Abstracts of Papers

COMPARISON OF DUAL-MODE TRANSIT SYSTEM WITH VARIOUS TRANSIT BUS OPTIONS

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The annual costs and level of service of a dual-mode transit system (DMTS) are compared with those of exclusive busway bus (EBB), exclusive busway with small bus feeder (EBB/SBF), expressway bus (EB), and conventional bus (CB) systems. Large- and small-bus versions are studied. The systems, defined for Milwaukee in 1990, all provide the same capacity and routes. The Milwaukee Dual-Mode Study base-line data are used. Trip time and transfer characteristics are used as measures of level of service. Construction of busways and creation of reserved lanes increase vehicle speed that, in turn, increases driver-vehicle productivity and decreases travel time. The use of small buses allows for shorter headways, more privacy, and demand-responsive service. But small-bus operations are not economical unless automated operations are used. Transfers may have an unacceptable effect on the ridership of the exclusive busway and small-bus feeder system.

The small-bus dual-mode system and large-bus exclusive busway system are the two most comparable systems: Annual cost of the busway system is 21 percent less, but ridership is expected to be 17 percent lower than that of dual mode because the dual-mode perceived trip time is 27 percent shorter. The busway system can be provided at the lowest cost, and implementation does not involve the large capital investment and construction impact. However, the busway system is only practical in cities with extensive freeway networks and provides an unfavorable cost growth characteristic.

NATIONAL POTENTIAL FOR URBAN DUAL-MODE SYSTEMS

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This study determined that 44 urbanized areas accounting for 68 percent of the 1990 urbanized area population are potential candidates for urbanwide dual-mode systems. These numbers in themselves would appear to justify further research and development (funded by federal and other sources) of dual mode. However, if the various constraints and assumptions used in this analysis were relaxed or changed, the potential market for dual mode would expand considerably. For example, if the constraint of urbanwide service with a specified access time were relaxed, the list of dual-mode candidates would expand to include areas with a need and ability to pay for corridor or limited-area circulation systems. A different definition of the size, composition, and operation of the dual-mode vehicle fleet would likewise enlarge the dual-mode market. Perhaps the most far-reaching change in assumptions would be a statutory revision permitting a higher federal contribution to transit project costs. If, for instance, the federal government's share increased to 90 percent, even the small urbanized areas with relatively limited fiscal capabilities could consider dual mode as an alternative transportation system. Since, then, the potential market for dual mode is even larger than that specifically identified in this study (i.e., more than 68 percent of the urbanized area population), it is considered that there is a strong case for continuing to explore the various technological, economic, and social issues related to dual mode.

PALLET RAIL-CARRIER DUAL-MODE TRANSPORTATION SYSTEM

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One solution to urban transportation problems incorporates a pallet type of rail-carrier dual-mode transportation system. This system is technically feasible and incorporates a fully electrically propelled and controlled pallet rail-carrier vehicle applying ac drive with eddy current clutch and brakes. Present manual mode components of automobiles and buses require limited interface equipment to operate. Automated-mode rail carrier permits speeds as high as 96 to 192 km/h (60 to 120 mph) and is applicable as a means of transportation in urban centers as well as between cities and cross country. Pallet rail-carrier dual-mode systems open the possibility of transforming present automobiles and buses into battery-powered units for electric propelling, which will help reduce considerably the hydrocarbon and nitrogen oxide pollution as well as assist in fossil fuel conservation. The rail system guideway also permits automated operation of rapid transit vehicles or incorporates other mass transit systems with limited additional cost.

Ferrying container cargo between cities or across countries could be performed within the system moving at the same high speeds resulting in an economical and effective distribution system throughout the country.

TOWARD DUAL-MODE USE OF BICYCLES IN PUBLIC RAPID TRANSIT

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It is time to begin using the bicycle as a basic part of the transportation system of the United States. The need for improved public transportation is increasing daily. Because of time delays and funding limitations only a small part of this need can be met by completely new systems and guideways within the next 10 years. With a number of inexpensive changes the capabilities of the bicycle for short trips can be combined with those of existing (or new) public transit systems for longer trips. If a bicycle could be taken aboard public rapid transit, the speed, comfort, and safety of the transit vehicle could be combined with the versatility, energy efficiency, and door-to-door convenience of the bicycle. A car would then be necessary only for some trips, and the need for more than one car per family would be reduced. In this work the facilities and hardware needed for carrying bicycles on buses, planes, trains, and ships are discussed. Results of a bicycle-bus-trailer transportation study sponsored by the California Department of Transportation are presented, including demand analysis, prototype hardware, and operational experience.

