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Docket # 13917

Memorandum

U.S. Department of Transportation
National Highway Traffic Safety Administration

NHTSA-02-13917-3

Subject: ACTION: Final Regulatory Evaluation Platform Lift Systems for Motor Vehicles FMVSS Nos. 403 and 404

Date: NOV 27 2002

From: Rose A. McMurray
Associate Administrator
for Planning, Evaluations and Budget

Reply to Attn. of:

To: DOCKET

Thru: Jacqueline Glassman
Chief Counsel

Please submit the attached copy of the "Final Regulatory Evaluation and Regulatory Flexibility Analysis, Platform Lift Systems for Motor Vehicles FMVSS Nos. 403 and 404" to the appropriate docket.

Attachment

Distribution:
Chief Counsel
Associate Administrator for Rulemaking
Associate Administrator for Enforcement
Associate Administrator for Applied Research

#

U.S. Department
Of Transportation

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FINAL REGULATORY EVALUATION AND REGULATORY FLEXIBILITY ANALYSIS PLATFORM LIFT SYSTEMS FOR MOTOR VEHICLES FMVSS NOS. 403 AND 404

Office of Regulatory Analysis and Evaluation
Plans and Policy
May 2002

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EXECUTIVE SUMMARY

On July 26, 1990, the President signed into law the Americans with Disabilities Act (ADA) of 1990 (P.L. 101-336, 42 U.S.C. 12101, et seq). Title II of the ADA requires newly purchased, leased or remanufactured vehicles used in fixed route bus systems to be readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs. Title III requires public transportation services from private entities to be readily accessible to and usable by disabled individuals, including individuals who use wheelchairs.

The Act states that the Secretary of Transportation is required to promulgate implementing regulations for public transit and paratransit buses. NHTSA was designated by the Secretary to establish minimum safety requirements for lift-equipped buses for use by disabled persons in the public transportation environment. These lifts are to be used by people who cannot walk up stairs, people who use a cane or walker, and people in wheelchairs.

FMVSS Nos. 403/404 addresses minimum vehicle safety requirements applicable to lift equipment designed for purchased, leased or remanufactured transit buses (fixed route), paratransit buses, and vans (demand response route) as well as personal vans/MPVs, school buses, over-the-road buses (including remanufactured OTRB) and all types of vehicles equipped with lifts. The lift equipment requirements are contained in FMVSS No. 403 and the vehicle requirements are contained in FMVSS No. 404. Although not required by the ADA, NHTSA is requiring that all motor vehicles, if lift-equipped, meet the minimum safety performance requirements specified in FMVSS No. 403.

The annual number of persons injured in lift-equipped bus and van incidences in NEISS is small 248 per year. The agency has not been able to quantify the benefits associated with the Final Rule because the NEISS accident data lacks adequate and sufficient descriptive information needed to pinpoint the probable cause of injury. However, there are a number of qualitative benefits associated with the Final Rule that incorporates the most relevant requirements of industry standards and guidelines (e.g., Disabled Veterans Administration, Society of Automotive Engineers and Federal Transit Authority.) Thus, manufacturers need only comply with one standard rather than several, which will provide a consistent level of safety for all lift users. The Final Rule sets minimum safety standards for lifts. In addition, the Final Rule addresses the injury mechanisms that have been identified by the agency.

The total consumer cost of the Final Rule is estimated to be between $3.1M - $4.7M per year. This was based on cost of $213 per vehicle for (8,288-10,425) Public-Use vehicles, and a cost of $147 per vehicle for (8,800-17,000) Private-Use vehicles.

by the Secretary to establish minimum safety requirements for lift-equipped buses for use by disabled persons in the public transportation environment. These lifts are to be used by people who cannot walk up stairs, people who use a cane or walker, and people in wheelchairs. NHTSA published an NPRM February 26, 1993 (See 58 CFR 11562) entitled Lifts for Accessible Transportation, FMVSS No 401, which was a vehicle-based standard which included transit buses, paratransit buses, and school buses, but excluded personal vans/MPVs, trucks, truck tractor, motor homes and over-the-road-buses (OTRB). In the July 27, 2000 SNPRM (65 CFR 46228) NHTSA proposed replacing FMVSS No. 401 with FMVSS No. 141 (a lift equipment standard) and FMVSS No. 142 (a vehicle standard). The agency has subsequently changed the proposed FMVSS Nos. 141 and 142 with FMVSS No. 403 Platform Lift Systems for Motor Vehicles and FMVSS No. 404 Platform Lift Installations on Motor Vehicles, in the Final Rule.

FMVSS Nos. 403/404 addresses minimum vehicle safety requirements applicable to lift equipment designed for purchased, leased or remanufactured transit buses (fixed route), paratransit buses, and vans (demand response route) as well as personal vans/MPVs, school buses, over-the-road buses (including remanufactured OTRB) and all types of vehicles equipped with lifts. The lift equipment requirements are contained in FMVSS No. 403 and the vehicle requirements are contained in FMVSS No. 404. Although not required by the ADA, NHTSA s requiring that all motor vehicles, if lift-equipped, meet the minimum safety performance requirements specified in FMVSS No. 403.

II. BACKGROUND

Guidelines pertaining to accessibility by the disabled to public transportation were prepared by the Architectural and Transportation Barrier Compliance Board (ATBCB), which is also referred to in this regulatory evaluation as the Access Board.[1] DOT incorporated the Access Board's guidelines, requiring compliance with them in a final rule establishing accessibility guidelines. NHTSA's Final Rule has adopted most of the Access Board's lift performance guidelines (i.e., platform size, lift capacity, slip resistance, safety interlocks, edge guard heights, etc.), but because of the need for objectivity and reproducibility, has expanded some of those requirements, where necessary, to include further delineation and specificity (i.e., load levels, load directions, load application points, time durations, dimensions, etc.) necessary to support compliance tests (i.e., deflection test, working load test, proof load test, ultimate load test, dynamic outer barrier and overload test, inner roll stop load test, slip resistance test, hand rail test, etc.). By law, a Federal motor vehicle safety standard has to meet the need for safety and be stated in "objective" terms [(15 USC 1392 (a)]. Being stated in "objective" terms assures that the lift or bus manufacturers can interpret the requirements without ambiguity and that the proposed tests are reproducible (e.g., can be conducted in a similar manner regardless of the manufacturer or test facility location).

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[1] 36 CFR Part 1192 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Transportation Vehicles, Proposed Guidelines, Subpart B - Large Buses and Systems (GVWR greater than 19,500 lbs.) and Subpart G - Vans and Small Buses (GVWR less than or equal to 19,500 lbs.), prepared by the Architectural and Transportation Barriers Control Board (ATBCB), 56 FR 11824-11871. Also see Final Guidelines, Subpart B-Buses, Vans and Systems (56 FR 45529-45581) and 49 CFR Parts 27, 37,and 38, Transportation for Individuals with Disabilities, Final Rule, Department of Transportation (DOT)(56 FR 45584-454804)

In developing the Final Rule, NHTSA has relied extensively on the Access Board and Federal Transit Administration (FTA) sponsored guidelines, as well as standards and recommended practices/procedures of other organizations, such as the Department of Veteran Affairs (DVA) [formerly the Veterans Administration (VA)] and the Society of Automotive Engineers (SAE).[2,&,3] The DVA requirements and the SAE draft recommended practices are intended for the private, personally-licensed lift user (e.g., a disabled person with a modified van or MPV).

The Access Board's guidelines were adopted from FTA sponsored active and passive lift guidelines, and are believed to reflect the capabilities of lift equipment on the market today. The FTA guidelines were developed by a large panel of regulators; transit bus owners/operators; users and bus manufacturers in the 1986-87 time frame.[4] NHTSA added requirements beyond the Board's guidelines that are based on the FTA guidelines. Most lifts are currently being marketed and designed around the FTA's guidelines, and the improvements required by NHTSA in the Final Rule are not expected to increase lift costs significantly.

