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The Accessible Fixed-Route Bus Service Experience

MAY 1981

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16. Abstract This research report discusses the operator and user experience with the provision of lifting devices on regular bus transit services to facilitate the entry and exit of wheelchair users and semi-ambulatory passengers. Lifts are used very little, averaging less than six boardings per day systemwide at all but a very few sites. All operators have reported some denied boardings due to lift equipment problems. Lift usage growth over time has been slow. Declines of 50 percent or more from fall to winter usage levels have been experienced in cold weather climates.

Many operators have been experiencing considerable difficulty with lift service. Lift malfunctions due to poor lift design, faulty maintenance practices or operator error have occurred at a rate of one for every six or fewer lift passengers boarded at several sites. Nevertheless, the impact on overall transit operations has been small since operators have made few, if any, changes in schedules or the number of buses deployed, and delays caused by lift usage or lift malfunctions have been infrequent due to the low number of attempted boardings.

Accessible bus service is somewhat more costly than non-accessible service. The major components of the approximate $2000 incremental cost per year per bus are the annualized capital and the inspection, maintenance and repair costs for the lifts. The incremental cost per lift using passenger has ranged up to several hundred dollars per boarding. However, with current Federal and state capital and operating assistance programs, the transit operator's share of the accessible bus service expenses generally amounts to less than half of the total expenses.

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PREFACE

The author wishes to express his appreciation to those who supplied information regarding accessible bus equipment and operations. Staff members of the following transit operators provided data for this study: Greater Bridgeport Transit District - Bridgeport, Connecticut; Champaign-Urbana Mass Transit District - Urbana, Illinois; Connecticut Transit Management, Inc. - Hartford, Connecticut; City of Detroit Department of Transportation - Detroit, Michigan; Southeastern Michigan Transportation Authority - Detroit, Michigan; Southern California Rapid Transit District - Los Angeles, California; Milwaukee County Transit System (Milwaukee Transport Services, Inc.) - Milwaukee, Wisconsin; Orange County Transit District - Santa Ana, California; Palm Beach County Transportation Authority - West Palm Beach, Florida; Santa Monica Municipal Bus Lines - Santa Monica, California; Metro, Municipality of Metropolitan Seattle - Seattle, Washington; Washington Metropolitan Area Transit Authority - Washington, D.C.; and the Wichita Metropolitan Transit Authority - Wichita, Kansas.

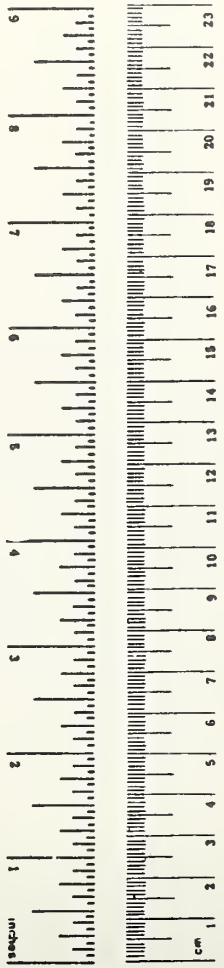
The author also wishes to thank David Nelson of Charles River Associates, Inc., David Koffman of Crain and Associates, and Larry Englisher of Multisystems, Inc. for their input concerning the projects which they are evaluating for the Transportation Systems Center.

Finally, the author wishes to thank Howard Slavin, Chief of the Evaluation Branch, Urban and Regional Research Division, Transportation Systems Center, for providing valuable, constructive advice.

METRIC CONVERSION FACTORS

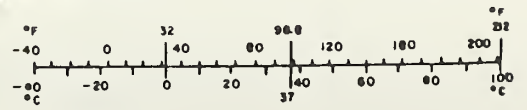
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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1. INTRODUCTION

Fixed-route bus services which are accessible to persons in wheelchairs or with step climbing impairments are becoming increasingly more numerous across the United States. While some states and transit authorities had established a policy of fixed-route accessibility prior to July 1979, the effective date of the U.S. Department of Transportation (DOT) regulations to implement Section 504 of the Rehabilitation Act of 1973, a large number of accessible services have been instituted in response to the mandate of these regulations. The DOT regulations stipulate that all buses ordered after July 2, 1979 must be accessible to handicapped persons.

The DOT Section 504 regulations, which mandate rail as well as bus accessibility, have been the subject of considerable controversy. The Section 504 regulations have been hailed by supporters as the best method of providing transportation service to the handicapped (i.e., offering them the same service as that provided to non-handicapped persons) while being assailed by detractors as either not serving the needs of the majority of the handicapped or as not being a cost-effective use of scarce transit funds. The American Public Transit Association had filed suit in court to overturn these regulations, but as of January, 1980 no final judgement had been rendered in the case. The Congress also has debated the issue, but while the House of Representatives of the 96th Congress passed a bill allowing some flexibility in local decisionmaking regarding the most appropriate local handicapped transportation, the Senate did not vote on this issue. The Administration has stated that it will review this regulation, along with others, in accordance with its efforts to reduce government regulation. Consequently, there is the possibility that the DOT Section 504 regulations will be modified during the coming year.

Regardless of the outcome of these legal tests and policy reviews, there is a need for information concerning existing accessible fixed-route service impacts. This information is useful for operators initiating accessible services and, if local options are permitted, for those localities choosing among several alternative handicapped transportation services. The findings of the accessible bus experience to date will also be useful in supporting Federal policymaking on the transportation of the handicapped.

In order to respond to the need for information on accessible fixed-route bus services, the Transportation Systems Center, under the sponsorship of the Urban Mass Transportation Administration's (UMTA) Service and Methods Demonstration (SMD) Program, has been evaluating operational experiences with accessible bus services. Operational data have been obtained from SMD demonstrations in Champaign-Urbana, Illinois and Palm Beach County, Florida and SMD sponsored evaluations of locally initiated services in St. Louis, Missouri, Washington, D.C., Seattle, Washington, and Hartford, New Haven and Stamford, Connecticut. In addition, data have been obtained from all operators with both 30 or more accessible buses and at least 30 percent of the peak fleet accessible, as well as from all other transit agencies with over

100 accessible buses. With very few exceptions, the latter transit operators have not kept detailed records on accessible bus operations. In most instances, the only information readily available from these operators was a description of the equipment and service offered and some form of lift usage record. At a few sites, even data on lift utilization were not available. As a result, this study draws most heavily from the experience at sites of SMD-sponsored projects where detailed operational data have been recorded.

2. ACCESSIBLE EQUIPMENT

A principal element in making fixed-route bus service accessible to handicapped persons is the installation of a level-change or lifting mechanism to carry persons in wheelchairs or with step-climbing impairments between the ground and bus floor level. San Diego Transit, in early 1977, using five buses retrofitted with lifts, was the first transit operator in the country to offer this type of service. By the end of 1980, more than 90 other transit operators had retrofitted or purchased over 4100 standard-size buses with lifts, and over 2300 more were on order. These buses represented about 12 percent of the nationwide transit fleet.

