U.S. Department of Transportation

The Role of Rehabilitation in Transit Fleet Replacement

March 1983

TECHNOLOGY SHARING REPRINT SERIES

Prepared for PSCOG
Puget Sound Council of Governments

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March 1, 1983

The Role of Rehabilitation in Transit Fleet Replacement

FISCAL YEAR 1983
TRANSPORTATION OPERATOR ASSISTANCE PROGRAM

MARCH 1983

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ABSTRACT

TITLE:	The Role of Rehabilitation in Transit Fleet Replacement
PROJECT MANAGER:	Don Secrist/Mike Smith
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ABSTRACT: This report describes the concept of transit vehicle rehabilitation and its role in fleet replacement programs. It summarizes national and local experience in rehabilitation of diesel buses, trolleys, and vans. Life-cycle costing methods are used to compare the cost effectiveness of rehabilitating old vehicles versus purchasing new vehicles. The potential need for fleet rehabilitation is investigated for this region's public transportation operators based on current fleet make-up and age distribution.

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FOREWORD

The Puget Sound Council of Governments (PSCOG) is a voluntary association of local governments (counties, cities, towns and Indian Tribes) formed to cooperatively plan for the future of the region. Member governments from the four-county region, comprised of King, Kitsap, Pierce and Snohomish Counties, are represented by their elected officials on the Assembly, Executive Board, Subregional Councils and Standing Committees of the PSCOG. A number of advisory committees provide policy guidance under which planning is conducted and documents produced. Transportation advisory committees include representation from the public transportation operators in the region.

The activities of the PSCOG are established annually in the Unified Planning Work Program which reflects consideration of the goals, objectives and priorities of the region. The transportation portion of the work program includes a number of special projects designed to assist the public transit and ridesharing operators. This report, The Role of Rehabilitation in Transit Fleet Replacement, was prepared to document work performed under the Bus Rehabilitation Project contained in the fiscal year 1983 work program. The project was conducted under the guidance of the Transportation Operators' Committee.

This report was accepted by the Transportation Operators's Committee and the Standing Committee on Transportation in February, 1983. In their acceptance, the committees also expressed the importance of maintaining regional data on fleet inventories and tracking comparative operating costs for different vehicle types.

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Puget Sound Council of Governments
March, 1983

EXECUTIVE SUMMARY

The concept of rehabilitating buses, trolleys, and vans to extend their service life has emerged as an alternative to the purchase of new vehicles. The Transportation Operators' Committee of the Puget Sound Council of Governments directed a study to investigate the cost-effectiveness of vehicle rehabilitation, to define the role of rehabilitation in fleet replacement programs, and to determine the potential for vehicle rehabilitation in the Puget Sound region.

The Role of Rehabilitation in Transit Fleet Replacement documents national and local experience with vehicle rehabilitation, including the criteria and methods by which to evaluate its cost-effectiveness, and the potential demand based on fleet age characteristics of individual operators in this region.

As the name implies, rehabilitation means restoration to a normal or "optimum" mechanical and operations state. For transit vehicles it typically involves extensive replacement and/or rebuilding of essential mechanical and electrical parts. It also involves refurbishment of upholstery, flooring, and other interior amenities. Rehabilitation is more extensive that the normal preventative maintenance program for transit vehicles. It would commonly be done on a vehicle which is between twelve and twenty years old and has accumulated between 500,000 and 850,000 miles, depending on local operating conditions. Experience nationally has shown that the cost of rehabilitating a bus is approximately half the cost of a new vehicle and that the extended service life is six to eight years.

The trade-offs between rehabilitating existing vehicles, purchasing new vehicles, or purchasing rehabilitated vehicles, can best be evaluated through life-cycle costing. Using this method, the trade-offs are a function of the initial capital costs, the actual operating and maintenance costs, and the expected service life, for both new and rehabilitated vehicles. Other important factors are the availability and amount of federal funding assistance for new versus rehabilitated vehicles, and the operator's desired image as projected through its equipment. No generalizations can be made on the cost-effectiveness of one strategy or another. The above factors must be analyzed by operator on a case by case basis.

Most operators in this region have had experience in supplementing their fleet replacement programs with rehabilitated buses. Pierce Transit, with the most extensive experience, has found vehicle rehabilitation to be a satisfactory means of meeting rapidly rising service demands in a short time frame with limited capital and an aging fleet. The largest operator, Metro, has evaluated rehabilitation potential and has decided not to pursue it at this time.

The five public transit agencies in the region operate a total fleet of 1600 buses and trolleys. Of these, as many as 400 are currently in need of replacement. The PSCOG study estimates that 280 of these vehicles are potentially suitable for rehabilitation.

Experience in the rehabilitation of vans is limited but could offer some potential for relatively short-term extensions of vehicle life in certain circumstances (perhaps on an experimental basis). In a sample survey of twenty-two vanpool operators across the country, four firms had rehabilitated a portion of their fleet, replacing interiors and engines, or just interiors, thereby extending the service life by two or three years.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are made to the transportation operators:

- Operators in this region should continue to utilize rehabilitation of vehicles as a supplement to new vehicle replacement programs.

- Exclusive use of rehabilitated vehicles for replacement of depreciated units by any operator should be avoided. While no specific ratio of new to rehabilitated vehicles is recommended for any given procurement period, the operators should attempt to reduce the overall age of their fleets through new vehicle purchase over time. Generally, in the long term, rehabilitated vehicles should represent a minor versus a major component of the replacement program.

- Investigate the potential for utilizing vehicles owned by one agency that are suitable for rehabilitation by another agency in need of rehabilitated vehicles.

- Investigate the potential for a limited experimental van rehabilitation program to determine its cost-effectiveness based on the operating conditions and mileage accumulation experience in this region.

I. INTRODUCTION

A. Purpose and Scope of the Study

This report briefly outlines the concept of transit vehicle rehabilitation, as applied to date, and identifies additional potential it may hold for this region. The report was developed primarily from secondary source material, supplemented with current inventory data and local experiences. It is intended as a recap and overview of the rehabilitation issue and will supplement local information regarding when, where, and how rehabilitation fits into local fleet management programs. Further investigation into specific applications of rehabilitation would, of course, be required prior to local decisions.

B. What Is Transit Vehicle Rehabilitation?

As the name implies, rehabilitation means restoration to a normal or "optimum" mechanical and operational state. Typically, it involves extensive replacement and/or rebuilding of all parts that experience deterioration during the normal operation of the vehicle. The following list includes most of the essential items that should be taken care of in a bus rehabilitation:

- o engine rebuild
- o transmission rebuild
- o brake and brake system replacement
- o suspension rebuild
- o steering system rebuild
- o cooling system rehabilitation
- o exhaust system replacement
- o heating and defrosting system rehabilitation
- o wire harness replacement
- o instrument and gauge replacement
- o interior lighting replacement
- o interior and exterior repainting
- o floor cover replacement
- o seat reupholstering

- o wheel house replacement; window latch and seal replacement
- o energy absorption bumpers

It can include:

- o wheelchair lifts
- o kneeling services
- o air conditioning systems
- o other passenger amenities not featured in earlier models

In the average case, a bus that is a candidate for rehabilitation will have reached 12 years of operation and/or 500,000 miles. In certain types of operations in certain areas, however, buses can reach the point of needing comprehensive rehabilitation sooner than this. In other cases, buses with considerably greater mileage will not reach a potential rehabilitation stage, and may even function well beyond 12 years. However, technological obsolescence due to vehicle age, may affect the rehabilitation decision if current operating needs cannot be attained through full rehabilitation (e.g., the need for certain safety or convenience features that cannot be easily retrofitted to the old bus hulk).

The rehabilitation threshold for vans decreases from 12 years to 5 or 6 years or less and/or 125,000 miles; however, no explicit standard has yet been established. Rehabilitation features, as might be expected, may differ but are generally represented by the first eight items on the bus list. Other items, such as gauges, interior lighting and wire harnesses probably would not need complete rehabilitation and/or replacement because they are not old enough to have experienced significant deterioration.

Small buses are those vehicles which fall between vans and "standard" 40 foot transit vehicles. Their rehabilitation potential and requirements are also somewhere between those for vans and 40 foot buses. Generally, most of the smaller vehicles (including vans) have not been manufactured to be as

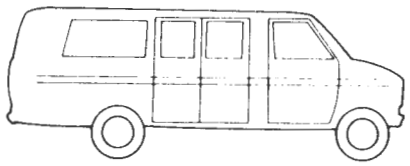
durable as the larger vehicles. Figure 1 illustrates the categories of small transit vehicles from vans to 35 foot "commuter buses". Also shown are the larger transit vehicles for purposes of comparison. Generally, the larger vehicles of the small bus group tend to be more durable and may compare favorably to standard buses in terms of rehabilitation potential. These smaller buses, however, would have to be evaluated on a case-by-case basis to determine whether the chassis, frame, and other features are suitable for rehabilitation. In addition, since this class of transit bus is relatively new in terms of mass production and use, opportunities for rehabilitation may be limited in comparison with the standard bus.

In this report, the term rehabilitation will refer to a thorough rebuilding and/or replacement of all essential mechanical and esthetic items. Lesser forms of rehabilitation can, of course, be pursued. In general the more thorough the rehabilitation, the greater the vehicle reliability and longevity and the lower the maintenance costs.

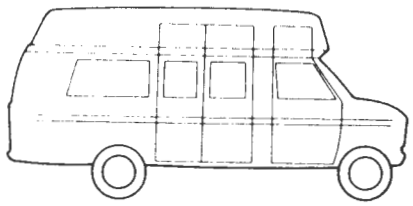
Maintenance is distinguished from rehabilitation primarily to the extent to which the vehicle is restored to an optimum state. Maintenance programs include work on most of the essential items listed above and are designed to keep the vehicle in an operational state with all equipment functional. It may include major work on certain items including engine overhaul, should it become prematurely required, but normally does not include comprehensive "restoration" of all features to an original or optimum state. Transit vehicles eventually reach a point in their maintenance cycle when they become too costly or otherwise impractical to maintain. Experience has indicated that this point occurs on the average after twelve years and/or 500,000 miles for standard buses. At this point, the bus may become an eligible candidate for rehabilitation. No established standards exist for vans or smaller buses. Vans, however, tend to have about one-fourth the mileage at rehabilitation as that of the standard bus, with smaller buses being evaluated on a

Figure 1. Types of Vehicles

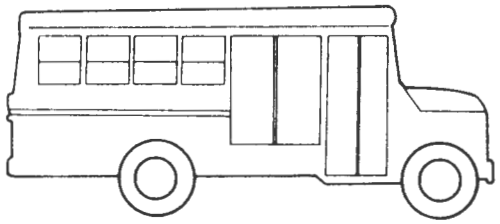
Standard Van



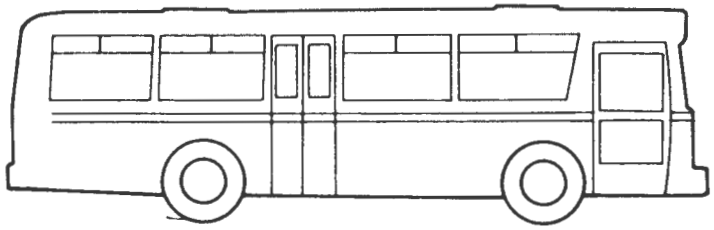
Modified Van



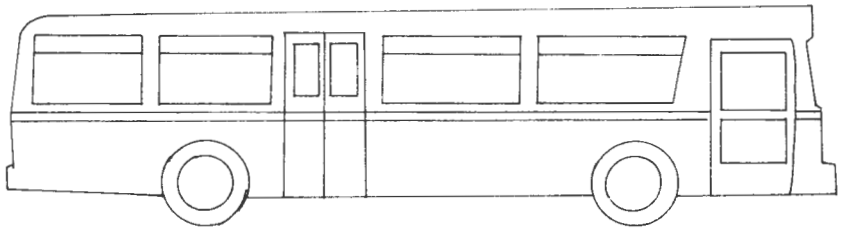
Body on Chassis
25'



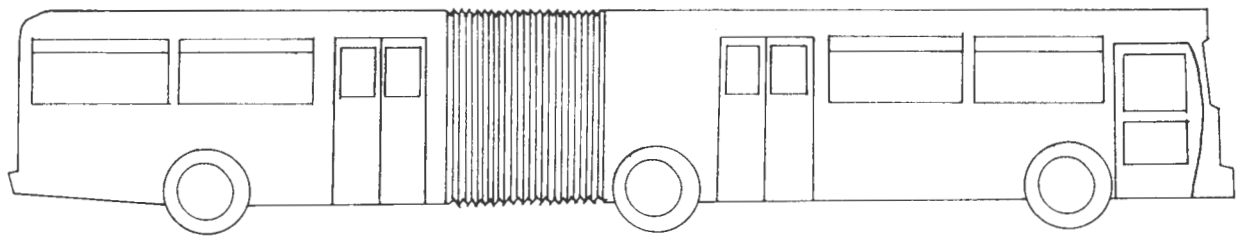
Small Bus
35'



Standard Bus
40'



Articulated Bus
60'



case-by-case basis.

In summary, a rehabilitated transit vehicle is a completely restored older vehicle that has reached a point in its life cycle where maintenance to keep it in operation is too extensive, expensive, or otherwise infeasible.

C. Available Federal Funding for Rehabilitation: The UMTA Program

The Urban Mass Transportation Administration (UMTA) issued proposed policies and guidelines for funding rehabilitation projects in February 1980. In January 1981, a "final" policy and regulation was issued following review and incorporation of comments received during the review period. That January 1981 program is currently being used as a guide in reviewing funding proposals. At this time, the UMTA program represents the only available federal funding source for fleet rehabilitation. This program "guideline" is highlighted as follows:

- Vehicles must, to the extent structurally feasible, be equipped with features as specified in the regulation (see Appendix A, CRF640.107d).
- The guideline Applies to standard transit buses used in mass transit service, including commuter buses, 35 feet and over. Other types are treated on a case-by-case basis.
- The UMTA program will fund up to 80 percent of eligible rehabilitation costs; 85 percent with Interstate Transfer funds; and 75 percent using Federal Aid Urban System (FAUS) funds.
- The UMTA program will fund up to 20 percent of applicant's fleet for rehabilitation.
- Buses must be in lots with common features to assure similar rehabilitation needs.

- Vehicles should be at least 12 years old or have 500,000 miles. Variations will be considered on a case-by-case basis. Vehicles must require major structural improvements in all cases except if over 15 years and 750,000 miles.

- UMTA will consider applicant's maintenance program in awarding funds.

- The rehabilitation must extend bus life at least 5 years.

- The cost may not exceed 70 percent of average amortized value of a new bus (based on 12 year life) multiplied by the number of years the bus life is extended.

- Retrofit of handicapped or special features not found in the original bus is funded separately.

- Rehabilitation may be performed in-house if normal procurement and labor procedures are followed and if normal maintenance is not affected.

- Contracts for work must include at least a 6 month warranty on parts and labor.

- If work is done outside, applicant must have inspector on-site. This is an eligible grant cost.

- Rehabilitated buses must conform to accessibility requirements for handicapped to the extent that it is structurally feasible.

- Rehabilitation work must be completed within 12 months of award of contract.

- Rehabilitated buses must be maintained properly.

- Buses may not be rehabilitated for the purpose of stock piling.

New guidelines are expected to be adopted to replace the 1981 guidelines. Until the new guidelines are issued, the old ones will remain in effect as a guide for reviewing applications for bus rehabilitation. A complete version of the guidelines is included in Appendix A.

The UMTA program provides a useful framework for evaluating rehabilitation potential and is referred to throughout this study. However, it should not be assumed that the UMTA definition and approaches are the only reasonable way to deal with the rehabilitation issue. It happens to offer the only available outside funding source and, therefore, should be followed if "outside" assistance is needed. The guidelines should not discourage innovative interpretations since a decision to rehabilitate may well be economically sound with or without federal participation. Also, UMTA clearly has flexibilility for dealing with applications on a case-by-case basis. In addition, the above guidelines are not regulations and will not bind UMTA, but rather provide a base position from which they may be convinced to deviate. Appendix B gives several examples, based on the UMTA formula, of the local funding share which would be required under varying assumption of rehabilitation cost and extended service life. Agencies interested in rehabilitation should first evaluate that decision on its own merits.

The remainder of this report provides some suggestions concerning what to consider in evaluating the rehabilitation issue.

II. WHEN IS FLEET REHABILITATION APPROPRIATE?

This chapter examines the fleet rehabilitation issue in terms of when and under what circumstances it might be appropriate to consider rehabilitation. The chapter reviews the experiences of operators with rehabilitation and identifies methods of evaluating rehabilitation potential. Finally, it looks at some of the options available for pursuing rehabilitation within the context of current operations. The final rehabilitation decision must be subjected to a more refined analysis based on the individual operator's needs and resources. The information in this report is intended only to assist in structuring this refined analysis, providing some initial direction, and identifying many of the key questions that must be addressed prior to proceeding with a fleet rehabilitation decision.

A. Experience with Rehabilitation

On a national scale, rehabilitation is a relatively new phenomenon brought about in part by increasingly constrained financial resources and the need to place a maximum number of vehicles into service in a short period of time for the least money. As a result of the relative newness of bus rehabilitation, the availability of rehabilitation contractors with both experience and reputation is limited. Contractors are not generally available in the Northwest. Most rehabilitation work is being performed in the Midwest and California. Locally, Everett Transit, Community Transit and Pierce Transit have been involved in rehabilitation and other operators have considered or expressed an interest in using this option. Following is a recap of both nationwide and local experiences.

1. Rehabilitation Nationwide

Nationally, an Urban Mass Transportation Administration (UMTA) survey found eighteen transit operators involved in rehabilitation programs in 1980[1]. Of these, four were performing the rehabilitation in-house and fourteen were using outside contractors. In 1980, about 230 buses were rehabilitated by outside contractors for the fourteen public transit agencies in the survey. Another 150 buses were rehabilitated in-house. At that time, an additional 500 vehicles were earmarked by these public agencies for outside rehabilitation and another 1,000 for in-house rehabilitation. Ten transit systems were using rehabilitated buses in 1980. As of September 1980, only two of the ten had been using rehabilitated buses more than one year (Chicago-RTA which began in 1977 and Detroit DDOT which began in 1979). Experience was quoted as being favorable but obviously very limited in terms of ability to assess the relative value of rehabilitation versus other options.

Costs of rehabilitation in 1980 ranged from $30,000 to $70,000 per unit with 1000 to 1200 hours of labor for outside contractors, and $26,000 to $50,000 with similar hours for in-house efforts. The UMTA report estimates that a complete rehabilitation, using outside contractors and meeting all requirements for grant funding would average about $55,000 per unit (1980 dollars).[2] Appendix C contains a summary of specifications used in making this cost estimate. UMTA also found that in-house rehabilitation estimates ran in the $30,000 per unit range but probably did not adequately reflect plant use, overhead, higher labor costs, supervision, and other internal "buried" costs. If these costs are considered, in-house reha-

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1. Survey and Analysis of Bus Rehabilitation in the Mass Transportation Industry, ATE Management and Service Company for UMTA, November 1980, pages 2 to 14.
2. IBID pages 6-1 to 6-6.

bilitation probably would be comparable or even higher than if done by a contractor. True costs, however, must be honestly calculated and any disruption of on-going maintenance activities or operations should be avoided. If the vehicles, either in-house or contractor rehabilitated, are to be lift-equipped, another $15,000 should be added, raising the average costs to $45,000 and $70,000 respectively.