The agency identified a number of reasonable safety improvements in the SNPRM, not contained in the Access Board's guidelines. These improvements include: upgraded outer barrier height

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[2]VA Standard Design and Test Criteria for Safety and Quality of Automotive Wheelchair Lift Systems for Passenger Motor Vehicles, VAPC-A-7708-3, June 28, 1977

[3]National Workshop on the Bus-Wheelchair Accessibility, Guideline Specifications for Active Wheelchair (WC) Lifts, Passive WC Lifts, WC Ramps, and WC Securement Device , UMTA Publication-UMTA-IT06-0322-87, May 1986

[4]National Workshop on the Bus-Wheelchair Accessibility, Guideline Specifications for Active Wheelchair (WC) Lifts, Passive WC Lifts, WC Ramps, and WC Securement Device , UMTA Publication-UMTA-IT06-0322-87, May 1986

and strength; control panel lettering size and illumination; high contrast platform markings for standees; threshold warning device; anti-crush interlock; outer barrier and inner roll stop interlock devices; and a bridging interlock device. The final rule included all these improvements except for the anti crush interlock and the bridging interlock device. The SNPRM also proposed a number of safety tests, which include: slip resistance test; wheelchair retention test; handrail test; corrosion resistance test; and fatigue endurance test. In no area did the agency propose a less stringent requirement than specified by the Access Board.

III. SAFETY NEED

Although some of the Final Rule requirements can be justified on the basis of accident and injury data, the agency's rule is based on Access Board and FTA sponsored guidelines and recommendations as well as SAE practices and procedures. The FTA sponsored guidelines were developed in consultation with bus drivers and transit system operators and reflect engineering judgment and common practice. The requirements being proposed are consistent with those published by many organizations concerned with bus lift systems for the disabled, e.g., the FTA, the Department of Veteran Affairs (DVA), the Society of Automotive Engineers (SAE).

NHTSA estimates 1,238 lift-related accidents and injuries occurred in vehicles covered by this Final Rule (vans and buses) in 1991-95 or 248 injuries per year. NHTSA analyzed the most recent NEISS data (1991-95) from the Consumer Product safety Commission concerning the incidence of lift-related accidents and injuries and found 972 and 266 incidences for vans and buses, respectively, compared to the same data studied in 1986-90 which found 381 and 140 incidences, respectively.[1] All things being equal, the agency believes there has been an increasing trend in lift-related injuries of 2.5 X and 1.9 X, respectively, for vans and buses for these two five year increments of time. NHTSA believes the increase is due to increased ridership/usage due to the ADA and not a decrease in lift safety. The agency can not pin point the cause of these particular lift-related incidences, whether lift operator or equipment related.

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[1] Wheelchair Users Injuries and Deaths Associated with Motor Vehicle Related Incidents, Research Note, September 1997,National Center for Statistics and Analysis, Research and Development, NHTSA, 400 7th Street SW, Washington, DC 20590. Also see School Transport News, February 1998, for same data page 1 and page 18.

Generally, there is very little information regarding WC lift accidents and injuries. Very few lift related accidents or injuries can be associated directly with the requirements except by anecdotal information or defect investigations conducted by the agency. NHTSA has conducted a few defect investigations concerning WC lifts in the 10-12 years prior to the SNPRM. The commenters presented little, if any, lift user injury data (WC user or otherwise). A recent TRB article on tort liability arising out of the ADA shows that for the 1991-1995 period there have been a limited number of tort claims, out of millions of fare trips, filed against a sample of 43 transit companies involving disabled riders involving wheelchairs.[2] WC lifts were not implicated as a source of injury or the subject of a tort in this study.

Since implementation of the ADA, there has been a doubling in "disabled riders" from 7,534,002 (1991) to 16,839,291 (1995) based on the responses of 43 transit agencies responding to a TCRP survey. For the same agencies (1991-1995), WC ridership, based on the number of trips, increased by a factor of 5 [from 298,912 (1991) to 1,498,395)].[3] There are 6,000 agencies that provide public transportation in the U.S. and they have probably experienced similar increases. Although the number of WC related tort claims increased for the same 43 agencies from 1 to 27 from 1991 to 1995, lifts/ramps are not mentioned as a source of injury or a tort liability issue.

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[2] Potential Tort Liability for Transit Agencies Arising Out of the Americans with Disabilities Act, Transit Cooperative Research Project (TCRP), Legal Research Digest, No 11 , July 1998, Transportation Research Board (TRB), National Research Council.

[3] Ibid

NHTSA's large scale, nationally representative accident data bases (FARS, NASS) do not reveal any bus lift accidents or injuries as these data systems are used to record accident, injury and fatality information for vehicles in transport. Since lifts are operated only when the vehicle is not in transport, lift accidents and injuries are excluded from these databases.

The agency reviewed the 1991-1995 WC user injury data from the Consumer Product Safety Commission, National Electronic Injury Surveillance System (NEISS). This is considered to be a nationally representative database. Out of 7,121 WC injuries involving motor vehicles as shown in Tables III-1 and III-2, 48 percent involved vans and 12 percent involved buses (e.g., school buses, transit buses and OTRB). The motor vehicle injury incidence types involving WCs were as follows: 35 percent were WC securement related, 26 percent involved collisions with a motor vehicle, 19 percent (1,366/7,121) were lift related, 15 percent were related to transferring to and from a WC and 6 percent were ramp related.

The wheelchair lift-related injuries predominantly happen on lift-equipped vans (71 percent 972/1,366) and buses (19 percent 266/1,366). While passenger cars were involved in about (8 percent 111/1366) of the incidents, and ambulances/ambulettes were involved in (1 percent 17/1366) of the incidents. For these lift-related motor vehicle incidents, 3.1 percent resulted in serious injuries while 69.5 percent were moderate and 27.3 percent were minor. Over 95 percent of WC incidents were reported in the category of "released without treatment," while the other 5 percent were hospitalized. For ramps, 90 percent of the incidents involved vans and 10 percent automobiles.

Table III-1
Preliminary Nationwide Estimate of Wheelchair Occupants
Injured in Motor Vehicle-Related Incidents
By Type of Wheelchair Incident and Body Type of Motor Vehicle
NEISS Data Files: 1991-95

Type of Wheelchair Incident	Body Type of Motor Vehicle(1)					Total Wheelchair Occupant
	Auto	Van	Bus	Ambulance	Truck	
Securement(2)	0	1,617	422	455	0	2,494
- non/improper securement	0	1,478	422	402	0	2,302
- securement unknown	0	139	0	53	0	192
Collision with MV	1,511	122	34	0	152	1,819
Hydraulic Lift	111	972	266	17	0	1,366
Transferring(3)	488	335	134	34	44	1,035
Ramp	43	364	0	0	0	407
TOTAL	2,153	3,410	856	506	196	7,121
Total Wheelchair Incidents 1991-95(4)						299,734

Source: U.S. Consumer Product Safety Commission

(1) Ambulance category includes ambulettes.
(2) Refers to securement within the vehicle; either the assisted or unassisted by others, generally without lift or ramp involvement.
(3) While transferring to or from a motor vehicle, either assisted or unassisted by others, generally without lift or ramp involvement.
(4) All wheelchair cases whether motor vehicle-related or not such as falling out of the wheelchair or injured while in it, at home, in resident institutions, outdoors, etc.