A number of different buses and lifts are currently being produced. The two largest suppliers of buses to U.S. transit operators are General Motors Corporation and Grumman Flxible Corporation. Both produce only "advanced design" bus models. General Motors uses its own wheelchair lift on the RTS series buses. Flxible currently delivers their 870 model bus with an Environmental Equipment Corporation (EEC) lift. However, Flxible will, if the purchaser desires, deliver buses without lifts. In this instance, the transit operator can install lifts of its own choosing. "New look" buses produced by two Canadian bus manufacturers, Flyer Industries and General Motors of Canada, have captured a significant but smaller share of the U.S. market. Flyer will equip their buses with Lift-U or with Vapor Corporation lifts. General Motors of Canada is currently using EEC lifts. In addition, there are several other bus manufacturers who are producing or who have orders for lift-equipped buses. Gillig Corporation, Transportation Manufacturing Corporation (TMC), Chance Manufacturing Company, and Blue Bird Company produce small-to-medium-size lift-equipped buses. Gillig and TMC use Transportation Design and Technology (TDT) lifts, while Chance installs Vapor lifts and Blue Bird installs Collins lifts. Neoplan, a German firm, produces standard-size buses. They will equip their buses with either a Vapor lift or one of their own design. Ikarus, a Hungarian company, (under a licensing agreement with Crown Coach Corporation) and MAN, a German company, have orders to build articulated buses for the U.S. market. Ikarus utilizes the Vapor lift while MAN will install either the Lift-U or the Vapor lift. The majority of bus manufacturers install the lifts in the front doorway of the bus. There are some exceptions, however. General Motors RTS series has the lift in the rear doorway. Neoplan offers the option of its own lift in a separate doorway

adjacent to the regular front door. MAN and Ikarus offer the option of the lift in the articulated trailer section doorway.

3. ACCESSIBLE SERVICES

In order to provide a background for the discussion of findings in the remainder of this paper, a summary of the amount of accessible service operated at sites supplying a lift usage count is contained in Table 1.

Table 1 reveals a range of peak fleet accessibility of from 5 to 100 percent. Palm Beach County is the only location in the country with all of the fleet lift-equipped. Five other locales utilize some accessible buses on all routes.

The Section 504 regulations require that at least one-half of the peak-hour bus service be accessible by July 2, 1982. For those sites not achieving this status, interim accessible transportation for handicapped persons who could otherwise use the system must be provided. Of the transit systems owning 30 or more accessible buses as of December 1980, only those in Hartford, New Haven, Stamford, Palm Beach County and Wichita scheduled more than 50 percent of the peak fleet in accessible service. One other, Bridgeport, had sufficient accessible buses to reach this level.

TABLE 1. ACCESSIBLE SERVICES
(November 1980)

Site	Accessible Buses on Property	Bus/Lift Combination	Accessible Buses Scheduled in Peak	Percent of Peak Fleet Accessible	Number of Routes Accessible	Percent of Routes Accessible
Bridgeport	39	GMC/GM	23	48	14	100
Champaign-Urbana	40	25 Flx/EEC 15 GMC/EEC[1]	11	33	3	30
Connecticut Transit						
Hartford	155	Flx/EEC	152	64	21	100
New Haven	100	Flx/EEC	82	75	18	100
Stamford	25	Flx/EEC	24	86	8	100
Detroit						
DDOT	163	GMC/GM	110	18	8	14
SEMTA	111	GMC/GM	70	22[2]	8	15
Los Angeles	430[3]	200 AMG/TDT 230 Flx/EEC	159	8	21	10
Milwaukee	250	100 Flx/Vapor 150 GMC/GM	141	27	17	29
Orange County	175	GMC/GM	100	30	12	22
Palm Beach County	67	40 TMC/TDT 23 GMC/TDT[1] 4 GMC/RI[4]	50	100	19	100
St. Louis	157[3]	Flx/TDT	40	5	12	7
Santa Monica	47	Flx/EEC	35	35	10	83
Seattle	163	Fly/Lift-U	90	11	23	23
Washington, D.C.	150	Flx/Vapor	102	6	37	28
Wichita	31	26 GMC/GM 5 Chance/Vapor	31	67	19	100

[1] Retrofitted lifts are used in this combination.
[2] More than 22% of the peak buses are accessible, but only 22% are scheduled.
[3] Not all of the buses are being operated as accessible buses.
[4] The lifts used in this combination were furnished and installed by Recreational Industries. These buses are not used in fixed-route service.

4. USAGE OF LIFTS

4.1 LIFT-USER BOARDINGS

Lifts are used very little at most sites. Only the Orange County and Seattle transit systems are averaging more than six lift-assisted boardings per day. Recent daily lift-assisted boarding totals for each system are shown in Table 2 as well as daily lift-assisted boardings per scheduled accessible bus.

TABLE 2. ACCESSIBLE BUS LIFT USAGE

Site	Month of Count	Daily Lift Boardings Systemwide	Daily Boardings per Scheduled (Peak) Accessible Bus
Bridgeport	Oct. 1980	2.7	0.12
Champaign-Urbana	Nov. 1980	1.7	0.14
Connecticut Transit			
Hartford	Sept. 1980	5.2	0.03
New Haven	Sept. 1980	5.9	0.07
Stamford	Sept. 1980	1.2	0.05
Detroit			
DDOT	Oct. 1980	0.7	0.006
SEMTA	Nov. 1980	2.1	0.03
Los Angeles	Oct. 1980	5.0	0.03
Milwaukee	Oct. 1980	2.1	0.01
Orange County	Oct. 1980	17.0	0.17
Palm Beach County	Nov. 1980	3.9	0.06
St. Louis	Oct. 1980	1.0	0.03
Santa Monica	Oct. 1980	1.3	0.04
Seattle	Oct. 1980	54.0	0.60
Washington, D.C.	Oct. 1980	5.7	0.06
Wichita	Oct. 1980	2.0	0.04

Only one operator is carrying more than 0.17 lift-assisted trips per day per scheduled accessible bus. None achieve as much as one boarding per day per bus. Seattle comes the closest to this figure, with 0.6 daily boardings per bus. To date, operators report that over 90 percent of the boardings have been made by persons in wheelchairs.

Most of the sites have experienced lift usage growth over time. This growth has generally been slow and characterized by step-like increases interspersed with periods of stable ridership. This pattern is probably due to the addition of a few regular riders at random times combined with fairly constant ridership by existing lift users. However, because of the lack of an

extensive observation period at most sites, firm conclusions concerning long term ridership trends cannot be made at this time.

4.2 SEASONAL VARIATION

Another evident ridership pattern is the reduction in lift-assisted boardings during winter months in cold weather locales. For example, during the period of maximum ridership in St. Louis, monthly lift boardings dropped from 158 in September, 1977 to 82 in January, 1978, a decrease of 48 percent. New Haven's lift utilization decreased from 50 to 17 (66 percent) from September, 1979 to January, 1980. At these two locations, lift utilization rebounded to 254 and 81, respectively, by the following April. In Milwaukee, monthly lift boardings dropped from 49 to 15 (69 percent) between September, 1979 and January, 1980. Champaign-Urbana experienced a 45 percent decline (from 93 to 51) and Washington, D.C. a 24 percent decline (from 50 to 38)[5] from September, 1980 to December, 1980.