The 1980 U.S. fleet of buses under eighteen years of age stood at about 48,000 standard size buses. In order to maintain an average vehicle age of six years[3], at least 4,000 buses would need to be purchased or replaced each year. Since this has not occurred, the average age has continued to increase and was up to nine years in 1980 (compared with 9.7 years in this region). This deferred capital improvement backlog will eventually create a severe problem if not corrected. Rehabilitation can assist in lowering the average age of the U.S. fleet by accelerating the replacement of depreciated buses. According to UMTA, this could amount to one-fourth or more of all bus replacements. Appendix D shows the 1980 inventory of buses eighteen years and younger and a sample bus replacement schedule using the 4,000 per year figure.

PSCOG staff conducted a telephone survey of twenty-two organizations who operate vanpools across the country. The purpose of the survey was to determine what experiences these organizations may have had with rehabilitating vans. Table 1 summarizes the results of that survey.

As indicated in the table, two organizations reported significant experience with rehabilitating vans: Tennessee Valley Authority and Aerospace. The average age of a van when rehabilitated was five to six years with rehabilitation

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[3] The current useful life of a standard bus has been estimated at 12 years (see Reference 4). A balanced replacement schedule would suggest an average fleet age of 6 years.

Table 1
Telephone Survey of Major Vanpool Operators

		Van American Network	TVA	Prudential	Gulf Oil	Rides	Conoco	ATENA	3M
OWNERSHIP	Individual Owner/Operator								
	Agency Sponsor Owned								
	Leased		x			x			
	Company Sponsor Owned			x			x	x	x
	Leased	x			x				
FLEET CHARACTERISTICS	Number of Vehicles	600	553	450	280	260	199	165	150
	Seats per Vehicle	15	10	12,15	12,15	15	12,15	12	12
	Age of Oldest Vehicle	5	6	6	5	4	3	5	4
REHABILITATION	Criteria Mileage		100,000						
	Age in Years		5-6		4				
	Cost of Rehabilitation		$ 4-5,000		$ 5-700				
	Seat and Interior Replacement		x		x				
	Engine Rebuild or Replacement		x						
	Expected Added Life		50-60,000 miles		2 years				
REPLACEMENT	Criteria Mileage	80,000		75,000		80,000	45,000	100,000	70,000
	Age in Years	4		5		4	3		4-5
	Cost of Replacement Van	$ 15,000				$ 16,000	$ 13,500		$ 13,000
	Expected Life of New Vehicle	4 Years		5 Years		4 Years	3 Years		5 Years

Table 1 (cont'd)
Telephone Survey of Major Vanpool Operators

		AT&T	Commuter Pool	Chrysler	USAA	Union Carbide	Bechtel	Texas Eastern
OWNERSHIP	Individual Owner/Operator							
	Agency Sponsor Owned		x					
	Leased							x
	Company Sponsor Owned	x		x	x	x		
	Leased						x	
FLEET CHARACTER-ISTICS	Number of Vehicles	134	132	120	98	80	70	70
	Seats per Vehicle	12	12,15	12,15	12,15	12	14	12,15
	Age of Oldest Vehicle	5	3	1 Month	5	2 1/2	2 1/2	3
REHABILI-TATION	Criteria Mileage							
	Age in Years				5-7			
	Cost of Rehabilitation				$ 2,000			
	Seat and Interior Replacement				x			
	Engine Rebuild or Replacement							
	Expected Added Life				1-2 Years			
REPLACE-MENT	Criteria Mileage	IND.						100,000
	Age in Years	IND.	4	1	5-7	4	5-6	4
	Cost of Replace-ment Van	$ 14,000	$ 12,000		$ 16,000	$ 13,500	$ 22,000	$ 14,000
	Expected Life of New Vehicle		4 Years		5-7 Years	4 Years	5-6 Years	4 Years

Table 1 (cont'd)
Telephone Survey of Major Vanpool Operators

		Brown & Root	Aerospace	Smith - Cline	South New England Telephone	Fluor	Golden Gate Transit	Zenith
OWNERSHIP	Individual Owner/Operator							
	Agency Sponsor Owned						x	
	Leased							
	Company Sponsor Owned	x		x	x	x		x
	Leased		x					
FLEET CHARACTERISTICS	Number of Vehicles	65	63	39	33	30	27	4
	Seats per Vehicle	12	10,12	12	15	12	12,15	12
	Age of Oldest Vehicle	3	7	5	6	2	5	5
REHABILITATION	Criteria Mileage		125,000					
	Age in Years		6					
	Cost of Rehabilitation		$ 4,000					
	Seat and Interior Replacement		x					
	Engine Rebuild or Replacement		x					
	Expected Added Life		2 years					
REPLACEMENT	Criteria Mileage			90,000	IND.		100,000	80,000
	Age in Years	5		4	IND.		5	
	Cost of Replacement Van			$ 12,000			$ 16,000	$ 12,000
	Expected Life of New Vehicle			4 years			5 Years	80,000 miles

costs running from $4,000 to $5,000. Mileage when rehabilitation occurred was in the 100,000 to 125,000 mile range. Gulf Oil completed essentially cosmetic rehabilitations of interiors for about $500 to $700 per unit but did not get involved in mechanical rehabilitation. The USAA rehabilitation also involved only interior work but was much more extensive. Since neither included mechanical work, they could not be classified as true vehicle rehabilitation.

Rehabilitated vans were projected by the two agencies to give an additional life expectancy of about two years or 50,000 to 60,000 miles. This is less than one-half of the life expectancy of new vans as stated by the twenty-two vanpool organizations. Rehabilitation costs were about one-fourth the cost of a new vehicle.

Of the 3,600 vans operated by the twenty-two agencies, only thirteen were being rehabilitated by two agencies--approximately one-half of one percent of the vans in the survey. It is unknown whether others may become involved in rehabilitation but some of those interviewed expressed a preference for purchasing new equipment and surplusing old equipment rather than rehabilitating it.

2. Rehabilitation Experience in the Central Puget Sound Region

Locally, four transit agencies have been involved in rehabilitation of buses, primarily in response to available federal funding through the UMTA program described earlier. One of those agencies, Metro, has not proceeded with a bus rehabilitation program, but has evaluated it carefully before deciding against rehabilitation at this time. The overall rehabilitation potential of the central Puget Sound region will be discussed later in Chapter 3. Below is a brief description of local experiences to date in this region.

a. Metro.

Metro has evaluated the potential for rehabilitation of coaches on several occasions. To date, their only completed rehabilitation project has been three electric rail trolleys for the special waterfront line. These trolleys were rehabilitated in-house by Metro using core units from Australia.

Metro explored the possibility of rehabilitating rubber wheel trolleys, but after an extensive evaluation of costs and product quality concluded that it would not be cost effective. A summary of that evaluation is contained in Appendix E. The primary concerns were that the cost was not significantly lower for rehabilitation than for a new coach, and that the better federal match ratio available for new units could make them equally attractive despite the lower overall cost for rehabilitation.

The ultimate decision was to surplus the old trolleys, buy new ones gradually, and use diesel buses in the interim to service the trolley routes.

Metro's most recent experience has been in considering the rehabilitation of seventy 1968 GMC coaches. Again, after careful evaluation of the potential for these coaches, it was decided not to pursue rehabilitation at this time. They also reviewed other coaches in their fleet and concluded that the 1968 GMC group would be the only one appropriate for rehabilitation purposes. This was because the others either had already exceeded or would exceed Metro's maximum life expentancy for coaches of twenty years or 850,000 miles. Only the thirteen-year-old GMC's would stay within the twenty year guideline, assuming seven years extended life following rehabilitation. Another consideration was that the 1968 GMC's had been maintained in excellent condition and many would need only about one-half of the required replacement/rehabilitation items listed in the UMTA guidelines. Additional details of the evaluation are contained in Appendix E.

In summary, Metro has decided not to become actively involved in rehabilitation of buses based upon their evaluation of cost effectiveness and practicality. Their direct experience with rehabilitation has been with rail trolleys that were done in-house and resulted in a very satisfactory product.

b. Pierce Transit

Of the public transit operators in the region, Pierce Transit has been the most actively involved in the rehabilitation of buses. To date, Pierce Transit has taken delivery of 25 rehabilitated 1959-1960 series 5301 and 5303 "new look" GMC buses. The first twenty were completed by Dickerson Bus Lines of Minneapolis and Anoka, Minnesota using cores (base buses) provided by the contractor rather than by Pierce Transit. These rehabilitated units were delivered for $45,000 to $46,000 each including inspection and incidental costs. Thus far, only minor problems have been encountered which have since been corrected and have resulted in changed specifications for subsequent deliveries. These coaches are projected to last about seven to ten years and appear to be performing well during their first year of service.

Another twenty coaches have been ordered from Transportation Design Technology, Inc. (TDT) of San Diego, California. Thus far, five have been delivered. These were also "new look" GMC 5301 and 5303 units provided by the contractor. The core units from TDT appear to Pierce Transit inspectors to be much sounder than the earlier Dickerson units. The TDT cores were acquired on the West Coast and are generally in better condition than the Midwest/East Coast cores where salt treatment on the roadway in the winter and severe weather are a factor in the deterioration of chassis and frame. These units from TDT have a delivered price of about $54,000 including inspection and incidental costs. Another fifteen will be delivered within the next six months.

Pierce Transit has programmed another twenty units of rehabilitated buses in next year's capital program, bringing to sixty the total number of rehabilitated buses being purchased. The total Pierce Transit fleet now stands at 165, making rehabilitated units a growing proportion of the total fleet. Pierce Transit, however, views these purchases as supplementary to its new bus procurement program, and not a replacement of that program. It allows the operator to put a larger number of reliable, relatively attractive and inexpensive units in service in a shorter time period. When building service, it is important to maximize reliability, rider appeal, and ability to respond to demand. It appears that rehabilitated buses are helping Pierce Transit meet these requirements.

c. Community Transit

Community Transit has recently become involved in the rehabilitation of buses, having signed a contract with Transportation Design Technology, Inc. (TDT) of San Diego for six units with costs varying, depending upon condition of core coach, from $45,000 to $50,000 each. This will not include work on the propulsion systems. TDT was selected from seven bids, three of which were from the West Coast. Delivery is expected to be completed by February 1983. Core units were "new look" GMC coaches.

Community Transit currently has seventy buses, fifty-four of which are three years or less in age. Their rehabilitation program, therefore, is aimed at maintaining reliable, relatively attractive coaches to supplement a new fleet of vehicles rather than upgrade a predominantly older fleet. This "deferred maintenance" approach provides a useful and lower cost option to keep the operating fleet in top condition pending eventual replacement by new vehicles at a later date.

d. Everett Transit

Everett Transit has submitted an application to UMTA to rehabilitate six 1972 and 1973 Twin coaches. An additional fourteen 1972-1973 Twin coaches will be rehabilitated as well. Unlike Pierce Transit, Everett Transit is using existing ten year-old core units that have proven to be well suited to service requirements in the Everett area. These twenty rehabilitated coaches represent nearly two-thirds of the Everett Transit fleet. The remaining nine GMC coaches, eight to twelve years old, will be replaced by new buses and probably will be surplused rather than being rehabilitated since the GMC's have not proven to be as well suited to Everett's service needs.

3. Pros and Cons of Rehabilitation Based on Experience Here and Elsewhere

Clearly, rehabilitation is fast becoming a serious option to operators both locally and across the country for a number of reasons. Conversely, rehabilitation has displayed numerous pitfalls and raised concerns that should be carefully considered prior to taking this option. Following is a list of pros and cons based on the experiences, both local and nationwide, of

operators that have been actively engaged in reviewing this relatively new program.

a. Why is rehabilitation a good idea?

- o Initial cost of rehabilitating coaches can be one-third to one-half that of a new coach, thereby, offering an affordable alternative to many operators.
- o Declining federal and local sources for capital spending make lower cost alternatives more attractive.
- o Capital requirements have typically exceeded available resources, forcing reconsideration of lower cost alternatives.
- o Postponement of replacement decisions can eventually create significantly higher maintenance costs. If newer coaches cannot be justified because of higher initial cost, rehabilitation presents an option to outright postponement of replacement decisions.
- o Reliability is the key to building service; road breakdowns and delays affect rider confidence. If new coaches cannot be purchased, rehabilitation may offer an alternative to increase overall fleet reliability in the short-to-mid-term period.[4]
- o In periods when new bus procurement is slow, service level and reliability can be enhanced by rehabilitation.
- o Quality of rehabilitated products has been considered generally quite good by those who have participated in the program. Rehabilitation can add up to ten years to the life of the bus. Considering that the average amortized "life" of a new bus is twelve years, the rehabilitation option can be attractive in many local circumstances.
- o Rehabilitation will recycle rather than dispose of structurally sound bus cores that might otherwise be discarded. The energy needed to manufacture a new vehicle is saved.

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[4] Some operators have noted that newer buses, especially ADB's (Advance Design Buses), can actually have maintenance costs in excess of those for rehabilitated vehicles (based on conversation with Pat Jones, American Public Transit Association staff member).

- Federal funds are limited. Even if the local share is about the same for new versus rehabilitated buses, more buses can be put into service for a given amount of federal dollars under the rehabilitation option.

b. What are the shortcomings of rehabilitation?

- The basic design of a rehabilitated coach is twelve to twenty (or more) years old. If the expected life for a rehabilitated bus is seven to ten years, the bus will be nineteen to thirty years old when replacement is again considered. New bus design technology is considered superior because of modern passenger comfort and safety features.[5] Many of these features cannot be economically retrofitted to an old core.

- Parts availability can be a problem. Replacement parts become increasingly more difficult to acquire as the vehicle gets older. The old coach may begin to deteriorate at a faster rate if replacement parts cannot be obtained, thus shortening useful life.

- Federal funding shares for rehabilitated buses are based on a percent of a twelve year new-bus life cycle. Rehabilitated buses are projected to last only about seven years on the average, making the proportion of local matching funds potentially larger than the proportion needed on a new coach (even though the amount of local funds may be greater for a new coach because of higher overall cost).[6]

- Rehabilitation should not be considered a replacement for new equipment purchases. If used, it should be properly scaled to avoid outdated (obsolete) fleets.

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5 Major technological improvements include lighter, stronger metals, rust resistant panels that will withstand minor collisions, improved interior conditions.

6 UMTA uses 70 percent of the value of the rehabilitated bus based on a twelve year new bus amortization schedule. For example, if a new bus costs $120,000 ($10,000 per year over twelve years), and a rehabilitated bus is projected to last seven years, then the eligible amount is $10,000 (per year) times seven years = $70,000 x 70 percent = $49,000. The federal federal funding share is 80% of $49,000 or $39,200. Most rehabs currently run about $55,000 to $60,000. Local share, then, would be $60,000 minus $39,200 or about $21,000. For the $120,000 new bus, the local share would be 20% of $120,000 or $24,000.

- Since rehabilitation is a relatively recent enterprise, experience in this area is still somewhat limited. Contractors are not plentiful and it is too early to tell if significant problems will arise in quality control and durability. In short, most rehabilitation firms and their products are essentially untested.

B. How to Evaluate Rehabilitation Potential

This section will define the concept of life-cycle costing and discuss its application to transit vehicles. The use of life-cycle costing methods to evaluate the trade-offs between rehabilitation versus maintenance, and rehabilitation versus replacement, will be covered.

1. Definition of Life-Cycle Costing

The underlying concept which should be used in the evaluation of fleet rehabilitation potential is life-cycle costing. As a general definition, life-cycle costing can be described as the total quantifiable cost to the owner for a unit of equipment, taking into consideration the initial capital cost plus other costs of ownership, such as operation and maintenance, over the life of the equipment. When applied to public transit vehicles, the initial cost is the purchase price of the vehicle--bus, trolley, van, etc. The other costs of ownership include fuel or electric power, repair and/or replacement of major components or subsystems over the vehicle service life, and the preventative maintenance program over the vehicle service life. Life-cycle costs usually do not include drivers' wages, but do include both labor and materials for repair and maintenance items.

2. Simplified Procedure for Estimating Life-Cycle Costs

A generalized procedure developed by UMTA (Reference 8) for estimating life-cycle costs is based on seven cost compo-

nents. The components, listed below, are described in terms of a conventional bus, but would be applicable also to trolley coach or van.

A = Bus lifetime adjustment factor
B = Acquisition cost per bus
C = Cost of expendables (fuel, oil, tires, coolants, lubricants) over lifetime of bus
D = Transmission repair costs over lifetime of bus
E = Brake repair costs over lifetime of bus
F = Air conditioning and ventilation repair costs over lifetime of bus
G = Preventive maintenance costs over lifetime of bus

where

$$A = \frac{\left[\begin{array}{l}\text{Number of years intending to} \\ \text{keep bus in service}\end{array}\right] \times \left[\begin{array}{c}\text{miles/year} \\ \text{average utilization}\end{array}\right]}{\text{Manufacturer's estimate of bus life in miles}}$$

The bus lifetime adjustment factor "A" provides the means to account for differences between the manufacturer's estimate of bus service life and the transit operator's estimate of service life based on rate of mileage accumulation and length of time the bus is expected to be in service.

The acquisition cost is the initial purchase price of the bus. The fuel cost is determined from the estimated lifetime mileage for the bus, its fuel consumption rate (gallons/mile), and the estimated cost of fuel (dollars/gallon). The cost of oil, tires, and lubricants are computed in a similar manner. The repair costs for transmission, brakes, and air conditioning/ventilation equipment are based on the number of repair events expected in the lifetime of the bus, and the labor plus material costs of each event. The preventative maintenance costs are based on the number of maintenance events expected during the lifetime of the bus, and the labor plus materials cost per event. Data on the expected number of repair and maintenance events, fuel consumption rates, and cost of materials are usually provided by the manufacturer. Data on fuel cost, labor rates, and mileage accumulation are usually drawn from the transit operator's records.

The total life-cycle cost (LCC) is then:

$$LCC = A[B + C + D + E + F + G]$$

Since the above costs are accumulated incrementally over the life of the bus, the effect on inflation must be considered to determine actual costs to the owner. However, for purposes of comparing vehicles from different manufacturers or comparing new bus purchases with rehabilitation options, the costs may be computed in constant dollars.

3. Maintenance Versus Rehabilitation

For most public transit systems, maintenance and repair costs are the second largest component of total operating costs, after driver's wages. The trade-off, which must be weighed by each operator, is between a high-cost maintenance program which extends the service life of the original vehicle and a low-cost maintenance program supplemented by major rehabilitation (after 10-15 years) to restore the vehicle to nearly new condition and thereby extend its service life. The objective in both cases is to achieve an 18-20 year service life overall.

The rehabilitation approach, in effect, offers the option of deferring maintenance on non-safety items thereby holding overall operating costs. The dollars saved on maintenance will be off-set by the large capital expenditure for bus rehabilitation. However, deferring some of the operating costs for a few years may be desirable for the overall economic well-being of the transit property.

Another aspect of the trade-off between maintenance and rehabilitation is the impact of in-service failures. A more expensive preventive maintenance program minimizes the incidence of in-service failures, i.e. bus breakdowns which disrupt

schedules and inconvenience riders. A minimum level maintenance program reduces the annual operating budget but a portion of the savings will be lost in higher labor and equipment costs for road calls.

An additional cost of in-service failures, although not quantifiable, is loss of public confidence. Most transit operators consider public confidence and support crucial to their success; therefore, they lean toward a maintenance program which assures a high degree of reliability in service delivery.

