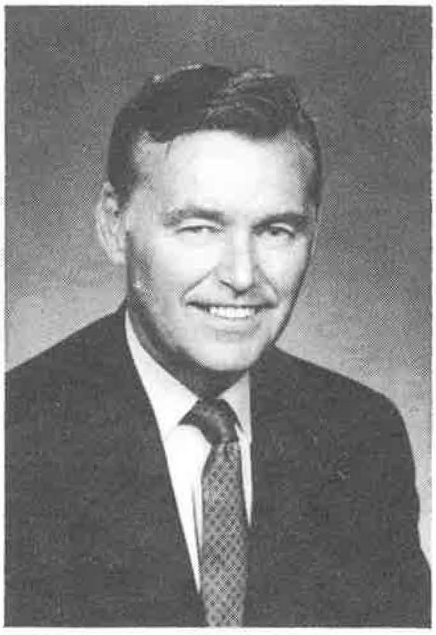
Finally, cost is a major issue associated with all technologies and applications. The savings and benefits gained from implementing customer service systems must be examined and documented. Savings in terms of improved bus predictability, improved scheduling, enhanced customer information, increased off-peak ridership, and more equitable fare structures may all be possible. If these can be documented, it may lead to increased acceptance by policy-makers of the initial capital expense of some technologies. The potential of charging customers for enhanced transit information was also discussed, although there was not agreement on the feasibility of this approach.

A number of activities were identified for possible future TRB involvement. First, providing a realistic state-of-the-art assessment of the feasibility and cost-effectiveness of different technologies was identified as an important activity. This included an analysis of the benefits associated with the different projects and the issues involved in implementation. It was also suggested that TRB could play an important part in focusing on the bigger picture of integrating transit and traffic management systems. This will help provide individuals with a whole range of transportation options.

It would also be appropriate for TRB to further examine the needs of transit customers and provide market research tools to transit operators. Finally, examining the institutional barriers associated with implementing different technologies and identifying ways to overcome these is a very timely research need. These may include public/private issues, bank acceptance and involvement in fare payment methods and smart cards, privacy, and the barriers associated with different public agencies working together, especially highway and transit groups. TRB can play an instrumental role in assisting to identify these issues and approaches to resolving them. Developing research tools, synthesis reports, and providing other information would be of value.

Overall, the workshops in this track provided a wealth of information on the state-of-the-practice and on projects in the planning stage. The interest and enthusiasm shown by the speakers and members of the audience provides an indication of the high level of interest in this area. I hope the conference has stimulated your thinking and provided you with new ideas.

Facility Operations and Vehicle Technologies



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My task was to follow the workshop track on Facility Operations and Vehicle Technologies. I would like to provide a historical perspective on technology development in transit, examine some of the major elements covered in the workshops, and summarize what all this may mean for the future.

The story of the impact of technology on urban and public transportation is well known. A technological evolution has been occurring since the first horse-drawn carriages were used in the 1700s. This evolution included changes in propulsion, guideway design, speed characteristics, and vehicle configuration. Technology changes associated with all these elements have

radically influenced our ability to transport people and goods.

The major technological milestones include cable-driven cars, steam and electric railways, and the invention of the automobile, bus, and truck. All of these had major impacts on the shape and form of our communities. Further, each of these changes, modifications, and technological innovations was based on a desire to change the way things were currently being done, to improve on the status quo, and develop new markets. They were the product of people's imagination, persistence, curiosity, and intellect. The success of these technologies was based on their ability to beat the competition and to establish new markets based on their unique characteristics. To replace an existing technology, the new technology had to provide better service and greater reliability at a cost the public would accept.

The motivation to improve technology is still strong. This motivation is based on the same concerns as those previously mentioned. Other motivating factors are also present today, however. These include maintaining our competitive advantage with other nations, improving air quality, limiting energy consumption, improving safety, reducing congestion, and enhancing mobility.

The process of developing a new technology, whether it is a simple device or a complex system, follows a logical process that includes a number of elements. First, the problem or need must be identified. Second, facts and information must be gathered and assembled relating to the problem. Establishing the criteria that the new system should meet is also important. Identifying alternatives and evaluating them against the criteria is a critical step. This is followed by the production of a prototype, demonstrating and evaluating it, and redesigning it if necessary. Finally, the last step is to introduce the product into the market.

A variety of papers and presentations at this conference focused on aspects of this technological development process from various viewpoints and at all stages. They covered a wide spectrum of topics, technologies, and stages of development. Some were at the idea stage, while others had been tested and evaluated.

Five general areas were covered in the workshops in this track. These included the use of MAGLEV technologies for high-speed ground transportation, alternative fuels, technologies to assist in meeting the requirements of the ADA, low-floor buses and other new bus concepts, and new vehicle guidance technologies. A total of 21 papers were presented at these five sessions. The speakers were all excellent and clearly demonstrated the interest, commitment, and enthusiasm of the modern day agents of change. I will not try to summarize each of the presentations, as you will have the opportunity to review them in the conference proceedings.

I would like to briefly summarize the focus of each session, however. The workshop on MAGLEV examined the current studies underway to assess the potential for MAGLEV technology in the United States. Although MAGLEV has been considered an alternative mode for high-speed ground transportation since the 1960s, there is currently renewed interest. There are a number of corridor studies underway in this country and both the Germans and Japanese have developed prototypes.

MAGLEV is a high-speed transit mode, capable of operating at up to 300 miles an hour. It is a competitor to air travel between cities in densely populated corridors where airport demand and boarding times are excessive. Current studies are examining corridors where MAGLEV may be competitive with other modes and may provide a realistic alternative.