Table III-2
Preliminary Nationwide Estimate of Wheelchair Occupants Injured in Motor Vehicle Related Incidents
By Type of Wheelchair Incident, Severity of Injury and Medical Disposition of Case Neiss Data Files: 1991-95

	Medical Disposition of Case				
Injury Severity	Treated & Released	Hospitalized	Fatality	Total Cases	Percent of Total
All Five Types					
Minor Injuries	1,826	.34	0	1,860	26.1
Moderate Injuries	4,335	368	0	4,703	66.1
Serious Injuries	225	290	0	515	7.2
Died(1)	0	0	43	43	0.6
Total	6,386	692	43	7,121	100.0
%	89.7	9.7	0.6	100.0	
Securement					
Minor Injuries	705	0	0	705	28..3
Moderate Injuries	1,435	172	0	1,607	64.4
Serious Injuries	122	60	0	182	7.3
Died(1)	0	0	0	0	0
Total	2,262	232	0	2,494	100
%	90.7	9.3	0	100.0	
Collision with Motor Vehicle					
Minor Injuries	532	34	0	568	31.2
Moderate Injuries	831	120	0	951	52.3
Serious Injuries	103	154	0	257	14.1
Died(1)	0	0	43	43	2.4
Total	1,468	308	43	1,819	100.0
%	80.7	16.9	2.4	100.0	
Hydraulic Lift					
Minor Injuries	373	0	0	37	27.3
Moderate Injuries	933	17	0	950	69.5
Serious Injuries	0	43	0	43	3.1
Died(1)	0	0	0	0	0
Total	1,306	60	0	1,366	100.0
%	95.6	4.4	0	100.0	
Transferring					
Minor Injuries	128	0	0	128	12.4
Moderate Injuries	815	59	0	874	84.4
Serious Injuries	0	33	0	33	3.2
Died(1)	0	0	0	0	0
Total	943	92	0	1,035	100.0
%	91.1	8.9	0	100.00	
Ramp					
Minor Injuries	86	0	0	86	21.1
Moderate Injuries	321	0	0	321	78.9
Serious Injuries	0	0	0	0	0
Died(1)	0	0	0	0	0
Total	407	0	0	407	100.0
%	100.0	0	0	100.0	

Source: U.S. Consumer Product Safety Commission.
(1) Either dead-on-arrival (DOA) or died in the hospital emergency room.

The NEISS database lacks the necessary detail in order to identify the lift malfunction type/mode or the operator failure modes responsible for each accident. NHTSA also examined the NEISS Death Certificate file from July 1973 to present and identified two fatalities involving wheelchair lifts; (1) the occupant fell from the wheelchair on a hydraulic lift while boarding a bus (11-21-81), (2) the wheelchair occupant was pinned under the van's hydraulic lift (5-17-90). A national estimate of lift related fatalities can not be extrapolated from these two cases. In the 1991-95 NEISS study, 12 wheelchair users died in motor-vehicle related incidences, but none involved a lift malfunction or falling on to/off of a ramp (e.g., 9 involved a direct collision between a wheelchair and a motor vehicle, 2 were from improper or no WC securement and 1 was from transferring to or from a motor vehicle).

NHTSA's Office of Defects Investigation (ODI) has reported two cases in 1985 and 1989 (EA85-030 and PE89-144) in which accidents occurred on bus lifts due to operator and maintenance error. In the first case, the lift operator accidentally tried to stow a passive lift with the disabled user still on the lift. For a passive lift, the platform is converted to steps when in the stowed position. The lift user was thrown to the pavement and died from serious injuries. As a result of this accident, the passive lift manufacturer built-in a load sensing device to prevent premature stowage. In the second ODI case, the automatic outer barrier malfunctioned and the wheelchair and its occupant tumbled off the lift onto a pedestrian standing next to the lift. Both persons were hospitalized. The problem was caused by insufficient outer roll stop maintenance. Maintenance practices were subsequently modified to include more periodic inspection intervals.

Personal Use Vehicles - The National Mobility Equipment Dealers Association (NMEDA) estimates 20,000 vehicles of all types (e.g., automobiles, vans, trucks etc.) are modified with adaptive driving equipment annually by some 450 conversion companies. According to the Census Bureau, 4 percent of Americans ages 17 - 75 or some 7.3 million people, have physical disabilities that limit their mobility.[4] About half of these people use wheelchairs, scooters, or other mobility devices. The Exemption from Make Inoperative Prohibition NPRM (63 FR 51547, September 28, 1998) estimated that there are about 383,000 vehicles on U.S. roads modified with adaptive equipment to accommodate persons with disabilities.[5] Some percentage of these vehicles are personal use vehicles, equipped with lifts and ramps. Based on a United Kingdom figure of 250,000 disabled drivers (See Automotive Engineering International, March 1998), the agency extrapolates there could easily be over 1 million disabled drivers in the U.S. population. The proportion of personal vehicles lift-equipped is unknown, and the number of WC users who drive (and need a lift) is unknown and the number of wheelchair users who are passengers (and need a lift) is unknown.

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[4] "In a Wheelchair and Behind the Wheel," Specialty Market Magazine, September 20, 1998. New York Times Web Site.

[5] "Estimating the Number of Vehicles Adapted for Use by Persons with Disabilities," NHTSA Research Note, January 1997, NCSA/ NHTSA.

Public Transit & Paratransit Buses - According to the APTA, some 6,000,000 people use transit buses on a typical weekday. Of these, about 1.2 percent or 72,000 are estimated to have disabilities.[6] In addition, it is estimated there are 1,411,000 wheelchair users, 64,000 users of scooters, 1,687,000 users of walkers, and 5 million users of canes/crutches in the U.S. all of which could potentially use lifts on public transportation vehicles.[7]

[6] American Public Transit Association, APTA 1997 Fact Book

[7] "Assistive Technology Devices and Home Accessibility Features: Prevalence, Payment, Need and Trends," La Plante, M.P., Hendershot, G.E., and Moss, A.J., National Center for Health Statistics, Hyattsville, MD 1992.

IV. FINAL RULE REQUIREMENTS

There are two types of lifts: passive and active. In transit-type buses, where passive type lifts are typically used, the lift is often located in the front door so that disabled and non-disabled persons can use the same service door. In this case, the steps can be converted to a horizontal lifting surface. The width of the service door structure constrains the width of the passive lifts that can be installed (e.g., if the lifts are too wide the transit buses would have to be redesigned).

In active lift systems, the lift is separate from the front service door (typically in the right side, rear of paratransit and school buses) and there is much greater flexibility in the widths of the lifts that can be installed. When folded into the stowed position, this lift normally blocks the door in which it is installed. For both lifts types, the operator is within very close visual range of the lift user when operating the controls. The agency believes that the same level of safety is needed for both active and passive lifts.[1] Figures 1, 2 and 3 in the Appendix show the basic lift components and terminology to be used in the subject regulatory evaluation, while Figures 4 and 5 in the Appendix show the basic wheelchair dimensions and terminology used in sizing the lift platform.[2] In addition, a diagram of a Braun lift has been added to the Appendix of this report

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[1] Active Lift - The lift is located in a separate doorway, other than the service door, such as a right-rear side door of a paratransit bus or school bus. Passive Lift - The lift is located in the service door opening of the transit bus. The service door steps convert to a horizontal lifting surface.

[2] Preliminary Regulatory Evaluation, Lift Systems for Accessible Transportation, FMVSS No. 401, November, 1992, National Highway Traffic Safety Administration, Office of Regulatory Analysis, Docket No. 91-19-N01-002.

identifying the relevant lift components and parts. The purpose of this section is to summarize each part of the agency's Final Rule and to: (1) provide a rationale or justification for each requirement in the Final Rule, particularly the objective performance measures, (2) identify where the agency's Final Rule differs from the Access Board's final guidelines, (3) delineate where lift manufacturers currently do or do not meet the specifications, and (4) identify each area where costs may be incurred by either the lift or bus manufacturers. The costs will be quantified in Section VI. Cost.

Applicability - FMVSS No. 403, the equipment standard, divides the applicable safety requirements into two basic categories. The first category applies to lifts designed for installation on MPVs, except for motor homes, with a GVWR >4,540 kg (10,000 lbs.) and buses. This category applies to lifts for commercial and public-use vehicles including transit buses, paratransit buses, school buses and most paratransit MPVs. The second category applies mostly to lifts designed for installation on MPVs intended for personal use. There are fewer requirements for personal use vehicles, as hand rails, platform volume/size, lighting, platform marking, inner roll stop, controls illumination requirements do not apply and fatigue endurance requirements have been reduced. However, there is an exception. There is an optional inner roll stop requirement for lifts designed for personal use vehicles [<= 4,540 kg (10,000 lbs.) GVWR]. The reduction in requirements for personal lifts reflects the agency's belief that user/operator familiarity with their personal van's lift equipment outweighs any increased safety risk. FMVSS No. 404 is a vehicle standard requiring that all new lift-equipped vehicles have a FMVSS No. 403 compliant lift. Personal use vehicles do not have to be ADA compliant.