In summary, the key factors entering into the decision on investment in a maintenance program versus investment in a rehabilitation program are as follows:

- What is the current average age and condition of the fleet?
- What is the maintenance history for the vehicles now in service?
- What is the current condition of public confidence and support for the transit system?
- What federal funding opportunities are available for subsidizing operating costs (including maintenance) versus capital expenditures (rehabilitation)?

4. Rehabilitation Versus Replacement

Most transit operators have weighed the relative costs of rehabilitating versus replacing a portion of their bus fleet. The life-cycle costing method provides a realistic means of evaluating the relative merits of the two concepts. A third concept has emerged in recent years--that of purchasing rehabilitated buses from a manufacturer who acquires an inventory of used buses and offers them for sale, rehabilitated to a customer's specifications. This third concept is being used by some operators to quickly add to their bus fleet at a reduced capital outlay.

To properly compare the three concepts, the overall time frame must be some multiple of the new bus life and the combined

new-plus-rehabilitated bus life. An example of this is shown in Figure 2a. If the life of a new bus is assumed to be twelve years and the life of a rehabilitated bus is assumed to be six years, then the appropriate time frame for the analysis is thirty-six years. Figure 2b shows the same three concepts but with the life of a rehabilitated bus assmed to be eight years.

In each case, the life-cycle cost is the sum of the acquisition cost and the operating and maintenance costs over the service life of the vehicle, minus the residual (resale) value of the vehicle at the end of its service life. The operating and maintenance costs include expendables (fuel, oil, tires, lubricants, coolants), repair and replacement of major components, and preventative maintenance.

For each of the concepts shown in Figure 2 the life-cycle cost (LCC) can be estimated as follows:

New Bus Purchase/Replacement

$$LCC_n = \frac{T}{LN} [C_n + (O_n \times L_n) - R_n] \quad (1)$$

T = Term of Analysis
L_n = Life of new bus
C_n = Capital cost of new bus
O_n = Annual operating/maintenance cost of new bus
R_n = Residual value of new bus

New Bus Purchase/Rehabilitation

$$LCC_r = \frac{T}{L_n+L_r} [(C_n + C_r) + (O_n \times L_n) + (O_r \times L_r) - R_r] \quad (2)$$

L_r = Life of rehabilitated bus
C_r = Capital cost of rehabilitated bus
O_r = Annual operating/maintenance cost of rehabilitated bus
R_r = Residual value of rehabilitated bus

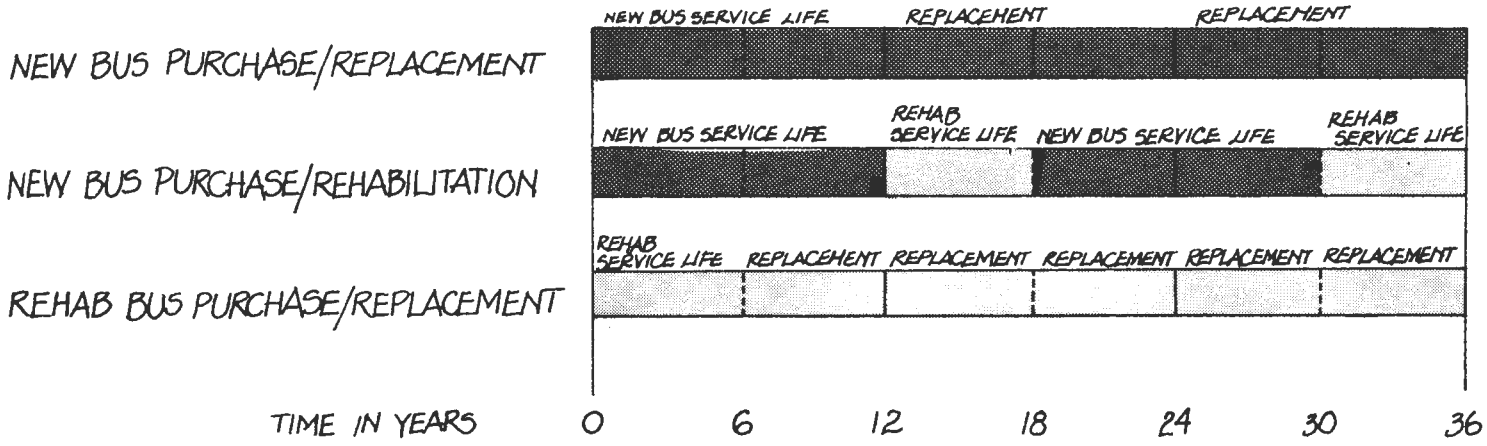
Rehabilitated Bus Purchase/Replacement

$$LCC_{rr} = \frac{T}{R_r} [C_r + (O_r \times L_r) - R_r] \quad (3)$$

An illustrative example of the life-cycle costs of the three above concepts, using costs and service life assumptions typical of current bus fleets, is shown in Table 2.

FIGURE 2: COMPARISON OF BUS REPLACEMENT AND REHABILITATION CONCEPTS

a) 6 YEAR REHABILITATED BUS SERVICE LIFE



b) 8 YEAR REHABILITATED BUS SERVICE LIFE

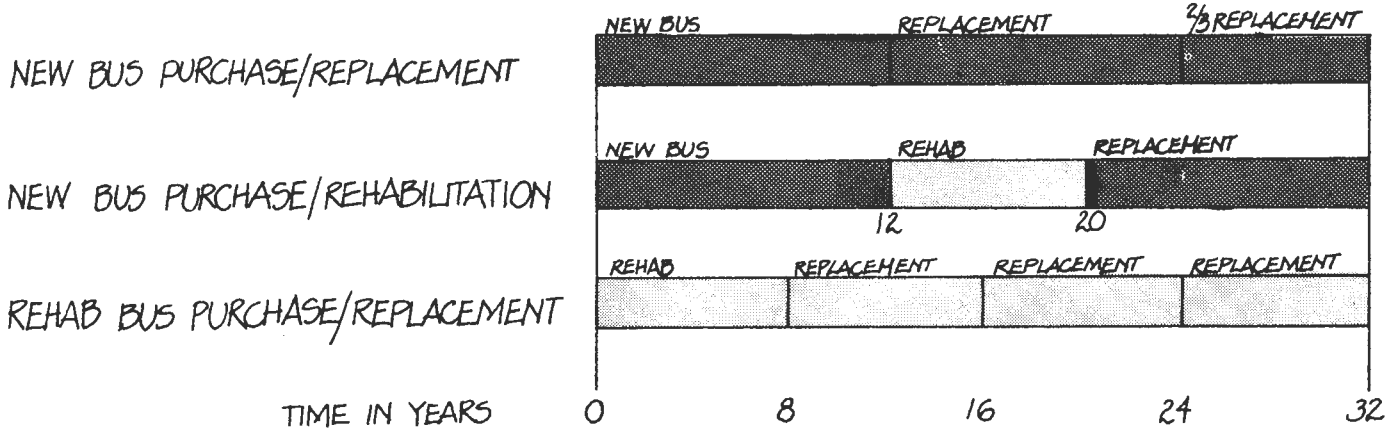


Table 2

Comparison of Life-Cycle Costs
for Bus Replacement and Rehabilitation Concepts

a) 6-year Rehabilitated Bus Service Life

		Life-Cycle Concept		
		①	②	③
T	(years)	36	36	36
Ln	(years)	12	12	-
Lr	(years)	-	6	6
Cn	($)	135,000	135,000	-
Cr	($)	-	55,000	55,000
On	($)	10,000	10,000	-
Or	($)	-	12,000	12,000
Rn	($)	5,000	-	-
Rr	($)	-	2,000	2,000
LCC	($ per bus over 36-year term)	750,000	760,000	750,000

b) 8-year Rehabilitated Bus Service Life

		Life-Cycle Concept		
		①	②	③
T	(years)	32	32	32
Ln	(years)	12	12	-
Lr	(years)	-	8	8
Cn	($)	135,000	135,000	-
Cr	($)	-	55,000	55,000
On	($)	10,000	10,000	-
Or	($)	-	12,000	12,000
Rn	($)	5,000	-	-
Rr	($)	-	2,000	2,000
LCC	($ per bus over 32-year term)	667,000	654,000	596,000

Based on this illustrative example, the life cycle costs vary within a narrow range for the three concepts. It can be concluded that the decision to replace fleet vehicles with new buses versus rehabilitated buses will be based on the following criteria.

- o The actual operating and maintenance costs for the individual operator.
- o The expected service life for both new vehicles and rehabilitated vehicles, based on the level of investment in maintenance.
- o The availability of federal funding assistance for new vehicles versus rehabilitated vehicles.
- o The image the transit operator wishes to project through the type of equipment used.

C. When and Where to Use the Rehabilitation Option

This section discusses the use of rehabilitation in varying circumstances, suggesting when and where it may offer the greatest potential. First, a preliminary screening evaluation is suggested that identifies general operator conditions under which rehabilitation might offer the greatest potential. Second, various rehabilitation situations are outlined, describing the use of rehabilitation as one solution.

1. Fleet Makeup and Service Requirements: A Preliminary Screening

The condition of an operator's existing fleet coupled with the demands placed on that fleet by routes and schedules help determine the potential for use of rehabilitated vehicles. Table 3 illustrates a number of hypothetical operator conditions using three variables to define condition: age of fleet; status of fleet maintenance; and extent of capital need backlog. These varying conditions are then related to service demand ranging from declining service to rapidly expanding service.

Table 3

Situations Where Fleet Rehabilitation
Might Be Appropriate

Operator Condition (three variables)	Service Requirements: Rapidly Expanding Service	Moderately Expanding Service	Static Service Need	Declining Service
Newer fleet (6 yr. ave. age) Well maintained High capital need	N/R	N/R	N	N
Newer fleet (6 yr. ave. age) Poorly maintained High capital need	R	N/R	N/R	N
Newer fleet (6 yr. ave. age) Well maintained Low capital need	N/R	N	N	N
Older fleet (8-10 yr. ave. age) Well maintained High capital need	R	R	R	N/R
Older fleet (8-10 yr. ave. age) Poorly maintained High capital need	R	R	N/R	N/R
Older fleet (8-10 yr. ave. age) Well maintained Low capital need	N/R	N/R	N	N

N = New buses preferred
N/R = Either new or rehab
R = Rehab buses preferred

As indicated in the table, certain combinations suggest greater potential for rehabilitation than others. In particular, older fleets with large capital backlogs and rapidly expanding service call for a maximum number of dependable coaches in service for the money available. This may involve use of rehabilitated coaches. On the other hand, newer fleets with stable or declining service present fewer pressing arguments for use of rehabilitation. With declining service, only older fleets with large capital backlogs offer potential. Even here, if building service is critical, new coaches may be the desired option. When service is static or declining, the older well maintained fleet may have limited potential for rehabilitation.

Again, Table 3 does not represent all operator conditions and, therefore, does not represent a comprehensive screen for identifying rehabilitation potential. It does, however, begin to focus attention on specific circumstances and/or combinations of conditions that may lead to the consideration of purchasing rehabilitated vehicles.

2. Using the Rehabilitation Option: Several Typical Situations

The following situations illustrate when the rehabilitation option might be appropriate. Because of the wide range and complexity of local operator circumstances, it is not possible to list more than a few general situations that may offer potential in the proper local context. These situations are not intended to be exhaustive, since many other applications of rehabilitation are possible. They do, however, represent some of the most common encountered to date based on a review of the literature and local experiences.

a. As an Interim Means of Meeting Emergency Short-Term Needs.

One of the common conditions that exists among operators is the need to put a relatively large number of clean,

dependable, and safe coaches into service in the shortest period of time for the least cost. Here, rehabilitation offers a reasonable alternative to purchasing fewer new buses or more used, and perhaps unreliable buses.

Comments: This option provides an excellent short-term means of meeting expanded service needs. It should not, however, replace the new bus purchase program since fleet age (obsolesence) can become a problem if too large a proportion of the fleet is older. The shorter service life of rehabilitated buses accelerates replacement requirements and eventually accummulates too large a replacement deficit to overcome.

b. As a Method of Upgrading a Relatively Small Number of Older Depreciated Buses

In fleets that have a relatively small collection of older buses that are at or beyond the cost-effective maintenance cycle, rehabilitation can be a lower cost alternative for keeping those buses in service or extending their maintenance cycle (sometimes referred to as "deferred maintenance" although this is not literally what is being done).

Comments: This option offers a smaller scale commitment to rehabilitation while not significantly affecting fleet makeup. It can be considered an extension of the maintenance program in this application. Again, if used too extensively and/or as a replacement for new bus purchase, it can result in cumulative maintenance problems in the future.

c. As a Primary Means of Upgrading an Extremely Old, Largely Depreciated Fleet

In certain circumstances, where new bus purchase is not a realistic option because of available resources and the overall condition of the existing fleet, it may be practical to use rehabilitation as a primary means of upgrading the fleet. The rehabilitation option allows the operator to maximize the number of replacements per dollar of investment while improving overall fleet quality.

Comments: This option should only be used in situations where new bus purchase is not a viable option and rehabilitation is the only practical means of putting enough dependable buses into service to meet present requirements. In such situations, yearly mileage may be low and, there-

fore, the expected life of the rehabilitated bus may approach that of a new coach. New bus procurement should still remain a component of the replacement program.

d. As a Means of Acquiring or Supplementing a Backup Fleet

Many operators have relatively few idle coaches that can be rotated into service to accommodate normal maintenance and/or special needs. The expense of new coaches for this purpose is too great and the dependability of older coaches may be low. In this instance, rehabilitation may offer a means of expanding backup capabilities while providing greater overall fleet dependability, flexibility, and longevity.

Comments: If federal matching funds are used, the backup fleet cannot be used for purposes of stockpiling buses. They must be used in regular service, even if on a rotating basis.

III. POTENTIAL FOR FLEET REHABILITATION IN THE CENTRAL PUGET SOUND REGION

This chapter presents a brief inventory of the region's public transit fleet and examines additional opportunities and/or need for vehicle rehabilitation. The need is based on age characteristics of the fleet and current service development requirements of individual operators.

A. Characteristics of the Region's Public Transportation Fleet

A summary of each transportation operator's current vehicle fleet is contained in Tables 4 - 9. The vehicles are grouped by manufacturer and model year. The total regional bus and trolley fleet amounts to 1,520 coaches with a total seating capacity of about 76,100. The public vanpool fleet consists of 132 vans providing 1,674 seats. This fleet represents the public vanpool program only. There are many other vanpools in service through private companies and private nonprofit service agencies.

B. Potential Need for Fleet Rehabilitation - By Operator

Approximately eighteen percent, or 280, of the region's buses fall into a category, based on age and model, that would be a standard for rehabilitation. This group includes all buses 10 - 20 years old plus all "new look" coaches built after 1959. In terms of availability of eligible core units, therefore, a relatively large supply exists. Although all of these vehicles would not be expected to be appropriate for rehabilitation, a large percentage of them would. As many as 250 vehicles could be made available for rehabilitation purposes. Metro, the largest transit operator in the region and owner of nearly two-thirds of the candidate buses, has already made a determination not to pursue rehabilitation at this time. The

Table 4

1982 Bus Fleet Characteristics

PIERCE TRANSIT

Manufacturer/Model	Model Year	No. of Coaches	Average Age (Years)	Length (ft)	Seating Capacity	Comments
Grumman 870	1980	33	2	35	45	
Flxible	1969	10	13	40	53	
GMC "New-Look" Model 4517	1968-74	82	14	35	45	
GMC "New-look" Model 5303	1960	20	22	40	53	
GMC "New-look" Model 4517	1960	20	22	35	45	
TOTAL		165	13.6		7065	

Table 5

1982 Bus Fleet Characteristics

COMMUNITY TRANSIT

Manufacturer/Model	Model Year	No. of Coaches	Average Age (Years)	Length (ft)	Seating Capacity	Comments
Flyer	1981	30	1	40	47	
Flyer	1980	2	2	35	39	
Flyer	1979	22	3	35	39	
GMC "New-look" Model 4519	1965	2	17	35	47	
GMC "New-look" Model 4517	1960	13	22	35	47	
GMC "New-look" Model 4517	1959	1	23	35	45	
TOTAL		70	6.3		3096	

Table 6

1982 Bus Fleet Characteristics

EVERETT TRANSIT

Manufacturer/Model	Model Year	No. of Coaches	Average Age (Years)	Length (ft)	Seating Capacity	Comments
Twin Coach Co.	1972	2	10	28	31	
Twin Coach Co.	1973	18	9	28	31	
GMC	1970	1	13	40	49	
GMC	1973	5	9	40	49	
GMC	1974	3	8	40	49	
Gillig Corp.	1981	3	1	35	39	
TOTAL		32	8.3		1178	

Table 7

1982 Bus Fleet Characteristics

KITSAP P1BAA
(formerly Bremerton Municipal and Bremerton-Charleston)

Manufacturer/Model	Model Year	No. of Coaches	Average Age (Years)	Length (ft)	Seating Capacity	Comments
Flxible	1974	7	8	35	41	
Twin Coach Co.	1943-47	39	37	35	41	used for worker-driver buspools
GMC 4100 Single-Door Suburban	1955-59	2	25	35	41	
GMC 4104 Single-Door Suburban	1959	2	23	35	41	
GMC 4106 Single-Door Suburban	1962-63	2	20	35	41	
TOTAL		52	31.4		2132	

Table 8

1982 Bus Fleet Characteristics

METRO TRANSIT

Manufacturer/Model	Model Year	No. of Coaches	Average Age (Years)	Length (ft)	Seating Capacity	Comments
GMC Model 4107	1966	2	16	35	45	
GMC SDM/S8M/TDH	1953-61	45	25	35-40	43-53	Proposed Sale
GMC Model 5105	1954-55	105	27	40	51	
GMC "New-look" Model 5305	1968	70	14	40	48	
Flxible	1963	99	19	40	51	
GMC Model 4512	1954-56	38	27	35	43-45	
A.M. General Model 10240B	1976	215	6	40	45	
M.A.N./ A.M. General	1978	151	4	60	72	Articulated
A.M. General Model 10240B	1978	10	4	40	45	
A.M. General Model 1024-0T	1979	109	3	40	45	Trolley
Flyer	1978	217	4	40	47	
Flyer	1979	35	3	35	39	Articulated
M.A.N.	1982-83	202	0	60	72	
TOTAL		1,298	8.56		69,651	

Table 9

1982 Van Fleet Characteristics

COMMUTER POOL

Manufacturer/Model	Model Year	No. of Vans	Average Age (Years)	Seating Capacity	Comments
Dodge	1979	21	3	12	
Plymouth	1980	81	2	12	
Plymouth	1980	30	2	15	
TOTAL		132	2.16	1674	

availability of candidate buses from Metro for use by other local transit agencies for rehabilitation purposes would depend on Metro's schedule for surplusing older vehicles and on whether the candidate vehicles would be among those surplused.

Complicating the picture is the fact that many of the rehabilitated vehicles put into service in the region to date are from core units supplied by outside contractors and did not involve using current local inventories. To discuss rehabilitation potential in this region, therefore, the demand for this type of vehicle must be assessed, not merely the supply of eligible vehicles. For discussion purposes, each transit agency's current fleet age distribution is summarized in Figure 3. For comparison, regional and national fleet age distributions are shown in Figures 4 and 5.

