An Informal Study of Transit Bus Tire Procurement and Recycling in Michigan

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16. Abstract

The tire procurement practices of several Michigan public transit agencies are examined. Cost comparisons between tire purchasing costs and tire leasing costs are performed. It appears that Michigan public transit agencies can save significant amounts of money by purchasing their bus tires rather than leasing them. Tire recycling methods are reviewed. The use of recapped bus tires appears to be the most cost effective and energy efficient method of recycling used transit bus tires. Cost comparisons of tire use cost for all-new and recapped bus tires offer significant operating cost savings to those Michigan public transit agencies not using them now.

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INTRODUCTION

This paper is submitted in response to a request, dated December 4, 1977, from Mr. Charles Uray, Jr., Deputy Director of the Michigan Department of State Highways and Transportation, for information on and evaluation of large bus tire procurement and recycling practices. Initially MTRP proposed the hiring of a consultant to perform an in-depth cost analysis of bus tire procurement costs and tire recycling practices. Because of fiscal limitations it was subsequently decided that information on bus tire procurement practices and tire recycling would be gathered through a search of available literature and through informal telephone interviews with selected Michigan public transit operators, bus tire lessors, bus tire recappers, and tire and transit trade associations. In the course of the study, it was discovered that an in-depth study of bus tire leasing costs in a cross-section of U.S. public transit agencies is currently being conducted by the American Public Transit Association, for the Chicago Transit Authority. It is expected that the APTA study will be complete by the end of this calendar year, according to APTA sources. Survey forms for the APTA study are attached in the Appendix of this report. A copy of the completed study report has been requested.

METHODOLOGY

The study was conducted in three phases. First, a review of available literature was conducted to provide background and specific information on the types of tires generally used by transit bus operators and the performance characteristics of those tires. Further literature review was conducted to determine the scope of acceptable tire maintenance practice and to examine the range of possible tire recycling methods currently available.

Next, informal telephone interviews were conducted with selected Michigan public transit authorities, tire manufacturers, trade associations, and tire recappers to provide information on the

tire procurement practices and tire procurement costs experienced by the various transit authorities interviewed and the range of services provided in the various lease contracts encountered. In all telephone interviews, an effort was made to procure cost and service information from source documentation (i.e., lease contracts and most recent tire mileage billings). In all cases, the necessary information was requested through management personnel of the several Michigan public transit authorities.

Finally, several cost analyses were performed. A comparison of tire leasing vs. tire purchasing costs was performed for the four Michigan public transit authorities with lease contracts which do not include maintenance service in the basic rates of their tire lease contracts. An estimate of the annual dollar savings which could be accrued by those public transit authorities by switching to purchased tires was made. A cost comparison of tire use costs for all new tires and a mix of new and recapped tires was made and annual savings accruing from maximized recapped tire use was estimated.

Summary Findings:

- Significant annual operating cost savings appear possible for the four Michigan public transit authorities analyzed if their bus tire procurement practices are switched from leasing to purchasing. Further, in-depth analyses of bus tire leasing costs appears to be warranted.
- An immediate switch from tire leasing to tire purchasing would require the purchase of all tires currently on buses and in spare inventory. Such a purchase could cause cash flow problems in Michigan public transit authorities operating budgets. Outside funding, from state or federal sources, for initial tire purchases could facilitate the changeover from tire leasing to tire purchasing.
- Rigorous tire inspection and maintenance programs are necessary to maximize tire tread and carcass life. Maintenance

and inspection provisions in tire lease contracts may contribute to extended tire life.

- Significant annual tire use cost savings appear possible through maximizing the use of recapped tires on bus traction axles. There is resistance among some Michigan public transit operators to the use of recapped tires on the basis of legitimate safety and operating concerns. A detailed evaluation of the safety and performance experience of those Michigan public transit authorities currently using recapped tires would be helpful in providing information on which decisions, by the various transit authorities, to use recapped tires could be made.

- Recapping of worn bus tires is the most cost effective and energy efficient means of recycling bus tires. Other available recycling technologies include their use as boiler fuel; use, after chemical or pyrolic decomposition, as a source of rubber for new tires, as a source of petroleum fuels and high BTU gas; use as landfill; use as a component of paving asphalt; and use in break-waters or artificial reefs.

