

## TRANSPORTATION RESEARCH AREAS

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One of the problems in the transportation research field is the lack of bibliographies on particular fields of research and the lack of source data from specific sites.

Some of the organizations that have excellent transportation research libraries are the Urban Mass Transportation Administration (UMTA), American Transit Association (ATA), Institute of Traffic Engineers, and Highway Research Board. The research libraries of many colleges that have transportation curricula also are available.

One document that lists all of the research projects that have been or are being conducted by UMTA is the Directory of Research, Development and Demonstration Projects.

Although ATA keeps statistical data on the operations and many facets of transit system activities, it is frequently difficult to compare the data among the many systems because of the following local and operational characteristics: topography, weather, labor, equipment age, operational policies, population density, local politics and laws, public and private cooperation, subsidy and tax considerations, and public support.

### RESEARCH AREAS

The following sections list and briefly describe some of the research subjects that have been given various degrees of consideration in the recent past. Suggestions for research are also given. The subjects are divided into 3 categories: operations, human factors, and equipment. Many of the subjects discussed could apply to more than one category.

#### Operations

There has been some research made of existing senior-citizen reduced-fare systems, including the following areas: means of determining eligibility, providing identification, use of weekly or monthly senior-citizen passes, standard procedures for allocating periods of day when senior-citizen reduced fares are not operative, effect on the senior-citizen ridership by hours of the day, total increase in ridership of the system, total deficits incurred by adoption of the senior-citizen reduced fares, means of subsidizing such fares, acceptance of subsidizing such fares by the general public and municipal officials, and socioeconomic aspects of the senior citizens.

Some researchers have indicated that the way to make transit more attractive is to speed its operation in downtown service. Because bus traffic speed is normally limited by the flow of other traffic, one of the few areas that might be improved is the loading and discharge speed, which currently averages 3 seconds per passenger. It has been estimated that a 1½-second per passenger loading and unloading speed would be needed to cut 10 percent of the total trip time of bus routes. One means of approaching this might be a more rapid handling of fares, which might include automatic fare collection.

The most equitable method of developing zone fares, including their effect on passengers and their cost-effectiveness, has been studied.

Kent University and the Mitre Corporation have studied the technique and method of developing hardware that will measure the length of a ride and establish a price depending on distance traveled for surface transit vehicles. This hardware should also count the passengers.

Further study should be made of the different means of using transit information systems both at individual bus stops and at transit station transfer points. This would include making available to the public at bus stops information pertaining to bus routes and schedules. A more complex type of information system, including the use of changeable message signs, warrants consideration and further research.

The use of telephone answering information systems in transit operations should be studied. Many complications are inherent in transit information systems. There should be studies made of transit telephone operators, telephone company information operators and management, and the general public with regard to the types of information they want and the restrictions that they would be willing to accept to have a more sophisticated and completely informative transit information system.

It is possible that a computer-oriented transit information system could be voice-actuated (in part) if potential passengers were trained to make a 1- or 2-word initial response to preprogrammed questions asked by the computer answering system. The results of this initial question and response would automatically tie the caller to the person or recorded voice that could supply the desired information most efficiently.

There needs to be more study made of vehicle cleaning and maintenance. The number of personnel, their responsibilities, wages, and duties, and the types and methods of cleaning should be determined.

Specific cleaning procedures need to be established, and vehicle parts that require maintenance and cleaning need to be identified. The procedure would include the following: wet-cleaning, vacuum-cleaning, waxing, material repair, and repair of vandalism. Vehicle parts that require care include the floor, walls, ceiling, seats, and stanchions.

Northeastern University has studied the quality of supervision in the transit field. Because many transit operators and mechanics become supervisors (based on longevity of service), there is a need for training programs that instruct new supervisors on how to deal with subordinate employees.

Although some work has been done by ATA on training needs, very little has been done on the best means of motivating mechanics and establishing a certification program that would be acceptable to the strong transit unions.

The Ottawa Transit System has done some excellent work in establishing an average time allotment for specific types of mechanical work. At the same time it has increased productivity and maintained high employee morale. A study of how this can best be done and how it has been attempted at other locations might be very helpful.

ATA has submitted a proposal to UMTA entitled FARE, an acronym for Financial Account and Reporting Elements. This proposal was not aimed entirely at requiring all transit systems to follow a particular single accounting system. Its purpose was to find the elements of the different types of accounting systems that would require least modification to provide absolutely uniform systems where necessary and provide rules of thumb for changing data in other types of accounting systems so that they can be interpolated with the standard system.

Several research projects pertaining to scheduling have been carried out by UMTA. An analysis of whether any of this computer-oriented work is actually related to the operational and human elements of providing bus service would be helpful. Various studies have been made of bus shelters, busways, bus lanes, traffic signalization, and street closings and malls. More work needs to be done in these areas.