Figures 6 - 10 depict operator vehicle inventories in terms of normal life cycles for new, rehabilitated, and used vehicles. These tables illustrate potential demand for rehabilitation and/or replacement of vehicles and collectively show a hypothetical replacement backlog of about 400 vehicles for the region.[7] Individually, operator "backlogs" vary significantly and suggest equally variable demands for rehabilitated vehicles. A brief description of each operator's replacement profile and potential for rehabilitation follows.

1. Pierce Transit

Pierce Transit has a fleet with an average age in excess of thirteen years (compared to 8.9 years nationally and 9.7 years for the region). Presently, only a relatively small replacement backlog exists, as shown in Figure 6. Within five years, however, an increasing number of 1968 to 1974 vehicles will have exceeded their normal life cycle of twelve years and will face a replacement decision that will involve over one-half

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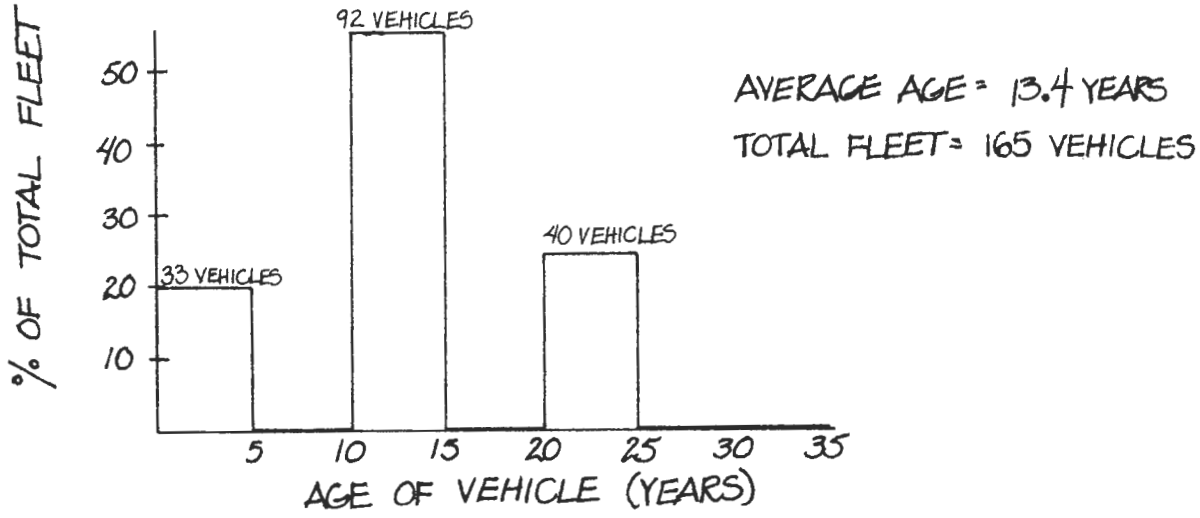
[7] This hypothetical backlog is based on a "normal" vehicle life cycle of 12 years for a new coach, 8 years for a rehabilitated coach, and 5 years for a used coach.

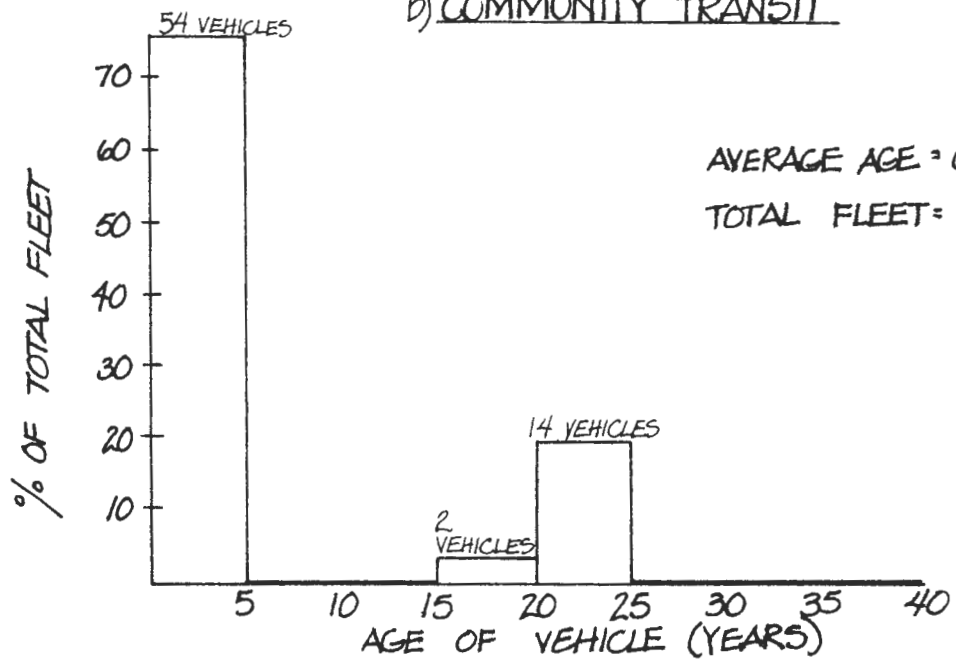
FIGURE 3
FLEET AGE DISTRIBUTION
BY OPERATOR
PUGET SOUND REGION
1982

a) PIERCE TRANSIT



AVERAGE AGE = 13.4 YEARS
TOTAL FLEET = 165 VEHICLES

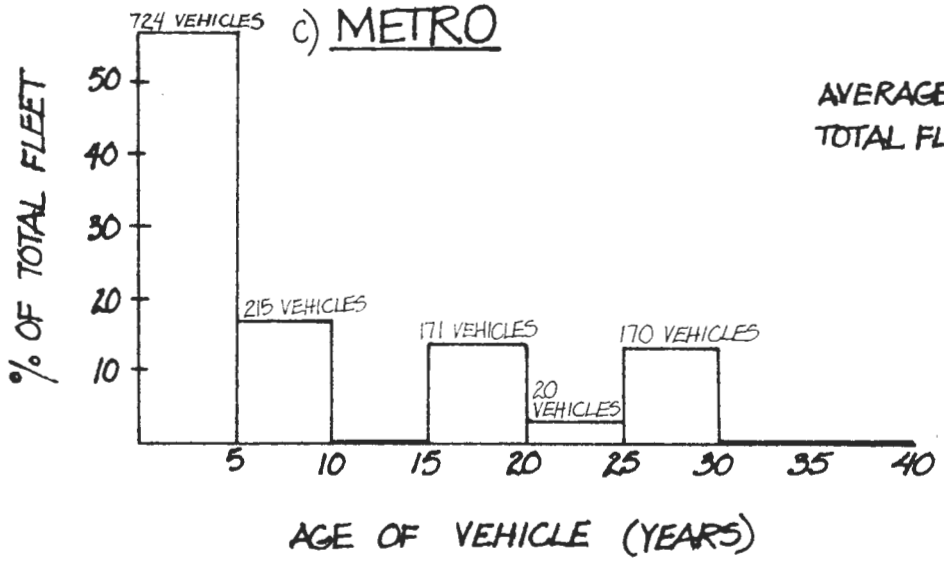
b) COMMUNITY TRANSIT



AVERAGE AGE = 6.3 YEARS
TOTAL FLEET = 70 VEHICLES

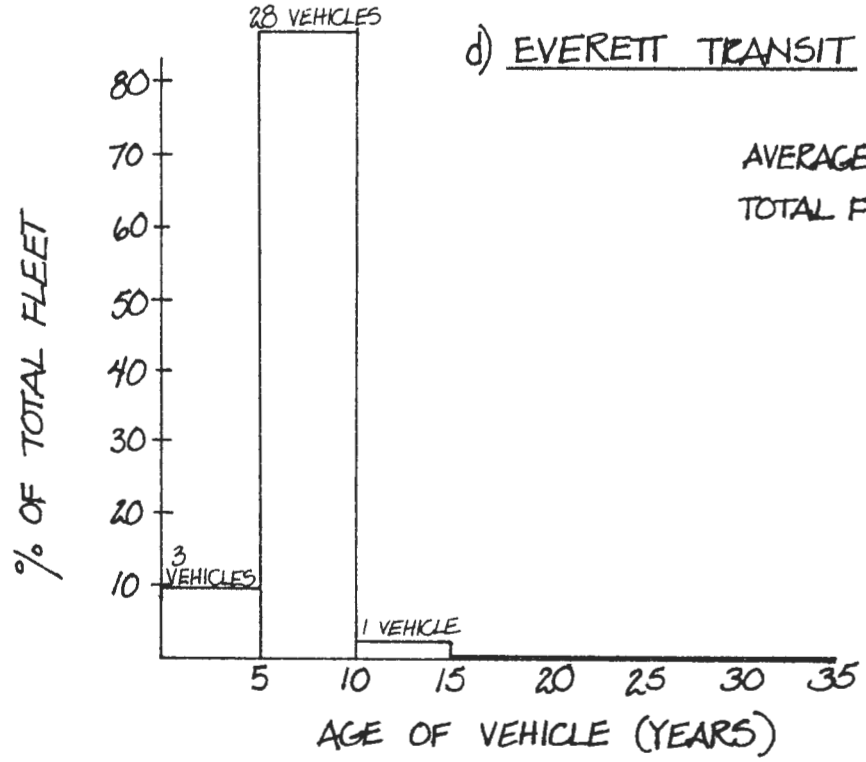
FIGURE 3 (CONTINUED)

c) METRO



AVERAGE AGE = 8.7 YEARS
TOTAL FLEET = 1300 VEHICLES

d) EVERETT TRANSIT



AVERAGE AGE = 8.3 YEARS
TOTAL FLEET = 32 VEHICLES

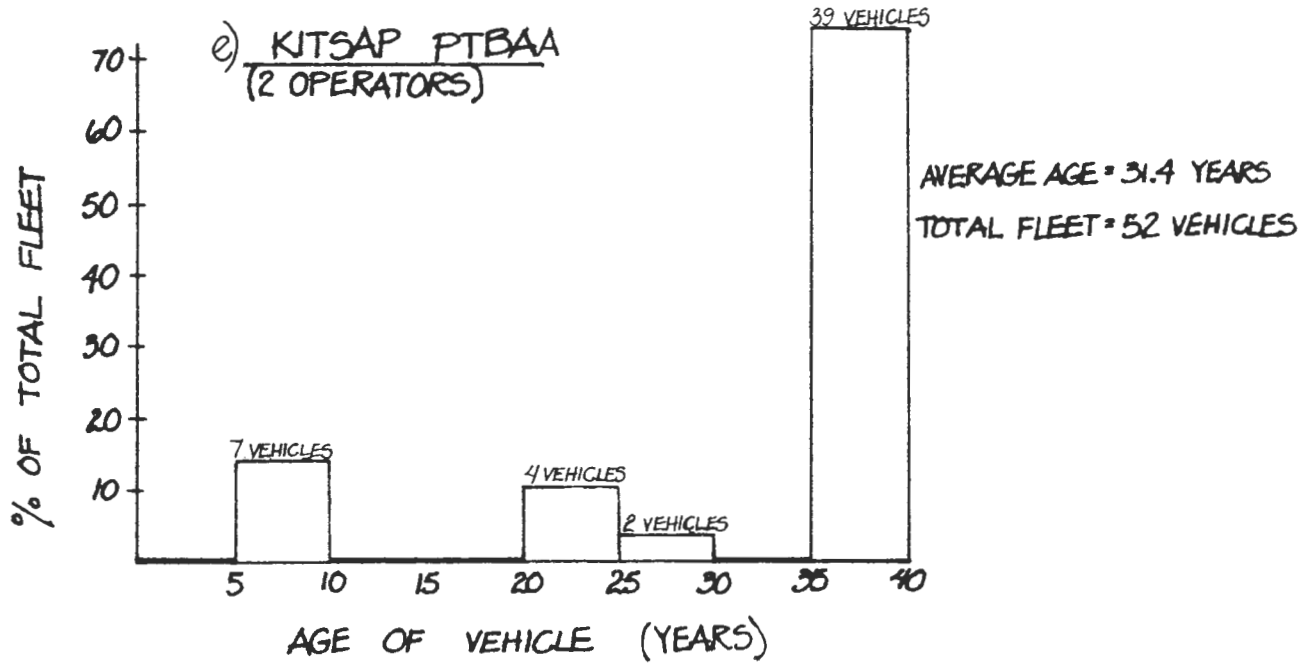

e) KITSAP PTBAA
(2 OPERATORS)
% OF TOTAL FLEET
70
60
50
40
30
20
10
7 VEHICLES
4 VEHICLES
2 VEHICLES
39 VEHICLES
5
10
15
20
25
30
35
40
AGE OF VEHICLE (YEARS)
AVERAGE AGE = 31.4 YEARS
TOTAL FLEET = 52 VEHICLES

FIGURE 4

FLEET AGE DISTRIBUTION
PUGET SOUND REGION
1982

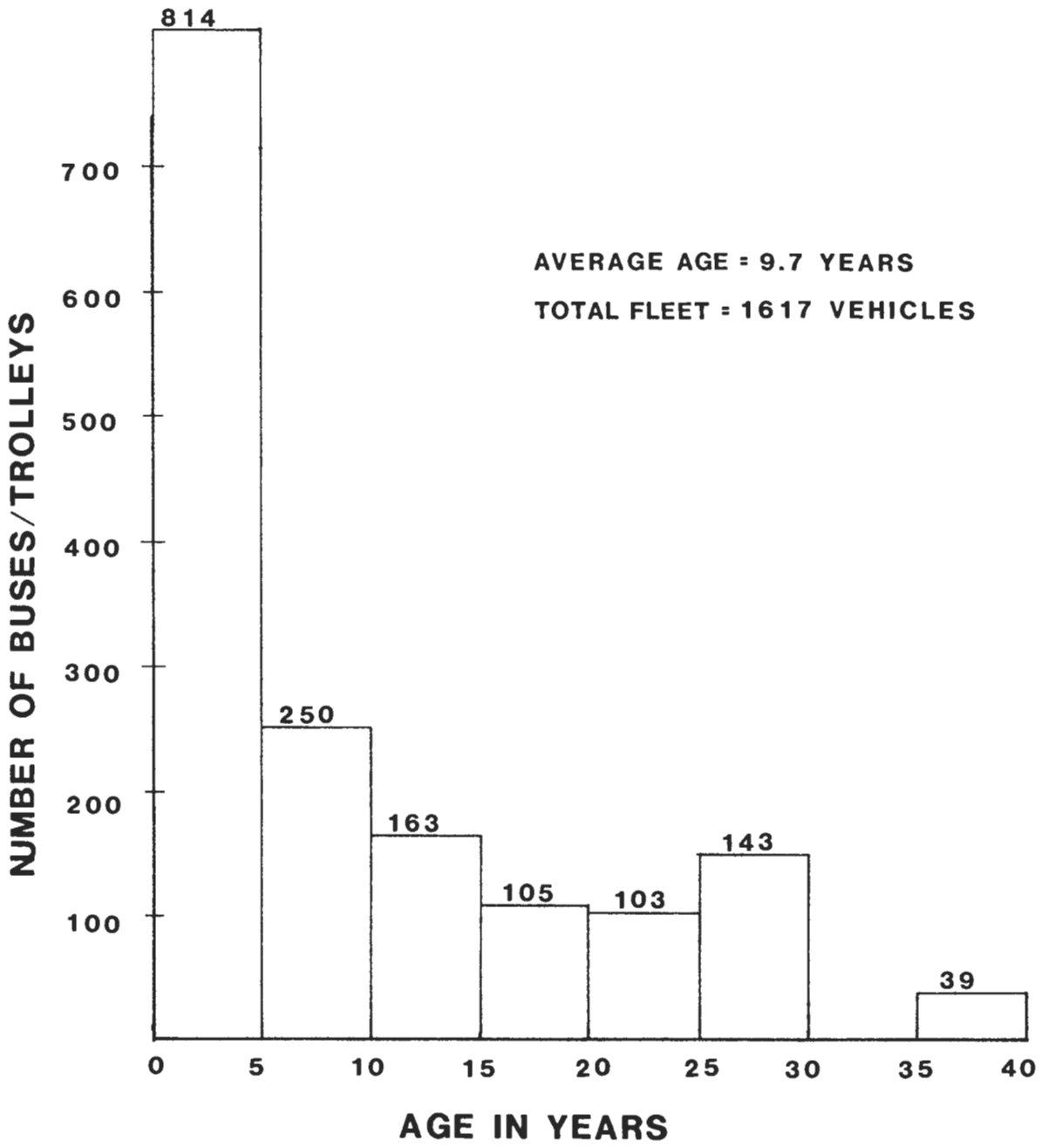
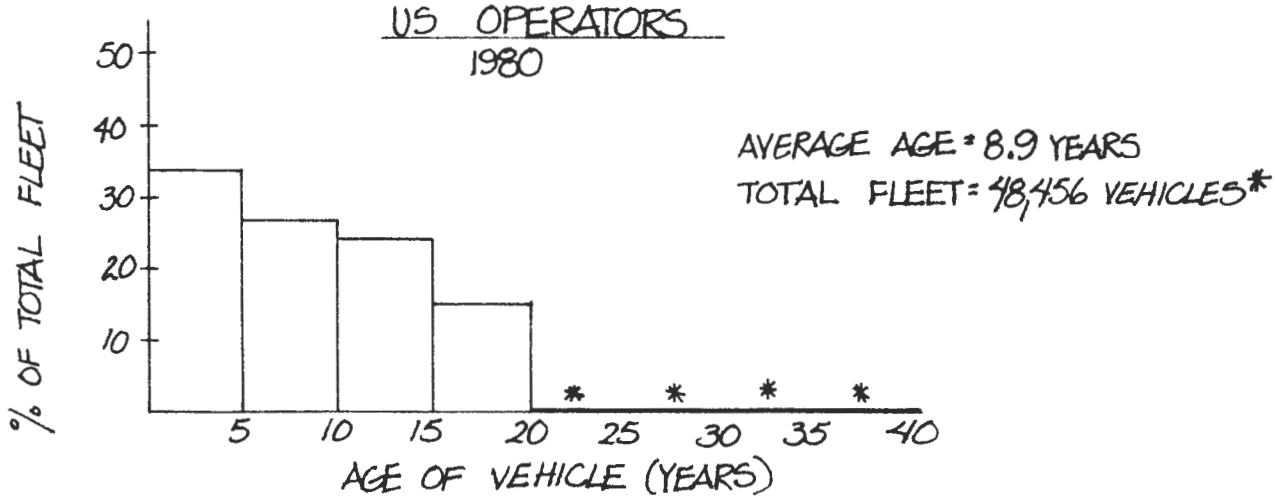