4.3 DENIED BOARDINGS

In addition to the lift users who actually board the buses, there are others who are unable to do so through some fault of the lift equipment, the driver, or the lack of room on the bus. The number of denied boardings, if available, is obtained through reports by the drivers. It has been found, in some instances, that data reported by drivers are not very accurate, particularly when this information might reflect unfavorably upon themselves. Nevertheless, driver reports are the only reasonable manner in which some data, such as denied boardings, can be collected. Table 3 shows the percentage of attempted boardings denied. Some of the denied boardings occurred because the bus was too crowded to let the wheelchair user on, and on a few occasions the tiedown positions were already occupied. However, the large majority of denied boardings were due to the fact that the bus either had no lift (contrary to the schedule) or the lift would not operate.

The number of denied boardings reported are generally less than 10 percent of the attempted boardings, yet the fact that some boardings are denied would be expected to inhibit potential users. However, the survey results from St. Louis, Seattle and Washington, D.C. indicate that only a small percentage of handicapped non-users of accessible buses are concerned about not being able to get on the bus. The difficulty of getting to and from the buses and the availability of other means of travel appear to be more important determinants of the trip and mode choice decision.

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[5]One week sample counts.

TABLE 3. DENIED BOARDINGS
(Summer-Fall, 1980)

Site	Percent of Attempted Boardings Denied
Champaign-Urbana	< 1
Connecticut Transit	
Hartford	7
New Haven	7
Stamford	17
Palm Beach County	4
Seattle	1-2
Washington, D.C.	11

4.4 TRIP RATES/UNDUPLICATED USERS

In addition to lift boarding and denial numbers, other interesting usage-related statistics are the trip rates of users and the number of different persons who make use of the service (unduplicated users). It is very difficult to determine the number of unduplicated users represented by the boarding figures at any of the sites due to the problem of identifying each person who boards using the lift. Nevertheless, there is some evidence from SMD sites concerning the actual number of different users. During the first eleven months of accessible service in St. Louis, when accessible service and ridership greatly exceeded present levels, 40 individuals took 92 percent of 1026 reported lift-user trips. (It was estimated that 1983 wheelchair users live within 1/4 mile of the BSDA accessible routes.) Only 13 of the 40 took more than 10 bus trips during this period.

In Seattle and Washington, D.C., surveys were conducted with identified users. Seventy-two lift users were found in Seattle. All but three use wheelchairs. (Approximately 1500 wheelchair users live in the City of Seattle alone, based on national incidence rates.[6]) The number of weekly bus trips which lift users claimed to make are shown in Figure 1. Fifteen claimed to make more than 10 one-way bus trips per week, while 30 stated that they make 2 or fewer one-way trips per week. The boardings reported by the 72 users (who do not represent all of the users) exceed actual lift use counts by about 40 percent. Consequently, the trip rates claimed by the users would seem to have been substantially overstated.

In Washington, D.C., 44 lift users were found. (Approximately 7600 wheelchair users reside in the WMATA service area according to national incidence rates.) Twenty-eight of the lift users were surveyed in the first round of surveys. Nineteen of these persons use a wheelchair. The trip

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[6]From the Summary Report of Data from the National Survey of Transportation Handicapped People, prepared for UMTA by Grey Advertising, New York, June, 1978.

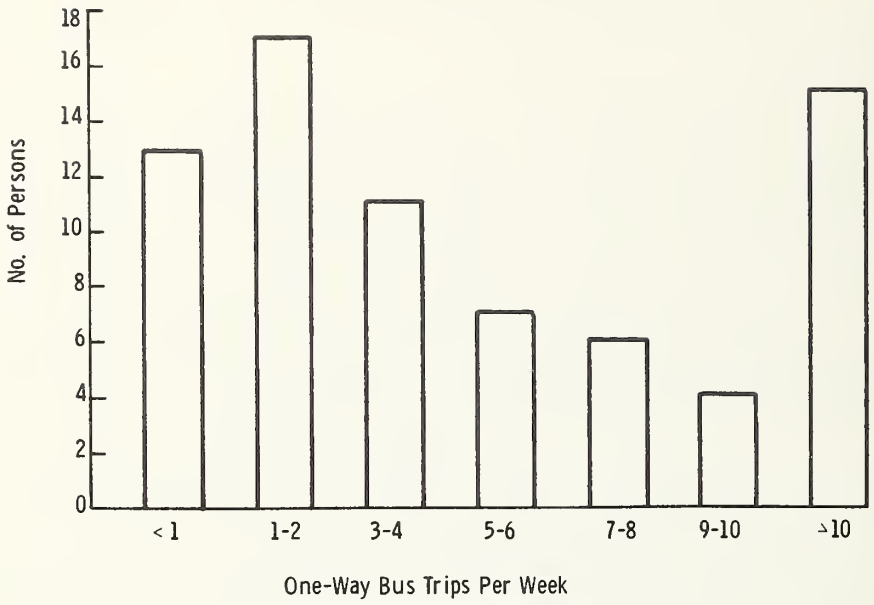

FIGURE 1. SEATTLE LIFT ASSISTED TRIP RATES

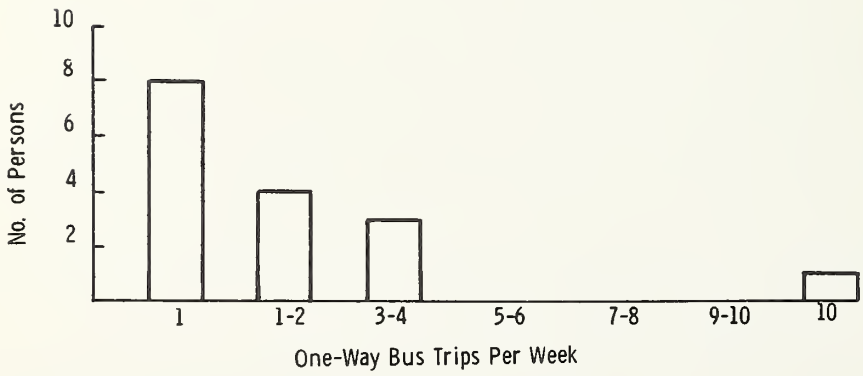

FIGURE 2. WASHINGTON LIFT ASSISTED TRIP RATES

frequency claimed by lift users is shown in Figure 2. Only six reported making any trips during the week before the survey. Five others made trips during the prior month. Two users made 50 percent of the trips reported in the survey. The total number of trips which the surveyed users professed to have made amounts to approximately the number of monthly trips counted by WMATA. It would appear that these trip frequencies were also overstated, since there are 16 other users whose survey results are not yet available.

In Palm Beach County, analysis of the origins and destinations of lift-users indicates that five lift-users account for most of the reported boardings. (National incidence rates would indicate that about 1000 wheelchair users live in the County.) The limited amount of information from locales which are not the sites of detailed SMD evaluations, confirms that only a small number of handicapped persons are currently benefiting from accessible service.

