CHAPTER 4

Implications of Trolley Bus Installations

Issues of economics, the environment, system design, and operations that relate to applications of the trolley bus mode were dealt with in four papers prepared especially for the Seattle workshop. Trolley bus systems were shown to be attractive for applications in which fuel considerations, environmental concerns, topographical factors, and ridership are of primary importance. These elements, coupled with technological developments, have prompted renewed interest by urban planning and transit officials in the trolley bus mode.

ECONOMICS

Carl Natvig of the San Francisco Municipal Railway not only explored the economics of the trolley bus state of the art but also summarized the economic history of the trolley. Several major themes were detailed. Probably the most important is that the economic justification for trolley electrification does exist today. This conclusion matches that of the Urban Mass Transportation Administration's Task II report on electrification feasibility--a report that deals with the potential market, capital, operating costs, impacts, and barriers related to trolley expansion. The economic justification is particularly important if, for a variety of reasons, transit installations of a major type are viewed as long-term investments.

Trolley systems have a relatively long life. The overhead wire and power supply equipment are by nature long-lived; support poles and underground feeder cable conduits can last almost indefinitely with proper maintenance. The trolleys themselves last longer than comparable motor buses, and other components such as overhead switches and rectifiers can last from 35 to 70 years depending on the density of operation and the degree of maintenance.

There is a high initial cost, it is true, but early returns on the capital investment that are initially low give way to increases in subsequent years. These increases can be substantial. By taking the long-range view, the benefit is maximized.

A second major assertion is that there was probably never a real economic reason to discontinue the nation's electrified bus systems. There was in fact no economic necessity for major trolley abandonments as occurred in the 1950s, 1960s, and 1970s in the United States. Long-term profitability and long-term service to the public were not the primary concerns of the privately owned systems in the 1950s and 1960s. However, when faced with economic collapse, they opted for abandonment whatever the long-term consequences might be. Where systems were maintained, economic collapse did not occur any earlier.

Finally, some of the major economic advantages of the trolley bus were identified: the lower maintenance cost of the vehicle, the longer life of the bus, the longer life of the electrical system, and the lower power cost for the trolley compared to that for the motor bus.

Two issues were raised that bear on the future directions of the trolley bus. The first is that trolley system operation may attract additional patrons. Cited were reports of increased patronage when the streetcar systems were converted to trolley bus operations in the 1930s, as well as data from San Francisco. Second was the issue as to whether platform savings can be realized from electrification. It has been asserted that superior acceleration of the trolley bus enables it to operate a given route, particularly one over hilly terrain, with a faster schedule and hence a lower cost.

ENVIRONMENT

Bo Persson of the National Swedish Environmental Protection Agency summarized the current status of environmental knowledge concerning trolley bus operations in urban areas. (Persson's paper was presented by Alonzo Wertz of the Tri-Met Transit Development Department, Portland, Oregon.)

The trolley, as a system, is a strategy that can help in the control of air and noise pollution in urban areas. Although diesel buses are only a minor source of air pollutants, the electrification of bus routes tends to be particularly effective in reducing further air and noise pollution on congested downtown streets where there are concentrations of people and vehicles in what are, in effect, canyons formed by narrow streets and tall buildings.

Some important new findings based on recent research in the United States, Japan, and Sweden showed that the use of the Ames test, which involved the exposure of salmonella virus to active substances, indicates that there is a high comparative mutagenic potential from diesel engine exhaust emissions. It was also noted that the high concentration of oxides of nitrogen in the exhausts of heavy-duty diesel engines contributes to possible carcinogenicity of diesel exhaust. The active nitro-aromatic compounds present in diesel exhaust are more likely to be formed by modern turbo-charged diesel engines than by older engines.

Visual pollution of intrusion is probably the trolley bus system's biggest disadvantage. However, careful planning and environmental design can alle-

viate much of the problem. Overhead wires can be toned down by landscaping techniques, for example.