A study now underway is examining this question and a report to Congress should be available soon. Some of the issues being considered are the guideway costs (which represent 80 percent of the total investment), traffic demand, financing potential, noise problems, human factor elements, and a variety of other technical and financial concerns. A MAGLEV demonstra-

tion in this country may be possible at some point in the future.

The second workshop in this track examined alternative fuels. A number of state and federal programs are focusing on the use of cleaner fuels as alternatives to diesel. Many areas are working on a variety of approaches to reduce pollution levels from cars, trucks, and buses. Transit vehicles are strong candidates for alternative fuels because of their constant use throughout the day, stop-and-go movements, and the use of common routes. In addition, transit is easier to regulate since most service is provided by or under contract to public agencies.

The alternative fuel technology options are relatively well known. They include retrofitting diesel buses with particulate traps and using alternative fuels such as ethanol, methanol, compressed natural gas (CNG), liquified natural gas (LNG), and propane. Demonstrations and additional operating experience are needed with all these alternatives.

The experiences with the use of alternative fuels in different areas of the country were discussed in the workshop. Under the Alternative Fuels Initiative program, FTA has awarded 60 grants that encompass 938 alternatively-fueled vehicles. Of these, 395 are CNG-fueled vehicles, 10 use LNG, 139 are methanol, and 177 are ethanol. Presentations were made by representatives from New York, Los Angeles, Houston, and Ontario. Electric vehicles were also discussed.

The use of alternative fuels is a complex issue and an area that is not easily summarized. One interesting presentation, worth noting was on the Houston METRO liquified natural gas program. The use of LNG is not as common as other alternatives. Part of the Houston program is motivated by the potential market for LNG, should it prove to have significant advantages over other alternatives. Favorable attributes of LNG cited by supporters included the weight and size of the fuel system, safety, emission levels, cost, domestic availability, on-site storage, and fuel quality.

The third workshop session focused on the application of new technologies for the disabled. Several basic concepts are important in developing transit-related technologies to meet the needs of this group. First, technology should deal with all aspects of the trip. Second, technology should promote self-reliance on the part of the traveler. Third, technology should be designed for the upper percentile of the user group and should integrate persons with physical, sensory, and cognitive disabilities.

Technological applications in this area should focus on four goals. These are to improve mobility, to facilitate information, to improve communications, and to assist in transportation control. The ideas being considered include wheelchair tiedowns, ramps, smart kiosks, talking bus stops, touch screens, menu-driven information, and telephone information systems. A catalog of ideas was presented in a matrix representing the five elements of the trip: understanding the system, accessing the correct vehicle, entering the vehicle, traveling on the vehicle, and departing the vehicle.

A variety of proposals and programs were discussed during this workshop. Key points made during the presentations included the need to test different options and alternatives and the importance of training, communication, user understanding, and standardization. Many ideas are not all that high tech; existing technologies may fill many of the needs in this area. In the past, the needs of the disabled may have been given a low priority. With the ADA, this can no longer be the case.

Two presentations focused specifically on platform safety in fixed-guideway systems and securing mechanisms for wheeled mobility devices. Both of these focus on the development of a better system that is more responsive to the needs of all travelers. The technology is available for making improvements in platform safety. The question is, How well do the different technologies work and what are the costs associated with the different alternatives? For example, a new concept for securing wheeled-mobility restraints was designed, built, and

tested using a process based on customer requirements. This included a lengthy process to understand the needs of the users and designing a system to meet those needs.

Technology changes associated with transit vehicle design, especially those relating to wheelchair passengers, provided the focus for the fourth workshop. Instead of using wheelchair lifts, lowering the floor of transit vehicles is being examined in some areas. This approach benefits all user groups by speeding the boarding process, improving access for all riders, and saving energy due to reduced vehicle weight. However, required clearance for the underside of vehicles has prevented the widespread use of many low-floor vehicles. Changes in vehicle mounting technologies may have eliminated many of these barriers. The session reviewed the status of the development of low-floored vehicle technology. Programs in Europe and Canada were presented and discussed. The Federal Transit Administration is initiating a new low-floor technology development program.

The final session focused on vehicle guidance technology. Two very different approaches were presented. The first addressed automated people movers and the second examined the electric trolley bus. Both of these technologies have been used in the past. People mover technologies were developed and a few tested in the 1960s and 1970s. There was widespread use of these systems for a variety of reasons. People mover systems have been implemented in downtown Detroit, Miami, and Jacksonville, and more are in use at airports and amusement parks. All these systems tend to be short, single-line loops. There is still considerable interest in people mover technologies as can be seen by the upcoming fourth national ASCE-sponsored conference.

The electric trolley bus is another technology that is currently experiencing a revival. This is a proven technology that is less polluting, quieter, and has a longer operating life than other alternatives. Trolley buses do have less flexibility, however, because of the overhead electric wires. Los Angeles has decided to "go back to the future" and utilize this technology to address air pollution concerns. Other areas are also developing new or expanding existing electric trolley bus systems.

To summarize, I think it is clear that these are exciting times for public transportation. The opportunities offered through the application of new technologies are unlimited. More research and development is needed to fully realize the benefits. The support of FTA and an expanded R&D budget are critical to the successful application of these technologies. A wide range of topics and applications was addressed in the workshops in the track. The use of these advanced technologies can have a major impact on the quality of transportation services in the 21st century.

Just as our predecessors worked diligently to improve the transportation system that existed when they were alive, our challenge is to continue to improve all aspects of the current transportation system. It has been a pleasure to be part of this excellent conference and I commend each of you for the part you play in improving our world through research. Thank you.