significantly to the vehicle downtime. However, the engine valve jobs are obviously mechanical failures of more significance. Similarly, the extent to which the transmissions of these vehicles have been rebuilt within a period of 3 years is equally significant.

Heavy and frequent use of brakes is required in DRT service. Friction and resulting heat warp the brake drums, causing excessive wear. Our experience with the small fleet in Batavia indicates that brakes must be relined every 5,000 miles (8000 km). Brake drums must be replaced at about each 10,000 miles (16 000 km). The heat also has an adverse effect on the brake return springs, which must be replaced at about 5,000 miles (8000 km).

Valve failure is the principal weakness in the automobile type of gasoline engines used in most of the small vehicles. These vehicles have chassis originally intended for motor homes or recreation vehicles. The manager of the Batavia garage reports that the engines in the Batavia fleet are not able to stand up under the heat and strain imposed on a 360 to 390-in.^{3} (5900 to 6400-cm^3) engine manufactured for automobiles. Frequent valve jobs are the result of this weakness.

Excessive heat caused by the frequent stops and starts in DRT service requires a better system for the cooling of the transmission oil. Here again, the standard heavy-duty transmissions, which are used in the chassis of small vehicles, cannot withstand the heat generated by DRT service. The result is frequent transmission jobs.

After 2 years of experience with this vehicle maintenance program, the management of the Batavia DRT system recommended, and the Board of Directors approved, a vehicle replacement program that calls for new vehicles after 75,000 miles (120 000 km) or 3 years of service. This decision was made in the belief that it is more economical to trade in this body-on-chassis type of vehicle at that point than to maintain it in service.

However, the decision relates to the chassis rather than to the body. The program establishes the life of the body as 6 years, and the bodies are remounted on new chassis.

The limiting factor on the chassis in Batavia is the durability of the component parts: engine, transmission, rear end, suspension, and brakes. Batavia vehicles operate in extreme weather conditions during the winter and are subjected to harsh corrosive effects of salt used on the highways. Body life in other places, therefore, might be more than 6 years.

Capital costs in 1974 were about $4,500 for the chassis and $15,500 for the body—an initial total of about $20,000. The capital cost for 2 chassis and 1 body during a period of 6 years, with about 150,000 miles (240 000 km), develops a favorable depreciation rate of $0.163/mile (1.6 km).

John B. Schnell, American Public Transit Association

I will first discuss the maintenance and operating costs for 3 fleets of buses in the city of Detroit for the fiscal year ending June 30, 1973. One is a fleet of small buses, another is a 1968 fleet of full-sized, 40-ft (12-m) diesel-powered buses, and another is a 1972 fleet of full-sized vehicles. The total maintenance cost is 34.71 cents/mile for the small vehicles, 7.54 cents/mile for the 1968 fleet of large vehicles, and 4.23 cents/mile for the 1972 vehicles. Depreciation increases the costs to 38 cents/mile for the small fleet, 5.39 cents/mile for the 1968 fleet, and 8.71 cents/mile for the 1972 fleet, giving a total cost per mile of 31 cents for the 1972 fleet, 36 cents for the 1968 fleet, and 19 cents for the small vehicles.

Many operators of small systems in small cities have said to us at the American Public Transit Association and to the U.S. Department of Transportation: "We do not need a big vehicle, and besides to operate a smaller vehicle is much cheaper." Well, certainly the cheaper operation of a small vehicle has yet to be substantiated, but logically the smaller vehicle should burn less fuel and have lower maintenance costs.

We all want competition, but I believe we have had make-believe competition in the past. In March 1974, the Bus Technology Committee of the American Transit Associa-

tion met in Phoenix and decided to form the Small Bus Specifications Subcommittee.

The subcommittee met in March, April, and May 1974. After the ATA midyear meeting in May, the subcommittee members talked for 1½ days with all the manufacturers. We started out with about 70 people and 15 different manufacturers' representatives. At first I think there was some thought that we were trying to put some manufacturers out of business, i.e., not allow them to bid, but that is exactly the opposite of our wish for a maximum of real competition. We want buses that we can readily maintain and operate, for we cannot market a service unless we have a reliable service.

As a result of the Small Bus Specifications Subcommittee work, we asked for and received quite a few comments from the manufacturers in that 1½-day meeting, and we gave the manufacturers another 6 weeks for their engineers to go over the specifications thoroughly. The manufacturers gave us a lot of positive, helpful suggestions. By July we had summarized the suggestions and met again to put together a final specification for the transit industry. We have had a large response from people interested in using this specification. The first system to request use of that specification through the U.S. Department of Transportation is the one in Tucson, Arizona.

We sent out a questionnaire asking the transit industry for other systems plans for using not only 30-ft (9-m) buses but smaller buses during the next 4 years, and we have told the manufacturers that we will summarize that information and send it to them. The results will also be sent to the transit industry.

I am opposed to putting 2 buses side by side and saying, "This bus is better than that bus" or "These 2 buses are equivalent and let them be bid on an equal basis." If we do that, we will repeat what we did with the 30-ft buses. That was not all the manufacturer's fault, and it was not all UMTA's fault. The manufacturers found it necessary to compete, and competing in this sense meant to have a lower price, which meant in effect to take something out of the bus, either workmanship or material.

We certainly would aspire to do the same type of thing that, according to Chaput, is being done in Canada, i.e., evaluating bus bids on the basis of much more than low price only. I believe this would provide the incentive to bus manufacturers to provide competitive, high-quality, reliable, small buses for the market.

John H. Davidson, Yellow Cab Company, Los Angeles

Operators of para-transit vehicles many times need equipment that may be used at times for dual purposes and at other times for a single purpose with a later change to another use. The question of the need, design, development, production, and use of such a diversified-use vehicle (DUV) has elicited much conversation and some study by users, manufacturers, and governmental agencies.

The comments given here are based on the results of discussions and surveys made in the parcel, light air cargo, and passenger demand-response delivery systems in the United States. The preponderance of replies are from those actively engaged in operating those services. They are not based on theoretical studies or on operating hypotheses. Therefore, the comments are biased toward operation in a present-day, real-world environment.

A diversified-use vehicle is a vehicle that can be readily and efficiently used in the ground transportation of one or more of the following products: able-bodied human passengers, handicapped ambulatory human passengers, handicapped human passengers of restricted movement (wheelchair passengers), local-delivery parcels, and light air-cargo parcels. The DUV can also handle one or more of these products simultaneously, depending on the needs of the service. The U.S. Department of Transportation has designated this topic for study, and requests for proposals relative to study, design, and prototype construction have been distributed.

From the discussion and surveys made within the International Taxicab Association