CRUSWAY

Paul W. Howells, Edwin H. Lederer, and Robert N. Lothes, Syracuse University Research Corporation

CRUSWAY is a simple dual-mode transit system as personal and as convenient as the automobile. It has the capacity to handle downtown traffic and yet is cheap enough for network coverage in the suburbs. Highlights of its features and performance are as follows: (a) way—elevated, enclosed, continual flow; (b) vehicles—minicars to bicycles, personally owned and driven; (c) user spectrum—senior citizens to school children; (d) network spacing—1 to 2 blocks in the center city and 2 to 4 blocks in the suburbs; (e) trip speed—24 to 32 km/h (15 to 20 mph) compared to 16 to 32 km/h (10 to 20 mph) for the urban automobile and 11 to 16 km/h (7 to 10 mph) for bus or subway; (f) capacity—7200 vehicles/hour in a 2.4-m (8-ft) way compared to 4000 vehicles/hour in a 6-lane street; (g) cost—$312 500/km ($500 000/mile) or 5 to 8 cents/passenger-km (3 to 5 cents/passenger-mile) with above network spacing; (h) fuel economy—about 210 passenger-km/liter (500 passenger-miles/gal) of fuel at the power station; and (i) noise and pollution—negligible. Because it provides a service like that of the automobile with far better economy, CRUSWAY has the potential to attract most urban travelers and ultimately to eliminate the automobile noise, pollution, and congestion in cities and to reduce our national oil consumption by about 30 percent.

DUAL-MODE TRANSPORTATION: AUTO-TRAIN AND BUS-TRAIN

David R. Miller and William H. T. Holden, Daniel, Mann, Johnson, and Mendenhall

Dual-mode vehicle transportation systems of the auto-train and bus-train types are those systems in which one vehicle, adapted for highway use, and so used at one or both ends of a trip, is carried for an intermediate portion of the trip on another vehicle, which in this case is a railroad car designed for this use. These systems are of two types—those adapted to carry passenger automobiles, described as auto-train systems, and those adapted to carry buses and described as bus-train systems. There are two types of auto-train: those for long-haul trips of several hundreds of kilometers in which passengers ride in other passenger cars of the same train and those for short-haul service in which passengers remain in and ride in the automobiles. Bus-train services are adapted to some special classes of service: airport access, commuter service, and possibly moderate-distance interregional travel. The short-haul auto-train is principally of value as a means of traversing a natural barrier, such as a mountain range or a body of water. Auto-trains may also have carrier cars of the bus type in their consist, as well as carrier cars for trucks. The auto-train and bus-train applications of dual mode offer potentials for competitive types of service for both long- and relatively short-haul trips. There is an obvious weight penalty per passenger when a road vehicle containing the passengers is carried on a special railroad car. But under certain conditions, especially those requiring the availability of the automobile at both ends of the rail link, these systems offer capacities greater than those possible with purely highway systems, and also higher speeds. The latter should offset loading delays. Bus-train operation similarly has the weight disadvantage, but provides a one-seat ride and can also take passengers to destinations not on rail lines. It may also permit passengers to be transported in a freight mode of rail operation. In each of these applications, the ultimate criterion is economic: the ability of dual mode to provide competitive service. In particular, dual-mode applications of this type may offer potentials for service in situations where it could not otherwise be provided.

ESTIMATING THE LABOR SAVINGS IN A DUAL-MODE TRANSIT SYSTEM

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Dual-mode transit systems will be less labor intensive than nonautomated bus operations because a large percentage of the average trip will be made on an automated guideway. The theoretical labor saving is given by the ratio (on-guideway travel time)/(total travel time), but the practical saving will be somewhat lower because of unavoidable inefficiencies of vehicle and driver scheduling. To determine the practical saving achievable, data from the 1971 Milwaukee County Dual-Mode Systems Study were used as input to computer programs to cut and schedule runs to produce driver schedules consistent with vehicle schedules and labor agreement requirements. A practical saving of 58 percent could be obtainable for a case in which the theoretical saving was 66 percent.