

data that are specific to a particular application has been demonstrated.

It is recommended that this effort be continued because the usefulness of the data bases will decline over time unless they are periodically modified to

- Add information on new types of small transit buses entering the market and

- Update information on maintenance and operating costs of buses already included in the data bases.

Also, a similar project should be undertaken to investigate reliability of small buses, which is a major factor affecting the quality of service, the cost of maintenance, and the spare bus capacity required to meet service objectives. Therefore, the users of small buses will benefit from a study in which the maintenance records of a large number of

small buses are examined to evaluate their reliability. The end result of such a study will be estimates of reliability of various bus types, expressed in terms of time-to-failure and time-to-repair statistics for different components.

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Revitalizing Express Bus Services in a Suburban Community: A Public-Private Partnership

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ABSTRACT

In response to rapidly deteriorating privately owned and operated express bus service, Prince William County, Virginia, developed a program designed to stabilize and improve services. The program, conceived by a citizens advisory committee and initiated with state and local funding, uses a public-private partnership whereby the local government purchases and remanufactures suburban coaches and then leases the coaches to a private operator. Lease fees are nominal, and the private operator is contractually obligated to the local government to provide all necessary coach maintenance. Thus the local government in effect provides a capital subsidy to a private operator and helps provide reliable public transportation without becoming the actual provider. The local government reviews routes and schedules and assists in marketing but does not defray operating costs. To date, the county has remanufactured and leased 10 suburban coaches to a local private operator. This has resulted in the availability of more reliable, more comfortable, and safer express bus service for county commuters. Express bus patronage is increasing, and the county hopes to remanufacture and lease an additional 10 coaches. The program appears to be successful and incorporates several strategies that may be of interest to suburban jurisdictions considering initiatives in express bus operations.

Prince William County, Virginia, is a rapidly developing suburban jurisdiction in the Washington, D.C., metropolitan area with a 1980 population of 144,700. Two Interstate highways, I-95 and I-66, provide access to key employment centers in Washington as well as to the Pentagon, Crystal City, Rosslyn, and Tysons Corner. Although most daily work trips from Prince William County are made by single-occupant vehicles, other modes have assumed greater impor-

tance in recent years. Throughout the 1970s a private operator provided express bus services from the residential eastern part of the county. However, in the late 1970s and early 1980s, deteriorating rolling stock, under capitalization, mediocre management, and severe winter weather contributed to unreliable and uncomfortable service. County residents were presented with the alternative of participating in ridesharing arrangements that were sponsored by a

local government ridesharing matching service. Because carpools and vanpools are permitted access to the I-95 high-occupancy-vehicle (HOV) lanes, it is not surprising that many commuters began to ride-share instead of using the express bus.

This contributed to a further decline in patronage, so in an effort to stabilize and improve express bus service, a Prince William County citizen advisory committee, the Mass Transportation Committee (MTC) began to examine the problem. The MTC, created on August 31, 1973, by the Prince William Board of County Supervisors (PWBOCS), is comprised of up to 15 county residents appointed by the county supervisors. To encourage coordination with other committees, the by-laws specify that one member be from the County Planning Commission, one from the Highway Safety Committee, and that there be an ex officio supervisor from the county board. Typically, this supervisor is also the county's representative at the Transportation Planning Board, which is the metropolitan planning organization for the region. The MTC's responsibilities include

- * Making recommendations to the Board of County Supervisors on the subject of mass transportation, which can be taken to include "commuter transit, bus service, rail service, mini-bus service, metro service, dial-a-bus service, carpools, and other public or private modes of transit; and shall include consideration of vehicles, transfer points, stops, routes, fees, regulations, applicable laws, stations, ramps, exclusive bus lanes, parking for users of mass transit services; and shall also include federal and state programs and grants for mass transportation; and other matters related to the above" (by-laws of the MTC);

- * Promoting the development of viable mass transportation services in the county;

- * Cooperating and working with public and private sectors throughout the county and region to improve levels of mass transportation services in the county;

- * Serving as a clearinghouse for ideas and suggestions for improving mass transportation services in the county, and acting as the county's point of contact with local, state, and federal agencies on matters related to mass transportation; and

- * Studying ways in which mass transportation services may be improved.

In the past, the MTC helped to develop the transit element of the county's comprehensive plan and to promote ridesharing. The MTC with state and local funding has helped to establish an interest free "start-up" loan for vanpool operators, and a ride-sharing coordinator position in the County Planning Office was established as a result of MTC efforts. Moreover, several MTC officials were instrumental in the development of the Virginia vanpool association. The vanpool association, a private organization, now provides information on financing, forming, operating, maintaining, and ride-matching for members. With these activities, the county has achieved an extraordinarily high rate of ridesharing. In fact, Prince William County in 1980 had the highest rate of ridesharing in the Washington, D.C., area: 37 percent.

In June 1981 the MTC began its most ambitious project to date. The project was suggested by a member who was aware of state funding available and who had the idea of obtaining 20 remanufactured buses. These buses would be owned by the county but leased to one or more private operators in an effort to stabilize service. Project MOVE was initiated to help "Make Our Vehicles Efficient." A subcommittee

of three individuals was assigned to develop a proposal for the Board of County Supervisors. The subcommittee was composed of a lawyer, a highway safety engineer, and a regional transportation commission official. One subcommittee member addressed legal questions that would be raised with the county attorney. The other subcommittee members talked to manufacturers and transit authorities to obtain estimates of costs and to learn about the availability of buses and the scope of remanufacturing that would be desirable. The scope of the project as initially proposed called for an estimated 20 vehicles, 40 ft in length with a seating capacity of 53 passengers at an investment of \$70,000 per vehicle. This unit investment of \$70,000 was expected to provide an extended economically useful life of 6 to 8 years of service. Several public transit agencies including Detroit, New Orleans, Philadelphia, Chicago, Washington Metropolitan Area Transit Authority, and New Jersey Transit had recently embarked on coach remanufacturing and this estimate was consistent with their costs.

Thus, the MTC subcommittee determined that there was a need to maintain an inventory of high-occupancy coaches to make the most efficient use of highway investments. This capability is even more critical if highway funding shortfalls delay the extension of high-occupancy-vehicle (HOV) lanes on I-95.