Evidence from six SMD evaluation sites indicates that persons in wheelchairs make fewer transit trips than the rest of the population. According to the National Survey of Transportation Handicapped People, persons who use wheelchairs comprise approximately 0.28 percent of the population. If, on the average, wheelchair users make the same number of transit trips as other persons, they would make 0.28 percent of the transit trips. However, observed wheelchair user bus trips account for only 0.02 to 0.10 percent of all passenger trips taken on accessible routes at the six sites. Considering their mobility limitations and the environmental barriers they encounter, this result is not surprising.

A more accurate measurement of lift-user bus trip rates will be obtained in Palm Beach County and Champaign-Urbana where attempts will be made to obtain travel diaries of all trips made by identified lift-users. However, even at these two sites, it is unlikely that all lift users can be identified or that all of the identified users will agree to complete the travel diary. Nevertheless, these data are expected to substantially increase the understanding of the travel patterns of persons who make use of the lift in order to board the bus.

A special attempt was made in the Seattle SMD study to ascertain why the ridership appears to be so much higher there than at other sites. It was found, however, that the rate of lift-usage, at least as a percentage of total ridership on the routes that are accessible, may actually be higher in Champaign-Urbana (where it is 0.1 percent) than in Seattle (where it is 0.07 percent) although the actual number of boardings is vastly higher in Seattle. Champaign-Urbana, however, is the site of the Rehabilitation Center of the University of Illinois where a large number of wheelchair users are enrolled. Further, a small number of frequent users on a small system affect ridership statistics much more than they would on a large system. Still, Seattle's ridership is higher than at any of the other sites discussed in this study. A number of factors may influence Seattle's rate of lift utilization. The lift equipment appears to perform more reliably than at many other sites. Handicapped spokespersons felt that the involvement of the disabled community in all phases of this project, the set of origins and destinations served, and the positive attitude and commitment of Metro personnel to make the service

work were important factors in generating the level of lift usage being experienced. Since many of these characteristics are not unique to Seattle, an explanation for the higher ridership in Seattle remains undiscovered.

4.5 SURVEY DATA -- LIFT USERS

The survey results in Seattle and Washington, D.C., reveal a number of characteristics of the lift users, their travel, and their travel difficulties. Persons using electrically powered wheelchairs represent 36 percent of WMATA lift users and 49 percent (or 40 percent of the trips made) of Seattle Metro users. Lift users tend to be young. Seventy-one percent of the lift-bus trips taken in Seattle were made by persons under 35 years of age. Many users are relatively affluent. Forty-five percent of WMATA users make over $20,000 per year; 30 percent make over $30,000 per year. About half of WMATA users are full time workers. Male users outnumber female users in Washington, D.C. by two to one. Approximately two-thirds of the WMATA users live in households owning no cars. Sixty-two percent of WMATA lift users and 78 percent of Metro lift users make more than 6 one-way trips per week in motor vehicles of some type; over a third take more than 10 motor vehicle trips per week. Work is the highest single trip purpose category reported by users, accounting for 25 percent of Seattle and 42 percent of Washington, D.C. trips.

WMATA users reported that the most serious problems with utilization of the lift buses were inoperable lifts or the substitution of a non-accessible bus, and the difficulty of getting to the bus stop. Close behind were bad weather and the lack of bus shelters. (Forty-four percent of both Metro and WMATA users say they would not use the lift bus in rainy or stormy weather.) Seattle users reported similar problems, plus difficulties in maneuvering from the lift to the tiedown position (particularly when the bus was crowded) and securing the wheelchair in the tiedown position.

4.6 SURVEY DATA -- NON-BUS USERS

Handicapped non users of the lift buses were surveyed in Washington, D.C., and Seattle. Non users of the WMATA service (of the 87 surveyed, 31 were wheelchair users) indicated that the most important reason for not using it was a preference for other modes, principally the automobile, either as a driver or as a passenger. Other significant reasons were the difficulty of getting to the bus stop due to obstacles or distance and the fact that the buses do not run where or when they desire to travel. Similar responses were received in Seattle. Over 47 percent of the 73 Metro handicapped non users surveyed were unable to get around by themselves and consequently would be unable to get to the bus stop unaided. The next most frequently stated reasons were the distances to an accessible bus stop and the lack of service to desired destinations. Other major reasons included a preference for other

modes of transportation and the undesirability of waiting outdoors for the bus. Fifty-two percent of the Seattle sample of non users would rather have door-to-door service instead of fixed-route accessibility, while only 18 percent of the lift users expressed this preference.

5. ACCESSIBLE SERVICE QUALITY

5.1 MISSED RUNS

An important measure of service quality to the user is the reliability of the service. One gauge of service reliability for lift users is the number of accessible bus runs completed compared to the number of accessible bus runs scheduled. Table 4 shows the percentage of scheduled runs operated by buses without working lifts.

TABLE 4. MISSED RUNS

Site	Percent of Scheduled Runs Missed
Champaign-Urbana	< 1
Hartford	12
New Haven	8
Stamford	9
Palm Beach County	< 1
St. Louis	6
Seattle	< 1
Washington, D.C.	30

Missed runs are caused by the unavailability of accessible buses. Reasons for unavailability include road breakdowns due to mechanical malfunction or operator error, accident damage which keeps the bus out of service, the lack of replacement parts and a low spare ratio. Bus unavailability can be caused by a lift problem, but is more often the result of another malfunction with the bus. This is evidenced by the fact that only 10 to 15 percent of accessible bus road breakdowns are caused by lift problems. A principle reason for Connecticut Transit's missed accessible runs is the low spare ratio in Hartford (2 percent) and Stamford (4 percent).

5.2 BOARDING/ALIGHTING DIFFICULTIES

Other indicators of accessible service quality are the percentage of boardings and alightings accomplished without difficulty, the number of boardings denied and the safety of the passenger. In a sample of 734 attempted boardings in the three Connecticut Transit Divisions, 68 percent were accomplished without problems, 24 percent were accomplished with some difficulty and 7 percent were denied due to a lift malfunction. Ten trips, or slightly over 1 percent, were denied due to crowded buses. Data are not available from other evaluation sites at this time concerning the percent of attempted boardings encountering difficulties. As discussed previously under lift usage, denied boardings have reached 7 percent or more of attempted boardings at four sites.

The above data indicate that accessible service is not highly reliable at present. If attempted lift usage were higher, the number of missed or non-accessible runs would be a more serious problem, as a larger number of wheelchair or other handicapped patrons would be passed by at the bus stops. It is expected that service reliability will improve as new lift designs and modifications are accomplished. However, lift equipment will always be subject to malfunctions caused by operator error and other causes.

5.3 SAFETY

A few lift users have been involved in incidents resulting in injuries to themselves or damage to their wheelchair. Incidents of this nature have been infrequent, averaging 1 for every 400 to 600 lift boardings. Nevertheless, there have been at least seven instances in which wheelchair users have fallen from their wheelchair to the ground. Fortunately, none of these persons have been seriously hurt, although some required medical attention.