FIGURE 5

FLEET AGE DISTRIBUTION

US OPERATORS

1980

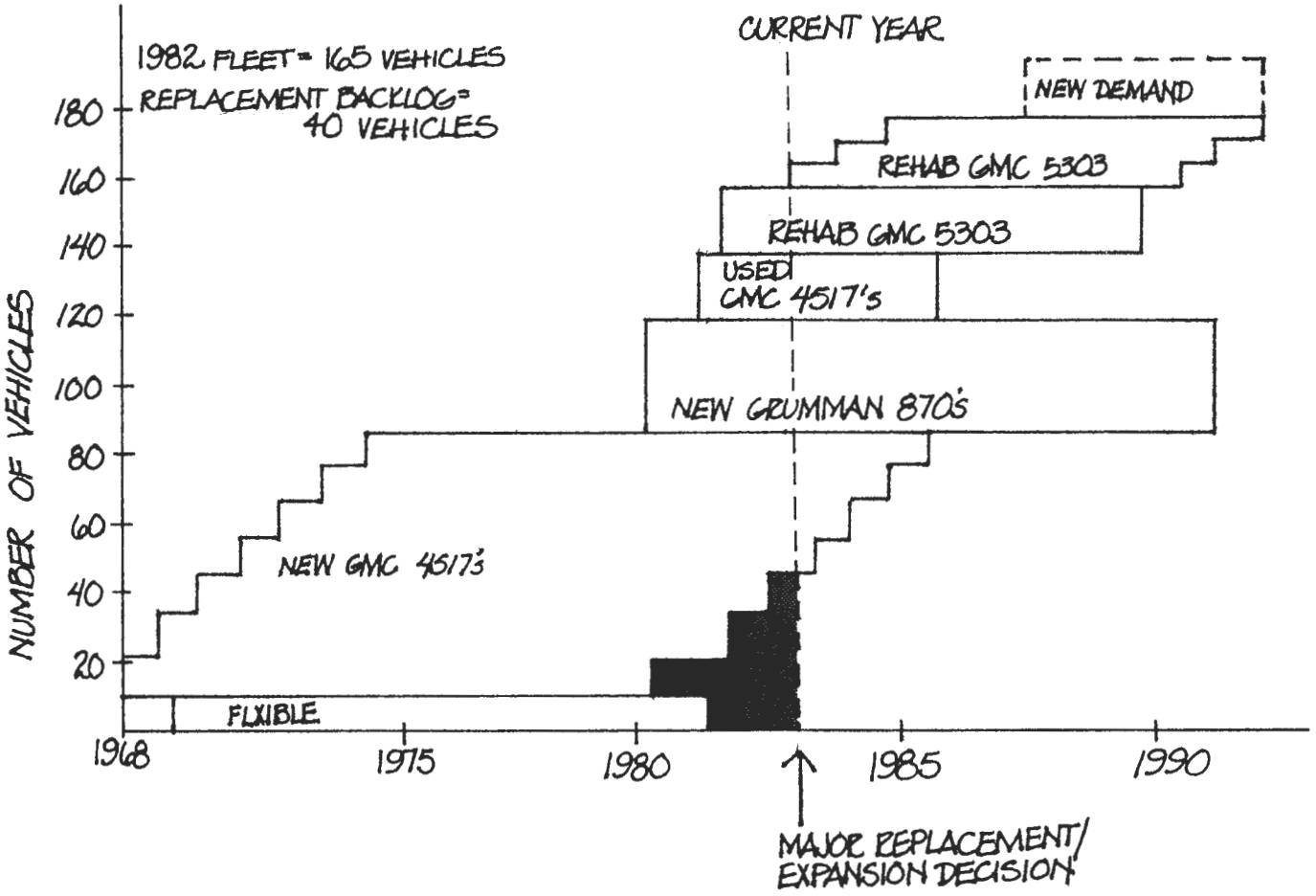


* DOES NOT INCLUDE ABOUT 5000 MORE VEHICLES THAT ARE OVER 20 YEARS OF AGE

SOURCE: REFERENCE 8

FIGURE 6

PIERCE TRANSIT
REPLACEMENT CYCLE



REPLACEMENT BACKLOG BASED ON NORMAL LIFE CYCLES

NOTES: 1) ASSUMES 12 YEAR LIFE CYCLE FOR NEW COACHES, 8 YEAR CYCLE FOR REHAB, 5 YEARS FOR USED
2) ASSUMES CONTINUED, IMMEDIATE AND SUSTAINED GROWTH IN DEMAND REQUIRING 165 OR MORE SERVICEABLE COACHES

of the present fleet. Pierce Transit has already supplemented their fleet with twenty-five rehabilitated buses and will shortly have a total of forty in service (almost one-quarter of their total fleet). An additional twenty may also be purchased next year. These rehabilitated buses were "new" to the fleet, not from existing inventory. New buses comprise only about one-fifth of the fleet but are scheduled to become an increasingly larger component of the replacement program in the future, particularly for meeting new demand. It is still conceivable that rehabilitation of some of the 1968 through 1974 GMC buses would be practical, but it is unknown whether rehabilitation will be a major component in the future because of the relatively large proportion of rehabilitated vehicles already in service.

Potential: limited--once the current program totalling 60 rehabilitated buses is complete, but could involve a portion of the 1968 to 1974 GMC vehicles depending upon demand for expanded service and availability of funding.

2. Community Transit

Community Transit, like Pierce Transit, is also now engaged in rehabilitation, but has a totally different fleet profile, i.e., a very new fleet backed up by an older reserve fleet which is being rehabilitated on a limited basis. Six units are under contract. Figure 7 depicts the current Community Transit fleet profile.

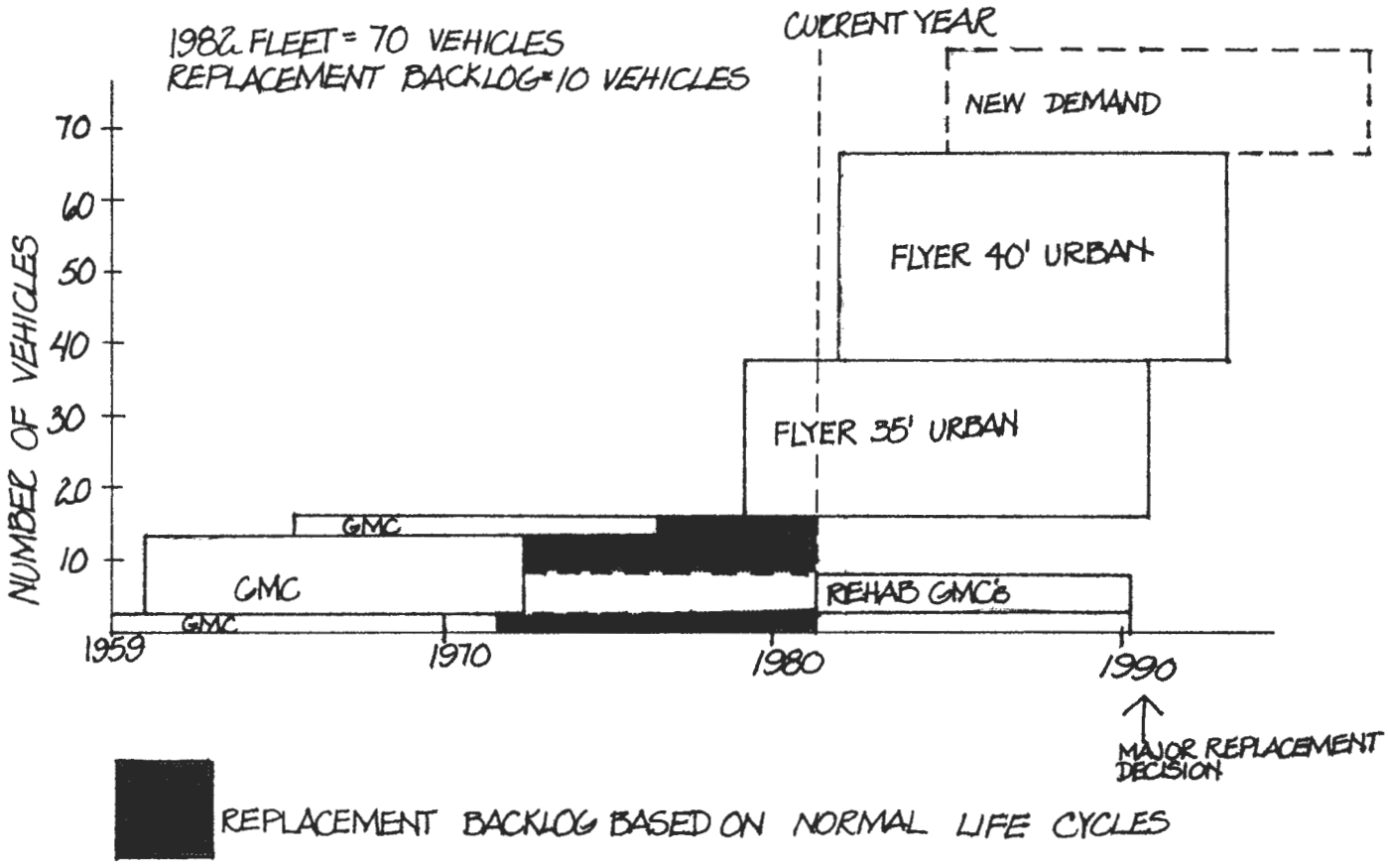
The active fleet is saddled with relatively high mileage demands that could push coaches past 500,000 miles in less than the normal twelve year life cycle. Community Transit could supplement with additional rehabilitated buses to reduce the pressure on the active fleet rather than purchase all new units. In order to reduce mileage below 40,000 per year per vehicle,[8] Community Transit would have to add an additional

[8] 40,000 miles per year per coach is the average figure for most transit agencies in the country. In this region, it tends to be less than this, or about 30,000 miles on the average.

FIGURE 7

COMMUNITY TRANSIT

REPLACEMENT CYCLE



NOTES: 1) ASSUMES 12 YEAR LIFE CYCLE FOR NEW COACH, 8 YEARS FOR REHAB

2) ASSUMES CONTINUED DEMAND FOR AT LEAST 70 COACHES

ten to twenty reliable, safe, and clean units. Community Transit currently has a replacement backlog of less than ten vehicles (1979 to 1966 GMC units). This amounts to about one-seventh of the total fleet. Since the active fleet is relatively new, with perhaps ten years left on the replacement cycle, and since seventy-seven percent of the fleet is only two years old, an additional ten or more rehabilitated units would not represent an excessive reliance on rehabilitation.

Potential: good--for up to ten rehabilitation replacements for the 1959-1966 GMC coaches. Six of these older units are already being rehabilitated which would bring the total number of rehabilitated vehicles to sixteen.

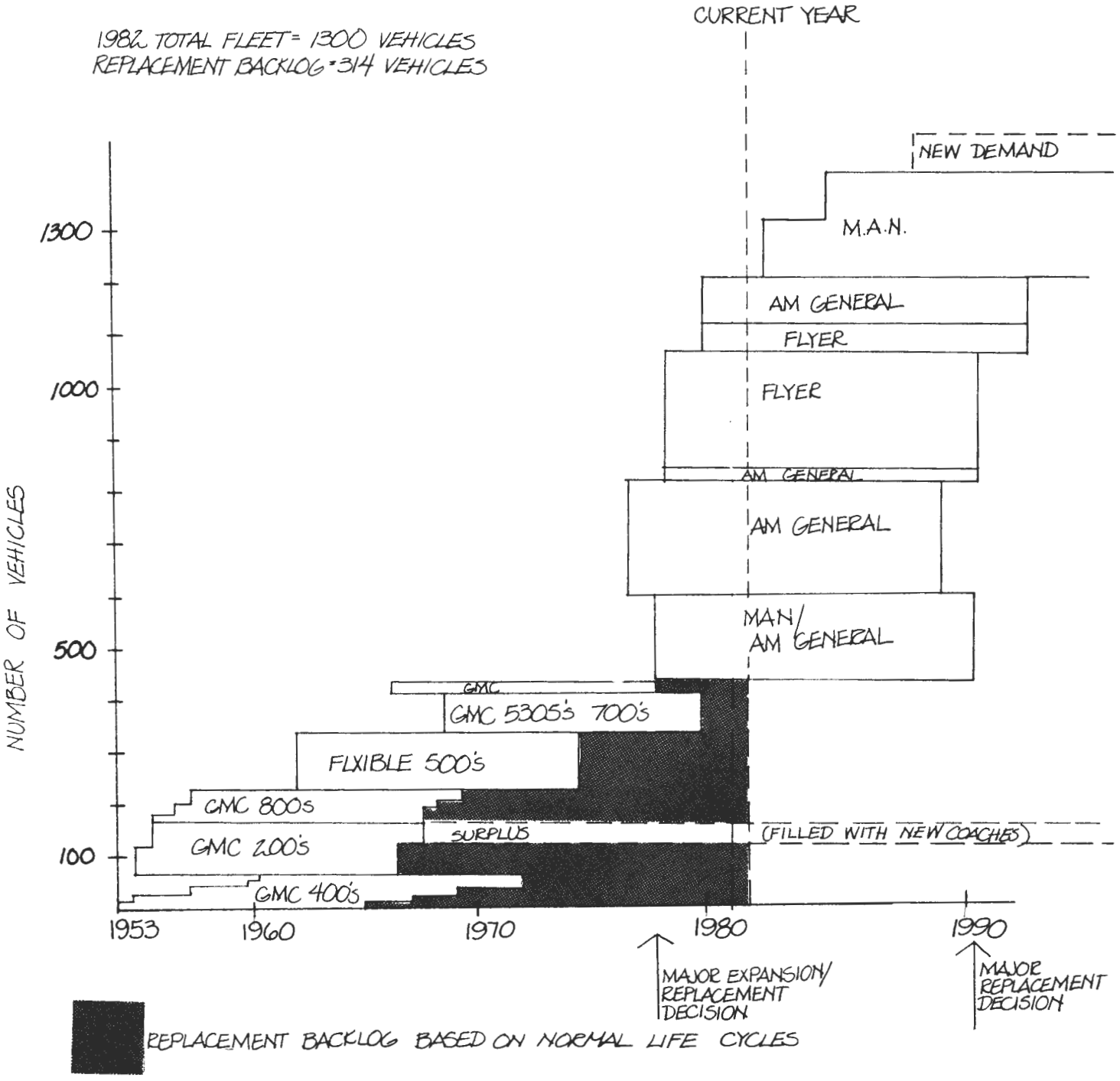
3. Metro

Metro (see Figure 8) has a relatively large number of older vehicles, seventy of which fall into the category of highly desirable for rehabilitation. These are 1968 GMC 700 series buses. Metro, however, has chosen not to pursue rehabilitation at this time, primarily because of static or declining service demands and adequate new bus replacement and maintenance programs. Older buses are being surplused selectively--forty-five of the 1954-1955 GMC 200's will be surplused this coming year. Metro has the in-house capability to perform rehabilitation if desired. The agency has established a "rule-of-thumb" for maximum bus age/mileage of twenty years or 850,000 miles. This eliminates fifteen to twenty year old units, such as their 1963 flexible coaches, from consideration for rehabilitation. Other local agencies, however, have used twenty-two year old "new look" buses as core units for rehabilitation. From a regional perspective, these older buses represent eligible rehabilitation units if purchased by another transit agency in the area.

Potential: mixed--with no internal desire to pursue rehabilitation at this time but with a relatively good stock of older buses that could be rehabilitated by Metro or by other

FIGURE 8

METRO
REPLACEMENT CYCLE



NOTES: 1) ASSUMES 12 YEAR LIFE CYCLE FOR NEW COACHES, 8 YEARS FOR REHAB
2) CONTINUED DEMAND FOR AT LEAST 1200 COACHES

operators in the region. The candidate vehicles include seventy 1968 GMC 700's and ninety-nine 1963 Flxible's. Although Metro has eliminated the Flxible units from consideration because of age and mileage, other agencies might evaluate their use as rehabilitation cores if made available by Metro.

4. Everett Transit

Everett Transit (see Figure 9) has the second youngest fleet in the region, yet many of the vehicles are nearing ten years of age--twenty-eight of thirty-two units, or 88%, are nine to ten years old. Assuming a life cycle of twelve years for new coaches, most of Everett Transit's fleet potentially faces a replacement decision in the next two to five years. The agency has applied for funding for rehabilitating six of the ten-year-old units. An additional fourteen units are planned for rehabilitation.

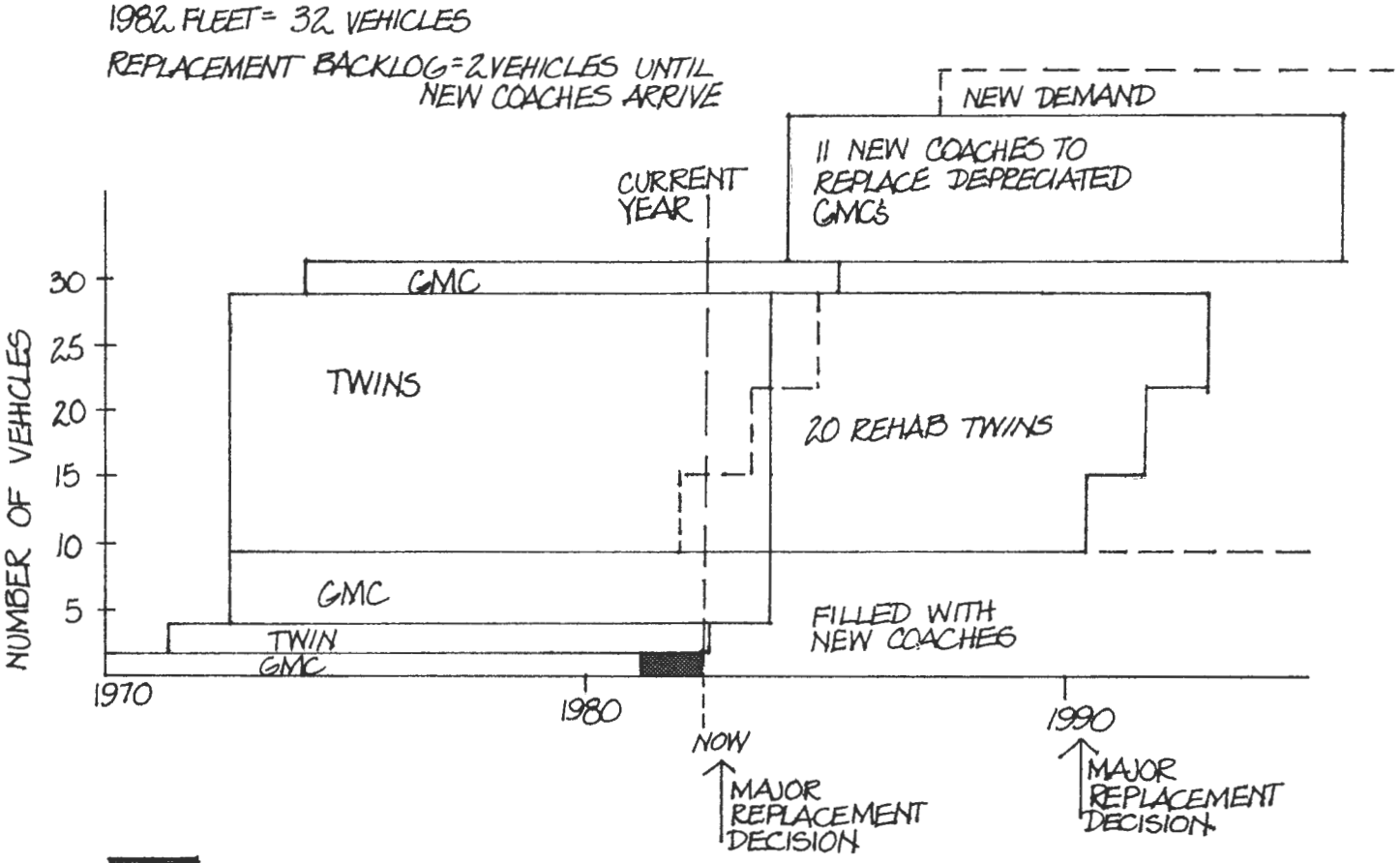
Rehabilitation has become a very real alternative for maintaining fleet strength and quality since Everett Transit would be unable to replace all units in a short time period with new vehicles alone. The agency, therefore, has initiated a phased rehabilitation program for the most severely worn vehicles in the existing fleet coupled with new bus purchases.