The subcommittee report was endorsed by the full MTC, which then recommended that the Prince William County Board of Supervisors initiate an application of \$1.4 million in Capital Assistance to Mass Transit under the provisions of Item 640.D of the 1981-1982 Biennial Budget of the Commonwealth of Virginia. The vehicles were expected to provide an extended economically useful life of 6 to 8 years of service. As noted previously, these vehicles would be leased under competitive bidding procedures to a private transit operator for exclusive use in commuter service between the county and employment centers in metropolitan Washington. As originally conceived, operating lease conditions were not to cover routes or fares, nor provide county financing for operation. Lease conditions would require maintenance of equipment, appropriate insurance, and reimbursement of all county expenses for administration of the project. It was hoped that the successful bidder would provide the funds for the 5 percent local match required to obtain state aid for mass transportation.

To summarize, the rationale behind this project was based on the need to provide reliable, comfortable, and flexible service; to address the deteriorating condition of the existing rolling stock of the financially ailing private company; and to help relieve congestion on major routes such as I-95.

The proposal was endorsed by the full MTC in November 1981 and, after lobbying of the Board of County Supervisors, the project was presented in December 1981 and the board approved the program concept and directed county staff to prepare the appropriate documentation for state officials.

Accordingly, a grant application was drafted, and in early 1982 the Prince William Board of County Supervisors approved, by a narrow margin, the formal submission of a \$1.4 million grant application to the Virginia Department of Highways and Transportation (VDH&T). The initial grant application generated several conferences between state and local transportation staff. One issue, the source of the local match, was of concern to state officials. The citizens committee had hoped that the private operator would provide the required local 5 percent match. However, in order to provide funds, state officials needed a local match from the public sector.

In effect, Prince William County, a fiscally conservative local government, would be required to provide approximately \$70,000 in local funds.

These staff conferences set the stage for a work session with the Prince William Board of County Supervisors (PWBOS), at which time state procedures and guidelines were communicated to local elected officials. This work session was instrumental in explaining to local decision makers the fiscal, operational, and policy implications of pursuing the grant application. It is important to note here that these discussions with state public transportation officials were typified by candid and constructive exchanges, which contributed to the establishment of a positive working relationship between state and local staff.

In late spring 1982 the PWBOS reaffirmed its desire to seek state funding for the program and subsequently directed county staff to pursue the grant application. Thus state officials, in June 1982, were evaluating a \$1.4 million grant application to be funded under the Experimental Aid for Public Transportation program. Pursuant to the program's funding formula, if the grant were approved, the state would reimburse the county for up to 95 percent of total program costs, and the county would be responsible for the remaining 5 percent.

The review process culminated in a recommendation from VDH&T staff that the Virginia Highway and Transportation Commission approve the grant application. Consequently, in August 1982, the commission approved \$1.4 million in funding for the Prince William County Commuter Bus Program.

APPROACH

Shortly after the grant award and execution of the necessary state-local agreements, staff began work on the two key program elements: vehicle procurement and selection of one or more private operators.

Vehicle Procurement

Because many of the program tasks, particularly those involving coach specifications and preventive maintenance programs, required knowledge or skills unavailable at the local staff level, a decision was made to seek consultant assistance. Consultant participation was structured such that local staff were actually doing much of the "legwork": forming contacts with individuals in the remanufacturing industry and with key staff of public transit authorities that were already involved in coach remanufacturing either through in-house programs or by private contractor. At the beginning the consultant's role was mainly to provide a technical check on the products developed by local staff. This was intended to allow the staff to develop as much technical expertise as possible. For example, the consultants provided resources and guidance in developing remanufacturing specifications and reviewed the final product, but the actual specifications were developed at the local level so that they were tailored to local needs. More extensive consultant assistance was employed during the actual remanufacturing process. This on-line inspection was important to ensure contractor compliance with the county's specifications and to ensure quality control.

A significant decision about vehicle procurement was made at this stage. A turnkey approach was adopted whereby the remanufacturer would be required to locate and purchase vehicles in addition to remanufacturing. This approach eliminated several firms that were unwilling to locate vehicles. Also

at this time staff were beginning to focus on the type of coach necessary for operations. Although over-the-road, three-axle coaches were attractive, it was thought that a suburban configuration with overhead reading lights, all forward-facing seats, and under locker loaders, was most appropriate.

At this stage county staff began to develop remanufacturing specifications. Drawing from documents supplied by other transit authorities and discussions with industry representatives, the county in conjunction with its consultants began the task of developing comprehensive specifications that would later be incorporated in a bid document. Because a basic objective of the program was to provide safe, reliable, and comfortable public transportation, rigorous specifications were drafted. The major coach components specified for remanufacturing were (a) power module, including engine, transmission, and accessories; (b) steering system, including universal-joint assemblies and drag link assemblies; (c) heating, ventilating, and air conditioning system; (d) suspension, axles, and differential; (e) brakes, wheels, and wheel bearings; (f) fuel tank and line; (g) exhaust system; (h) electrical system; (i) structure (underframing) including bulkheads; and (j) exterior surface and interior, including seats, rubber floor covering, and paint.

These vehicle remanufacturing specifications were incorporated into a bid document that was issued in the late spring of 1983. Three responses were received: two from remanufacturers in the northeast and one from a firm in the midwest. One bid was immediately declared nonresponsive because it clearly failed to respond to the program goals and was not accompanied by the required bid bond. Of the two remaining bids, one was certified as responsive, but it was feared that the unit cost, in excess of \$100,000 per coach, would provide far fewer coaches than needed. The remaining bid also exceeded budget but not as significantly. However, the bid proposed remanufacturing General Motors Corporation (GMC) transit diesel hydraulic (TDH) vehicles, which are a basic transit configuration. The issue of whether to accept a TDH took several weeks to resolve, and, after a meeting of state and local officials and the consultants, it was decided that the county would exercise its option of not awarding a bid.

At this point the county was faced with a private operator that was barely solvent and a delay of several months before the project could be rebid. Consequently, the MTC held a special meeting that was attended by approximately 100 concerned commuters. Although the meeting was often heated, it was valuable in providing citizens with accurate information on the program's timetable.

The remanufacturing specifications were soon rebid using a more flexible procedure: competitive sealed proposals. This approach allowed for limited negotiation and evaluation of factors other than unit cost, such as quality of work and delivery schedule, and resulted in selection of a midwest remanufacturer at a significantly lower unit cost of \$73,000. (The complete remanufacturing specifications are given in the appendix.)

Shortly after the contract between the county and the remanufacturing firm was executed, a preproduction meeting of the remanufacturer, county staff, and the consultant management and inspection team was held at the bus remanufacturing facility. Refinement of the specifications and a production schedule were discussed. The contractor and the on-line inspector had to agree on the staging of the remanufacturing process, the interpretation of rebuilding in application to specific components, the testing procedures to be followed, tolerances permitted, and instrumentation used to conduct the

tests. Because more than one inspector would be assigned to the project at different periods, it was essential to adopt basic uniform inspection procedures in order to avert any production delays that could result from contrasting styles or methods used by subsequent inspectors.