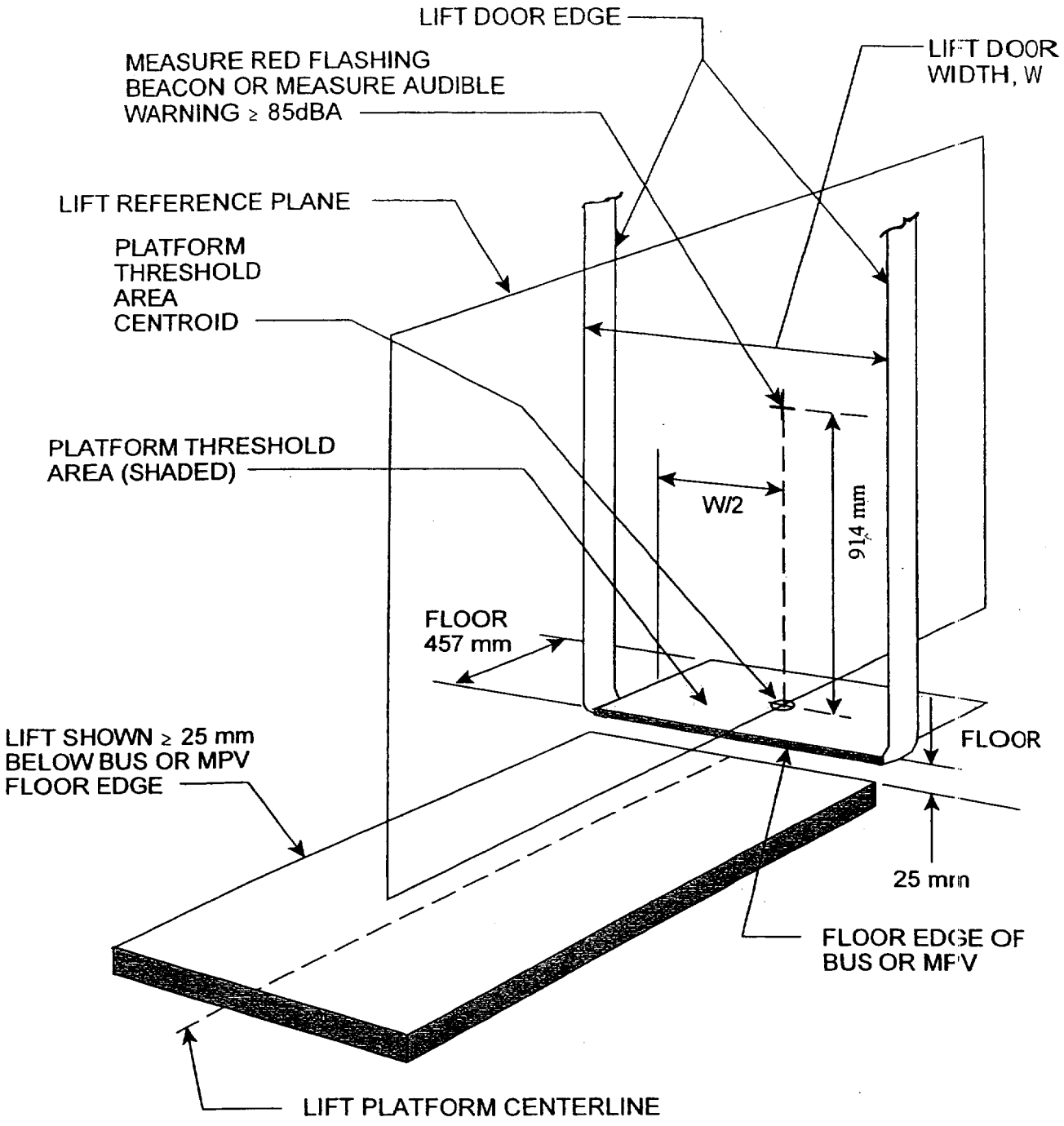
Performance Requirements

1. Threshold Warning Signal (S6.1)[3]

This requirement is designed to warn deboarding lift users, at the lift door, that the lift platform is not at vehicle floor level. Located on the floor of the transit or paratransit bus at the lift door opening, the platform threshold area is 457 mm (18 in.) deep measured from the edge of the lift door and as wide as the lift door. Except in cases where the platform is loaded over the vehicle floor such as with a personal rotary lift, a visual or audible warning is to activate: (1) if portions of a passenger's body or mobility aid is on the "platform threshold area" and (2) if the lift platform is more than 25 mm (1") below the "floor reference plane". Once a warning signal is activated, it must continue to operate until the "platform threshold area" is vacated, or the lift is returned to the vehicle floor level. (See Figure IV-1)

If a visual warning is used to comply (S5.1.1), it is to consist of a flashing red beacon with 20 candela (minimum) power and be visible to a wheelchair user backing onto the lift. The flash rate specified by (S6.1.4) is between 1 to 2 Hz. Typically, the warning light would be located inside the bus or MPV inside the lift door opening. The warning beacon accommodates hearing impaired and deaf pedestrians standing near the lift. The red beacon's intensity is to be measured 914 mm (3') above the centroid of the platform threshold area as shown in Figure IV-1.

[3] The alpha-numeric in parentheses refers to the pertinent section of the regulatory text.



PLATFORM THRESHOLD AREA AUDIBLE WARNING MEASUREMENT POINT (S5.1.)

FIGURE IV-1

If an audible warning is used to comply (S6.1.2), the intensity of the audible warning (>=85 dBA @ 500-3000 Hz) is to be measured at 914 mm (3') above the center of the "platform threshold area." The audible warning signal is continuous until the lift user vacates the platform threshold area. Threshold Warning Signal (S6.1), is currently contained in SAE personal lift requirements, but would be new for transit and paratransit buses. This type of warning is important in the public transportation environment where a lift might be sequentially used by several patrons and it is important to personal vans particularly if the lift is rear mounted and the user backs on to the lift. This requirement does not apply to rotary lifts because their lift platform is rotated over the van/MPV's floor when being loaded.

2. Lift Operational Requirements (S6.2)

Maximum Velocity (S6.2.2) and Acceleration (S6.2.3) - This requirement is concerned with the maximum allowable operating velocity and acceleration of the lift, both horizontally and vertically, as well as the lift stowage/deploy velocities. The operating velocities and accelerations are measured unloaded and loaded (0 lbs. and 272 kg mass (600 lbs.)), respectively. The stowage/deploy velocities are measured unloaded. The vertical and horizontal velocity components of the lift platform are not to exceed 152 mm/s (6 in./s) horizontally or vertically and the acceleration of the platform is not to exceed 0.30 g's horizontally or vertically. The horizontal/vertical components of the stow/deploy velocity are not to exceed 305 mm/s (12 in./s).

Acceleration is to be measured per SAE J211, October 1988, with a CFC filter requirement of F_H = 3 Hz and F_N = 5 Hz. The accelerometer for this test is located at the centroid of the lift platform. NHTSA studied the applicability of the CFC 60 filter proposed in the NPRM and determined that it was insufficient. They studied existing University of Virginia (UVA) and VRTC data and determined that a CFC 3 filter was sufficient to attenuate the acceleration signal to a level below the 0.3 g's limit and, therefore, is recommended for use. A copy of the NHTSA study entitled "Determination of Electronic Filtering for Post-Processing of Wheelchair Lift Acceleration Data, June 1996" has been placed in the Docket No. NHTSA-98-4511.

These minimum performance requirements are consistent with the Access Board's guidelines. The speed and accelerations are designed to be compatible with existing equipment and should not place a new design requirement on lift manufacturers.