6. IMPACTS ON OTHER BUS RIDERS

6.1 DELAYS

Accessible service also has some impact on non lift-using bus passengers. These passengers experience delay, usually on the order of from 2.5 to 3 minutes for each lift-user boarding.[7] Deboarding normally causes a slightly

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[7]Discussed later in this paper.

smaller delay. In the case of a road call, delays of 20 minutes or more would be experienced.[7],[8] There is no evidence to date that bus riders have exhibited any strong reactions to delays of this nature. Whether this attitude would change if lift usage increased substantially is uncertain.

6.2 SAFETY

In some instances, non lift-using passengers have sustained injuries as a result of lift-equipped bus service. The Bi-State Development Agency (BSDA) in St. Louis and the Palm Beach County Transportation Authority (COTRAN) each reported about 50 incidents involving passengers tripping on the front stiars of the bus. Two-thirds of the BSDA incidents resulted in the filing of an injury claim. At both locations the lift changed the riser height of the front steps from the standard dimension. Most other operators report few, if any, nonhandicapped passenger incidents involving the accessibility features. The lifts, therefore, do not seem to pose a serious safety risk for nonhandicapped bus passengers at most locations.

7. OPERATOR IMPACTS

7.1 SCHEDULE MODIFICATIONS

Very few transit operators have made changes in service frequency, bus routing, or layover time due to the implementation of accessible buses. St. Louis is the major exception. Since BSDA was the first large accessible fixed-route service operator, and wheelchair ridership levels were an unknown quantity, BSDA wanted to insure that lift delays did not disrupt schedule adherence. Consequently, layover times were increased at the ends of accessible routes in instances where layover time had been less than 11 minutes. In order to accomplish this, while keeping scheduled headways constant, extra buses sometimes had to be inserted on some runs. BSDA estimated that this action resulted in 24,435 additional service hours for the first 12 months of accessible service. For the last 10 months, BSDA estimated that 15,200 extra hours of service were provided. Based upon the level of lift utilization and on-road lift problems, however, it would appear that most, if not all, of the extra service hours were unnecessary. This does not

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[8]Aggregate passenger delay in a bus with all seats occupied would be on the order of 2 hours for a lift-user boarding and 1.5 hours for a deboarding. Similarly, aggregate passenger delay in the case of a road call would total at least 14 hours.

mean that delays in service did not occur as a consequence of accessible service operation. Quite the contrary, delays occurred due to lift malfunctions as well as due to wheelchair boardings and alightings. (Estimated delays totalled about 500 hours in the first 12.5 months of accessible service, compared to 24,435 extra scheduled service hours.) However, these incidents occurred infrequently and in no predictable pattern. It would not appear to be cost-effective to expend large sums of money on the provision of extra hours of service in order to cover random occurrences. Even in Seattle, where lift usage is much higher than at any other site, no changes in schedules or bus assignments are being made to compensate for lift-related delays, nor are any contemplated.

COTRAN was another operator who increased layover times (on routes where layovers were less than 5 minutes). New layover times on all routes were set between 5 and 8 minutes. COTRAN found this schedule change to have been unnecessary, since lift usage has been on the order of one to two boardings per day. Consequently, COTRAN plans to eliminate the added time at the next schedule change.

Connecticut Transit made route deviations on from 8 to 10 routes in order to provide improved service to major handicapped trip generators. Connecticut Transit also scheduled additional buses on several high-density routes in Hartford and New Haven. They did this because of both the loss of seating capacity and a fear that lift usage would seriously affect system performance. On high-volume routes, schedule adherence is frequently a problem. This would be exacerbated by the added dwell time for wheelchair patrons. The added buses were utilized in part to cushion the impact of lift-usage delays. However, the new buses have fewer seats than the buses they replaced. Therefore, the second reason for adding buses was to maintain seated capacity. A portion of the lower seating capacity of these buses is caused by the provision of wheelchair tiedowns. The economic impact of these changes due strictly to accessibility would be small. In any event, these costs were not quantified in the short-term Connecticut Transit evaluation. The Southeastern Michigan Transportation Authority was another operator who added buses on some accessible routes.

7.2 SCHEDULE ADHERENCE

As mentioned above, wheelchair patron boardings and alightings result in longer bus dwell times. The durations of these added dwell times are somewhat uncertain since actual boardings or alightings have been measured at very few locations. WMATA's drivers report average dwell times of 3 minutes for boarding and 2.5 minutes for alighting (5.5 minutes total). The California Department of Transportation staged some wheelchair-user trips on regular bus runs. Their measurements of dwell times averaged 1.9 minutes for boarding and 1.3 minutes for alighting (3.2 minutes total). BSDA measured entry and tiedown time at 2.2 minutes in an unoccupied bus in the yard. Exit time was 1.6 minutes (3.8 minutes total). The Southern California Rapid Transit District and the Orange County Transit District both estimated boarding and

alighting times at 3 minutes each. Santa Monica Municipal Bus Lines quoted 2.5 minutes for each of these functions. Three to seven minutes probably represents the range of combined on-and-off dwell times for most wheelchair patrons, barring any lift problems. The impact of this added delay on the operator's schedule adherence would be very much dependent upon the route and the time of day. It would severely disrupt short-headway, high-volume peak-period routes. It would have virtually no impact on long-headway, low-volume routes. At current ridership levels and without any significant number of regular wheelchair-using bus commuters, the overall operator's schedule adherence impact due to longer dwell times is small. This could change if lift usage increases dramatically.

Bus breakdowns due to lift malfunctions also cause disruptions to schedule adherence. Road breakdowns sometimes can be fixed by a supervisor dispatched to the scene or by a mechanic sent from the garage. This is commonly referred to as a road call. In other cases, another bus is sent to replace (or change-off) the broken down bus. In all of these instances, the delay can be considerable, on the order of 20 minutes or more. As with boarding delays, the impact on schedule adherence would depend on the route, on the time of day of the malfunction, and on what can be done with the passengers. Breakdowns are most disruptive on short-headway, high-volume routes. Obviously, the seriousness of the problem depends upon the frequency of breakdowns requiring the assistance of a supervisor or mechanic. Unfortunately, as in shown in Table 5, road calls due to lift malfunctions are not uncommon.

TABLE 5. LIFT-RELATED ROAD CALLS

Site	Road Calls per Month per Scheduled Lift Bus	Lift Passengers per Road Call
Hartford (EEC)	0.24	3.8
New Haven (EEC)	0.24	6.5
Stamford (EEC)	0.38	2.1
Palm Beach County (TDT)	0.15[9]	8.4
St. Louis (TDT)	1.10	1.2
Seattle (LIft-U)	0.51	36.5
Washington, D.C. (Vapor)	0.35	6.0
Milwaukee (Vapor)	0.13	3.7

Many of the on-road lift malfunctions occur when the lift is being deployed to board or deboard a passenger. Consequently, one of the factors affecting the breakdown frequency is the number of times the lift is deployed. The number of successful boardings for each road call is also indicated in

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[9]This includes change-offs at the end or routes which did not result in running-time delays.