Three areas are identified in which there is a need for more information on the environmental impacts of trolley buses: first, the content of toxic agents in diesel exhaust, especially the emissions of mutagenic substances as well as the emissions of such substances that could form mutagens in the urban area; second, activities on the dilution of diesel exhausts in the street environment and measurements of diesel exhaust components in areas affected by diesel buses (e.g., bus-only streets or near bus terminals); and, third, how individual doses of exposures to diesel engines could be used as a method to quantitatively evaluate various policies relative to the introduction of trolley bus operations.

From the environmental point of view, the introduction of trolley systems in large cities could have important positive effects. The trolley represents an attractive alternative to the conventional diesel bus without the noise and diesel exhaust disadvantages.

OPERATIONS

Llew Lawrence, Director of Operations for the Edmonton Transit System, stressed the importance of putting the passenger first in the design and operation of transit systems. From this basic principle were derived the desirability and importance of a trolley operation as part of a comprehensive transit system. A status report on trolley bus operations in Edmonton identified in particular the return to full operation of the trolley system after a lapse of some years due to a lack of rolling stock. With the recent introduction of the new BBC fleet of trolleys--basically a modern electrical plant in the standard GM "new look" bus body--complete electric operation has returned.

The importance of using the trolley bus for heavily serviced areas such as city trunk-routes was stressed. The relationship of trolley bus operation to the development of timed transfer focal points in Edmonton was also examined. In particular, reference was made to the Jasper Place timed transfer focal point--truly a development that broke new ground in North American transit operations. Edmonton also plans in the future some minor system extensions, the upgrading of overhead lines, and the retraining of bus operators to refresh their trolley driving skills. Possible major electrification of certain routes is being considered.

The notion of inflexibility was raised as a positive attribute that can be used by the transit system to stave off requests for special off-route deviations and requests for other than the fixed-route services that transit systems ought to be providing for the benefit of all of their passengers.

The concept of teamwork as a requirement of trolley operation was identified. A parallel was drawn between railway operations, which require considerable teamwork and coordination among the operating staff, and the trolley bus system, which, unlike the diesel bus system, requires a lesser degree of coordination and teamwork in order to operate effectively for the benefit of the passengers. The primary question here was whether or not the introduction of trolley bus operations can be of some assistance in restoration of morale and a sense of shared purpose among the operating staff.

SYSTEM DESIGN

Thomas G. Matoff, Director of Transit Development for the Tri-County Metropolitan Transportation District of Oregon (Tri-Met), Portland, pointed out that the trolley bus, once a major transportation mode in the United States, is now undergoing a renaissance; however, it is still not significant on an industrywide basis. Only 1 percent of the U.S. transit passengers is carried by trolley buses, and less than 1 percent of the systems is actually operating trolleys. Despite its environmental advantages, economy of operation is the key to making the trolley bus mode more viable. If the economic stage is not set, electrification will not occur on a large scale, and the trolley bus will never become dominant on a nationwide basis.

Related to this conclusion is the fact that the economical operation of a trolley bus system is only possible with dense operational levels. There are two multidestinational design strategies that can lead to these dense operating levels--the timed transfer focal point system, such as is used in Edmonton, suburban Vancouver, and, to some degree, in Portland, and the grid system for urban levels of service. These two kinds of networks actually serve public needs better than the traditional radial route system and, at the same time, by concentrating downtown service on relatively few routes they can lead to dense operation levels and set the stage for an economical electrification of routes.

It was concluded that electrification should not be looked at as an individual route-by-route determination, but that trolley buses are best considered as part of an overall strategy to redesign the transit system to work better for more people. Current analyses under way in Portland were briefly cited, as well as the position that the articulated trolley bus with multiple wide doors, chopper control, and self-service fare collection in use on a multidestinational network could well be the most efficient and effective type of transit bus.

SELECTED MATERIALS

Trolley Bus Economics

Carl Natvig

Quiet, no air pollution on city streets, 100 percent more energy efficient, one-third less maintenance, 25-year life with no major overhauls--these are the virtues of the trolley coach. This sounds amazing considering that the trolley coach, replete with all of these advantages, has been around in a fairly well-developed form since the early 1930s. The question, then, is: Why has not the trolley coach, with all of the concern about petroleum shortages and air or noise pollution, enjoyed a resurgence in use along with the turnaround of the transit industry? The basic answer, of course, is because it is a trolley and requires a substantial investment in