ONE: TRANSIT BUS TIRES, A PHYSICAL DESCRIPTION

The tires available for use on transit buses operated by public transit authorities in Michigan can be described generally in terms of their body ply construction, tread design and tread rubber depth. There appears to be little difference between transit bus tires and tires used in the heavy trucking industry. No evaluation of the service characteristics of the various transit bus tires was found in the literature during this study, though some evaluative literature is available on similar heavy truck tires. The interested reader is referred to that literature, listed in the bibliography, for further information.

Tires available for transit use are either of bias-ply construction or radial ply construction. Radial ply construction includes steel or synthetic fiber belts under the tire tread. The radial ply design is used by only one Michigan operator (Flint) with limited reported success. Radial ply tires are expected to gain wider acceptance in the heavy trucking industry (up to 40 percent of the heavy truck tire market by 1985, according to industry sources,[1]) because their lower rolling resistance reduces energy requirements up to 10 percent and because their stronger body construction allows a higher percentage of radial tires to be recycled through recapping.[2] No significant differences between bias and radial ply constructions were found in the literature in the areas of traction and tread life.[3]

Tire tread designs available for transit use are of two general types. Ribbed tires are grooved along the tread of the tire, while lug tires are grooved across the tread of the tire. Lug treads are used to provide high traction, particularly in off-the-road and inclement weather environments, and are used on drive wheels.

Studies of heavy truck tires show ribbed tire tread designs provide better normal use traction and produce significantly less tire noise than do tires with lug tread designs.[4] None of the Michigan transit authorities surveyed reported using tires with lug treads in any transit bus operation.

Tread rubber depths provided on transit bus tires are categorized by tire manufacturers as "City," "City/Suburban," and "Intercity," treads. The "City" tire has a heavy layer of rubber under the original tread and is suitable for "regrooving," or cutting a new tread, after the original tread has become sufficiently worn. "City" tires are generally restricted to service where speeds do not exceed 35 mph. "City/Suburban" tires have less tread depth than "City" tires, are not regroovable, and are restricted to service where speeds do not exceed 55 mph. "Intercity" tires have less tread than "City" or "City/Suburban" tires, are not regroovable and may be run at sustained highway speeds. Allowable tread rubber depths vary with highway speed ratings. A thinner tread rubber depth is preferred at higher speeds because of its ability to dissipate heat caused by friction and tire flexing.

Tire sizes and load ratings in use by Michigan public transit authorities range from 9.00 X 22, 12 ply to 12.50 X 24.5, 14 ply. The heaviest tires, 12.50 X 24.5, 14 ply, are required for use on the new General Motors RTS 2 transit bus. A sample of load ratings for single and dual truck and bus tires is illustrated in Table One.

This study found that all but one transit authority in Michigan uses bias ply bus tires, and that all use tires with ribbed tread designs. The authorities were divided in their use of "City," "City/Suburban," and "Intercity" tires though the "City" tire is the dominant tire in Michigan's urban areas.

TABLE ONE

Maximum Allowable Tire Loadings of Selected Large Truck Tires

Size	Load Range	Ply Rating	Singles		Duals	
			Load (lb)	Pressure (psi)	Load (lb)	Pressure (psi)
10.00-20	F	12	5430	85	4760	75
10.00-20	G	14	6040	100	5300	90
10.-22.5	E	10	4610	80	4040	70
10.-22.5	F	12	5150	95	4520	85
11.00-20	F	12	5920	85	5190	75
11.00-20	G	14	6590	100	5780	90
11.-22.5	F	12	5430	85	4760	75
11.-22.5	G	14	6040	100	5300	90
10.00-22	F	12	5780	85	5070	75
10.00-22	G	14	7000	100	5640	90
11.00-22	F	12	6290	85	5520	75
11.00-22	G	14	7000	100	6140	90
11.-24.5	F	12	5780	85	5070	75
11.-24.5	G	14	6430	100	5640	90

SOURCE: Erlick, Kamm, Jurkar and Jackson, A Truck and Bus Tire Use Pattern Survey, Final Report, Stevens Institute of Technology, Davidson Laboratory, Hoboken, New Jersey, 1971, p. 15.

TWO: TIRE PROCUREMENT PRACTICES

Leasing

Most major tire manufacturers provide tire leasing services to public transit authorities. The basic rates charged by the manufacturers are determined by considering the types of tires leased, the types and conditions of equipment the tires will be used on and the terrain, weather conditions, and urban conditions experienced by the public transit authority. The basic rates are indexed by factors which allow for changes in the prices the manufacturer may pay for natural and synthetic rubbers, nylon and steel tire cord, and labor.