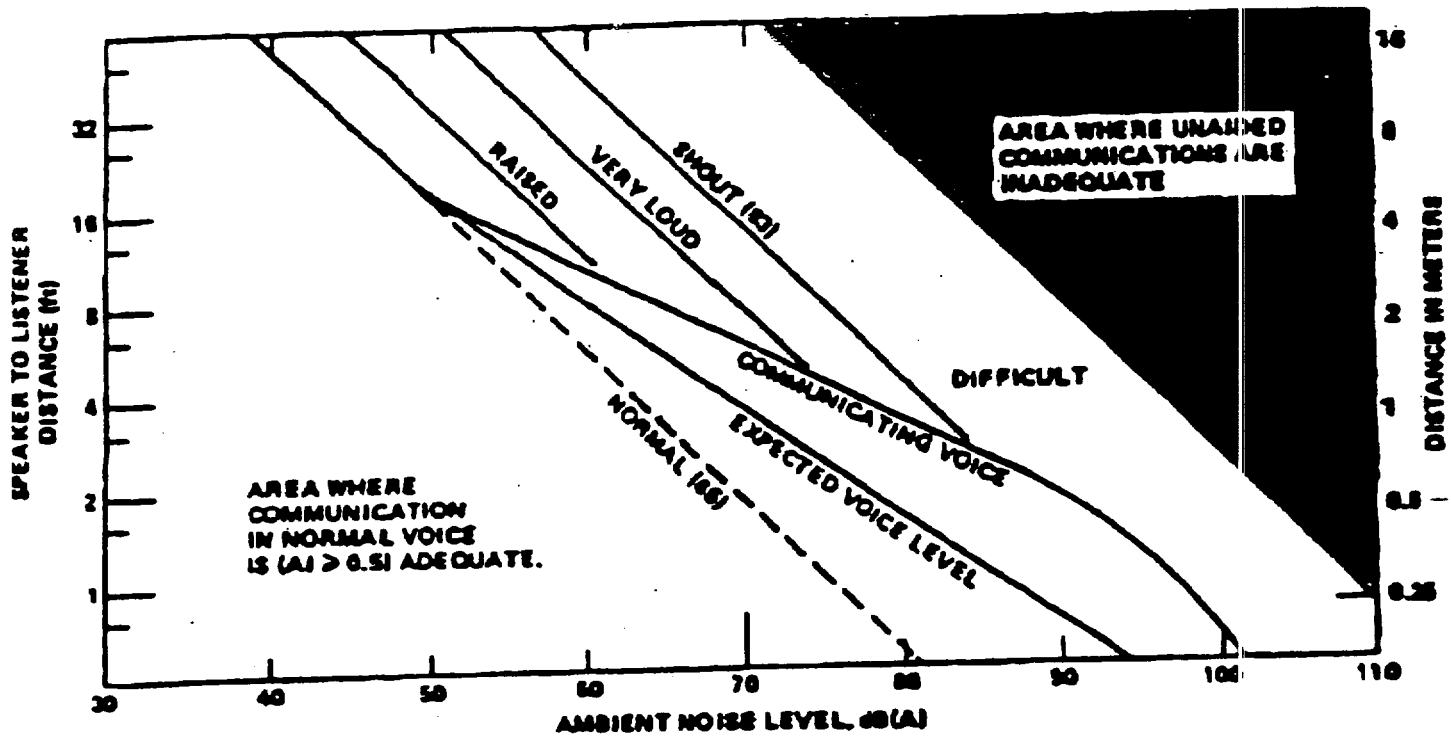
Interior Maximum Operating Noise Level (S6.2.4) - This requirement sets a maximum lift operating noise level of 80 dBA inside the bus at a fixed operator position or in the area of the lift platform, during the lift operating cycle. This will allow for the communication of instructions between the lift operator and lift user (or vice versa) during both normal and emergency lift use. Assuming a maximum communication range of 913 mm (3') (which should be sufficient during lift operation), 80 dBA would be the maximum allowable lift operating noise. (See VRTC reference Human Factors Design Handbook, Second Edition, W.E. Woodson, B. Tillman, and P.

Tillman and Figure IV-2 taken from that reference).[4] Measurements are to be made at the fixed operator position at the lift controls and anywhere on the lift platform.

VRTC measured 85 dBA ambient noise at 305 mm (1') from a Braun Lift electric motor and 78 dBA and 75 dBA, respectively, for a TMC bus lift being raised and interior ambient noise with the engine running. Also, VRTC measured the ambient noise levels at 6 bus stops and found an average of 79 dBA. The 75 dBA level has been used by the San Diego Transit Corporation in its lift specifications and was adopted by FTA in their guidelines for both passive and active lifts. The 85 dBA warning signal outside the bus would be completed within 4-8 seconds and would not interfere with, or contribute to, the 80 dBA maximum allowable equipment operating noise level. This maximum noise level does not apply to the deploying or stowing aspects of the lift equipment when the lift platform is unoccupied. A maximum lift noise level is not contained the Access Board's final guidelines. It is believed that all lift equipment would comply, hence no cost impact is anticipated.

[4] The Vehicle Research and Test Center (VRTC) is located in East Liberty, OH and is part of NHTSA's Office of Research and Development.

FIGURE IV-2



Permissible Distance Between a Speaker and Listeners
Copied from Human Factors Design Handbook, Second Edition by W.E. Woodson, B. Tillman, and P. Tillman

Figure IV-2 Permissible Distance between a Speaker and a Listeners

[Speaker to Listener Distance (feet) versus Ambient Noise Level dB(A). Reference: Human Factor Design Handbook, Second Edition, W.E. Woodson, B.Tillman and P. Tillman.]

3. Platform Requirements (S6.4)
Unobstructed Platform Operating Volume (S6.4.2) – The Final Rule requires that the lift platform have a minimum clear width of 762 mm (30 in.) measured from the platform surface to 762 mm (30 in.) above the platform, and a minimum clear length of 1,219 mm (48 in.) measured from 51 mm (2 in.) above the surface of the platform to 762 mm (30 in.) above the surface of the platform. This represents an unobstructed volume of length, width and height 1,219 X 762 X 724 mm (48" X 30" X 28.5"). See Figure 6 in the Appendix.

NHTSA's unobstructed platform operating volume is based on the Access Board's requirements. The size of the lift platform was determined by the length and width of the population of wheelchairs-in-use and constrained by the known distance between structural members (A and B pillars) of doors in buses. In addition, at least 1,219 mm (48 in.) of length is also needed to accommodate three-wheeled mobility aids called "scooters" which are longer than most traditional wheelchairs and as long as the larger wheelchairs. NHTSA's requirement is believed to accommodate 90-95 percent of the wheelchair population and nearly 100 percent of the scooter population. This requirement is consistent with the Access Board's guidelines.

The requirements would apply to lifts on vehicles greater than 4,540 kg (10,000 lbs.) GVWR as these would be commercial vehicles serving the public with a variety of wheelchair/mobility aid sizes and configurations. No platform volume or size is required for MPV lifts or lifts on vehicles 4,540 kg (<=10,000 lbs.) GVWR such as trucks, truck tractors, or motor homes as it is believed platform size is tailored to the preference of the individual user, the mobility aid size,

and vehicle size. This requirement is consistent with the Access Board's guidelines. All buses, except the ones with narrow entrance ways mentioned above, can accommodate a 762 X 1,219 mm (30" X 48") platform, hence, there is no FMVSS cost impact of this requirement.

Platform Slip Resistance (S6.4.12 and S7.2) A minimum platform surface slip resistance of 0.65 is required to prevent wheelchairs and people using walkers and canes from slipping on the platform's surface, particularly when wet. A slip resistant surface reduces the accident potential for people standing on the lift and provides traction for a wheelchair. A performance test (S7.2) measures the slip resistance of the lift loading platform when wet using a friction block rather than a specific wheelchair design as proposed in the NPRM. The Friction Block Method proposed in the SNPRM and adopted in the Final Rule has been shown to be practicable, objective and repeatable.

The Department of Transportation (DOT) regulations for disabled individuals are contained in 49 CFR, Part 38 - Americans with Disabilities Act (ADA) Accessibility Specifications for Transportation Vehicles. Section 38.23(b) is concerned with vehicle lifts and states "...the platform surface shall be slip resistant." The Federal Transit Administration=s (FTA) procurement guidelines for bus lifts also requires slip resistant surfaces. The Department of Veterans Affairs (DVA) standard for wheelchair lifts specifies that the lift platform surfaces must provide "adequate tire traction." The same requirement is contained in the SAE draft standard for wheelchair lifts. However, none of the requirements stated above provide an objective test procedure for determining the adequacy of the slip resistance of the lift platform.