Additional rehabilitation potential beyond the twenty units may be limited. Dramatically increased demand in the future, however, could change this situation. Twenty rehabilitated buses represent nearly two-thirds of the current fleet. Once new coaches are on-line, this figure will fall to less than one-half of the fleet, but is still considered a high proportion based on the experience of other operators.

Potential: limited--once current phased rehabilitation programs have added twenty rehabilitated vehicles to the fleet. Rapid increase in demand for service could reactivate the potential for additional rehabilitated coaches in the future.

FIGURE 9

EVERETT TRANSIT
REPLACEMENT CYCLE



NOTES: 1) ASSUMES CONTINUED DEMAND FOR AT LEAST 32 COACHES
2) ASSUMES 12 YEAR LIFE CYCLE FOR NEW COACHES AND 8 YEARS FOR REHAB

5. Kitsap PTBAA

Bremerton-Charleston and Suburban Transit (see Figure 10) have an extremely old fleet, most of which would not be considered appropriate for rehabilitation. Of the fifty-two vehicles in the fleet, forty-one are greater than twenty-two years old, and thirty-nine are in the thirty-five to forty-year-old category. Only five units appear to be suitable for rehabilitation. Their replacement backlog includes all but the seven 1974 Flxible units. With such an extensive backlog it might be feasible to repeat the Pierce Transit strategy of maximizing total units in service by purchasing "new" rehabilitated coaches. Since yearly mileage demands are lower than in the other areas of the region, rehabilitated buses could be expected to last longer than the normal seven to ten years and could represent a relatively long-term solution for providing dependable service.

Potential: high--lacking a significant supply of recyclable units within the existing fleet, purchase of rehabilitated coaches could be used to upgrade an extremely old fleet. Up to forty vehicles may be needed to meet the current replacement backlog. However, a mix of rehabilitated and new buses would be more desirable, for maximum service reliability to allow phased fleet replacement.

6. Seattle-King County Commuter Pool

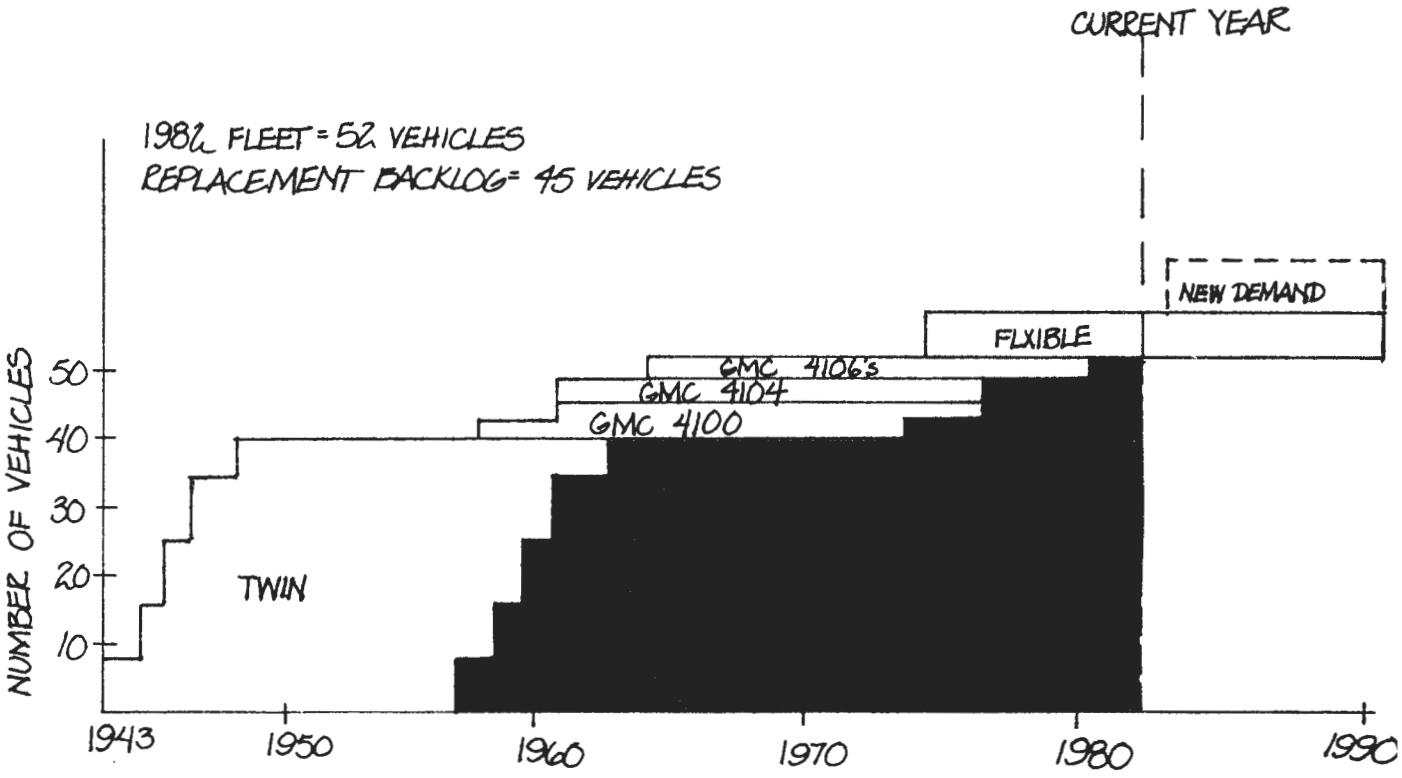
The opportunity for rehabilitation of publicly owned vans in this region revolves primarily around Seattle-King County Commuter Pool where most of the publicly owned vans are in operation. Based on experiences across the country (see survey - Table 1), rehabilitation of vans has had a very limited and inconclusive result. Only two agencies out of twenty-two contacted by PSCOG have any real experience with rehabilitation and then only on a limited basis involving primarily engines and interiors. Review of the literature suggests that small

FIGURE 10

KITSAP PTBAA

(BREMERTON - CHARLESTON + SUBURBAN)

REPLACEMENT CYCLE



REPLACEMENT BACKLOG BASED ON NORMAL LIFE CYCLES

NOTES: 1) ASSUMES 15 YEAR LIFE CYCLE FOR NEW COACHES, 10 YEARS FOR REHAB AND 6 FOR USED

2) ASSUMES CONTINUED DEMAND FOR AT LEAST 52 COACHES

transit vehicles in general are not constructed as durably as the larger coaches and, therefore, do not lend themselves to the same type and character of rehabilitation as larger buses. Vans are typically considered candidates for rehabilitation after five years and 100,000 to 125,000 miles and usually require work primarily on engine and interior. Costs run about one-third to one-fourth that of a new coach and give about two additional years service, needing replacement or overhaul again at that point.

Commuter Pool's inventory is currently less than five years old with twenty-one of the 132 vans approaching a replacement decision within the next year. The remaining 111 vans should not need to be replaced before 1984 or 1985. When the replacement decision arrives, Commuter Pool may wish to become involved in rehabilitation on a limited scale to determine the cost effectiveness and acceptability of this method of replacement. Experience nationwide is too limited to clearly recommend commitment to an extensive rehabilitation program. In a relatively new enterprise such as vanpooling, image and appeal are still important conditions that perhaps only new vehicles can provide. There may, however, be circumstances where rehabilitated units could play a useful role, but probably not on a large scale.

It is suggested, therefore, that a small number of older vans be selected for rehabilitation on a trial basis to determine the scope and effectiveness of this alternative in the replacement schedule.

Potential: good--for an experimental program of perhaps a few vans. Based on experience from such a program, additional vans might be considered for rehabilitation in the future. Funding is not assured for this type of rehabilitation, but is probable that some form of federal funding support could be secured.

Joint Rehabilitation Potential: Based upon limited experience nationwide and locally, pooling of rehabilitation needs through joint purchasing of vehicles appears to offer little

or no cost savings. However, Pennsylvania recently engaged in a multi-jurisdictional new bus purchase effort involving the state's largest operators[9]. One thousand buses were involved in the purchase which, in effect, elevated a foreign coach manufacturer (Neoplan) to the status of a major North American builder. The bid price was $6,000,000 lower than the next lowest bid by GMC. It is conceivable, under certain conditions, that cost savings can be realized if the order is large enough to command competitive leverage among bidders, particularly newcomers in the market. It is unlikely, however, that a large enough order of rehabilitated vehicles could be assembled in this region to have a significant effect on the competition.

C. Summary of Regional Potential

Presently, twenty-five rehabilitated buses are in service in the region with another twenty-seven to be delivered in the near future. Thirty-four more are scheduled for purchase in future years. An additional twenty-five to 100 rehabilitated vehicles could become part of the operator's replacement program based on replacement backlogs, available core vehicles, and the need to maintain reasonable new versus rehabilitated replacement ratios. Coupled with new bus purchases, the current replacement backlog of nearly 400 buses could be partially met with additional rehabilitated vehicles.

A potential for van rehabilitation also exists but, because of uncertainities about the cost effectiveness and utility of rehabilitation for vans, it should be approached on a smaller, perhaps experimental, scale involving only a few vans at first. If successful, rehabilitation could become part of the replacement program for the present Commuter Pool fleet and for other van operators in the region.

Pooling of rehabilitation needs through joint purchasing of vehicles appears to offer little or no costs savings to operators in this region.

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9 "Pooled Bus Purchase," Metropolitan Transit, August, 1982.

IV. CONCLUSIONS AND RECOMMENDATIONS

GENERAL:

- The rehabilitation of aging and/or neglected transit vehicles is an effective means of prolonging vehicle life.

- Rehabilitated vehicles provide an opportunity to put a maximum number of relatively safe, clean and reliable coaches into service for the least expenditure of funds.

- Rehabilitated vehicles can play a significant role in a comprehensive replacement program that includes new coaches. Exclusive use of rehabilitated vehicles for entire fleets does not appear to be a prudent fleet management strategy because:

    - New equipment offers many safety, convenience and image features that cannot be acquired through using a rehabilitated vehicle; and

    - Rehabilitated vehicles become increasingly obsolete as years pass which can shorten life cycle and lead to premature and more expensive replacement decisions.

- Rehabilitation offers potential in situations where growing service, an aging fleet, and limited capital exist. An emphasis on new bus purchase appears to be more appropriate with static or declining service where a good maintenance program is in place.

- Rehabilitation demand need not be dependent upon available supplies of local candidate vehicles; salvage values are sufficiently low to allow contractors to offer "new" rehabilitated units for about the same price as rehabilitating a vehicle already owned by the operator.

- Experience in rehabilitation in the U.S. is relatively new but is being pursued by increasing numbers of operators, primarily because of limited funds, increasing service demands, and satisfactory performance by such vehicles.

- Different levels of rehabilitation exist. While this report uses the definition in its most thorough form, more limited forms of rehabilitation can be performed with varying results. Generally, the more thorough the rehabilitation (and therefore the more costly), the longer the vehicle will last and the more dependable it will be.

COST:

- o Federal funding assistance is available for purchase of both new and rehabilitated vehicles. However, because of the difference in required local matching funds, a given amount of local match may buy approximately the same number of buses, whether new or rehabilitated, particularly when rehabilitation cost approaches the maximum allowable cost established by UMTA.

- o If availability of federal funds is limited, however, an operator may purchase more rehabilitated buses than new buses for a given amount of federal funds.

- o Life-cycle costing methods suggest that rehabilitation is slightly more cost-effective than new bus purchase under varying assumptions, being clearly more cost-effective when eight years is assumed for rehabilitation service life rather than six years. Lowering maintenance and operation costs for rehabilitated vehicles to a figure comparable to that of new buses can increase this cost-effectiveness advantage.

- o Rehabilitation offers the option of scaling down the preventative maintenance, thereby holding down overall operating costs. The trade-off is between a higher cost maintenance program to extend service life of an original vehicle (beyond the normal 12 years) and the lower cost maintenance program which anticipates a major vehicle rehabilitation at the end of the nominal service life.

- o The decision to replace with new buses or rehabilitate existing buses, based on life-cycle costs, is a function of:

    - Initial capital costs of new versus rehabilitated vehicles.

    - Actual operating and maintenance costs for new versus rehabilitated vehicles.

    - Expected service life for both new and rehabilitated vehicles.

    - Availability and amount of federal funding assistance for new versus rehabilitated vehicles.

    - Operator's desired image as projected through equipment type.

- Based upon limited experience nationwide and locally, pooling of rehabilitation needs through joint purchasing of vehicles may offer little or no cost savings.

- There does not seem to be a significant advantage to rehabilitation of vehicles in-house. Some operators across the country have suggested that in-house rehabilitation, when all costs are considered, could be even more costly than if done by an outside contractor. This is due to labor costs, overhead and other inefficiencies inherent to in-house work.

LOCAL POTENTIAL:

- Most operators in this region have had experience with rehabilitated buses to supplement their fleet replacement schedules. Pierce Transit, with the most extensive experience, has found it to be a satisfactory means of meeting rapidly rising service demands in a short time frame with limited capital and an aging fleet. The largest operator, Metro, has evaluated rehabilitation potential and has decided not to pursue it at this time.

- Potential demand for additional rehabilitated vehicles in this region still exists despite significant rehabilitation commitments by many of the region's operators. As many as 400 vehicles (of a total 1,600) are currently in need of replacement in this region; some of these could be rehabilitated.

- A significant supply of candidate buses for rehabilitation now exists in this region but they are not necessarily owned by those in need of the rehabilitated units. As many as 280 suitable units are potentially available for rehabilitation purposes.

- Contractors who perform rehabilitation of buses are not generally available in the Northwest. Work must be done in areas as far away as the Midwest or California.

VANS/SMALL TRANSIT VEHICLES:

- Experience in the rehabilitation of vans is limited but could offer some potential for relatively short-term extensions of vehicle life in certain circumstances (perhaps on an experimental basis). In a sample survey of

twenty-two vanpool operators across the U.S., including both public and private entities, four firms had rehabilitated a portion of their fleet, replacing interiors and engines, or just interiors, extending the service life by two to three years.

- Small transit vehicles are generally not constructed as durably as standard coaches, making long-term rehabilitation of smaller vehicles a case-by-case decision.

RECOMMENDATIONS:

- Operators in this region should continue to utilize rehabilitation of vehicles as a supplement to new vehicle replacement programs.

- Exclusive use of rehabilitated vehicles for replacement of depreciated units by any operator should be avoided. While no specific ratio of new to rehabilitated vehicles is recommended for any given procurement period, the operators should attempt to reduce the overall age of their fleets through new vehicle purchase over time. In general, in the longterm, rehabilitated vehicles should represent a minor versus a major component of the replacement program.

- Investigate the potential for utilizing vehicles owned by one agency that are suitable for rehabilitation by another agency in need of rehabilitated vehicles.

- Investigate the potential for a limited experimental van rehabilitation program to determine its cost-effectiveness based on the operating conditions and mileage accumulation experienced in this region.

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APPENDIX A

Interim UMTA Bus Rehabilitation "Guidelines"

PART 640—BUS REHABILITATION PROGRAM, POLICY AND REGULATIONS

Sec.

Authority: 49 U.S.C. 1602 and 1604; 23 U.S.C. 103 and 142; 49 CFR 1.51.

§ 640.101 Purpose and Policy.

(a) The purpose of this part is to set forth the Urban Mass Transportation Administration's policies and procedures for the administration of its bus rehabilitation program for urban transit buses.

(b) UMTA will participate in the funding of the rehabilitation of buses subject to the conditions stated in this Part, in order to provide a limited and definitive framework within which to explore the many unknown impacts of an ongoing bus rehabilitation program.

§ 640.103 Applicability.

(a) This policy is applicable to the following funds administered by UMTA—Discretionary Grant Funds (Section 3) 49 U.S.C. 1602; Formula Grant Funds (Section 5) 49 U.S.C. 1604; Interstate Transfer Funds 23 U.S.C. 103(e); and Federal-Aid Urban System funds 23 U.S.C. 142.

(b) The bus rehabilitation program applies to standard transit buses used in mass transit service, including commuter buses used in standard transit service, that are 35 feet and over.

(c) UMTA will consider funding the rehabilitation of other vehicles, using the requirements of this Part to the extent feasible, on a case-by-case basis.

(d) The requirements in § 640.105 apply to all bus rehabilitation proposals. However, UMTA will consider the merit of each proposal for funding of bus rehabilitation, and will review proposals on a case-by-case basis if the proposal varies from the requirements.

§ 640.105 Requirements.

(a) Through the end of Fiscal Year 1983, UMTA will participate in bus rehabilitation projects of 20 percent of an applicant's bus fleet.

(b) Buses must be selected for a rehabilitation project in lots based on a common feature that gives reasonable assurance that they are part of an identifiable group with roughly similar rehabilitation needs (e.g., date of entering service, mileage, visible signs of corrosion).

(c) As a general rule, each bus to be rehabilitated should be at least 12 years old or have accumulated 500,000 miles. If a prospective grantee believes that extraordinary conditions or circumstances warrant the rehabilitation of buses that are less than 12 years old or have accumulated less than 500,000 miles, UMTA will review the specific circumstances of such a proposal on a case-by-case basis, and, in addition to requiring a sound program for the rehabilitation work, will pay particular attention to the grantee's program for routine bus maintenance.

(d) The rehabilitation of a bus is intended to extend its service life to at least seventeen years from the date of the bus' original entry into service, but in no case should the extended service life of a bus last less than five years. The extent of UMTA's participation in a given project is based upon the number of years a bus' service life is prolonged.

(e) The full cost of rehabilitation may not normally exceed seventy precent (70%) of the average annual amortized value of a new bus (based on a twelve year life), multiplied by the number of years the bus life is projected to be extended. The Federal share will be determined as described in § 640.109(a). This formula does not include the retrofit of accessibility features for the handicapped or other improvements which add components to the bus' original specifications. UMTA will fund the Federal share of the additional costs of handicapped accessibility features on rehabilitated buses and will consider funding the Federal share of additional costs of new equipment such as noise suppression devices, safety equipment, and air conditioning apart from the funding formula.

(f) Bus rehabilitation activities may be performed with grantee in-house capability or such capability may be procured from outside sources. Normal procurement procedures and grantee labor agreement procedures must be followed. Bus rehabilitation may not be a substitute for routine bus maintenance, and, if performed in-house, must not in any way interfere with regular bus maintenance activities. UMTA's operating assistance program is the primary source of funds in support of regular operational maintenance.

(g) Bid documents for rehabilitation must require rehabilitation to a performance level commensurate with the bus' original condition, within the limits of readily available parts, and provide a balance among structural, cosmetic and mechanical rehabilitation. Contracts for work must include at least a six month warranty on parts and labor.

(h) If the rehabilitation work is done through a contract with outside resources, grantees shall have an inspector at the site where bus rehabilitation work is carried out. The inspector will be responsible for final determination of the extent of rehabilitation work to be done. The inspector is also responsible for monitoring the actual rehabilitation work and ensuring that the operator's interests are protected. The transit property shall have the right to inspect the contractor's records for the rehabilitation project.

(i) Each rehabilitated bus shall conform to the requirements of 49 CFR 27.67(c) regarding the addition of accessibility features for the handicapped to renovated vehicles. Such vehicles, to the extent structurally feasible, must be equipped with these features.