A production schedule was presented by the remanufacturer that showed a project completion date of 3.5 months. The consultant questioned the feasibility of the schedule, indicating that it was overly ambitious and without contingency considerations. Despite the reservations of the inspector, the remanufacturer was confident that the targeted completion date was within the capabilities of the firm's production crews.

Production on the county project began in the final week of January 1984, and delivery of the first bus was anticipated in mid-February. A request for a 2-week extension of the delivery date was submitted by the firm to compensate for severe inclement weather that had delayed supplier shipments. The first vehicle was not received by the county until the final week in March. It was later learned that many of delays were due to financial constraints affecting the firm. As of this writing, the county has taken delivery of 10 of the 20 buses slated for remanufacture.

As each bus was received by the county, a post-delivery inspection was performed by a team consisting of the inspector, the operator's maintenance personnel, and county staff. All defects were recorded and reported to the firm's quality control staff. Also, the county's on-site inspector was alerted to specific problems discovered after delivery. This created an effective feedback loop, so similar problems could be avoided on remaining coaches. When the postdelivery inspection had been completed, the acceptance of the coach was certified and county officials released payment of the coach.

Operator Selection

The process of selecting a private passenger transportation carrier to operate the remanufactured coaches was undertaken by the county in tandem with the advertisement of the second bus remanufacture request for proposals (RFP). It was decided that citizen involvement would continue through this phase of the project.

Operator RFP

A Citizens Coordinating Committee (CCC) was appointed by the Board of County Supervisors to serve as the steering committee in the solicitation and selection of a commuter bus operator. A draft RFP was developed by the planning staff and distributed to CCC members for review and comment. The RFP package was designed for the solicitation of carriers that had sufficient administrative, maintenance, and operational experience in the bus service industry. Background information about corporate status, personnel organization; certification by the Interstate Commerce Commission and the Virginia State Corporation Commission; and a submission of the financial condition of the company were required of each firm offering a proposal. Details regarding the bidders' operating capabilities in the following areas were also requested in the RFP document:

- Existing facilities and bus fleet size and composition,
- Maintenance capabilities,
- Existing services provided by the operator,

- Services proposed for Prince William County,
- Lease fee proposal, and
- Experience of firm and existing contractual obligations.

A weighted evaluation system that indicated how the offeror's proposal would be judged was included in the RFP. The criterion of greatest value was the operator's ability to provide safe over-the-road operations. This criterion accounted for 65 percent of the total rating scheme and included the operator's competence in maintaining the motor coaches as well as his effectiveness in providing for an adequate driver training and safety program. The bidder's financial capabilities and service (route and schedule) proposal, which formed the remaining items of the evaluation criteria, assumed weighted values of 20 percent and 15 percent, respectively.

The operator RFP was advertised for bid in October 1983 with 1 month allowed for receipt of proposals from prospective bidders. On the closing date, November 9, the County Purchasing Office had received two proposals from interested firms. (A total of 35 RFP documents had been sent to firms requesting an RFP package.) Along with the RFP, a sample lease agreement, also developed by the staff, was included in the proposal mailout.

Proposal Evaluations and Operator Selection

The Citizens Coordinating Committee members, who monitored development of the RFP document and operator lease agreement, received copies of both proposals and were asked by the staff to assess the merits of each individually. It was agreed at that point that the committee would invite each operator to make a verbal presentation at the next CCC meeting. Both bidders consented to meet with the committee and present their submission.

In early December the CCC convened subsequent to the presentations by the operators and voted unanimously to select Washington Motor Coach Inc. (WMC), a company that was currently providing commuter bus service in the county, as the operator for the bus lease program. The CCC recommendation of WMC as the program operator was submitted to and approved by the Board of County Supervisors on January 17, 1984. The Virginia Department of Highways and Transportation, after a thorough review of the proposals, concurred with the selection and authorized county execution of the service-lease agreement with WMC.

Lease Agreement

The drafting of a lease document, which would primarily govern the use of the buses as well as institute scheduled vehicle maintenance controls and service reporting requirements, was undertaken by the planning staff before the operator RFP solicitation. A number of vehicle lease arrangements between public transit properties and contracting parties (both public and private) were examined for their applicability to the lease program envisioned by county officials. The lease contract that appeared closest in character to the county's effort was the agreement that existed between New Jersey Transit and various individual private operators that supplied commuter services with vehicles rented from that state's Public Transit Organization. Many of the terms and conditions were, in effect, adapted for use in the county's contract.

The lease agreement, through the terms set forth in it, was designed to achieve the following goals:

- Assure that the equipment is used for program-specific purposes,

- * Assure that the public investment in the equipment is protected, and
- * Promote the efficient use of the equipment.

The conditions highlighted next were included in the lease in order to accomplish these program goals:

Use of Vehicle

The motor coaches are restricted to commuter transportation service. All other uses, with the exception of special purchase of service or emergency transportation authorized by the county, are restricted. State guidelines prohibit the use of the coaches for charter service.

Maintenance and Repairs

The operator is responsible for maintenance and repair of the buses. A scheduled routine preventive maintenance program is incorporated as part of the lease. A maintenance reporting system required of the operator enables the county to monitor operator performance.

Insurance

The operator is required to carry an insurance policy that includes minimum liability coverage of \$10 million. The county reserves the right to approve the insurance carrier or the policy in whole or in part. The operator agrees to hold the county harmless from all loss or damage.

Service Coverage and Reporting Requirements

The operator and the county agree to joint approval of all route and schedule development in the county.

The operator is responsible for keeping service and financial records of the company's performance. A summary of these data is reported to the county's Bus Operations Review Subcommittee (BORS).

The draft lease agreement was reviewed by the CCC, the County Finance and Purchasing Offices, the County Insurance Broker, the County Attorney's Office, and the VDH&T. A final lease was completed in January 1984 and executed in April before the delivery of the first bus from the remanufacturer.

OPERATIONS AND SERVICE MONITORING

April 5, 1984, marked the initial day of service with the first county-leased coach. The vehicle was planned for rotation among the 12 service runs on the operator's three routes until more remanufactured buses were delivered to the county. This would permit the widest exposure to the system's riders. Passenger reaction to the coach was extremely favorable.