Thus, as material and labor costs to the tire lessors increase, the rates paid by tire lessees also increase automatically. Some variations in base rates, apparently resulting from differing service conditions, were noted among the public transit authorities surveyed. The one authority using radial ply tires reported a per mile rate significantly higher than it pays for bias ply tires.

Lease contracts often include service provisions, such as spare tire inventorying, tire inspection and repair, tire recapping, tire mounting, tire balancing and tire regrooving. In some cases selected tire services may be provided by the transit authority itself, by a third party contractor or under a separate cost reimbursement contract with the tire leasor.

Lease contracts usually provide for a large proportionate mileage cost reduction after a new bus tire has been used for a specified number of miles. Among the fleets surveyed the reduction was 50 percent, occurring after the tires had been run for 60 thousand to 100 thousand miles. The fleets surveyed which lease recapped tires (CATA and Grand Rapids) achieve their cost reductions after those tires had been run 20 thousand miles and 40 thousand miles, respectively.

Tire lease costs are in general accrued and paid monthly, based on estimated or actual fleet mileage. The rates commonly quoted per mile are per vehicle, or for a set of six tires. Mileage charges are not accrued on a tire until it is actually mounted on a bus.

Purchasing

Public transit agencies may purchase transit bus tires directly from manufacturers, through local tire dealers, or, in Michigan, through a state centralized purchasing plan. Transit bus tire purchase costs range from $95 to $115 per new tire among the authorities surveyed. New tires purchased through the State of Michigan were priced at about $75.00 per tire. Recapped tires were

priced at about $75 per tire by the one authority surveyed which purchased them, and at $60.00 per tire by a tire recapper.

None of the authorities surveyed which currently purchase tires reported that they sold tire carcasses to tire recappers, though apparently the Kalamazoo authority has an arrangement with a local tire recapper to provide recapping services on its used tires.

Both of the authorities purchasing bus tires reported that they had contracts with third parties to provide tire maintenance and repair services.

Table Two summarizes the procurement practices and the lease contract provisions of the Michigan transit authorities surveyed.

Lease vs. Purchase

The special operating conditions and maintenance agreements included in several of the surveyed authorities' tire lease contracts tend to obscure the portion of the contractual leased mileage cost accruable to only bus tire use. Four cases where tires are leased and service is provided by a third party or on a cost reimbursement basis by the leasor are available for a simple cost analysis. In those cases the lessor supports only the cost of carrying an inventory of spare tires and the cost of in-service tire losses. Assuming a mean tire life of 100,000 miles and annual vehicle mileage of about 35 thousand miles, an approximate three year tire life can be expected. Assuming that the practice of monthly tire lease payments is common to the four authorities analyzed and with known tire purchase costs, it is possible to compare the cost of purchasing tires to the cost of leasing them for these four cases. Table Three summarizes the results of this analysis. The analysis used per tire, per mile costs to calculate the lease cost per tire for 100,000 miles. Pre-bonus and bonus tire mileage rates are included in the 100,000 mile cost calculation. Monthly payments are calculated by dividing the 100,000 mile total lease cost into 36 equal monthly payments. The effective annual interest rate is calculated using the general formula:

$$P = R\left[\frac{(1 + i) - 1}{i(1 + i)}\right]$$

Where:

P = the principal amount or, in this case, the cost of a new tire plus 10 percent for spare tire inventory and 1.5 percent for tire losses due to operating damage, tire defects, etc.

R = the monthly lease payment

i = a monthly interest rate (annual rate/12)

