisted of somebody sitting down with a slide rule and working out an improved design of a carburetor or a brake system. I think we would be surprised how much transportation progress has been achieved this way. The results were not always optimal and frequently had unfortunate social and environmental consequences, but for a long while it was the only approach we had. And by and large it worked.

More recently we began to improve on this "seat-of-the pants" approach by introducing the discipline of systems analysis with its notion of design standards and performance requirements. This has given us more definable targets and a more rational approach toward technology development. In general it has been a great improvement over the earlier unsystematic approach.

Unfortunately, all too often transportation system requirements are defined in terms of engineering characteristics rather than in terms of the service levels the system should provide to users. We read that system X will have on-board switching capability or that system Y will have minimum operating headways of so many seconds. But the public, in spite of Sunday supplement fascination with new technology, is largely unconcerned about such matters. The user of a public transportation system perceives only the service characteristics: speed, frequency, availability, and amenity. Thus, the great amount of attention that is devoted to the nature of the propulsion, control, guidance, suspension, and other subsystems (as typified in debates such as steel versus rubber wheel, or air cushion versus magnetic levitation) may be largely beside the point. In reality, the primary issues for decision are the service qualities the system should provide to prospective users, reflected in system attributes such as waiting time, travel time, degree of on-time arrival (dependability), number of transfers, interior comfort, walking distance to the nearest station, security, and contingency measures in case of breakdown. These parameters—rather than the hardware characteristics—should provide the underlying guidelines for the definition of system performance.

It would be grossly inaccurate and unfair to imply that modern research and development management is oblivious to these matters. Like environmental impacts, service qualities have become an integral element of transportation analysis. Indeed, looking at the program of this conference, I was struck by the variety of meanings attached to the term "dual-mode transportation" and the broad interpretation given to it by the paper selection committee. Side by side with papers on the futuristic technology of automated dual-mode concepts, one finds a number of papers dealing with nothing more mysterious or technologically sophisticated than the bus in an exclusive lane. I was fascinated to note that even the use of bicycles in combination with rapid transit has qualified in the minds of the author and the paper selection committee as a legitimate dual-mode concept!

Of course, I was wrong to use the expression "not sophisticated" when referring to the busway concept. On the contrary, viewing the bus in an exclusive lane as a dual-mode system represents highly sophisticated thinking. For it indicates the ability to distinguish between technology (input) and service (output). It shows a grasp of the true meaning of dual mode as a service concept rather than a particular combination of guidance, control, and propulsion.

This approach to transportation analysis has some interesting consequences. It says that by varying certain parameters, such as vehicle size, headways, cruise speed, network coverage, and system operating policies, any given technology can be made to provide different levels of service, costs, and environmental effects. And conversely, that different technologies can offer similar levels of service. Thus, an automated guideway system with intermediate-sized vehicles operating in a pre-scheduled mode behaves from a service standpoint more like a light rail transit system than like a true PRT system. Similarly, multiple dial-a-ride installations could simulate at least some of the service characteristics of a PRT system.

This observation has more than just academic implications. It suggests that the initial testing of new, high-risk transportation technologies might perhaps be satisfactorily accomplished with the help of surrogate, lower cost technologies. For example, an express bus proceeding on a busway from an outlying suburb to the fringe of the downtown district and then operating flexibly on

local streets could be used perhaps to simulate to some degree the service characteristics and dual-mode behavior of the more advanced automated guideway concepts. And similarly, could we not use the bus rapid transit concept to model some of the service qualities of a subway and thus obtain valuable evidence as to demand generation, land use impacts, and the like in advance of the decision to invest in a rail system?

The potential of using such surrogate demonstrations as part of staged strategies to implement high-capital or high-risk transportation systems has been largely overlooked. Let me simply suggest that this approach merits some attention.

Focusing on the service issue is an important requirement of effective research and development planning. But to some extent it simply begs the question. For it leaves unresolved two important matters: What should be the level-of-service objectives for new technology? Who is to define them?

All too often the formulation of new system service objectives is left by default to the research and development community. I do not think that this is necessarily bad. But I have yet to understand the process by which these objectives are arrived at, and I have been struck by the close coincidence that exists between these objectives and the engineering performance targets the research and development team wishes to see attained. I suspect, in other words, that there is a large element of self-fulfilling prophesy in this process: that the level-of-service parameters are more often than not defined not by any externally identified "needs" but by the desire for technological virtuosity. The issue, as I see it, is, Should technology lead or respond? I, for one, would venture the opinion that in a public sector with high social content—such as the transportation sector—technology should seek to adapt to the needs rather than vice versa.

I do not intend this in any way as a vote of nonconfidence in the research and development profession. Nor do I mean to imply that the technologists are somehow less qualified than others to participate in setting national technological priorities. But I do believe that the identification of unmet transportation needs can be done more effectively at the local level: that local planning bodies, transit operators, and local officials are in a much better position to perceive and articulate the latent transportation needs and desires of their communities than are the research and development analysts—or those in the federal bureaucracy for that matter. Urban areas should play an active role in identifying gaps in transportation service and in setting out service requirements and priorities for new transit technology. What I am suggesting, in short, is that local government and the transit industry should become active partners in shaping a national policy for research, development, demonstrations, and implementation.

Let me finally turn to a third issue, which, for want of a better definition, I will call the ultimate system syndrome. There is simply no valid reason why a single system or a single technology must dominate an entire metropolitan area. And yet, this is often the consequence of our present master planning for areawide transportation solutions. Too often, in our desire to bind an entire metropolitan region closer together in order to enhance its economy, we are drawn into considering vast, monolithic transportation systems. Yet we all know that no one single mode and no corridor transit system of whatever technology are able to satisfy the many travel needs within and between the many local neighborhoods and communities that make up a large metropolitan area.

I trust that those of us who wish to carve out a future role for new systems will take this lesson to heart and will learn to think small. The real challenge before us is to know not how to design the biggest new system with the widest possible area coverage but how to begin modestly and how to introduce a system that will evolve gracefully over time, ensuring compatibility and flexibility in the long run, and demonstrating progress in the near term.

For example, many cities have short corridors in their downtown areas that could justify some kind of an automated guideway shuttle today. Why not be content with such modest opportunities? As operating experience, confidence in the performance of the system, and public acceptance grew, the line could be extended and some connecting segments built. Progressively, the system could expand, generating additional ridership and public support. Eventually, through a period of years, a full, areawide PRT network could emerge.

Such a time-phased, staged, incremental approach to implementation is particularly applicable to new systems for which the uncertainties are especially large, but it is also relevant to any new, large capital investment in transit. We do not know the future that well to set in concrete or steel or electronics all of our options for public transportation at this time. Why don't we begin more modestly, with transit system elements and services that we can both justify and afford and, learning while we use them, generate public support and patronage for expanded, more ambitious systems? To me this represents a more sensible and a more realistic strategy for new system implementation.

If I have sounded a note of restraint, it is not because I do not believe in new systems but rather because I want to be sure that they are in a position to succeed. There is a real danger that, unless we proceed with caution, the acceptance of new transportation technology will be greatly curtailed. That, in my opinion, would be a most unfortunate development, for in the long run new systems offer the best hope of combining improved mobility with an improved urban environment.