Table 5. This data confirms that St. Louis did have a great deal of difficulty in operating accessible service. Seattle, on the other hand, although having the second highest monthly road call rate per scheduled accessible bus, has the least number of road calls per lift-assisted boarding. Nevertheless, several accessible service operators have been experiencing a lift-related road malfunction for every one to four lift-using passengers. Breakdowns of this frequency indicate very poor performance. The reason that lift related breakdowns have not had a greater disruptive effect on bus operations is because of the low frequency of lift usage.

It should be emphasized that the road call experience shown in Table 5 is not necessarily indicative of the quality of the lift equipment itself. The lift performance is dependent upon a number of factors, including the degree of maintenance it receives, its susceptibility to accidental damage, and the driver's ability to perform the proper operational sequence of steps. It is also inappropriate to rate lift performance on the basis of data from one or two operators. Further, many modifications have been made to the lift equipment by the manufacturers; thus the lifts currently being produced may not be the same version as the one on which performance was measured. The TDT lift is a striking case in point. The TDT lift presently being marketed is vastly different from the model deployed in St. Louis and Palm Beach County.

7.3 UTILIZATION OF ADDITIONAL LABOR RESOURCES

The provision of accessible service consumes a substantial amount of personnel hours, which can require extra expenditure of funds. Personnel involved with accessible service include management, planners, schedulers, advertising and public relations staff, as well as drivers, mechanics, supervisors, and checkers. There are instances wherein persons spend considerable time on accessible service. BSDA, for example, had the equivalent of three full-time staff persons assigned to accessible bus tasks. Seattle has one person's entire time, plus a sizeable portion of another person's time, assigned to accessible bus work. In Champaign-Urbana, one-third of a staff person's time is spent on accessible buses. There is also likely to be some staff overtime necessitated by accessible bus activities.

If the fleet is largely accessible, continuing accessible service planning should be minimal. However, if the percent of fleet accessibility is small, considerable staff effort may be required in assessing operations for the purpose of making changes and improvements in accessible service or in planning for the introduction of added service. Staff time also will be consumed in dealing with handicapped groups, arranging and participating in field demonstrations, handling complaints concerning lift service, collecting data on various aspects of the service, and developing advertising and marketing campaigns. The larger the accessible fleet, the larger these latter activities are likely to be.

The greatest amount of labor will be consumed in driver training and in performing mechanical repairs and inspections on the lifts. Several operators

have hired full-time mechanics just to maintain and repair lifts on the buses. For others, the equivalent number of full-time mechanics has been calculated based on the amount of labor hours spent on the lifts. The number of full time lift mechanics at the sites are shown in Table 6. COTRAN and Connecticut Transit spend many fewer labor hours on lift maintenance and repair than do other operators.

TABLE 6. ADDED MECHANICS

Site	Dedicated Lift Mechanics	No. of Buses per Lift Mechanic
Champaign-Urbana	1	40
Connecticut Transit	2 (equiv.)	140
Detroit (DOT)	9	18
Los Angeles	16	27
Milwaukee	12	20
Palm Beach County	1 (equiv.)	63
Santa Monica	1	47
St. Louis	8 (equiv.)	20
Washington, D.C.	9	17

Another activity which can result in extra labor hours is the frequent cycling of the lift equipment. Since lifts are deployed infrequently to pick up or let off passengers, some operators have required drivers to cycle the lift each day. This serves the dual purpose of ascertaining whether the lift is operating properly and of keeping the drivers familiar with lift operating procedures. In only one known instance (Rhode Island), are all drivers paid extra time for this activity. Connecticut Transit has chosen not to have the drivers cycle the lifts daily. Instead, they have recently instituted a program in which five drivers (two each in Hartford and New Haven and one in Stamford) spend two hours each weekday cycling and inspecting the lifts on the buses in the yards. In this manner, each lift is checked about twice per month.

Driver training, particularly for large properties, can consume large amounts of labor hours. Most operators have provided from 3 to 4 hours of training on the operation of the lift and on the handling of handicapped passengers. This training consumed 6279 driver pay hours at WMATA, 1250 hours at BSDA, and 2480 hours in Connecticut. Normally, all drivers have been given this training even if they are not scheduled to be driving on an accessible route. Training has usually been given outside of regular duty hours. In addition to driver hours involved in training, there have been substantial instructor hours consumed as well, since this training is most appropriately conducted in small groups. In Connecticut, instructor hours equalled 50 percent of driver hours. The ratio at other sites has been lower than 50 percent.

A small amount of driver and staff time has also been consumed in conducting field demonstrations of accessible bus lift usage for potential

lift patrons. The number of field demonstrations conducted has varied considerably by transit operator.

The transit operators at SMD evaluation sites claim that the operation of accessible service has not been an issue in labor negotiations so far. It has, in fact, resulted in a substantial amount of extra paid hours for mechanics, drivers (principally for training) and, to some extent, for office staff.

8. COSTS OF ACCESSIBLE BUS SERVICE

There is no question that making transit services accessible results in extra costs. Added costs associated with purchase of the accessibility equipment, training of drivers and mechanics, maintenance (encompassing road calls, repairs, routine maintenance and inspection), and marketing and advertising are a certainty. Extra costs may or may not be incurred as a consequence of service planning, schedule modifications, insurance premiums and accident claims. Costs of these items as discerned in SMD evaluation sites are discussed below under the categories of capital, start-up, and operating costs.

8.1 CAPITAL COSTS

Capital expenditures for accessible service consist principally of the cost of the lifts and tiedown devices. Other accessibility features such as kneeling devices, special lighting, added stanchions, lift-operation warning devices, special destination signal devices, etc., if provided, are relatively inexpensive and would make up a small but unknown portion of the capital cost. For recent purchases, the cost of the lift alone cannot be identified, as it is not listed separately in the bus manufacturer's bid price. Prior to the effective date of the Section 504 regulations, the cost of accessibility features usually was a separate item in the bid. At that time, accessibility costs ranged from $5000 to $8000 per bus and added from 8 to 12 percent to the total bus cost. The costs of retrofits were from $15,000 to $24,000.

Recent discussions with General Motors and Grumman Flxible revealed that the cost of accessibility features has gone up. General Motors estimated the cost of a wheelchair lift plus two sidewall wheel clamps and seatbelts at $11,500, with the lift accounting for virtually all of the cost. Grumman Flxible stated that an early 1980 bid included a figure of about $17,000 for the accessibility package which included an EEC lift and one tiedown position. The cost of a crated EEC lift (not installed) was said to be $10,000. The new TDT lift, plus one tiedown, adds about $13,000 to the cost of a Transportation

Manufacturing Corporation bus. Recent evidence indicates that the cost of a Lift-U lift, with installation, is in the vicinity of $8000. At these prices, the accessibility features for an order of 100 accessible buses would cost between $800,000 and $1.7 million dollars.

The capital cost of the accessibility equipment can be transformed into an annual cost. Using a discount rate of 10 percent, a service life of 10 years, and a scrap value of zero, annualization of recent cost figures from GM would be $1870 per bus per year, while Flxible's would be $2765 per year per bus. The annual cost of a Lift-U installation would be $1300 per bus. It should be noted that the operating agency will not pay all of these costs. With 80 percent Federal funding of bus purchases, and in some cases state assistance as well, the cost to the operator will be 20 percent or less of the annualized bus capital cost.