Data Reporting

The monitoring of bus operations focused on three areas of reporting: service information, level of maintenance, and financial records review. Each of these items is a reporting requirement in the lease agreement. Data-specific reports are detailed as follows:

- * Service reporting includes daily ridership figures, daily driver manifest, daily rider check

(random), documentation of passenger complaints, and accident reports.

- * Maintenance reporting includes daily bus driver vehicle safety report, fuel and oil consumption report, mechanic work orders, preventive maintenance service schedules, vehicle road call report, and a monthly unit maintenance expense summary.

- * Financial reporting includes a quarterly company balance sheet and income and expense reports. These statements are prepared by the operator's accountant and are not publicly disclosed but are reviewed by the county's Bus Operations Review Subcommittee.

Because WMC is a small concern, much of these data had not been recorded before the execution of the lease. Bus maintenance files had not been kept for any of the units because of the limited administrative staff. Service documentation had been limited to ridership figures and revenue totals. The reporting requirements of the lease necessitated expanding the administrative staff from two to three persons, two of whom also drive the buses.

Company Organization

A breakdown of WMC personnel should emphasize that each of its 25 employees including the president of the firm can be classified as a driver; however, a more accurate division of labor, which reflects the actual duties and responsibilities of the work force, is given in the following table:

<u>Category</u>	<u>Status</u>	<u>No. of Employees</u>
Administrative, clerical		3
Drivers	9 full time	16
	7 part time	
Mechanics and vehicle service personnel	4 full time	6
	2 part time	
Total employees		25

Operating with nonunion personnel, the owner of WMC is able to contain labor expenses sufficiently to allow for committing the majority of the company's resources to commuter bus service. The ability to continue operating with a large part-time contingent in the labor force is critical in local commuter bus service, which does not provide the larger profit margins of charter service. Nearly one-half of the drivers who are part-time employees are actually full-time workers in the Washington metropolitan area. They receive a \$7.00 fee for each one-way trip driven. As worker-drivers, their responsibilities entail driving a morning scheduled run, parking the bus, and returning in the afternoon from their full-time position to make a scheduled evening run. Full-time driving staff receive \$13.00 for each one-way commuter run made.

Full-time drivers will generally have additional duties that can include bus maintenance, record keeping, dispatching, and interim charter and contract driving. Several of the worker-drivers are employed by the federal government and occasionally are required to go on out-of-town work-related assignments. This has created driver scheduling problems for the operator who is unable to obtain immediate back-up assistance on short notice. Nevertheless, the decision of the company to use worker-drivers bears significantly on WMC's ability to keep labor costs at approximately 38 percent of the firm's total expenditures.

Routes and Schedules

WMC currently operates service on three base routes in the county. Seventeen daily commuter runs are provided on the three routes. The majority of commuter bus stops are concentrated along major arterial roads. Five formal commuter lots and numerous informal lots are the major staging areas for passenger boarding and alighting. All commuter destinations are limited to the major employment cores in Northern Virginia and Washington, D.C.

Initially, it was agreed to in the lease that the county and the operator would jointly approve all revisions or modifications of commuter routes and schedules. To date, the operator has had the independence of developing these changes without a great deal of input from the county other than submitting them for review to a bus operations committee. It has been observed, however, that many of the decisions regarding routes and schedules made by WMC hinge more on operator experience than on the use of accepted route planning and scheduling techniques. If the system is to sustain an orderly route expansion and as the scheduling system requires greater sophistication in its planning, it may be necessary for the county to assume a larger role in this aspect of service development by supplying the necessary expertise.

Fares

Passenger fares for the commuter bus service vary from a daily round-trip ticket range of \$7.00 to \$9.00 to the weekly 10-ride discount pass range of \$20.00 to \$23.00. The operator is somewhat limited in establishing his fare structure by the fares charged by vanpool and carpool operators. The ridesharing network in the county is well organized and the fares set by the bus operator must be competitive to avoid a loss of ridership. Thus the need to include fare controls in the lease agreement was determined to be an unnecessary regulation.

According to the latest financial data provided by the operator, commuter fare revenues comprised more than 95 percent of the total income earned by WMC in 1984.

Ridership

Table 1 gives WMC's ridership since the operator formally assumed the provision of commuter bus service in September 1983. As noted earlier, the county bus lease program began in April 1984.

TABLE 1 Washington Motor Coach Commuter Service Passenger Trip Summaries

	Average Daily Trips 1984 ^a	Average Daily Trips 1983	Monthly Total Trips 1984	Monthly Total Trips 1983	Year-to-Date Trips 1984
January	744		15,640		15,640
February	731		14,635		30,275
March	767		16,885		47,160
April	800		16,811		63,971
May	822		18,101		82,072
June	844		17,726		99,798
July	857		17,998		117,796
August	908		20,888		136,684
September	1,102	665	19,552	9,988	158,236
October	1,053	716	23,168	14,332	181,404
November		802		15,245	
December		757		12,883	

^a Average daily passenger trips are based on the service days for each month.

This is not the place to speculate on the reasons why the increase in ridership has occurred. An effort to measure passenger satisfaction with the service is planned in the near future and may provide the county and the operator with some insight into the specific reasons for the increased usage of bus service by county commuters.

Passengers per vehicle trip at the present time reflect a systemwide average of approximately 29 riders (October 1983) or roughly 60 percent of vehicle capacity. This average has remained fairly constant throughout the operator's history of service despite the enhancement in the level of service during that time (total daily commuter runs have risen from 24 daily one-way vehicle trips to 36 one-way vehicle trips since September 1983). What is somewhat surprising is that the bus operator has maintained the 60 percent seat occupancy with a minimal effort to market the service and attract new passengers during expansion.

Marketing

The operator is essentially responsible for promoting and advertising the service; however, the county has assisted WMC in distributing route and schedule information through its COMMUTERIDE program. COMMUTERIDE is a combined effort by the county ridesharing and commuter bus programs to assist residents of Prince William County in seeking alternative means of commuting to their places of employment. Acting as a broker for commuter services, the COMMUTERIDE office will supply ride-matching services for carpool and vanpool requests and also will provide commuter bus schedule information. Because pooling services are a directly competing mode, WMC is not overly comfortable with the idea of the dual promotion; however, the county is committed to the combined approach because it provides the commuter with a wider range of alternatives for the journey to work. To date, both the ridesharing and commuter bus programs have sustained patronage growth.

The operator has chosen not to advertise the bus service to any great extent; instead WMC has largely relied on the county and word of mouth to communicate the availability of service. Approximately one-tenth of 1 percent of the total company expenditures have gone toward the purchase of advertisement. The county through its Commuter Bus Administrative budget has committed funds on a limited basis, which may be used to match WMC revenues for the purchase of advertising for the bus service. This incentive to advertise commuter bus transportation has not affected WMC's decision to refrain from developing a marketing program for its service.