During the development of an NPRM for vehicles with wheelchair lifts (previously called FMVSS No. 401), the agency proposed a procedure for measuring platform resistance in which a loaded power wheelchair would be placed on a wet, 30 degree inclined lift surface until sliding occurred. This was believed to occur at about a 0.60 coefficient of friction (COF). Unfortunately, testing at VRTC (Docket No. NHTSA-98-4511) revealed that this was not an effective method because, in many cases, the wheelchair tipped over before sliding could occur. Subsequently, VRTC staff conducted a literature search to determine other test procedures, which might be useful in determining slip resistance and selected ANSI/RESNA WC13 - 1991 Determination of Coefficient of Friction of Test Surfaces for further investigation. NHTSA proposed the ANSI/RESNA WC13-1991 coefficient of friction (COF) test procedure with the following modifications:

Procedural Changes to ANSI/RESNA WC/13:

1. The test surface area 450 X 100 mm (17.5" X 3.94") is horizontal and clean from dust, dirt and debris.

2. Pull the test block by a mechanical means to achieve a pull rate of 20 +/- 2 mm/s.

3. Pull the test block for a minimum of 13 seconds and use only the last 10 seconds of force data to calculate the average force, which is to have 2% accuracy in the 25N - 100 N range.

4. Collect force data at a frequency of >= 10 Hz.

5. The link between the test block and pulling mechanism shall have a stiffness>= 1 X 10^5 N/m.

6. Evenly spray 3 ml (0.10 oz.) of distilled water per 100 cm^2 (15.5 $in.^2$) of test surface area. Begin the test within 30 seconds of the water spray.

7. Prepare test block friction surface by lightly abrading with waterproof silicon carbide paper, grade P120, weight D (120 wet and dry).

8. Pull the block in only one direction with pull force parallel to test sample surface.

9. Determine the average pull force from a minimum of five trials over any area.

10. Performance Criterion: Any area of a lift platform surface must have a coefficient of friction >= 0.65 as measured by the test procedure.

11. The lift surface can be tested in any direction using the test block and different surfaces on the same lift platform must meet the same minimum requirements.

For further details on the lift platform COF test procedure, a report prepared by the agency has been placed in the docket (Docket No. NHTSA-98-4511) entitled "Evaluation of ANSI/RESNA WC/13 To Determine the Coefficient of Friction of Wheelchair Lift Platforms, June 6, 1996."

The Final Rule requires that a modified ANSI/RESNA WC/13 test procedure to determine the slip resistance or the coefficient of friction (μ_p) of WC lift platforms. The agency believes that this procedure is objective, repeatable, practicable and meets the need for safety. In addition, it is believed that the majority of lifts currently marketed in the U.S. can meet or exceed the required 0.65 value for μ_p , when the platform is wet. Platform Markings (S6.4.10) must be slip resistant as well. There could be multiple friction surfaces on a lift platform, therefore, the coefficient of friction must be>=0.65 anywhere on the lift platform surface including the platform markings. All lifts come equipped with neoprene rubber mats or other slip resistant surfaces and it is expected that industry would comply, as a whole, without changes or modifications.

Platform Protrusions (S6.4.3) - Protrusions on the lift platform make it difficult for wheelchair boarding/deboarding. For an electric wheelchair, additional propulsive power may be needed to overcome a floor level obstruction, but the sudden acceleration could result in loss of control and an accident. NHTSA is proposing that when the lift's outer barrier (wheelchair retention device) or inner roll stop is down, movement on or off the lift platform should be easy and uninhibited. For buses and MPVs (>4540 kg (10,000 lbs.) GVWR), NHTSA is proposing in the SNPRM that lift platform surfaces are not to have protrusions which rise more than 6.5 mm (0.25") when measured perpendicular to the platform surface. For personal use vehicles, lift platform surfaces are not to have protrusions, which rise more than 13 mm (0.5") when measured perpendicular to the platform surface. All portions of the sides of a protrusion that are between 6.5 mm (0.25") and 13 mm (0.50") above the platform are to have slopes not exceeding a 1:2 ratio.

For buses and MPVs>4,540 kg (10,000 lbs.) GVWR, NHTSA's SNPRM is consistent with all aspects of the ADA including for protrusion height. The Access Board has a 6.25 mm (0.25") maximum, which NHTSA has adopted. Lift manufacturers have indicated that mechanisms to hold the required outer barrier in-place may require protrusions through the lift platform when the outer barrier is up. Such protrusions would be allowable in the subject SNPRM. The Access Board, FTA and SAE all have protrusion limitations and NHTSA is adopting the Access Board's specifications. All currently manufactured lift equipment would be expected to comply.

Gaps, Transitions and Openings (S6.4.4) NHTSA is concerned about vertical transitions entering or exiting the platform at the ground/floor levels, slopes between transitioning vertical planes, vertical gaps, horizontal gaps, platform surface openings and edge guards gaps. Poor vertical transitions can be an impediment to power as well as manually operated wheelchairs. In addition, vertical gaps, which are too large, can impede boarding/deboarding passengers. The small tires of the wheelchair could get caught in horizontal gaps or platform openings. The requirements are as follows:

S6.4.4.1 Vertical Transitions - For ground level loading, the maximum vertical transition height is 6.5 mm (0.25") and for lift to bus floor transitions, the maximum vertical height is 6.5 mm (0.25").

S6.4.4.2 Slopes - No vertical transition can be more than 6.5 mm (0.25") at either the ground or vehicle level. Horizontal gaps are limited to13 mm (0.50"). Between 6.5mm and 13 mm (0.25"-0.50") rise, the platform or vehicle surface slope can not exceed a 1:2 ratio. Above a 13 mm (0.50") rise, the slope an not exceed 1:8 ratio. The total allowable rise is limited to 76 mm (3.0"). (See Figure IV-3 - Allowable Transition Dimensions and Slopes for Platform Entrance and Exit at Vehicle and Ground Level.)

S6.4.4.3 Vertical Gaps - For the inner roll stop and outer barrier (e.g., Wheelchair Retaining Device) in the upright, deployed position, the SNPRM defines a Block Test 15.9 X 15.9 X 102 mm (0.625" X 0.625" X 4") where the long axis is held perpendicular to the "platform reference

plane" to measure maximum allowable clearances. The block device can not pass between any gaps.

S6.4.4.4. Horizontal Gaps - The SNPRM specifies that horizontal gaps are to be designed such that they do not pass a sphere of 13 mm (0.50") diameter, with the lift at ground level or at floor level.

S6.4.4.5 Platform Surface Openings - Some platforms employ steel mesh surfaces normally covered with a rubber mat. The exposed openings in the mesh can be an impediment to a wheelchair if too large. This Final Rule specifies that platform openings are to be designed such that they do not pass a sphere of 19 mm (0.75") diameter.

S6.4.4.6 Edge Guards - The vertical gaps between the lift platform and the "moving" edge guards (those mounted to the platform structure) can not pass a sphere of 13 mm (0.50") diameter. For horizontal gaps between the lift platform and fixed edge guards (those mounted to the vehicle structure or lift frame) can not exceed a sphere of 6.5 mm (0.25") diameter.

The maximum gap distances are to be measured when the lift is loaded with 272 kg mass (600 lbs.). NHTSA is adopting the Access Board's gap specifications and it is believed that all lift equipment can be installed to operate within these tolerances without further modifications or adjustments to either the lift design or installation. No additional manufacturer costs are anticipated due to this requirement.

Figure IV-3 - Allowable Transition Dimensions and Slopes for Platform Entrance and Exit at Vehicle and Ground Level.

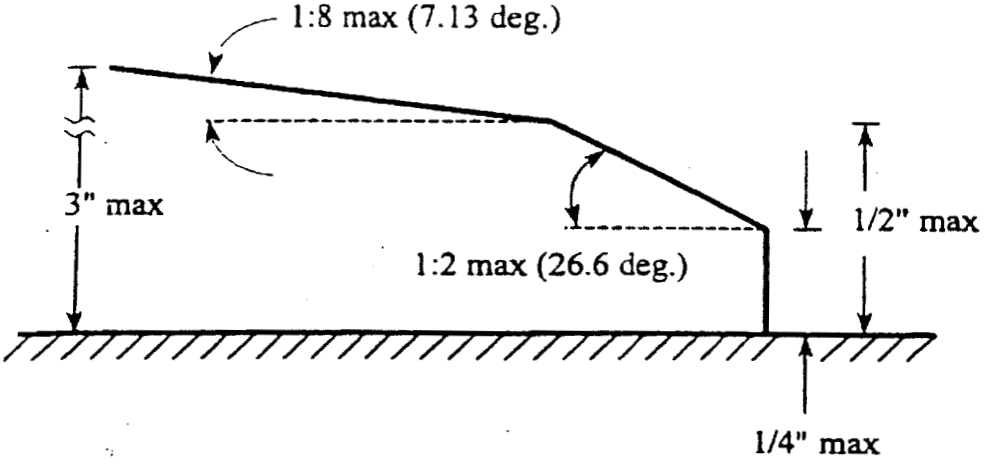


Figure IV-3 Allowable transition dimensions and slopes for platform entrance and exit at vehicle and ground level.