TABLE TWO: Summary of Michigan Transit Bus Tire Procurement Practices

Transit Agency	Transit Bus Fleet Size	Purchaser Lease	Vendor	Vendor Services	Local Services	Tire Types Used	Tire Cost Per Mile	New Tire Bonus Mileage	Recapped Tire Bonus Mileage	Bonus Discount	Remarks
DDOT	900	Lease	B.F.Goodrich	Repairs, inspections, inventories, regrooving, balancing, inventory, delivery, mounts, cost included in lease.	Tire changing, daily pressure checks, pressure checks at inspection intervals, provides tools, space.	City, all bias ply.	$.012752/mi/bus	90,000 mi	Not used	50%	
SEMTA	238	Lease	Goodyear	Tire mounting, repairs, inspections, balancing, inventory, delivery, service cost reimbursement agreement.	Tire changing, periodic pressure checks, provides tools and space.	City/suburban intercity (all bias ply)	$.01213/mi/bus	93,000 mi	Not used	50%	
GRTA	64	Lease	Firestone	Inventory, delivery, inspection, recapping	Daily & periodic inspection, mounting, changing, repairs, balancing, regrooving.	City (all bias ply)	$.012431/mi/bus	100,000 mi	40,000 mi	50%	Uses recapped tires extensively, plans to purchase tires gradually, beginning 1-1-79.
CATA	53	Lease	Goodyear	Service provided by third party: Repairs, inspections, tire mounting, balancing, regrooving, Goodyear provides inventory, recapping, delivery.	Tire changing, periodic pressure check.	City, City/Suburban (All bias ply)	$.01207/mi/bus	60,000 mi	20,000 mi	50%	No tire failures in nine months of recapped tire tests on four coaches.
Flint	45	Lease	Firestone	Inspection, maintenance mounting, regrooving, balancing, inventory.	Tire changing, periodic pressure checks.	City,(bias and radial)	$.014808/mi/bus[1] (bias) $.020565/mi/bus[1] (radial)	40,000 mi 55,000 mi	Not used	UNK	User reports bead failures on Firestone radial tires. Vendor claims failures due to overheating, user claims manufacturing defect. Plans to purchase tires in future.
AATA	35	Lease	Firestone	Inventory, delivery.	Tire changing, mounting, regrooving, inspection repairs, balancing.	City (all bias ply)	$.01320/mi/bus (9:00 x 20) $.01807/mi/bus (11:00 x 20)	70,000 mi 70,000 mi	Not used	50%	
Battle Creek	25	Purchase	Firestone	Third party provides road service, mounting, balancing, repairs, inspections, recapping.	Tire changing, periodic pressure checks.	City/ (all bias ply)	New: $115./tire Recapp $75./tire	- -	- -	- -	States that "recapped tires equivalent to new tires in average tire life."
Kalamazoo	40	Purchase through State of Michigan plan	Goodyear	Third party provides inspection, repairs, mounting, balancing, road service.	Tire changing, inventory, periodic pressure checks	Intercity, (all bias ply)	New $95-100/tire	- -	Not used	- -	Tire mileage average currently under study.

1. Base rates established 11-4-76, may be higher now because of materials and labor factors.

TABLE THREE

Analysis of Selected Bus Tire Costs, Assuming 100,000 Mile Tire Life

Agency	Lease Cost Per Mile, Per Tire[1]	Pre-Bonus Miles[1]	Bonus Miles	Per Tire Total Lease Cost (100,000 Mi.)[2]	Per Tire New Purchase Cost, Including Spares and Losses[3]	Average Monthly Lease Payment[4]	Estimated Annual Interest Rate[5]
SEMTA	$.0020217	93,000	7,000	$195.09	$128.23	$5.42	29%
CATA	$.0020117	60,000	40,000	$160.93	$128.23	$4.47	15%
AATA	$.00222 (9.00 X 20)	70,000	30,000	$188.70	$128.23	$5.24	27%
	$.0031167 (11.00 X 20)	70,000	30,000	$264.92	$139.38[6]	$7.36	48%
Grand Rapids	$.0020723 (12.00 X 22.5)	100,000	0	$207.23	$150.53[7]	$5.76	22%

[1] As reported by the listed transit agencies.

[2] Calculated for 100,000 mile tire life, pre-bonus miles at full current rate, bonus miles at 50 percent of current full rate.

[3] At $115.00 per new tire, 10 percent spare inventory, 1.5 percent losses.

[4] Assumes 36 month tire life, average monthly payment - per tire lease cost (100,000 mile)/36.

[5] Annual rate of interest, compounded monthly, necessary to equate monthly payments to $128.23 principal. The formula $P = R \frac{(1 + i)^n - 1}{(1 - i)^n}$ was used to derive annual interest rates where P = principal amount ($128.23 or $139.38 or $150.53), R = monthly payment, i = monthly interest rate (annual rate/12) and n = 36 months.

[6] Base price adjusted to $125.00 per tire, plus 10 percent for spare tire inventory and 1.5 percent for losses.

[7] Base price adjusted to $135.00 per tire, plus 10 percent for spare inventory and 1.5 percent for losses.