§ 640.107 Eligibility criteria

(a) The need to rehabilitate a bus is to be determined first on the basis of the need for structural improvements as described in § 640.107(d)(1) of this part. This determination must be made prior to the approval of supplementary cosmetic or mechanical improvements. However, buses that exceed 15 years of service life or 750,000 miles may qualify solely on the basis of major mechanical deterioration.

(b) Applicants shall ensure that—

(1) Rehabilitation work will be done according to a predetermined timely schedule and completed no later than 12 months after the award of an UMTA capital grant;

(2) Rehabilitated buses will be maintained in good operating condition;

(3) Rehabilitated buses will be used in mass transit service through the extended life of the bus as determined by the formula specified in § 640.105; and

(4) Bus rehabilitation will be undertaken as a separate and distinct activity from bus maintenance programs.

(c) If the applicant violates the terms of this regulation, UMTA may suspend all payments under the bus rehabilitation project or require that the grantee dispose of the property.

(d) The following items are eligible for assistance under the bus rehabilitation program:

(1) Structural Improvements:

(i) Stepwells.

(ii) Wheelwells, wheels, bearings.

(iii) Minor structural components.

(iv) Exterior panels.

(v) Window sashes.

(vi) Doors.

(vii) Flooring.

(viii) Accessibility features for the handicapped.

(ix) Structural framing.

(x) Front axle, rear axle, bulkheads.

(2) Supplementary Improvements:

(i) Seats.

(ii) Electrical wiring.

(iii) Lighting.

(iv) Duct Work.

(v) Signs.

(vi) Control Panels.

(vii) Steering system.

(viii) Windows.

(ix) Seats.

(x) Interior sidings.

(xi) Accessibility features for the handicapped.

(xii) Interior and exterior paint.

(3) Mechanical Improvements:

(i) Engine.

(ii) Air compressor.

(iii) Transmission and drive train.

(iv) Heating, ventilation and air conditioning system.

(v) Brake drums.

(vi) Fuel system.

(vii) Exhaust system.

(e) Buses may not be rehabilitated for the express purpose of stockpiling as described in 49 CFR Part 639.

§ 640.109 Funding Determination.

(a) Bus rehabilitation projects are eligible for UMTA capital funds on an 80% Federal/20% local share funding basis. Bus rehabilitation projects funded with Interstate transfer funds could have a federal share of as much as 85% as provided in 23 U.S.C. 103(e)(4); projects funded with Federal-aid urban systems funds could have a Federal share of 75% as provided in 23 U.S.C. 142.

(b) UMTA will participate in the additional costs of retrofitting handicapped accessibility features on rehabilitated buses beyond the amount calculated by the funding formula.

(c) UMTA will participate in the additional costs of new equipment such as noise suppression devices, safety equipment, and air conditioning beyond the amount calculated by the funding formula.

(d) Costs associated with the inspector required by § 640.105(h) are eligible project costs for UMTA funding through the bus rehabilitation program.

§ 640.111 Project Requirements.

Grants made under the bus rehabilitation program are subject to all UMTA requirements for capital projects as contained in UMTA Order 1000.2.

(49 U.S.C. 1602 and 1604; 23 U.S.C. 103 and 142; 49 CFR 1.51)

Dated: January 19, 1981.

Theodore C. Lutz,

Administrator, Urban Mass Transportation Administration.

[FR Doc. 81-2987 Filed 1-23-81; 9:34 am]

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The following examples illustrate the application of the formula allowing for the increased costs of bus rehabilitation to be 70 percent of the average annual amortized capital cost of a new bus (normally 12 years), multiplied by the number of years the rehabilitated bus life is to be extended, using an 80% Federal share.

Example No. 1

The first example assumes the cost of a new bus without handicapped accessibility features to be $120,000; 70% cap; the extended life to be 5 years.

$120,000 ÷ 12 years (life of new bus) (average annual amortized value)	$10,000
70 percent (cap) of $10,000	7,000
5 years (extended life) × $7,000 (total project cost)	35,000
Accessibility features	+ 20,000
	55,000
80 percent (Federal share) of $55,000	44,000

Example No. 2

The second example assumes the cost of a new bus without handicapped accessibility features to be $120,000; 70% cap; extended life to be 8 years.

$120,000 ÷ 12 years (life of new bus) (average annual amortized value)	$10,000
70 percent (cap) of $10,000	7,000
8 years (extended life) × $7,000 (total project cost)	56,000
Accessibility features	+ 20,000
	76,000
80 percent (Federal share) of $76,000	60,800

Example No. 3

The third example assumes the cost of a new bus without handicapped accessibility features to be $120,000; 70% cap; extended life to be 10 years.

$120,000 ÷ 12 years (life of new bus) (average annual amortized value)	$10,000
70 percent (cap) of $10,000	7,000
10 years (extended life) × $7,000 (total project cost)	70,000
Accessibility features	+ 20,000
	90,000
80 percent (Federal share) of $90,000	72,000

APPENDIX B

Local Share Requirements for UMTA Funding

Figure B-1 and Table B-1 and B-2 illustrate the effect on local share of varying the new bus prices and years of extended life within the UMTA funding formula. The illustration uses four rehabilitated bus (rehab) prices to show how the cost of the rehab itself is affected by these varying conditions.

As shown in the illustration, extending projected life for the rehab greatly reduces local share up to the point of reaching the maximum 80% federal match limit. It should also be noted that the estimated cost of a new bus comparable to the one being rehabilitated significantly affects the relative amount of local share for a new bus versus a rehab. This estimated new bus price is established by UMTA, based on current market prices but should be monitored by the applicant to assure fairness and accuracy. The projected service life of the rehab is estimated by the applicant but must be justifiable and realistic. Clearly, if local share is a concern, the longer the projected rehab vehicle life, the more favorable the share ratio.

In most cases, an applicant can keep the dollar amount of local share for a rehab lower than that for a new bus. The applicant can even achieve the dollar amount equivalent to the 80/20 match ratio under the proper new bus price and extended life assumptions. In some cases, however, the dollars of local share for a rehab will approach or even exceed that of a new bus because of the higher percentage local share required, as illustrated in Figure B-1. In an average case, the dollars of local share for either new or rehab purchases, using the UMTA formula, can be very close and may, therefore, not be an overriding factor in the decision. The focus would then fall on available UMTA funding amounts as well as local funding sources.

The message is to look at local share very carefully when comparing new and rehab bus purchases, particularly the assumptions for extended rehab life and the cost of a comparable new coach.

FIGURE B-1: LOCAL FUNDING SHARES FOR TYPICAL REHAB PROGRAMS

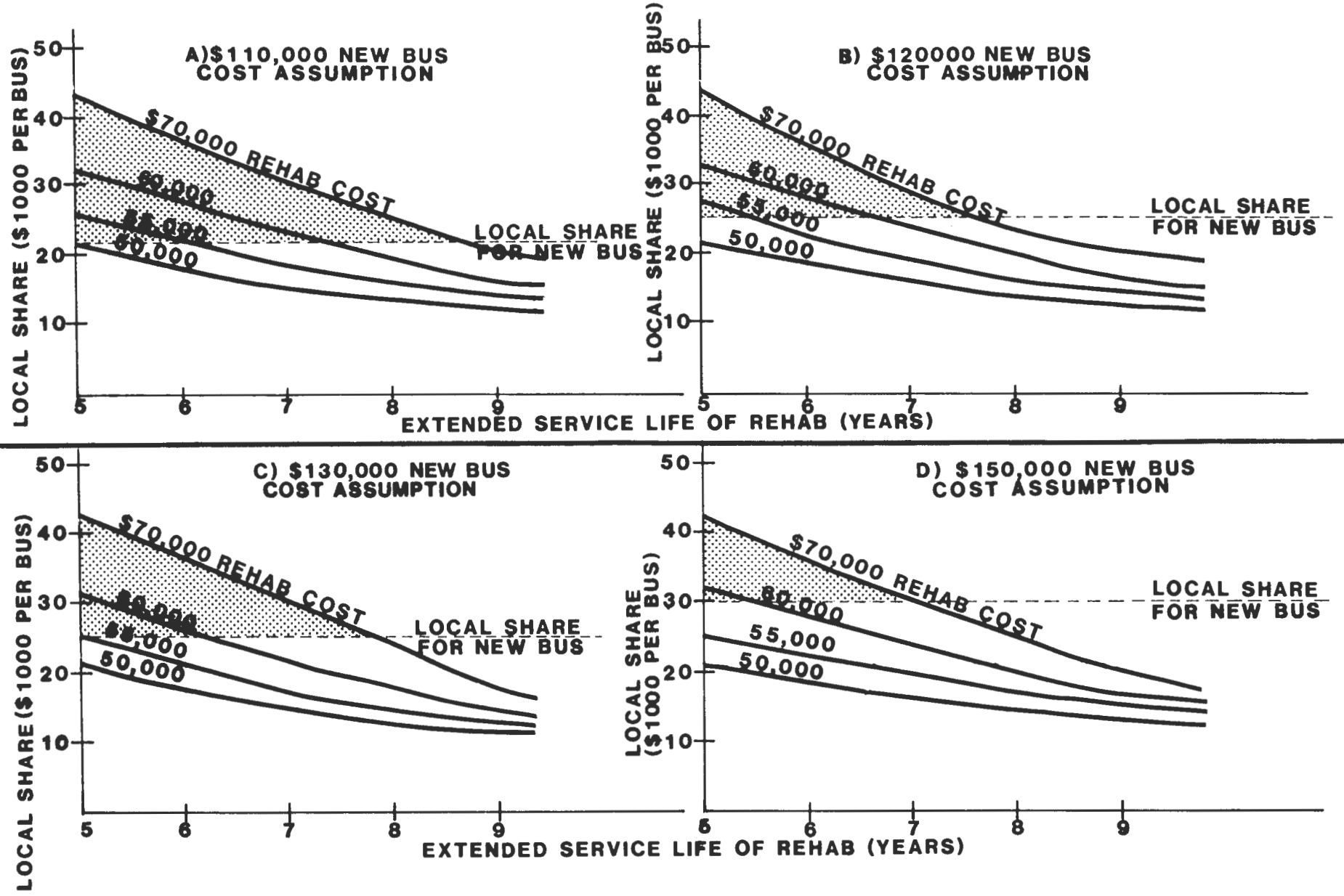

TABLE B-1

FEDERAL FUNDING SHARE UNDER VARYING ASSUMPTIONS OF NEW BUS COST AND YEARS OF EXTENDED LIFE USING UMTA FORMULA

a	b	d	c	e	f	g
New Bus Cost	Annualized Cost Over 12 Yrs (a ÷ 12)	Extended Service Life (years)	Local Share for New Bus (20% of a)	Maximum Allowable Cost per Rehab Bus (d x b)	Amount Eligible for Fed. Funding (70%of e)	Maximum Federal Share (80%of f)
$120,000	$10,000	5	$24,000	$50,000	$35,000	$28,000
		6		60,000	42,000	33,600
		7		70,000	49,000	39,200
		8		80,000	56,000	44,800
		9		90,000	63,000	50,400
130,000	10,800	5	26,000	54,000	37,800	30,240
		6		64,800	45,360	36,288
		7		75,600	52,920	42,366
		8		86,400	60,480	48,384
		9		97,200	68,040	54,432
140,000	11,700	5	28,000	58,500	40,950	32,760
		6		70,200	49,140	39,312
		7		81,900	57,330	45,864
		8		93,600	65,520	52,416
		9		105,300	73,710	58,968
150,000	12,500	5	30,000	62,500	43,750	35,000
		6		75,000	52,500	42,000
		7		87,500	61,250	49,000
		8		100,000	70,000	56,000
		9		112,500	78,750	63,000

Source: UMTA formula (see appendix A), PSCOG analysis

TABLE B-2

FUNDING SHARES FOR VARIOUS REHAB BUS COSTS

New Bus Cost	Extended Service Life (years)	Funding Shares ($ per bus)							
		$55,000 Actual Rehab Cost		$60,000 Actual Rehab Cost		$50,000 Actual Rehab Cost		$70,000 Actual Rehab Cost	
		Federal*	Local	Federal*	Local	Federal*	Local	Federal*	Local
$120,000	5	$28,000	$27,000	$28,000	$32,000	$28,000	$22,000	$28,000	$42,000
	6	33,600	21,400	33,600	26,400	33,600	16,400	33,600	36,400
	7	39,200	15,800	39,200	20,800	39,200	10,800	39,200	30,800
	8	44,000	11,000	44,800	15,200	40,000	10,000	44,800	25,200
	9	44,000	11,000	48,000	12,000	40,000	10,000	50,400	19,600
130,000	5	30,240	24,760	30,240	29,760	30,240	19,760	30,240	39,760
	6	36,288	18,712	36,288	23,712	36,288	13,712	36,288	33,712
	7	42,336	12,664	42,336	17,664	40,000	10,000	42,336	27,664
	8	44,000	11,000	48,000	12,000	40,000	10,000	48,384	21,616
	9	44,000	11,000	48,000	12,000	40,000	10,000	54,432	15,568
140,000	5	32,760	22,240	32,760	27,240	32,760	17,240	32,760	37,240
	6	39,312	15,688	39,312	20,688	39,312	10,688	39,312	30,688
	7	44,000	11,000	45,864	14,136	40,000	10,000	45,864	24,136
	8	44,000	11,000	48,000	12,000	40,000	10,000	52,416	17,584
	9	44,000	11,000	48,000	12,000	40,000	10,000	56,000	14,000
150,000	5	35,000	15,000	35,000	25,000	35,000	15,000	35,000	35,000
	6	42,000	13,000	42,000	18,000	40,000	10,000	42,000	28,000
	7	44,000	11,000	48,000	12,000	40,000	10,000	49,000	21,000
	8	44,000	11,000	48,000	12,000	40,000	10,000	56,000	14,000
	9	44,000	11,000	48.000	12,000	40,000	10,000	56,000	14,000

*See Table B-1 for federal share based on maximum allowable cost for a rehab with each extended life assumption.

Source: UMTA formula (see Appendix A), PSCOG Analysis

Appendix C

UMTA GUIDELINES

(Source: Reference 8)

4.0 REHABILITATION PPOCEDURES FOR FIVE YEARS EXTENDED LIFE

UMTA has proposed that 35 and 40 foot transit buses at least twelve years old be considered for rehabilitation. The rehabilitation must be of a magnitude that the useful life of the bus would be extended for a minimum of five years of reliable city service. In determining the extent of such rehabilitation, it is possible that the level of work necessary to assure five years of additional life may result in substantially longer extensions of useful life. It is difficult, however, to determine how many years beyond five may be realized with any high degree of confidence.

Minimum work procedures are considered necessary in order to implement UMTA's concept of such rehabilitation and guarantee at least five years of additional service life. These have been established together with appropriate safeguards and documentation according to the following:

- Engine and Accessories
- Transmission
- Cooling System
- Structure
- Body
- Front Axle
- Rear Axle
- Wheels, Bearings
- Brakes
- Suspension
- Steering System
- Fuel System
- Exhaust System
- Electrical System
- Heating System
- Air Conditioning
- Interior and Exterior Paint
- Documentation
- Road Test (or Dynamometer Test)
- Warranty Provisions and Implementation
- Pre-qualification of Bidders

4.1 ENGINE AND ACCESSORIES

Remanufactured engine to Detroit Diesel Allison specifications by Detroit Diesel Allison approved rebuilder on in-house equivalent
New engine mounts
New or remanufactured accessories
Remanufactured engine cradle as required
New air cleaner filter elements
Clean air ducts

4.2 TRANSMISSION

Remanufactured Detroit Diesel Allison transmission to Detroit Diesel Allison specifications by Detroit Diesel Allison approved rebuilder or in-house equivalent
Remanufactured accessories to customer specification
New filter assembly
New U-joint assembly

4.3 COOLING SYSTEM

New silicone hoses throughout
New hose clamps
New or reconditioned radiator core
New gaskets
New thermostat (engine)
New air compressor water lines
New transmission water lines

4.4 STRUCTURE

4.4.1 Upper

New body posts as required
New carlines as required
New reinforcements as required
New body panels as required
New strainers and stiffener as required

4.4.2 Underframe (front)

New brackets
New reinforcement assembly
New angles
New bulkhead
New cross member
New beam assembly
New support assembly

4.4.3 Underframe (intermediate)

New bulkhead assemblies
New stiffener
New bracket assembly
New cross member assembly

4.4.4 Underframe (rear)

New bulkhead assemblies
New angles
New reinforcement assembly
New beams
New support assemblies
New closure panel
New longitudinal plate
New brackets as required
New engine mounting brackets as required
New floor reinforcement plate, rear bay frame

4.4.5 Floor

New floor, OEM equivalent, 3/4" thick 5 ply laminated grade AC plywood (chemically treated) from the rear axle front bulkhead to the engine bulkhead and from the front bulkhead forward to the driver's platform.

4.5 BODY

New front and lower panels
New skirt panels as required
New windshield panel assembly as required
New stepwells and wheelhousings
New rear end closure door
New transmission door unless existing door is in like new condition
New radiator door unless existing door is in like new condition
New service access doors
New rubber fenders
New mouldings
Repaired window body panels and flanges as required

Remanufactured entrance and exit door engines and door mechanisms with:

New bearings
Bushings
Rollers
New seals
New retainer
New filter
Repaired door and new glass as necessary

New seals for emergency door (if equipped) and new glass if necessary
New or remanufactured windshield wiper system and windshield washer system (if equipped)

Interior items replaced as required:

Side trim panels
Melamine headlining panels
Modesty panels (or repair)
Mirrors
Bell (signal) cords and eyes
Dials, gauges, switches, warning devices in driver panel area

New rubber floor covering (plain or ribbed) and platform plate to customer's specification
New ribbed rubber stepwell treads to customer specification
New seat tracks and inserts
Recovered seats including driver's seat to customer specifications
Reconditioned seat frames as required

New channel and filler for the following:

Windshield
Rear windows
Transom windows
Destination sign

New side window seals and channels
New intermediate window seals (if applicable)
New glass replacement as required
New battery tray

4.6 FRONT AXLE

New steering knuckle kingpins
New bushings
New bearings
New tie rod assemblies
New front axle bumpers

4.7 REAR AXLE

New gasket and seal kit, complete
New rear axle bumpers
New rear axle housing if cracked or bent, or otherwise required
Remanufactured differential and carrier assembly

4.8 WHEELS, BEARINGS

New wheels only where necessary because of wear or deformation
Replace stripped or broken wheel studs
New cups and cones
New wipers, seals, and gaskets

4.9 BRAKES

Return to standard:

New brake drums
New linings
New shoes, as required
New cam shafts
New slack adjusters
New anchor pins
New bushings
New seals
New brakeshoe return springs
New brake chamber assemblies

Return parking brake to standard:

New drum
New linings, new shoes as required
New anchor pins
New bushings
New seals
New brake return springs
New slack adjuster level
New link pins
New parking brake control components as required

Remanufactured air compressor and governor
New brake application valve
New brake relay valve
New air tanks
New U-bolts
New Teflon hose assemblies with stainless steel braiding
New valves as required

4.10 SUSPENSION (Front and Rear)

New radius rod bushings
New lateral rod bushings
New rear upper radius rod bracket
New leveling valves and linkage
New bellows and piston assemblies
New shock absorber assemblies

4.11 STEERING SYSTEM

Remanufactured steering gear
Remanufactured power steering pump (if applicable)
Remanufactured booster cylinder (if applicable)
New hoses
New fittings
New steering U-joint assembly
New drag link end assemblies
New drag link tube assembly

4.12 FUEL SYSTEM

New fuel filters and strainers
Clean fuel tank
Repaired fuel tank as required

4.13 EXHAUST SYSTEM

New muffler
New tailpipe
New exhaust pipes
New gaskets
New clamps

4.14 ELECTRICAL SYSTEM

New units to replace the following as required:

- Lamp assemblies
- Lenses
- Sealed beam assemblies
- Relays
- Circuit breakers
- Switches
- Amphenol connectors
- Cables
- Gauges
- Solenoids

New bulbs, complete replacement
All circuits and components checked for compliance to OEM specifications
Remanufactured starter
Remanufactured alternator
Remanufactured voltage regulator
Batteries as required

4.15 HEATING SYSTEM

Reconditioned heater core
Reconditioned defroster core
New filters
New seals
Reconditioned valves
Remanufactured defroster motor
Remanufactured heater motor

4.16 AIR CONDITIONING

New A/C compressor
New clutch
New driver shaft

Remanufactured condenser pump
or
New A/C condenser alternator drive assembly
New alternator

) Depending on coach equipment

Remanufactured condenser motor
or
New A/C condenser fan drive motor assembly

) Depending on coach equipment

New brackets
New filters
New hoses and fittings
New expansion valve
New seals
Reconditioned evaporator cores
Reconditioned condenser core

4.17 INTERIOR AND EXTERIOR PAINT

Interior and exterior paint to customer's specifications after complete preparation of all areas to be painted.