8.2 START-UP COSTS

Start-up costs are those expenditures for activities which must be accomplished prior to or at the beginning of new services. Start-up costs are, in actuality, operating costs which have been separated from other operating costs since they do not recur, at least in the same magnitude, once accessible service is well underway. Start-up activities consist of planning the service, training the drivers and mechanics, inspecting and preparing the equipment for service, and making the target population aware of the service and of how to use it. Planning the accessible service may involve insignificant extra transit authority expenditures if this activity consumes small amounts of time. However, if large portions of one or more persons' time is allocated to accessible bus activities, substantial staff costs for the planning function may be entailed. Specific figures on pre-implementation staff costs are only available from St. Louis and Palm Beach County, where the costs were $14,040 and $51,260, respectively.

Driver training is a certain expense. At BSDA, the cost was $16,322 for a program which included 1 hour of instruction per driver. In Palm Beach County, this cost was $13,500 for 5 hours of instruction per driver. The cost of 4 hours of instruction for all of Connecticut Transit's drivers was $44,640. WMATA estimated driver training costs at $144,000 for a 3.5-hour program. Milwaukee spent $6800 for a 0.5-hour instruction program. Seattle's 2-hour training program cost $35,000. These costs represent a range of from $7 to $175 per driver trained. A reasonable training program might consist of a 4-hour course encompassing lift operation and sensitivity training on the problems that handicapped persons encounter and on how to deal with them. Such a program, at a cost of $11 per driver-hour (for salary, fringe benefits and overhead), would cost $44 per driver. The cost of instructors might add perhaps from 25 to 50 percent, making the total program cost between $55 and $66 per driver. This range might be different for each city depending upon the prevailing salary rate.

The only cost figure for maintenance preparation available from any of the SMD sites was provided by BSDA. Their cost estimate for mechanic training and for inspection and preparation of the lifts for service was $31,010. This is a high figure, but it should be noted that BSDA had numerous mechanical difficulties with their lifts.

The final start-up cost is advertising and marketing. This expense has been relatively modest except in Palm Beach County. BSDA spent $25,400 prior to and during the first few months of service. Connecticut Transit spent about $20,000 on newspaper ads on their accessible service. Palm Beach County, on the other hand, spent almost $70,000, but the advertising encompassed much more than promotion of the accessible service since many changes were instituted simultaneously with the accessible service.

8.3 OPERATING COSTS

Operating costs for accessible service have many components. These include the costs of administrative staff time, schedule modifications, maintenance, inspection, ongoing training, and ongoing marketing and promotion. They may also include the settlement of accident claims and insurance premium increases. These costs are discussed below.

8.3.1 Administrative Staff

Once initial service has been implemented, staff time spent on service planning, data collection, handling complaints and processing accident claims varies among operators depending upon the amount of service that is accessible. Records of staff time spent on specific activities are usually not kept, however, making estimates of expended staff time difficult to obtain. BSDA estimated $68,180 for the first 12.5 months of accessible service. Wichita estimates $10,000 per year for staff time. Preliminary data from Seattle indicate a cost of $75,000 per year. It would appear, from discussions with the transit operators at other SMD sites, that the equivalent of one or more full-time persons would be required to accomplish the staff activities associated with accessible bus services where substantial amounts of this service are offered.

8.3.2 Schedule Modifications

As discussed under operations, only BSDA calculated a cost attributable to schedule changes for accessible bus service. Their estimates of schedule-change cost for 22.5 months was $358,376, or nearly $16,000 per month. However, based or current lift usage levels, it does not seem that costly

schedule changes are warranted. Only where additional buses are inserted to maintain seated capacity can a case be made for including schedule-change costs for accessible service. Adding buses to maintain capacity may be desirable if "advanced design" buses replace old "new look" buses. Even in this instance, the costs of adding capacity to compensate for the seats lost in providing wheelchair tiedowns would only be a portion of the total added capacity costs, as more seats are lost due to the smaller seating capacity of newer buses than are lost due to the provision of tiedowns. In St. Louis, Detroit (SEMTA), and Connecticut, extra buses were employed. However, only in St. Louis was this due solely to the provision of accessible service.

8.3.3 Maintenance and Inspection

Costs of maintenance and inspection include those for routine inspection, preventive maintenance, road calls, lift repairs and parts. Available maintenance costs are shown in Table 7.

TABLE 7. LIFT MAINTENANCE AND INSPECTION COST

Site	Projected Annual Cost per Lift
Champaign-Urbana	$ 684
Connecticut Transit	552
Milwaukee	912
Palm Beach	840
St. Louis	2268
Seattle	427
Wichita	500

The BSDA estimates can be discounted due to their excessive problems with a lift model that is no longer being manufactured; COTRAN, with a slightly improved version of the same lift, experienced many fewer problems and much lower cost. This would seem to indicate that maintenance policies, procedures, workload, and the capabilities of the maintenance personnel significantly effect maintenance costs. Excluding St. Louis, lift maintenance and repair costs are averaging around $650 per lift per year.[10] Unfortunately, it is not known whether increased maintenance effort would make lift performance significantly more reliable.

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[10]Labor hours consumed by mechanics working on the lifts in Champaign-Urbana and Connecticut represent 4 and 2.5 percent, respectively, of all mechanic labor hours spent on the accessible buses.

8.3.4 Training

Pre-implementation driver training was covered under start-up costs. However, there is a need for an ongoing program for training newly hired drivers in lift operations and sensitivity to handicapped persons. Connecticut Transit, for example, hired 70 new drivers during 1980. Using their average operator hourly cost of $12 (including base salary, fringe benefits, overtime and overhead), plus the instructor's time for four hours of training per driver, this training cost Connecticut Transit $5040, or $72 per driver. No cost figures are available from any of the other sites concerning ongoing driver training, nor are they available from any of the sites relative to periodic testing of driver's performance in lift operations or for ongoing training of new lift mechanics.

8.3.5 Marketing and Promotion

Marketing and promotion are highly variable and site specific. However, most of the marketing and promotional expenditures occur prior to or at the time of initial implementation of accessible service and, therefore, can be considered start-up costs. Nevertheless, there is some continuing promotion of accessible service at most sites. COTRAN spent over $10,600 in the second and third months of accessible service. BSDA's radio commercials during 1978 and the first 6 months of 1979 cost $9800. Connecticut Transit's marketing and promotion costs are estimated to be $15,100 ($8000 for radio ads, $4500 for booklets, $2600 for field demonstrations) per year. Seattle's estimate is also about $15,000 per year. Costs are not yet available from other sites.

8.3.6 Accidents and Insurance

Many transit operators are self-insured either in full or in part. Consequently, their added liability costs will be due to payment of claims rather than increased insurance premiums. Accessibility-related injury claims have been filed at four sites. The majority of incidents involve minor injuries to ambulatory persons or damage to wheelchairs, and have been settled for a few hundred dollars or less. BSDA reported claims involving 33 incidents over 22.5 months. Another 18 incidents did not result in any payment. Only four incidents involved wheelchair users, all during the first year. Claim payment for these incidents averaged $1120. Settlements for claims by ambulatory passengers (mostly for tripping on steps) averaged $185 in the first year and $435 during the second year. The increase probably reflects a greater awareness of BSDA liability and the current consumer-oriented environment. Overall, claim settlement cost BSDA a total of $13,600, or $412 per claim. COTRAN reported 37 accessibility-related incidents (no wheelchair users) during the first 8 months of accessible service, almost all of which involved tripping on the front steps while boarding or alighting.