Bus Maintenance Program

At the time that a proposal was submitted by WMC for the operation of the county buses, the company was having all of its major repairs and corrective maintenance performed by a private firm located about 40 miles south of the county. This was of some concern to the operator selection committee because of the number of non-revenue-miles that would be accumulated by the buses. Before the execution of the lease agreement WMC was able to secure occupancy at the bus storage and maintenance facility that was vacated by a previous operator. The facility is centrally located in the highly populated eastern section of the county.

With the physical capabilities to perform all forms of maintenance, the owner of WMC began to employ both full- and part-time mechanics. Consequent-

ly, the problem of accrual of non-revenue-miles has been eliminated.

The operator's maintenance facility consists of four maintenance bays (two with pits) and one bus wash lane. Maintenance employees are specialists in engine and transmission servicing (including rebuild projects), air conditioning, body work and painting, and electrical troubleshooting. Part-time specialists perform many of the maintenance tasks during the evening hours.

The preventive maintenance (PM) program was implemented shortly after the execution of the lease. PM inspections are scheduled at 5,000-mile intervals or at least once each month, whichever occurs first. Driver manifest sheets are used to track upcoming PM. The filing system responsibilities are assigned to a driver with the company. An analysis of the efficiency and effectiveness of the operator's maintenance program has not been undertaken as of this time.

Service Profitability

The operator's financial reports indicate that, between April and August 1984, the company maintained an even balance between expenditures and revenues while significantly reducing its outstanding debt. As mentioned previously, the vast majority of income (95 percent) is received from commuter operations. Before April 1984, however, the operator had accrued earlier losses that can to a great extent be attributed to the in-house bus revitalization program that the WMC undertook to increase the fleet rolling stock. Many of these coaches are in marginal "revitalized" condition and probably will be sold or retired when the additional 10 county coaches are available for lease.

Although the Commuter Bus Program does not involve the support of an operating subsidy through public funding, the bus lease program is definitely a form of capital assistance to the operator. If calculated over the expected 6-year life of each coach and assuming an average passenger occupancy rate of 60 percent as a constant, the subsidy per trip is approximately \$0.79 per passenger. Annualized in dollars for a 20-bus fleet at the same passenger occupancy rate, the subsidy would equal \$231,889.00 or about 36 percent of the total projected revenue. How these estimates relate to the firm's costs is more difficult to determine because the operator will probably incur additional expenditures through program growth (e.g., implementation of an employee fringe benefits program). At current levels of spending, however, the operator is in a position to realize a profit, and this assessment is supported by WMC's most recent monthly income and expenditure statement.

SUMMARY, OBSERVATIONS, AND RECOMMENDATIONS

It is thought possible to present recommendations in three areas: program and policy development, vehicle procurement, and operations.

Program and Policy Development

- * Citizen involvement, if properly structured, can provide expertise to assist in the development of innovative public transportation programs and is often critical in persuading decision makers to pursue experimental programs.

- * Adequate institutional support is necessary to initiate a program in a timely fashion. Prince

William County was not able to bring to bear the resources of an established transit entity. Specifically, the lack of purchasing and fiscal staff with transit experience was a continuing weakness. County legal staff, however, very quickly got "up to speed" and provided positive support. In lieu of project engineers, the county had to rely on the expertise of private consultants. Consultant participation created weaknesses in project management.

- * Continued progress reports, in this case to the MTC, ensure continued citizen participation in the program.

Vehicle Procurement

- * Continued evaluation is needed to compare the long-term benefits of remanufacturing buses versus purchasing new buses. The procurement of remanufactured coaches may be an appropriate approach if passenger demand and funding constraints preclude the purchase of new coaches. The county was able to purchase remanufactured coaches at about half the cost of new coaches. Typically, remanufacturing is a fleet replacement technique and not used for program start-up. Although it is preferable to begin a program with new coaches, the Prince William County approach appears to be cost-effective.

- * The level of remanufacturing is the key determinant of unit cost. Coach restoration ranges from low-cost, cosmetic work (seats, paint, glass) to rebuilding of major components (power train) to complete remanufacturing (including structural work). Prince William County desired a comprehensive, thorough remanufacturing, and contractors' bids were priced accordingly.

- * The method of procurement also influences cost. Use of a competitive sealed proposal approach allows flexibility and limited negotiation of specifications and price. Prince William County was able to execute a remanufacturing contract within budget using this method.

- * Geographic proximity of the remanufacturer emerged as a more significant factor than originally anticipated. Travel to the midwest from Northern Virginia was expensive and time consuming. Using a firm within 1 hour flying time would have allowed for more effective project management.

- * The number of on-line inspectors should be carefully limited. The county's consultant used an excessive number of production line inspectors; this led to problems with the consistent application of standards.

Operations

- * Although the authors are not able to pinpoint the exact factors that have contributed to the increase in commuter bus ridership at this time, it can be assumed that it is a result of some service improvement and may indicate a longer term reverse trend toward the use of commuter bus service by residents of the county.

- * The development of bus routes and schedules has largely been performed by the operator with the county reviewing the service proposals. The responsibility for this aspect of service development may require reevaluation by the county if the program is to sustain an orderly and systematic growth.

- * In the county RFP for the solicitation of operators, it was required that a prospective operator ensure that the necessary facilities be secured for operating and maintaining the vehicles (ideally to be located in the county to avoid accumulating substantial deadhead mileage). It should be noted

that such facilities (storage and maintenance) are often limited in their availability and it is recommended that potential sites be investigated before the solicitation of operators to ensure that the offerors can in fact locate such a facility. Notification in the RFP of county involvement in the site location could have generated a greater response by interested operators.

- To date, the operator has chosen not to commit moneys to marketing the program to any great degree, even with limited county matching funds available to do so. Because the county desires to achieve maximum vehicle use by its commuting residents and in light of the value of the capital subsidy, the operator may be requested to place greater emphasis on promoting the service.

- The program at this time does appear to have the potential for profit accrual by the operator. It is premature to estimate to what extent profits can be realized. Much will depend on the operator's ability to manage his resources if and when new growth occurs.

- The roles of the operator and the county are still being defined and will evolve further as the experiment matures. Unless circumstances dictate otherwise, the goal of the program will be to maintain the bus service as a function of the private operator.