The estimated annual interest rates listed in Table Three represent the annual interest rates which would be charged if money were borrowed to cover the cost of new tires, spares and losses, and repaid in 36 equal monthly payments, equal to each authority's current average monthly lease payments over the course of three years. All the calculated interest rates appear to be higher than current market borrowing rates available to the agencies concerned. The calculations appear to strongly favor the purchase of bus tires over the current lease practices. Table Four summarized the estimated annual dollar savings resulting from tire purchasing.

TABLE FOUR

Estimated Annual Tire Cost Savings From Purchasing New Bus Tires,[1] Four Michigan Public Transit Authority Fleets

Transit Authority	Fleet Size	Annual Lease Tire Use Cost[2]	Annual Purchase Tire Use Cost[3]	Estimated Annual $ Savings	Estimated Annual % Savings
SEMTA	23	$92,877	$74,713	$18,164	20%
CATA	53	17,058	16,638	420	2%
AATA	33[4]	17,487	11,260	6,227	36%
Grand Rapids	63	26,542	20,091	6,451	24%
TOTALS		$153,964	$122,702	$31,262	

[1]Assumes six tires per bus, 10 percent spare inventory, 1.5 percent losses due to damage, 12 percent annual opportunity cost, 35,000 miles annual per bus, $115 per tire new tire purchase cost.

[2]Calculated from average per tire monthly payment.

[3]Interest at 12 percent per year, compounded monthly.

[4]Excludes 9.00 X 20 tires.

It must be noted at this point that the data which form the basis of the calculations in Tables Three and Four were gathered informally through telephone interviews, and not directly from source documentation. Thus, caution is urged with respect to its possible dissemination and immediate use. While mileage rates from the most recent tire lease billings and for bonus mileage data directly from the current lease contract were specifically requested, it is possible that some errors of transposition or source documentation exist. It is recommended that a detailed review of current lease and purchase rates be undertaken by the respective transit authorities before any final action is taken on these findings.

It should also be noted that the tire purchase costs noted in Table Three are overstated, particularly when compared to tire prices available to state sponsored agencies as quoted on the State Open Market Price List. This overstatement results in significantly lower effective annual interest rates.

The immediate purchase of tires for transit bus fleets would require the initial purchase of tires currently in use and in spare inventory, as well as the purchase of replacement tires as they are needed. The initial purchase of tires in use and in current spare inventory would necessarily be borne by operating funds and, as such, would cause operating cash flow problems, according to some of the transit operators surveyed. Federal funding procedures effectively preclude the use of federal funds for operating costs. New tires may be purchased as part of a new bus using federal funds, but the cost of spares, replacements and losses would still have to be borne by the various transit authorities operating budgets. It may be possible to reduce potential cash flow problems by using federal capital funds to purchase new tires on new transit buses and using operating funds to purchase spares and replacement tires as needed. This program could allow new tire costs to be spread over a three year period. It may be impossible, however, according to several of the authorities surveyed, to maintain lease and maintenance agreements currently in effect as leased tires are replaced

with purchased tires by attrition. Such a program would further require accurate record keeping to assure that leased tires are not mixed with authority owned tires during the transition period. The provision of extra operating funds, perhaps through special State or federal operating grants, could provide another, more simply administered, solution.

In reaching a decision to purchase or lease transit bus tires, each transit authority should consider the alternative uses of available funds. Thus a decision to invest scarce operating funds in an inventory of tires should be made only after the returns available from alternative investments, such as new buses, passenger shelters, etc., are evaluated. If available funds are fully committed for investments which have the potential for returns greater than the investment in transit bus tires, the purchase of bus tires should be deferred. In this case, however, it appears that a cash loan from a commercial bank, resulting in periodic payments, might be advantageous when compared to the annual tire lease interest rates. Table Four illustrates the savings which are estimated to accrue from such a loan, at 12 percent annual interest, to the transit authorities analyzed above.

THREE: TIRE RECYCLING

Several alternatives are available for used tire disposal or recycling. The disposal of tires in a land fill operation creates environmental problems as whole tires are impractical to compact, tend to rise to the surface of a land fill, provide a good nesting ground for rodents and pose a significant fire risk. Shredding tires for land-fill disposal provides a better land fill material and eliminates the health and safety hazards associated with whole used tire disposal, though tire shredding adds to disposal costs. The use of used tires, whole or shredded, as land fill material also eliminates the possibility of reusing or consuming the tires' component materials for new manufactures or energy sources.