COTRAN has not provided claim data as yet. Milwaukee Transport has experienced only one claim of $435 for repair of a wheelchair. Connecticut Transit has experienced 6 wheelchair user incidents in 15 months of service. Three of these incidents have not resulted in a claim to date. Two were settled at a total cost of $397. The sixth claim, for $20,000, is being contested in court (also a cost), as it is thought by Connecticut Transit to be fraudulent.

Connecticut Transit is self-insured against liability for personal injuries and damage to the property of others. However, a private company insures Connecticut Transit's own property against damage. The lifts add only $515 per year to their total insurance premium.

At this time, costs due to insurance premium increases or claim settlements have been small. However, at least seven incidents have been reported in which persons in wheelchairs have fallen out of their wheelchairs while attempting to get onto or off of the lift or when the lift collapsed while they were on it. Although none of these persons have been seriously hurt, the potential exists for serious injuries and major lawsuits for damages.

8.4 TOTAL COST

The most current and complete accessible bus cost data available is from Connecticut Transit's Hartford, New Haven and Stamford Divisions. Start-up costs and projections of annual costs for accessible service in the three cities are shown in Table 8. As stated earlier, the $2,240,000 equipment cost was annualized using the capital recovery factor approach. Other annual costs were projected from the 3-month study period cost experience, current practice, or Connecticut Transit's stated intent to pursue certain courses of action. Table 8 shows a one-time start-up cost of nearly $80,000. This should be higher, but no figure was available for mechanic training, lift inspection, and lift modifications prior to service implementation. The annualized recurring costs are almost $540,000.

The largest component of the cost is the annualized capital cost. Excluding the equipment cost leaves a remainder of over $175,000, most of which is for inspection, repairs and maintenance. The annual cost per accessible bus is $1927 ($1302 for the equipment and $625 for operations). Start-up cost per bus is $284. Allowing for Federal capital and operating assistance, Connecticut Transit would be faced with an annual cost of $727 per accessible bus, or 38 percent of the total, to be covered by operating revenues and by state and local operating assistance.

TABLE 8. CONNECTICUT TRANSIT COST ESTIMATES

Cost Element	Start-up Cost	Annual Cost
Accessibility Equipment	-	$364,450[11]
Administrative Staff	$15,000	No Estimate
Maintenance, Repairs and Inspection	No Estimate	154,212
Schedule Modifications	-	Negligible
Driver Training	44,640	5,212
Marketing and Promotion	20,000	15,100
Accidents and Insurance	-	912
	$79,640	$539,714
Cost per Accessible Bus	$284	$1,927
Cost per Boarding		$164

Connecticut Transit's total annual costs per accessible bus appear close to those estimated at other sites. First year costs currently available from Seattle include those for capital ($140,000), administrative staff ($75,000), driver training ($35,000), maintenance and repair ($69,000), and marketing ($15,000). The annual cost of all of these items amounts to $2,055 per bus ($861 for equipment and $1194 for operations). These figures include both start-up and annual operating costs. The service cost in St. Louis is also in the range of $2000 per bus per year if the unnecessary service hour costs are excluded. (Two thousand dollars represents 2.5 to 4 percent of total service cost per bus per year.) However, actual costs could be different at other locales. Even so, at most sites, lift inspection, maintenance and repairs undoubtedly will account for the large majority of annual operating costs, although the annualized cost of the equipment may be even higher. The cost of accidents has been small to date, but may be the item that could increase costs most dramatically in a locale were a serious injury to occur.

9. COST PER TRIP

Based upon cost estimates from Connecticut, St. Louis and Seattle, total service cost appears to be in the vicinity of $2000 per year per accessible bus. The cost per lift-assisted passenger trip, therefore, depends on the frequency of utilization of the lifts. As shown in Table 8, the current cost per lift boarding for Connecticut Transit is calculated to be $164. In St. Louis the cost per trip for the first 12 months was $100, while the cost per

[11]This does not include the cost of any extra buses utilized as a result of operating accessible service.

trip for the last 10 months was $372. Seattle's cost per boarding is estimated to be $16. This is by far the lowest cost per trip discovered or calculated in this study and is due principally to higher ridership rather than lower costs. If the $2000 added cost per year per accessible bus holds for other cities, the cost per trip for the Fall of 1980 would have been as follows: Bridgeport - $80; Champaign-Urbana - $82; Detroit (DDOT) - $1293, (SEMTA) - $293; Los Angeles - $222; Milwaukee - $661; Orange County - $57; Palm Beach County - $90; Santa Monica - $200; Washington, D.C. - $146; and Wichita - $202. The cost per trip due to operating costs alone would have been between 30 and 60 percent of the above figures. As previously discussed, the operator will not bear all of this cost due to the availability of Federal and state capital and operating assistance programs.

10. TRANSFERABILITY

Most transit operators providing accessible fixed-route services are experiencing low levels of lift utilization. This pattern seems likely to continue, at least in the near future. Studies and surveys confirm that the majority of wheelchair users either cannot use or have no desire to use fixed-route bus service.[12]

Delays caused by the boarding and alighting of lift users will have little impact on overall schedule adherence unless the lifts are used much more frequently than they are at present. Costly schedule changes to allow recovery from lift usage delays are not warranted, due to the random nature of these delays and their infrequent occurrence. However, delays due to lift usage or lift malfunctions affect other passengers. While most lift usage delays are small (averaging from 2 to 3 minutes per boarding or alighting), the cumulative delays to all bus riders can be substantial, particularly in the case of an on-road lift malfunction.

The major impacts on transit operators will involve maintenance and added costs for providing accessible service. Even though lifts now being produced are more reliable than earlier models, they generally are not performing at a high level of reliability. Therefore, a high spare bus ratio should be maintained. In addition to mechanical, electrical and hydraulic failures of the complex lift mechanism, malfunctions also can be expected due to accidental damage to the lift or operator error (principally due to unfamiliarity with operating procedures). Daily cycling of the lift by operators may reduce the error rate. Nevertheless, considerable labor effort can be anticipated in inspecting, maintaining and repairing the lift equipment.

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[12]References 2, 3, and 6.

The cost of mechanic labor, together with the cost of driver and mechanic training and the annualized cost of the equipment, should comprise the principal added costs attributable to accessible service provision. Available data indicate that there will be an incremental cost in the vicinity of $2000 per year per accessible bus. On this basis, the cost of accessibility for some systems will range up to several hundred dollars per lift-using passenger. Since the Federal Government presently provides capital and operating subsidies, the operator's share of the incremental accessible service cost will likely amount to 50 percent or less of the total. However, some of this subsidy may disappear in the future as current administration proposals include the elimination of Federal operating subsidies by the mid-1980s.

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