- Much attention is being focused on the public-private partnership that has been used to meet the need for improved express bus service in the county. The success or failure of the program will largely be dependent on the balance achieved between the partners. The carrier has demonstrated his ability to control those operating costs (particularly labor costs) generally found to be much greater in the public sector or in a unionized environment. Some of the cost containment is necessary as a matter of survival. On the other hand, the public sector must ensure that the prospects for continued efficient private bus operations are buoyed by assisting the program when it is essential to do so, or suffer the consequences of an inferior or inadequate service.

CONCLUSION

To date, the county has remanufactured and leased 10 suburban coaches to a local private operator. This has resulted in the availability of more reliable and comfortable and safer express bus service for county commuters. Express bus patronage is increasing, and the county hopes to remanufacture and lease an additional 10 coaches.

This paper in some respects is a preliminary evaluation of the Prince William County Commuter Bus program. However, because the program appears to be successful and incorporates several approaches that may be of interest to suburban jurisdictions considering involvement in express bus operations, the authors are disseminating information in a timely fashion in the hope that other local and state transportation agencies may find it useful.

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APPENDIX: PRINCE WILLIAM COUNTY REMANUFACTURING SPECIFICATIONS FOR SUBURBAN COACHES

Power Module: Engine, Transmission, and Cooling System (accessories)

Engine

Remove, disassemble, inspect, and remanufacture 8V-71 engine and fluid fan drive to Detroit Diesel Allison (DDA) specifications, using original equipment manufacturer (OEM) parts; 6V-71 engines are not acceptable. Remanufacturing is to be performed by an authorized DDA contractor, in accordance with current DDA specifications. All seals, hoses, gaskets, and filter elements are to be replaced with new parts. The remanufactured engine is to be tested using a dynamometer; no engine will be considered remanufactured until dynamometer test results indicate the engine meets or exceeds specifications outlined by the engine manufacturer and that it will perform properly under service conditions. A copy of the dynamometer test result is to be submitted to the county or the county's authorized representative.

The following engine rebuild tasks are to be performed in accordance with current DDA specifications and procedures:

1. Cylinder block. Clean and degrease; scale and flush; pressure test. Measure and repair all irregularities; no welding or pinning allowed on cooling system.
2. Crankshaft. Clean, inspect, and magnaflux. Crankshaft journals and crank pins shall be precision chrome-plated to standard diameter.
3. Piston, liners, and connecting rods. Pistons and liners will all be replaced with new DDA kits. Connecting rods are to be reconditioned.
4. Oil pump. Oil pumps are to be completely reconditioned.
5. Camshafts. Clean, inspect, and magnaflux camshaft. Precision grinding may be used to maximum DDA allowable specification. All new bushings, bearings, seals, and thrust washers are to be used.
6. Gear train and idler gear. Timing idler and drive gears will be replaced with new DDA parts, including new bearings and thrust washers.
7. Flywheel. Flywheels are to be cleaned, inspected, and replaced when necessary.
8. Cylinder heads. Cylinder heads shall be cleaned, degreased, scaled and flushed, and magnafluxed. No welding or pinning repair is acceptable. All valves, guides, springs, keepers, followers, rollers, locks, and injector tubes to be replaced with new DDA parts, as necessary, and rebuilt.
9. Flywheel vibration damper. To be rebuilt with new DDA parts to current DDA specifications.
10. Injectors. All injectors are to be replaced with rebuilt C55 units.

11. Fan and drive. Shall be completely reconditioned, including crankshaft dampers.

12. Blowers. To be completely reconditioned, including new bearings, gaskets and seals, and new blower drive shaft.

13. Fuel pump. To be completely rebuilt.

14. Governor and cover. To be completely rebuilt, including new bushings, bearings, and seals.

15. Water pump. To be completely reconditioned, including new gaskets, bearings, seals, and impeller.

16. Thermostats. All thermostats to be replaced with new.

17. Oil cooler core. To be flushed, cleaned, and tested. Any faulty elements are to be replaced with new assemblies.

18. Oil relief and regulator valves. Shall be replaced with new assemblies.

Accessories, such as engine mounts and cradle, are to be replaced with remanufactured parts. Engines are to be painted DDA green. All oil hoses are to be replaced by new Strato-Flex Teflon No. 246 hoses. All engines are to be protected against low oil pressure and high water temperature by the installation of a Motor Guard Engine Shut Down System. The engine shut down system should have provisions for restarting the engine and moving the vehicle off the road.

Transmission

Disassemble, inspect, and remanufacture manual transmission to DDA specifications; all parts that are removed are to be replaced with OEM parts. Remanufacturing is to be performed by an authorized DDA contractor or by the contractor. Remanufacturing by the contractor is acceptable, subject to review and approval by the county. The remanufactured transmission is to be run in on a dynamometer; no transmission will be considered remanufactured until dynamometer test results indicate that the transmission meets or exceeds specifications as outlined by the transmission manufacturer and that it will perform properly under service conditions. All filters and filter assemblies, seals, gaskets, bearings, and bushings are to be replaced with new parts. New shift governors are to be installed. Vehicles must be able to attain a top speed of 60 to 65 mph with the engine properly governed.

The following components are to be replaced or repaired as necessary (optional transmission specification):

- Filter assembly,
- U-joint assembly,
- Transmission housing,
- Control valve,
- Converter housing cover,
- Converter housing,
- Direct and hydraulic clutch,
- Shifter fork and shift gears, and
- Bevel drive gears.

Cooling System and Radiator

The radiator is to be disassembled, cleaned, inspected, repaired as necessary, rebuilt, and pressure tested. As needed repairs will not remove over 10 percent of radiating capacity, new OEM cores are to be installed. All connecting hoses are to be replaced with new silicone hoses Strato-Flex Silicon No. 4214, new gaskets and two (2) new clamps at the

end of each connection. Radiator tanks and fittings are to be case iron or brass. New thermostats and transmission water lines are to be installed.

Air Systems

The air systems are to be purged of all foreign material, dirt, water, and so forth. The air compressor is to be a remanufactured B-1 TuFlo 700 size with ball bearing crankshaft. The air compressor governors shall be relocated on the left-hand hanger support and shall be preset for 135 psi.

Oil-Cooled Generator

Remove, disassemble, clean, inspect, and rebuild to Delco-Remy specifications. Test each unit under full load after rebuilding and provide the county with written certification of satisfactory performance.

Steering System

Provide new OEM steering U-joint assemblies, new drag link end assemblies, and new drag link tube assemblies. New hoses and fittings are to be provided throughout the steering system.