Appendix D

1980 NATIONAL BUS FLEET INVENTORY AND SAMPLE REPLACEMENT SCHEDULE

(Source: Reference 8)

TABLE 5-2

LARGE BUS FLEET AGE DISTRIBUTION: 1980

Number of 35 and 40 Foot Buses	Age Distribution[1] (Years)
1920	18
3085	17
2331	16
2769	15
2752	14
2208	13
1994	12
2002	11
1274	10
2349	9
2581	8
2701	7
4222	6
4714	5
4099	4
1580	3
2973	2
2902	1
48,456[2]	

[1] Average age = 8.9 years; median age = 8.4 years.

[2] In addition, approximately 4,900 35-and 40-foot transit vehicles are over 18 years of age and are either inactive, in storage or in very limited service.

TABLE 5-3

A SAMPLE BUS REPLACEMENT SCHEDULE FOR THE U.S. TRANSIT FLEET

	Buses to be Purchased	Number of Buses to be Retired	Year Purchased
1981	4000	1920	1962
		2080	1963
1982	4000	1003	1963
		2331	1964
		664	1965
1983	4000	2105	1965
		1895	1966
1984	4000	857	1966
		2208	1967
		935	1968
1985	4000	1059	1968
		2002	1969
		939	1970
1986	4000	335	1970
		2341	1971
		1324	1972
1987	4000	1257	1972
		2701	1973
		42	1974
1988	4000	4000	1974
1989	4000	180	1974
		3820	1975
1990	4000	894	1975
		3106	1976
1991	4000	1093	1976
		1580	1977
		2673	1978
1992	4000	300	1978
		2902	1979
		800	1980

Appendix E

REHABILITATION POTENTIAL OF ELECTRIC TROLLEYS

Metro Evaluation

1981 ESTIMATE
TROLLEY REHABILITATION

- 58 TROLLEYS
  - 43 TWINS
  - 15 PULLMANS
- 38 TO 41 YEARS OLD
- 1 TO 1.4 MILLION MILES
- EVALUATION TEAM APPROACH
  - METRO STAFF
  - OTHER TRANSIT PROPERTIES
  - OUTSIDE CONSULTANTS; BRAKES, ELECTRONICS
  - PRIVATE REHABILITATION FIRM
- ITEMS REVIEWED

AXLES FRONT/REAR	ELECTRICAL
AIR SYSTEM	WINDOWS
SUSPENSION	SEATING
FLOOR/STEPS	LIGHTING
PAINT	SIGNS

- ESTIMATED COST IN 1981 DOLLARS
  - WAS $155,550 FOR THE PULLMANS
  - AND $180,300 FOR THE TWIN COACHES

ESTIMATE TO REHABILITATE PULLMAN TROLLEYS
15 UNITS
PURCHASED IN 1943
AVERAGE MILES - 1,100,000

FOLLOWING IS A CAREFUL AND EXTENSIVE REVIEW OF PAST EXPERIENCES BY MAINTENANCE, PARTS AND SAFETY PERSONNEL; AND, OPERATORS. IT IS OUR JUDGEMENT THAT THE FOLLOWING ITEMS BE REPAIRED, REPLACED OR UPDATED TO OFFER A MINIMUM LEVEL OF SAFETY, DEPENDABILITY, RIDER COMFORT AND REASONABLE OPERATING COST CONTROL.

MAINTENANCE

ITEM I BRAKE SYSTEM (FRICTION)

A. WORKING COMPONENTS BADLY WORN
B. 1943 DESIGN BECAME OBSOLETE
C. STOPPING DISTANCE WHEN BRAKES ARE WORKING TO OPTIMUM, FALL 40% SHORT OF TODAY'S STANDARDS (SAFETY)
D. MANY PARTS ARE NO LONGER AVAILABLE

RECOMMENDATION: REPLACE AND UPDATE

ITEM II ELECTRICAL SYSTEM

A. WORKING COMPONENTS BADLY WORN
B. ELECTRICAL WIRING AND PARTS AGED AND NEED REPLACING TO AVOID ELECTRICAL HAZARDS
C. DESIGN BECAME OBSOLETE AND WAS NOT UPDATED; CONSUMES 20-25% MORE POWER
D. MANY REPLACEMENT PARTS ARE NOT AVAILABLE

RECOMMENDATION: REPLACE AND UPDATE

ITEM III DOORS

TROLLEY SERVICE INVOLVES A HIGH RATIO OF STOP AND GO SERVICE, (VERY FEW LONG RUNS). DOORS ARE USED EXTENSIVELY.

A. DOORS ARE BADLY WORN
B. OPERATING HARDWARE - WORN OUT
C. PARTS ARE NOT AVAILABLE

RECOMMENDATION: REPLACE AND UPDATE

ITEM IV POWER TRAIN

A. REAR AXLE - OBSOLETE

RECOMMENDATION: REPLACE. REPAIR PARTS WOULD NOT BE AVAILABLE AND THIS NEW AXLE WOULD SUPPORT NEW BRAKE COMPONENT.

ITEM V FRONT AXLE

A. KING PINS AND OTHER ITEMS - OBSOLETE

RECOMMENDATION: REPLACE. NEW AXLE WOULD ACCOMODATE NEW DESIGN; BRAKE PARTS AND AIR RIDE SUSPENSION, AND ALLOW INSTALLATION OF POWER STEERING.

ITEM VI BRAKE CONTROL SYSTEM

A. INSTALL NEW COMPRESSOR; VALVE FITTINGS; INCREASE FRICTION BRAKE AIR PRESSURE TO 90-115 LBS. TO IMPROVE STOPPING DISTANCE AND SAFETY.

ITEM VII WINDSHIELD WIPERS

A. SYSTEM OBSOLETE. NO PARTS AVAILABLE. EXISTING SYSTEM EXPOSES PERSONNEL TO HAZARD - POOR VISIBILITY TO OPERATOR.

RECOMMENDATION: REPLACE WITH NEW, UPDATED SYSTEM

OTHER ITEMS FOR CONSIDERATION FOR THE FOLLOWING REASONS:

.....RIDER SAFETY AND COMFORT

.....COMPONENTS HAVE BECOME OBSOLETE AND REPAIR PARTS ARE NOT AVAILABLE

IIX VENTILATORS - FRONT INTERIOR

IX VENTILATION HEAT DUCTS

X HEATING DEFROSTING SYSTEM CONTROL & BLOWER

XI WHEEL SANDERS

XII WHEEL FENDERS

XIII STEPS - FRONT & REAR

XIV DESTINATION SIGNS

XV GLASS & FRAMES

XVI DRIVER PLATFORM

XVII UPHOLSTER SEATS

XIIX PAINT

XIX STANCHIONS - SOME ARE BROKEN, SOME ARE MISSING.

UPON COMPLETING THIS REVIEW OF NEED, THE FOLLOWING COSTS WERE ASSEMBLED FOR RECONSIDERATION:

		PARTS	LABOR
1)	FRONT AXLE INCLUDES SUSPENSION - BRAKES (EXHIBIT I)	5,918	2,736 (171 HR)
2)	DRIVE AXLE INCLUDES SUSPENSION - BRAKES (EXHIBIT II)	12,497	5,568 (348 HR)
3)	BRAKE SYSTEM COMPRESSOR VALVES FITTING LINES AND MISC. PARTS (EXHIBITS III & IV)	8,000	LABOR INCLUDED
4)	STEERING ASSEMBLY (EXHIBIT V)	2,067	1,776 (111 HR)
5)	DOORS & OPERATING HARDWARE (EXHIBIT VII)	2,775	1,200 (75 HR)
6)	WINDSHIELD WIPERS (EXHIBIT VII)	670	640 (40 HR)
7)	DESTINATION SIGNS (EXHIBIT IIX)	1,340	608 (38 HR)

	PARTS	LABOR	HOURS
8) VENTILATORS - FRONT INTERIOR	$200	$800	50
VENTILATION DUCTS	800	640	40
HEATING, DEFROSTING SYSTEM	850	160	10
WHEEL SANDERS	400	640	40
*WHEEL FENDERS	300	576	36
STEPS - FRONT AND REAR	416	1280	80
FRAMES FOR WINDOWS			
*3 EXIT HATCHES	2200	3840	240
DRIVER PLATFORM	400	640	40
*UPHOLSTER & REPAIR SEATS (APPROX $250 EA SEAT)			
PAINT COACH	800	3200	200
*REPAIR STANCHIONS	600	1200	75
SUB-TOTAL	$40,233	$25,504	2594

*THESE COMPONENTS ARE NOT ALL DEFECTIVE, AND WOULD BE REPAIRED BASED ON CONDITION

9) RANDTRONIC BID - VIA PHONE
ELECTRICAL SYSTEM

CONTROL PACKAGE	$40,000
REPAIR MOTOR	5,000
RENEW WIRING	20,000
SUB TOTAL	$65,000

COST SUMMARY.....

PARTS	40,233	
LABOR	25,504	
ELECTRICAL CONTROLS	40,000	
OUTSIDE MOTOR REPAIR	5,000	
ELECTRICAL WIRING SWITCH RELAY TERMINAL, ETC.	20,000	
SUB-TOTAL	$130,737	(1594 HRS)
FREIGHT COST (EST)	3,000	
ENGINEERING COST (EST) ($50,000 TOTAL)	3,333 EA	
BRAKE CERTIFICATION (EST) ($80,000 TOTAL)	5,333 EA	
SUB-TOTAL	$11,666	

CONTINGENCIES

20% ON LABOR	5,100
20% ON PARTS	8,047
SUB-TOTAL	$13,147

TOTAL COST $155,550

(OVERHEAD NOT INCLUDED)

COST EFFECTIVE REVIEW

NEW TROLLEYS

Estimated Cost	-	$205,000
Estimated Useful Miles	-	850,000
Amortized over 30 years	-	24¢ mile
Aged	-	30 years

OLD TROLLEYS

Rehabilitated Cost	-	$155,500
Estimated Useful Miles	-	151,200
Amortized over 7 years	-	$1.02 mile
Aged	-	45 years
Amortized over 10 years	-	72¢ mile
Aged	-	48 years

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Assume cost could be reduced by 30%.....

Rehabilitated Cost	-	$108,850
Estimated Useful Miles	-	151,200
Amortized over 7 years	-	72¢ mile

HOURLY COST ESTIMATE

Trolleys average eight (8) miles each hour

1) New Trolley Cost per Hour - $1.93/hr
2) Rehabilitate (155,500 cost) 7 years - $8.22/hr
3) Rehabilitate (155,500 cost) 10 years - $5.76/hr
4) Rehabilitate (108,850 cost) 7 years - $5.75/hr

Operating cost per hr will change depending on extent of rehab.

GRANT FUNDING CONSIDERATIONS FOR COACH REHABILITATION

- MUST SHOW REHABILITATION TO BE COST-EFFECTIVE
- THE UMTA FORMULA TO DETERMINE THEIR PARTICIPATION IN A REHABILITATION PROJECT WOULD PROVIDE A FEDERAL SHARE OF $42,840 PER VEHICLE COMPARED TO THE TOTAL ESTIMATED COST OF $155,550 PER VEHICLE, LEAVING A METRO COST OF $112,710 PER VEHICLE.
- UMTA REHABILITATION POLICY HAS BEEN DESIGNED AROUND REHABILITATING A 15-YEAR OLD DIESEL COACH WITH 500,000 REVENUE MILES. TROLLEYS ARE 39 YEARS OLD - WITH OVER 1 MILLION REVENUE MILES.
- REHABILITATED VEHICLES MUST INCLUDE ACCESSIBILITY FEATURES IF STRUCTURALLY FEASIBLE.
- BUS REHABILITATION IS NOT MEANT TO BE A SHORT TERM SOLUTION!
- BUS REHABILITATION IS NOT A SEPARATE POT OF FEDERAL MONEY!
- THERE IS NO AVAILABLE SECTION 3 OR SECTION 5 MONEY IN FISCAL YEAR 1981.

OPTIONS

1) BUY NEW TROLLEYS
2) REHABILITATE OLD TROLLEYS
3) OPERATE DIESELS IN EXPRESS MODE

   PEAK HOURS ONLY

RECOMMENDATION

.....AS MORE TROLLEYS ARE NEEDED AND ECONOMICS ALLOW

BUY NEW ONES

IT'S MORE COST-EFFECTIVE

IT'S SCHEDULED IN THE TRANSITION PLAN

SURPLUS ALL THE OLD TROLLEYS PROVIDING FOR HISTORICAL PRESERVATION

.....TAKE OPTION 3

WE HAVE DIESELS AVAILABLE (202 NEW ARTICS)
MONEY WILL BE TIGHT IN 1982
PRIORITIZE THE 1990 PLAN
BUY TROLLEYS ACCORDING TO 1990 SCHEDULE

OLD TROLLEYS

ASSUME COST COULD BE REDUCED BY 30%...

ADJUSTED COST - $108,850

EXTEND LIFE ESTIMATE AT 7 YEARS...

EXPECTED MILES OF SERVICE

MONTHLY - 1,800 = 151,200 @ COST OF 71.9¢ PER MILE

HOURLY COST ESTIMATE

TROLLEYS AVERAGE EIGHT (8) MILES EACH HOUR

1)	NEW TROLLEY COST PER HOUR		-	$1.79/HR
2)	REHABILITATE (155,500 COST)	7 YEARS	-	8.22/HR
3)	REHABILITATE (155,500 COST)	10 YEARS	-	5.76/HR
4)	REHABILITATE (108,850 COST)	7 YEARS	-	5.75/HR

OPERATING COST PER HOUR WILL CHANGE DEPENDING ON EXTENT OF REHABILITATION.

August 25, 1981

BUS REHABILITATION CONSIDERATIONS

Decision Parameters.....

Diesel Bus - Term expired (new bus) - 850,000 miles or 20 years

Extended Term following rehabilitation - 7 years

Ending Age - or mileage following rehab - 20 years or 850,000 miles

Cost to rehabilitate should not exceed 20% of the new bus purchase cost.

Fleet Reviewed for Rehabilitation Possibilities.....

Series		Year	Quantity	Rehab ?
200	GMC	1954	104	no
400	GMC	1954-64	45	no
500	Flex	1963	99	no
800	GMC	1954	37	no
*700	GMC	1968	70	yes

*Recommended Rehabilitation.....

70 - 1968 GMC Coaches - 1982-83

Equipment Data.....

70 GMC coaches, manufactured in 1968, Model #T8H-5305
The average mileage is 550,000 miles; and, the condition is average for 13 year-old coaches.

Considerations.....

1. Design changes or modifications:
   a. Telma Retarder - Increase brake life
   b. Electronic Signs- Reduce maintenance cost
   c. Air Starter - Reduce maintenance cost & road calls
   d. Wheelchair -
2. Rehabilitation Components - See attached

BODY EXTERIOR

1. Replace damaged side panels
2. Replace or repair skirt panels
3. Replace or repair entrance and exit doors
4. Straighten and repair bumper brackets and bumpers (or replace bumpers)
5. Replace light bulbs
6. Replace damaged or missing lights
7. Replace or repair rub rails
8. Repair or replace window frames and latches
9. Replace broken glass, windshields, rear window or door glass
10. Repair or replace access doors
11. Repaint exteriors

Labor	$3100-3700
Material	$1200-2800
	$4300-6500

BODY INTERIOR

1. Remove, repair or replace, reinstall passenger seats
2. Repair and repaint driver's seat
3. Repair or replace stanchions
4. Repair light fixtures. (May replace centerline fluorescent fixtures with cove mounted, backlighted fluorescent)
5. Repair or replace power pack
6. If desired, recover ceiling panels with carpet or replace stained panels — Not included
7. Replace damaged side panels or replace all with carpet or other material — Not included
8. Repair or recover floors, stepwells
9. Repair or replace plywood floor - - - - - - - - - - - - - Not needed
10. Repair or replace instruments or gauges
11. Sand and repaint driver's area and dash
12. Repair or replace windshield wipers
13. Repair heater-defroster
14. Repair all door controls

Labor	$4500-5500
Materials	$2000-7000
	$6500-12500

POWER TRAINS

1. Steam clean
2. Check alternator output, replace with rebuilt unit if not satisfactory
3. Replace starter motor if faulty --- Not needed, convert to air
4. Replace air compressor if faulty

POWER TRAIN (Cont.)

5. Repair or replace hydraulic pump
6. Repair or replace fuel pump
7. Repair or replace water pump
8. Replace oil, fuel and water filters
9. Replace all cooling system hoses
10. Rod the radiator, repaint and reinstall
11. Check engine compression, inspect injectors, determine needs and advise for instructions. In any event, install balanced "S" injectors
12. Inspect and repair fan drive
13. Install new gaskets and tighten all oil, fuel and water lines
14. Install insulation (accoustical on firewall) and seal access door under the settee to prevent fumes from entering passenger compartment
15. Install new gaskets and seals on transmission. If transmission is faulty, rebuild it
16. Replace wiring in engine compartment
17. Inspect for oil and fuel line abrasions and replace as needed
18. Repaint area

Labor	$3100-4000
Materials	$1500-17,000
	$4600-21,000

BRAKES, SUSPENSION, STEERING, AXLES, ELECTRICAL

1. Inspect brake linings and drums and replace as needed
2. Inspect brake chambers and repair or replace
3. Inspect air and interlock systems and repair as necessary
4. Inspect and replace air bags if necessary
5. Inspect and repair leveling valves
6. Inspect and replace worn radius rod bushings and torque rod bushings
7. Inspect steering bevel and pinion gears and U-joint. Install new gaskets. Bleed the system of power steering units
8. Inspect drag link and tie rod bearings and assembly
9. Inspect and replace as needed ball joints, king pins and bushings
10. Inspect wiring harness and main electrical panel and repair as necessary

Labor	$3600-4400
Materials	$1500-4000
	$5100-8400

The 700 Fleet has been maintained in reasonably good condition and approximately 50% of the work detailed would not be necessary. Many of the power trains have been overhauled and have less than 100,000 miles of service; many of the coaches have been painted and repainting would not be necessary; etc.