The most cost effective and energy efficient use of a used bus tire is as a tire, by the application of a new tread surface through a recapping process. Tire recappers contacted in the course of this study indicated that up to 75 percent of all used transit bus tires can be expected to be suitable for recapping. Recapping costs for bus tires were estimated at about $60 per tire and tire tread life was estimated by the same sources at 80 percent of new tire tread life. Bus tires may be recapped as many as four times, though only one recap per tire is common in the trucking industry because of rising tire carcass inspection and repair costs with increasing tire carcass age. The use of radial ply tires could increase the average number of recaps which may be economically performed on bus tires, because of their stronger carcass construction. New truck or bus tires require about 20 gallons of oil to manufacture, truck or bus tire recapping requires only six gallons of oil.[5]

The use of recapped tires on traction and trailer wheels in the heavy trucking industry is common, and, along with programs of rigorous tire maintenance and inspection, is widely acknowledged as an area which can yield significant cost savings. Three of the transit authorities surveyed were using recapped tires and none reported tire failures because of carcass defects or tread separations.

Two general methods of tire recapping are in wide use. One method called "hot recapping" involves the application of uncured natural and synthetic rubber over a used tire carcass which is then cured, under conditions of high pressure and temperature in a mold or "matrix" which imprints a tread pattern. The other method, "cold recapping" applies a pre-cured and molded tread layer on a used tire carcass and bonds the new tread to the used carcass using high pressure and temperature. Both processes are reputed to yield good quality recapped tires.

Table Five illustrates typical per mile tire costs for new and recapped tires. Prices for this illustration are assumed to be $115 per new tire and $60.00 for a recapped tire. Expected mileage

for new and recapped tires are 100,000 and 80,000 miles, respectively. The recapped tire, running for 80,000 miles, achieves a 53 percent tire cost savings over the new tire, running for 100,000 miles.

TABLE FIVE

Per Mile Tire Costs at Run-Out, New and Recapped Tires

	Tire Price	Run-Out Per Mile Cost
New Tire	$115.00	$.00115
Recapped Tire	$ 60.00	$.00075

Recapped tires may not be used on steering axles in the U.S.[6] Thus, only four of the six tires used on a transit bus may be recaps. Table Six illustrates a comparison of tire use costs for 100,000 miles on a transit bus.

TABLE SIX

Comparison of Per Bus Tire Use Costs at 100,000 Miles
New Tire Life = 100,000 Miles, Recapped Tire Life = 80,000 Miles
New Tire Cost = $115, Recapped Tire Cost = $60.00

100,000 Mile Tire Use Cost, 6 New Tires, 100,000 Miles Each	100,000 Mile Tire Use Cost, 2 New Tires, 100,000 Miles Each, 4 Recapped Tires, 80,000 Miles Each, 4 Recapped Tires, 20,000 Miles Each	% Difference
$690.00	$530.00	23%

The use of recapped tires, on rear axles only, could save transit authorities 0.16¢ per mile in tire costs, a 23 percent cost reduction.

Table Seven illustrates an estimate of annual savings which could be captured by the surveyed transit agencies which do not

currently use recapped tires. For the purpose of the comparison it is assumed that buses travel 35,000 miles annually and that the subject transit authorities purchase new bus tires.

TABLE SEVEN

Comparison of New Tire Use Costs to Combined New Tire/Recapped Tire Use Costs, Annual,[1] Five Michigan Transit Authorities

Transit Fleet	Fleet Size	Annual Tire Use Cost New Tires Only[2]	Annual Tire Use Cost New and Recapped Tires[2]	Annual Savings
DDOT	900	$217,350	$166,950	$50,400
SEMTA	238	57,477	44,149	13,328
FLINT	45	10,710	8,348	2,362
AATA	35	8,330	6,493	1,837
KALAMAZOO	40	9,520	7,420	2,100
Totals		$303,387	$233,360	$70,027

[1]Assumes purchase of new tires, 35,000 miles travel per bus per year, 100,000 mile life for new tires, 80,000 mile life for recapped tires, $115.00 cost for new tires, $60.00 cost for recapped tires, recapped tires to be used on rear axles only.

[2]Rounded to nearest dollar.

A rigorous program of tire maintenance, including correct tire inflation, wheel alignment, dual tire sizing, prompt repair of small damages, and frequent inspections can help extend the original tire tread life and enhance the possibility of retreading by maintaining tire carcasses in good condition.[7] Certainly, tire maintenance and its associated labor and equipment costs should be included in an in-depth analysis of tire costs. Such cost data were not collected in this study but should be considered by any Michigan transit authority in its decision to use or not use recapped tires.