The steering column, overaxle steering box, and propeller shaft are to be rebuilt using new seals and bearings. All parts, including steering knuckles, are to be magnafluxed and inspected, and any components appearing defective will be replaced with new OEM parts.

Heating, Ventilating, and Air Conditioning

The heating, ventilation, and air conditioning systems are to be remanufactured to restore original performance levels. All lines are to be inspected and restored as required.

Heating and Ventilating

The heating system is to be entirely rebuilt, with rebuilt heating cores, rebuilt heater blower motors, rebuilt defroster motors, core and housing, rebuilt heater compartment doors, and reconditioned valves. New filters, seals, and hoses are to be provided as part of the heating system rebuild. The circulation pump and motor are to be restored and relocated to the engine compartment.

Recondition heater/defroster core as follows:

- Thoroughly clean by submerging in hot radiator cleaning solution.
- Repair as needed; repairs will not remove over 10 percent of radiating service.
- Straighten inlet and outlet pipes.
- Reassemble and test at 15 to 18 psi.
- Straighten pins and paint black.
- Install with new silicone hoses.
- Recondition water modulating valve; circulating pump and motor will be restored and relocated to the engine compartment.
- Recondition ventilation blower motors, installing new blower motor relays.
- Recondition ventilation heater cores, install new hoses, clamps, and sealing compound.
- Clean and recondition heater compartment doors.

Air Conditioning

The air conditioning system is to be entirely rebuilt, using new brackets, filters, hoses, fittings, expansion valves, and seals. A new air conditioning compressor, the TRANE Model CROG-1500-2A, or equivalent, is to be installed in conformance with the original equipment shown on the line ticket for each coach. New clutch and driver shafts are to be installed. All wiring and piping is to be properly aligned and supported to prevent vibration, chafing, and crimping.

The following components are to be restored or replaced with new OEM parts. The exact nature of the restoration will depend on whether the system is hydraulic or electrical.

- Remanufactured condenser pump (hydraulic system) or
- New AC condenser alternator driver assembly and new alternator (electrical system) and
- Remanufactured condenser motor (hydraulic system) or
- New AC condenser fan drive motor assembly (electrical system).

Front and Rear Axles and Suspension Including Steering: Differential

Where appropriate, components of the steering are to be magnafluxed and inspected, and any components appearing defective are to be replaced with new OEM parts.

Front Axle and Suspension

- Install new steering knuckle kingpins, bushings, kingpin bearings, tie rod assemblies, and front axle bumpers.
- Replace, with new parts, radius rod bushings, lateral rod bushings, upper radius rod bracket, leveling valves and linkages, bellows, piston, shock absorber assemblies, clamps, and bellows support assemblies.

Rear Axle and Suspension

- Install new gaskets, seals, and axle bumper assemblies; install new rear axle housing, as necessary.
- Replace, with new parts, radius rod bushings, lateral rod bushings, upper radius rod bracket, leveling valves and linkages, bellows, piston, shock absorber assemblies, clamps, and bellows support assemblies.
- Axle shafts are to be removed, cleaned, and inspected. Damaged or twisted axle shafts are to be replaced with new axle shafts.

Differential and Carrier Assembly

Inspect and repair as necessary differential and carrier assembly. Differential is to be remanufactured as necessary so that it meets or exceeds the original manufacturer's specifications.

Brakes, Wheels, Bearings, and Tires

Brakes

Front and rear brakes are to be returned to standard. This includes new brake drums, linings, shoes,

camshafts, slack adjusters, anchor pins, bushings, seals, brakeshoe return springs, and brake chamber assemblies. Front and rear hubs are to be inspected and replaced, if necessary. In addition, the following components of the brake system are to be replaced with new OEM parts:

- Brake application valve,
- Brake relay valve,
- U-bolts,
- Teflon hose assemblies with stainless steel braiding, and
- Valves (such as check valves and quick release valves).

The parking brake is to be returned to standard. This includes a new drum, linings, shoe, anchor pins, bushings, seals, brake return springs, slack adjuster level, link pins, and parking brake control parts (as required).

American Brake Block (ABB) 80 mixture or equivalent is required. The air tanks are to be inspected and repaired as necessary.

Wheels and Bearings

All wheels are to be inspected for deformation and out of roundness and worn or elongated bolt holes, and are to be replaced as necessary. All wheel studs are to be replaced. All cup and cones, inner and outer, are to be replaced with new parts. All wipers, seals, and gaskets are to be replaced by new parts. Wheel bearings and races are to be replaced with new parts.

Tires

Bidders should assume bias, over-the-road, 14-ply rating tires will be used. All tires and rims should be standard throughout the vehicles proposed.

Fuel System

The fuel tank and all lines are to be flushed and cleaned. All fuel lines are to be inspected for crimping, chafing, or other damage and replaced as necessary. The fuel tank is to be inspected and repaired as necessary. New pins on fuel filters and strainers are to be installed throughout the fuel system.

Exhaust System

All exhaust system components are to be replaced with new OEM parts. This includes new mufflers; new tailpipes and exhaust pipes; and new gaskets, clamps, and grommets. Left-hand and right-hand manifolds are to be inspected and replaced if necessary.

Electrical System

The electrical system will be completely inspected and tested to OEM specifications, including, but not limited to, the following:

- Visual inspection,
- Continuity test,
- Ohmmeter test, and
- Other tests as necessary.

Any defects found by the contractor or county inspector involving the main wiring looms and har-

nesses will require replacement (or repair) with new wiring looms and harnesses that meet or exceed original capacity. All subwiring looms and harnesses will be replaced in accordance with OEM specifications and standards.

For new electrical circuits, wiring diagrams are to be submitted to the county or its authorized representative for approval. Wire is to be of the original size or larger. Insulation is to be cross-link polyethylene and color coded so that the circuit of each wire can be readily determined at any point along the wire.

All wiring is to be properly grouped and installed so as to permit ease of replacement. Wiring is not to be run through metal or other parts of the structure, except where unavoidable; at such points rubber bushings are to be provided.

All electrical switches, relays, circuit breakers, solenoids, dash gauges, lenses, and bulbs are to be replaced with new parts. Lamp assemblies, sealed beam assemblies, cables are to be replaced with new OEM parts. Amphenol connectors are to be inspected and replaced as necessary.

The starter, alternator, and voltage regulator are to be remanufactured so that they meet or exceed the original manufacturer's specifications.

Batteries are to be replaced with new batteries that conform to OEM specifications. The existing battery cable is to be replaced with new 4/0 size battery cable, and the battery tray is to be replaced with a new tray constructed of steel and coated with corrosion resistant material.