The DVA and the Access Board specify a 31.25 mm (0.625") maximum vertical gap and 25 mm (0.50") maximum horizontal gap between the lift and the bus body. The FTA-sponsored guidelines and SAE draft recommended practice all have maximum bus body to lift gap allowances.

Platform Deflection (S6.4.5) – The Final Rule allows no more than 1.8 degree maximum lift platform deflection angle, measured relative to the bus floor, for the entire unloaded range of operation of the lift and 3 degrees maximum deviation from its unloaded position when loaded with 272 kg mass (600 lbs.). The angle is measured between an axis perpendicular to the lift platform surface and an axis perpendicular to the vehicle floor. The maximum allowable change in the angle is 4.8 degrees measured in any direction, between the axis perpendicular to the vehicle floor and platform reference planes when loaded with 272 kg mass (600 lbs.). The standee or wheelchair lift user's weight on the lift platform causes deflection of the lift relative to the bus floor, similar to the deflection of a cantilever beam. Establishing a maximum platform deflection level assures stability for the user, particularly someone with a walker, and controls the ramp or grade of the lift so an unattended person can manually roll the wheelchair off the lift into the bus. Lift deflection is measured independent of bus roll. The agency believes that all personal and commercial lift products will pass the deflection test.

Platform Edge Guard Height (S6.4.6) - Edge guards are low, fixed, vertical walls, which run along the length of both sides of the platform and prevent wheeled mobility aids from rolling,

sliding or being driven over the side of the platform. They are positioned parallel to the forward or rearward operating direction of the wheelchair and are designed to deflect the wheelchair's tires. NHTSA is requiring that during lift operation, the lift platform is to have continuous edge guards parallel to the direction of loading/unloading along each side. Edge guards mounted on the lift platform are to have a minimum height of 38 mm (1.50") measured vertically from the platform. The previous section (S6.5.4.6) defined the maximum allowable vertical 13 mm (0.50") and horizontal gaps 6.5 mm (0.25") for fixed and moving edge guards. An edge guard requirement and minimum edge guard height are required by both the FTA-sponsored guidelines and the ADA standards (49 CFR 38.23(b)(5)).

The California Administrative Code specifies a one inch minimum height for edge guards, while the DVA and SAE have no requirement. The Access Board recommends 38 mm (1.5") (minimum). A 38 mm (1.50") requirement, consistent with the Access Board's guidelines, is being adopted and applies to any part of the lift platform exposed or operated outside the perimeter of the bus. For example, an elevator type lift, operated entirely within the outside perimeter of the bus, would not need edge guards providing gaps between the side of the platform and the bus structure do not exceed gap requirements. All lift equipment currently in production are expected to comply.

9. Wheelchair Retention Device (S6.4.7, S7.7 and S7.13) - The outer barrier or wheelchair retention device of the platform is the only mechanical means which prevents the wheelchair from rolling, sliding or being driven inadvertently off the platform, when the platform is greater

than 3 inches off the ground. The outer barrier is the only safety device which can prevent a wheelchair occupant from accidentally falling from a raised platform and research has shown electric wheelchairs are capable of climbing over some barriers which are in use today. Lifts can achieve a height of 40-50 inches off the ground, depending on the bus's floor height with the result that the top of the head of the wheelchair occupant could be a total of 90-100 inches off the ground. A fall could cause serious injury. All lifts are designed with a wheelchair retention device regardless of intended vehicle GVWR. The Final Rule requires a dynamic test, employing a WC test device, to prevent the WC from climbing over the outer barrier, and an overload strength test to prevent the WC crushing, bending or plowing-through for the wheelchair retention device.

In their final guidelines issued September 6, 1991, the Access Board did not specify a safety test for the outer barrier or WC retention device, but deferred to NHTSA's expertise, as the agency was planning to issue proposed safety standards for lifts. In the Access Board's final rule it is stated (pg. 45535), "...the Board feels that NHTSA is the appropriate agency to define safety tests."

New WC Retention Test Method

The WC Retention Device or outer barrier can be defeated by (a) WC climbing, (b) loss of strength and rigidity or (c) WC tipping. The WC retention device test is designed to address the first two failure modes: (a) if traveling too fast, in the rearward direction, the large wheels of the wheelchair can climb-up and over the outer barrier resulting in occupant injury and (b) if

traveling too fast, in the forward direction, the smaller caster wheels can deform and bend the outer barrier such that the wheelchair could plow-through and off the lift platform also resulting in occupant injury. Regarding Item (c) above, to prevent tipping would require a 12" - 15" or higher outer barrier, which would have been too cumbersome and impractical. Running the test on an 8 degree incline as prescribed in the NPRM accentuated the tipping phenomenon, but did not cause the higher barriers to be climbed. The agency is requiring a dynamic WC test with zero ballast and a level lift platform in which a WC Test Device (S7.4.2) impacts the outer barrier at approximately 4 mph in a forward or rearward direction and remains upright. This provides the most stringent test for barrier height. Because the dynamic WC Test Device only develops an impulse loading of 1,200 to 1,400 lbs., a separate 7,117 N (1,600 lbs.) static overload test (S6.10) is also required for the outer barrier to ensure resistance to deformation, crushing or bending.

The WC Test Device must operate under its own power with speeds of 2.0 - 2.1 m/s (4.4 - 4.7 mph) in the forward direction and 1.75 - 1.80 m/s (3.9 - 4.1 mph) in the rearward direction at the test vehicle floor level (without ballast or added weights). The footrests of the WC are raised 25 mm (1") above the top of the outer barrier. Despite spinning motion of the power wheels, the WC is to remain upright at the conclusion of the impact test. For lifts designed for buses and MPVs>4,540 kg GVWR, the tests are conducted in forward and rearward loading directions.

For lifts designed for personal use vehicles <= 4,540 kg (10,000 lbs.) GVWR, trucks, truck tractors and motor homes, the outer barrier is to be tested either in the forward or rearward directions depending on the owner's manual boarding/deboarding instructions. If a rotary lift,

both outer barrier retention devices are tested. For lifts designed for personal use vehicles <=4,540 kg (10,000 lbs.) GVWR, trucks, truck tractors and motor homes, perform the dynamic WC test in the specified loading direction with footrests are adjusted to the shortest possible position and the platform is 90 mm (3.5 in.) above the ground (e.g., outer barrier deployed). Because there may be no room for the WC to gain impact momentum, the WC test device is moved up against the outer barrier and the speed controller actuated to a position equivalent to achieving the above speeds either forward or backward (depending on the loading instructions in the owner's manual). The lift platform surface is level. The power wheels can spin, but the WC test device must remain upright. The dynamic WC Retention Test is believed to be objective, repeatable and practical. The WC Test Device is defined below:

WC Test Device Specification (S6.4.2)

a. Cross-brace frame wheelchair, a sling seat and belt drive-type.

b. Pneumatic rear tires with 495 mm (19.5") to 521 mm (20.5") diameter.

c. Pneumatic front tires with 190 mm (7.5") to 216 mm (8.5") diameter.

d. Mass = 72.9 kg (160 lbs.) to 86.0 kg (190 lbs.).

e. Wheelbase = 457 mm (18") to 533 mm (21").

f. Horizontal distance from rear axle to CG = 114 mm (4.5") to 152 mm (6.0").

g. Vertical distance from the ground to the CG = 260 mm (10.25") to 298 mm (11.75").