There is need for a study of the procedures that can be followed to provide a truly intermodal region-wide transportation system. In Hamburg, Germany, there has evolved a system in which the fares, operations, schedules, and all aspects of the region's transportation systems are under one administration. Thus, there is a high level of scheduling cooperation among the several modes of transportation in the Hamburg area.

One of transit's largest problems is its high labor costs, which average 60 to 80 percent of all operating costs for the average transit system. Except for the 3 or 4 peak-ridership hours of the day, bus and rail service is generally maintained at a low level, and as a result there is a great deal of unused labor during most of the day. Although there would be many labor union problems to surmount, an obvious means of providing a more efficient utilization of manpower would be a more diversified use of the men and equipment during the nonpeak hours of the day. For example, in Switzerland transit vehicles carry the mail. Two major problems that would occur in the United States are the effect of competition with private enterprise and the labor unions' resistance to such a program.

### Human Factors

A bibliography and analysis are needed of commuter motivation publications that concern the conscious and subconscious means of motivating people to use mass transit. Some ideas that might be helpful in motivating the public to use transit are as follows: transit is cheaper, transit use is a civic duty, transit is safer, and transit is more convenient.

There are various human factors areas that need further study. Several suggestions for studies are as follows:

1. Determining how to measure the impact and cost-effectiveness of promotional work,
2. Studying the cost that employers incur by providing parking facilities for employees as opposed to paying transportation costs,
3. Studying the merits and feasibility of employers providing employees with free transit passes,
4. Determining the cost and convenience of automobile versus transit use in metropolitan areas,
5. Compiling a bibliography of and analyzing previous studies concerning transit subsidies,
6. Compiling a bibliography of and analyzing previous studies concerning automobile subsidies,
7. Completing the UMTA directory of research projects,
8. Summarizing and analyzing the results of the YOPHU (young, old, poor, handicapped, and unemployed) projects,
9. Compiling a bibliography of and analyzing articles related to noise created by transit vehicles, and
10. Studying vandalism and developing passenger security projects.

### Equipment

Studies concerning improvement of bus design are being made by General Motors, Rensselaer Research Corporation, and Booz-Allen. There may be merit in undertaking a study of the cost to both public and private transit systems of a newly designed bus insofar as the initial purchase funds are concerned. This study would relate to a newly designed bus if it cost 20 percent more than buses currently on the market or if the cost was 100 percent more than current prices.

A study should be made of the optimum economical life of each type of transit vehicle—rapid transit, car, and bus—taking into consideration the effect of capital, operating, and maintenance costs and the vehicle life on the marketability of transit.

A bibliography and analysis of the current state of the art in bus propulsion systems should be undertaken. This research would include the cost, principal characteristics, and effect on ecology of such systems.

A bibliography and analysis of the cause, prevention, and extinguishing of tire fires are needed at this time.

A bibliography and analysis of the state of the art of automated vehicle monitoring systems (as concerns their use as bus and rail transit vehicles) would be desirable. UMTA is currently responsible for some research in this area.

The effect of the introduction of the metric system on the transit industry should be studied. A bibliography and an analysis of existing articles on this subject might be helpful.

Railroading and all of its many fields of knowledge in the transit industry have rarely been recorded in textbook fashion and not at all recently. A bibliography and analysis of all existing texts in the following areas of rail transit would be very helpful: power and signals, way and structures, operations, and car equipment.

Recent retirement rules at some of the major rail transit properties have hastened the early retirement of the most knowledgeable senior employees. Much knowledge has been transferred from supervisor to employee over the years, but very few texts have attempted to record any of this knowledge.

A bibliography and analysis of all articles and publications in the field of harmonic vibrations and wheel spalling might be quite helpful. A proposal has been made for such a study, but no current research is under way. UMTA's Pueblo, Colorado, test track and testing facility may be ideal for testing some of the vibrations and other conditions found when steel wheels meet steel rails.

The subject of uniformity versus free enterprise is currently a controversial topic in the transit industry in several areas. For example, the San Francisco Muni recently received bids for new streetcars of a very sophisticated and modern nature. The bid prices reflected a cost in excess of \$500,000 per car. This amount is too expensive if streetcars are going to be competitive with buses. One solution might be a standard streetcar that the remaining streetcar properties would have to use in order to obtain Federal Capital Grant funds. Thus, any manufacturer could bid on the standard plans, and the components for the Boston streetcars would (generally speaking) be compatible with those for streetcars in Toronto or Philadelphia. Thus it would also be possible for Philadelphia, Boston, and San Francisco to bid for streetcars at one time, which would produce substantial savings generated by the ability to produce a large number of vehicles by a single manufacturer.

A bibliography and analysis of the literature on tunneling would be helpful to transportation personnel.

There is a need for a bibliography and analysis of the current state of research on the subject of guideways and people movers.