There is resistance to the use of recapped tires among several Michigan public transit authorities on the basis of legitimate safety and operating considerations. While tire recappers claim to have solved problems associated with poor tire carcass quality and tread separation, doubt remains among tire users and no research findings were found during this study to confirm the recappers' claims. Experience in the heavy trucking industry, however, appears to confirm the recappers' claims.[8] It is possible that data gathered from the experience of the three Michigan public transit authorities currently using recapped tires could lead to findings which will resolve the current controversy over the safety and operating effectiveness of recapped bus tires. Laboratory tests at several Michigan facilities could provide help in developing a statewide standard for bus tire carcass selection and the selection of acceptable recapping processes.

Other methods of used tire recycling include their use as breakwater materials, use as components of "artificial reefs" used as gamefish habitats, use of ground tires and recap buffings as boiler fuel or as asphalt paving components, use as a source of petroleum fuels, and use as a source of reclaimed rubber for the tire and rubber industry. The use of scrap tires as boiler fuel is not currently practical because of economic and environmental considerations. The use of ground tires as an asphaltic paving component is currently being tested and has resulted in improved road surface adhesion and reduced road surface cracking, according to federal reports. Demand for reclaimed rubber appears to be declining, apparently because of quality problems and market demands. The production of petroleum fuels from used tires is dependent upon capital costs and petroleum prices in the future.

A considerable body of literature exists on used tire recycling for truck, bus, and automobile tires. Literature sources are listed in this study's bibliography.

In the absence of specific projects, it is possible that the best current way to recycle totally used un-recappable bus tires

would be through a contract with a third party broker who would process or re-sell the scrap tires for reclamation or disposal.

FOOTNOTES

1. Tire Review, June, 1978.

2. Hunter, D. A. and Lee, W. D., A Study of Technologies to Optimize Truck Configuration for Fuel Economy, U.S. Department of Transportation, DOT-TSC-OST-75-46, 1975.

3. Thurman, G. R. and Leasure, W. A., Jr. (eds), Noise and Traction Characteristics of Bias-Ply and Radial Tires for Heavy Duty Trucks, Highway Safety Research Institute, The University of Michigan, Ann Arbor, Michigan, 1977.

4. Ibid.

5. Humpstone, C. C., Ayers, E., Kearney, S. G., and Schell, T., Tire Recycling and Reuse Alternatives, U.S. Environmental Protection Agency, 1975.

6. See FMVSS 117, 119 and CFR, Part 397.75 (d).
Also see: Safe Operating Condition of Truck and Bus Type Tires, Equipment Safety Committee, Washington, D.C., March, 1973.
Paragraph 6.1 e of VESC-9, regarding safe tires on front wheels of power units states: "It shall be considered unsafe if it has . . . e. any tire which has been retreaded, recapped or regrooved, except that they are permissible when used on vehicles in intra-city (city and suburban) service or on vehicles 10,000 pounds gross vehicle weight or less."

7. Humpstone, Ayers, Kearney and Schell, above.

8. "Recapping, One Last Road to Lower Costs?" Fleet Owner, July, 1978, pp. 107-110.

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APPENDIX

apta
american public transit association

b. r. stokes
executive vice president

COMPLIMENTARY COPY

July 6, 1978

TO ALL MEMBER TRANSIT SYSTEMS

SUBJECT: Tires Used on Transit Buses

Enclosed are two survey forms: "Leased Tires Used on Transit Buses" (WHITE paper stock) and "Purchased Tires Used on Transit Buses" (YELLOW paper stock); each form is a single sheet printed on both sides. IF YOU ARE NOT THE INDIVIDUAL WHO WILL COMPLETE THE ENCLOSED FORMS, PLEASE FORWARD THIS COVERING LETTER (OR A PHOTOCOPY OF IT) WITH THE FORMS WHEN YOU TRANSMIT THEM TO THE PROPER INDIVIDUAL(S) ELSEWHERE IN YOUR ORGANIZATION.

Please return both forms. If only one of the two forms applies to your transit system, please complete that form in its entirety and mark the other form "NOT APPLICABLE" in the space following the name of your transit system. Please complete and return your forms no later than July 31, 1978.