All internal lighting power packs are to be converted to individual ballast operation.

Structure

Underframing

Lift vehicle and remove all mechanical and electrical components, clean thoroughly and sandblast all underframing so as to expose the metal for complete inspection.

All engine bulkheads will be replaced using new steel bulkheads, new engine mounting brackets, new angles, new reinforcement plates, new closure panels, new support assemblies, new beams, and new longitudinal plates.

All remaining defects or excessive wear and tear found in the underframing/structure due to corrosion, fatigue, age, or abnormal use will be replaced completely in order to restore underframing/structure to meet OEM and county standards. The decision to replace all bulkheads other than the engine bulkhead will be based on the following conditions:

- * If more than 15 percent of each bulkhead is in need of repair, it will be removed and replaced with a new bulkhead.
- * If less than 15 percent of the bulkhead is defective, it may be repaired as necessary.

Replacement will be determined by the county inspector and the contractor's quality control department. All new replacement bulkheads must be of steel composition.

Floor

All floor covering will be removed to expose plywood. Contractor and county inspector will make a complete inspection of the condition of the plywood and the contractor will replace those sections that are deteriorated or do not meet OEM standards.

New black rubber flooring will be installed over plywood covering the rear reinforcing plate. The floor will be bolted down; if this is not possible, it must be screwed down with self-tapping screws.

Roof, Upper and Lower Posts

The posts, carlines, stiffeners, strainers, reinforcements, and panels are to be inspected and replaced with new parts as necessary.

Body Interior and Exterior, Doors, Seats, and Paint

The body interior, exterior structure, windows, doors, seats, and related items are to be completely restored in accordance with the following sections:

Body Interior

The interior is to be completely restored, with new moldings. All front stepwells will be replaced. All wheelhousings that are determined to be substandard by the contractor or the county inspector will be replaced as necessary. New rubber floor covering (aisle, toe board, and underseats) and platform plate, ribbed rubber stepwell treads, and window glazing will be installed. Additional interior items are to be replaced as necessary, including, but not limited to, the following components:

- * Interior panels;
- * Crown panels;
- * Windows: side, intermediate, drivers (windows are to be operable);
- * Brake and accelerator pedals;
- * Air ducts;
- * Grab rails;
- * Trim molding;
- * Window channels and seals; and
- * Destination signs, channel filler, rubber harness.

The driver's compartment is to be inspected and restored with new speedometers, pedal treads, and switches.

Body Exterior

The exterior of the body is to be completely restored, using new lenses, mirrors, wiper system (blades, arms, and motor), bezels, bumpers (Firestone Help bumpers), grilles, and reflectors. Transmission doors, radiator doors, rear end closure doors, and all other access doors are to be replaced as necessary with reconditioned parts. The following items are to be inspected and replaced as necessary:

- * Towing brackets,
- * Fluted panels,
- * Skirt panels, and
- * Roof panels.

Doors

Single front door vehicles are required. Doors and door mechanisms are to be inspected and restored as necessary using new bearings, bushings, rollers, pins, seals, retainers, and shims. Door glass is to be replaced as necessary.

Seats

Reclining or semireclining, high-back, cushioned seats are to be installed. All passenger seats must be forward facing. Seats are to be reupholstered, and seat assemblies including frames, reclining mechanisms, and adjustable headrests and footrests if so equipped are to be inspected and replaced with new parts or repaired. Additional seating specifications such as color arrangement, manner of attachment, and accessories will be specified by the county at a later date. Overhead package racks and individual reading lights are required. Vinyl/cloth box seats with supported expanded vinyl 4502 to the yard with Fifth Quality 4916 fabric for the cloth are required. Armrests and headrests should be vinyl.

Paint, Trim, Striping, and Undercoating

The bus interior and exterior are to be painted according to the graphics scheme specified by Prince William County.

Striping and decals are to be installed according to the graphics scheme specified by Prince William County.

Detailed painting and graphic specifications will be provided by the county at a later date. However, the bidder should submit the cost of a standard three color paint scheme. Exterior and interior paint is to be Dulux paint (Alkyd enamel) or an approved equivalent.

The bus understructure is to be undercoated with Tectyl 165G or an approved equivalent.

Life-Cycle Costing in the Transit Industry

ALLEN R. COOK, T. H. MAZE, UTPAL DUTTA, and MARK GLANDON

ABSTRACT

Life-cycle costing is an economic evaluation scheme that accounts for capital, operating, and maintenance costs during the usable life of transit vehicles. Cost containment is a major concern of transit agencies, and life-cycle costing has the potential to facilitate significant decreases in transit agency budgets as well as to enhance future budget planning and cost forecasting. However, a 1983 General Accounting Office (GAO) survey of 186 transit agencies found that most agencies lacked experience with and understanding of the procedures. The GAO concluded that most agencies lacked adequate technical information and adequately trained staff. In this paper an independent analysis of the original GAO data is reported. The analysis found that many agencies still keep largely manual operating and maintenance records. Some do not collect this information by individual bus. Seven prerequisites to good life-cycle costing procurement are presented.

Present practices in life-cycle cost procurement in the American bus transit industry are reviewed. The role of life-cycle costing is discussed first. There follows an analysis of the types of maintenance information collected by transit agencies and their experiences with life-cycle costing as reported in a 1983 General Accounting Office survey of 186 transit bus fleet operators in the United States. The paper concludes with a review of seven prerequisites for good life-cycle cost procurement.

LIFE-CYCLE COST PROCUREMENT

Background

Life-cycle costing is an economic evaluation scheme that accounts for capital, operating, and maintenance costs during the usable life of an investment. In theory, it is both a common-sense approach to equipment procurement and a well-established evalua-

tion procedure in engineering economics. Most private equipment investment and replacement decisions instinctively incorporate at least a recognition, if not a formal accounting, of life-cycle costing.

In practice, at least in the public sector, life-cycle costing has been promoted as an innovative alternative to equipment procurement based on minimum initial capital cost, the "lowest bid" (1). In the federal government life-cycle costing has been used for military procurement by the Department of Defense since the 1960s (1). It is also used by the General Services Administration for the purchase of such standardized items as typewriters and office supplies.

UMTA, in response to congressional dictates, first required life-cycle costing for the purchase of transit vehicles in 1982 (Federal Register, Vol. 47, No. 33, Feb. 18, 1982, pp. 7361-7364), and later, in 1983, UMTA made it optional. A 1983 General Accounting Office (GAO) report (2) castigated UMTA for not documenting the cost-effectiveness of