The Chicago Transit Authority will process completed tire survey forms and tabulate responses for the summary report. In order to expedite the processing of your completed survey forms, please mail your original color-coded forms to:

APTA Transit Bus Tire Survey
c/o Director of Audits
CHICAGO TRANSIT AUTHORITY
P.O. Box 3482
Chicago, IL 60654

In addition, please mail photocopies of your original forms to:

APTA Transit Bus Tire Survey
AMERICAN PUBLIC TRANSIT ASSOCIATION
1100 17th Street, N.W., Suite 1200
Washington, DC 20036

Please retain photocopies of your completed survey forms in your files.

If you have any questions regarding the two survey forms concerned with tires used on transit buses, please contact Chuck Kromer, Manager of Statistics; telephone (202) 331-1100.

Very truly yours,

B. R. Stokes
Executive Vice President

BRS:hb
Enclosure

LEASED TIRES USED ON TRANSIT BUSES

(continued)

3). What is the duration or length of your lease agreement? From _____ Through _____

4). What is your basic lease rate per bus mile (6 tires)? $_____.____

5). What indices are used to determine escalation (if any) of your basic lease rate? _____

6). When you purchase a new bus, who furnishes tires? Bus manufacturer ☐ Tire Leasing Agency ☐ Other ☐ (specify) _____

_____

7). Do you maintain a bus tire inventory? Yes ☐ No ☐ If "Yes," how large is the inventory? _____

8). Is your bus tire inventory centrally located? Yes ☐ No ☐

9). Do you maintain your bus tires in any way? Yes ☐ No ☐

10). Does your supplier have any obligation in the maintenance of the bus tire? Yes ☐ No ☐

11). What are your tire lease contract provisions that relate to the maintenance of bus tires? _____

_____

_____

_____

12). What was your cost for bus tire maintenance? 1977_____ 1976_____ 1975_____ 1974_____ 1973 _____

13). Did you ever purchase transit bus tires? Yes ☐ No ☐ If "Yes," why do you lease rather than purchase now? _____

_____

_____

_____

AMERICAN PUBLIC TRANSIT ASSOCIATION
1100 17TH STREET, N.W., SUITE 1200
WASHINGTON, D.C. 20036
PHONE (202) 331-1100

PURCHASED TIRES USED ON TRANSIT BUSES

1.) *Transit System Name _____

Mailing Address _____ City _____ State/ Province _____ Zip Code/ Postal Code _____

Prepared By _____ Title _____ Date Prepared _____ Phone Number (___) _____ Ext. _____

2.)

TIRE MANUFACTURER	TIRE SIZES	PLY	DESCRIPTION	AVERAGE LIFE TIRE MILEAGE	TOTAL NUMBER OF TIRES	PURCHASE PRICE OF TIRES FOR PAST FIVE YEARS				
						1973	1974	1975	1976	1977
GOODYEAR										
GOODRICH										
FIRESTONE										
GENERAL										
UNIROYAL										
OTHER (Name)										

*Would you like your organization to remain anonymous in the published summary report which APTA will publish? Yes ☐ No ☐

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LEASED TIRES USED ON TRANSIT BUSES

1.) *Transit System Name _____

Mailing Address _____ City _____ State/ Province _____ Zip Code/ Postal Code _____

Prepared By _____ Title _____ Date Prepared _____ Phone Number (___) _____ Ext. ___

2.)

TIRE MANUFACTURER	TIRE SIZES	PLY	DESCRIPTION	AVERAGE LIFE TIRE MILEAGE	TOTAL NUMBER OF TIRES	TIRE MILEAGE BONUS POINT MILEAGE AND RATE		
GOODYEAR								
GOODRICH								
FIRESTONE								
GENERAL								
UNIROYAL								
OTHER (Name)								

*Would you like your organization to remain anonymous in the published summary report which APTA will publish? Yes ☐ No ☐

PURCHASED TIRES USED ON TRANSIT BUSES

(continued)

3). What is the duration of your purchase agreement? From _____ Through _____

4). Did you ever lease transit bus tires? Yes ☐ No ☐ If "Yes," why do you purchase rather than lease now? _____

_____

5). How do you dispose of damaged transit bus tires or tires worn beyond use? _____

_____

6). Do you maintain a transit bus tire inventory? Yes ☐ No ☐ If "Yes," how large is the inventory? _____

7). Is your transit bus tire inventory centrally located? Yes ☐ No ☐

8). What was your cost for bus tire maintenance? 1977 _____ 1976 _____ 1975 _____ 1974 _____ 1973 _____