WC Retention Overload Test (S7.13)

Deploy the outer barrier with the lift 89 mm (3.5") above the ground. Apply 7,117 N (1,600 lbs.) and attain the load within 1 minute. If a rectangular outer barrier, the load is to be distributed [area = 25 mm (1") high by the width of the barrier face)] and centered 63 mm (2.5") above the platform surface. If the WC retention device is other than a conventional outer barrier design, apply the 7,117 N (1600 lbs.) directly to the WC test device (which would be pushed up against the retention barrier. The WC retention device must maintain 7,117 N (1,600 lbs.) for 2 minutes without cracks, separations, fractures or breakage.

For further details, the agency has placed in Docket No. NHTSA-98-4511) an analysis entitled, "Wheelchair Retention Device Impact test Analysis, June 6, 1996," Also, the same docket see an analysis entitled, "Determination of Center of Gravity of Cross-Bar Frame Powered Wheelchairs, June 6, 1996."

It is believed that very few, if any, lifts currently on the market would meet NHTSA's dynamic WC retention test in the loaded condition. Therefore , it is believed all personal and commercial lifts would certify using the 7,117 N (1,600 lbs.) static overload test. Although all lifts currently manufactured have an outer barrier [at least 76 mm (3") high], it is believed that they are of insufficient height to prevent WC climbing. VRTC found that 127-152 mm (5-6") high barrier would be needed compared to the 76 mm (3") barrier used on lifts today to prevent the wheelchair from climbing over the barrier given the test speed involved. Therefore, some consumer cost may be incurred to make the outer barriers 51 mm- 76 mm (2"-3") higher. The

FTA guidelines recommend either a static or dynamic test. The Access Board has deferred to NHTSA's expertise in establishing a viable outer barrier or retention device test.

10. Inner Roll Stop Strength (S5.4.8 and S6.5) - In addition to a wheelchair retention device or outer barrier, the proposed platform lift systems designed for buses and MPVs >4,450 kg (10,000 lbs.) GVWR, are to have an Inner Roll Stop which prevents the wheelchair from inadvertently rolling or sliding off the inner edge (vehicle side) of the platform and prevents contact (pinching) of occupant foot/toes between the WC lift platform and the vehicle structure. No inner roll stop is required on personal use vehicles <=4,540 kg (10,000 lbs.) GVWR, if they are loaded in a rearward direction, because it is believed the van/MPV's body will serve as a natural inner roll stop barrier to the large wheelchair tires. Similar to the WC retention device, NHTSA requires a dynamic test for the inner roll stop to retain the WC on the lift platform. The inner roll stop must prevent the front wheels of the proposed WC Test Device (S7.4.2), from moving in a forward direction at a speed of 1.5 m/s to 1.6 m/s (3.4 mph to 3.6 mph), from passing over the edge of the platform. This test is conducted at ground level, without ballast, and would be consistent with someone accidentally driving too fast onto the platform. In this case, the inner roll stop must retain the WC test device in an upright position.

With lift at floor level, the WC test device is used to apply a static load to the inner roll stop in a forward direction, on a level platform surface, by activating the controls equivalent to the WC test device achieving a 2.0 - 2.1 m/s (4.4 - 4.7 mph) speed.

The lift is raised to the floor level of the bus or MPV, and to conform to requirements, the inner roll stop must prevent the wheelchair test device from being pinched between the lift and any other structure (e.g., bus body or door structure) throughout the range of passenger operation. This simulates the potential for pinching of WC user feet/toes.

For personal use vehicles <= 4,540 kg (10,000 lbs.) GVWR, trucks, truck tractors and motor homes, either the above dynamic and static requirements must be met or there must be a warning notice in the owner=s manual that the WC user is to board in the rearward direction. In this case, the larger rear wheels of WC will protect against rolling off the lift platform. [The agency notes that the Access Board guidelines apply to buses and MPVs > 4,540 kg (10,000 lbs.) GVWR in which case the lift must be able to be loaded with the WC in a forward or rearward direction, whereas for personal use vehicles <= 4,540 kg (10,000 lbs.) GVWR, tend to be personal vans, and the size of the lifts dictates rearward loading.]

The agency is requiring these tests, although transit operators have reported no problems with existing inner roll stops. Also, the accident scenario involving running over the inner roll stop or off the inside of a lift toward the bus body appears to involve less risk of serious injury compared to an outer barrier failure with the lift at host vehicle floor level.

The static load test for the inner roll stop is consistent with FTA guidelines. The DVA and SAE do not have inner roll stop requirements for personal vans. The Board's final guidelines do not specify a static load test, but does require the inner roll stop as an inherent design feature. All lift

equipment currently on the market would be expected to comply without modifications or adjustments to the dynamic inner roll stop load requirements. It is also believed that commercial lift inner roll stops are sufficiently high to engage or stop the WC footrest and prevent pinching of the foot/toes between the lift platform and the vehicle body.

Hand Rail Dimensions and Strength (S6.4.9 & S7.12) - NHTSA is requiring dual handrails on lifts designed for Public-use MPVs and buses, but not on lifts designed for personal use vehicles. The Access Board requires movable hand rails (e.g., hand rails move with the lift) for all lifts (49 CFR 38.23 (b)(13) on public transportation vehicles. Handrails are necessary for manual wheelchair passengers to hold onto and assist themselves on/off the platform, and to control their speed. They are also used by ambulatory disabled persons (such as those with limited mobility on one side of the body) for assisting themselves on/off the platform and for standee stability while raising the lift.

NHTSA is requiring when the Public-use lift is fully deployed, hand rails are available on each side of the lift in order to accommodate disabled persons who may have mobility limitations on either the left or right hand side of their bodies. For lifts designed for personal use vehicles, handrails are optional, but if available they must meet the same load and deflection requirements as described below. The graspable portion of the hand rails are to be located at a height of 762 - 965 mm (30"-38") and are to be a minimum of 203 mm (8") in length. The cross sectional diameter or width of the handrails are to be between 31.5 mm (1.25") and 38 mm (1.50"). The handrails are to be capable of withstanding a force of 445 N (100 lbs.) applied with a 1,290 mm^2

(2 square inches) applicator at "any" point and in "any" direction, without exceeding 25 mm (1") of elastic deflection (and without permanent deformation) relative to the platform surface. The relative position of the hand rails are not to change throughout the passenger operating cycle and are required to maintain 38 mm (1.5") of clearance from the body of the test vehicle during the hand rail deflection test.

In addition, when 1,112 N (250 lbs.) are applied at "any" point and in "any" direction the handrail must not sustain failure (e.g., cracking, separation, or fracture). NHTSA based its force and deflection calculations on the following assumptions: 965 mm (38") high U-shaped railing, 38 mm (1.5") tube diameter, 1.6 mm (0.0625") wall thickness and 1010 hot rolled steel tubing.

This is consistent with the Access Board's requirement of two handrails for commercial vehicles, whereas the DVA and SAE does not require hand rails as these requirements apply personally licensed MPVs/vans. Lift equipment currently being marketed can comply with the number of railings and the proposed force levels.

12. Platform Markings (S6.4.10) - NHTSA is requiring that the following lift platform areas be marked on transit vehicles (Public-use buses and MPVs): (1) the edge of the bus door opening, (2) platform to door opening bridging device, if available, (3) the perimeter of the lift's loading surface, and (4) "any" designated standing area. The lift is to be marked using a painted solid stripe 25 mm (1") wide of solid color that contrasts with the lift platform background by 60 percent. The designated standing area is to be outlined with a box shape to help reduce the

potential for head contact with the bus door header area for a standing lift user. The marking of the platform edges will provide visual guidance to the wheelchair occupant so that they can properly position themselves prior to operation of the lift, assuring unimpeded operation of the outer barrier and inner roll stop. Knowing where to stand or place their wheelchair will reduce the potential for lift user accidents and speed up overall operation.

NHTSA is requiring that the contrasting color or shade be at least 60 percent contrast for the painted solid or chevron type stripe at the bus door opening, the lift platform perimeter, the bridging device, and any designated standing area calculated as follows:

$$\% \text{ Contrast} = ((L1-L2)/L1) \text{ X } 100 \%$$

where L1 equals the luminance in foot-lambert of the lighter color or shade and L2 equals the luminance in foot-lambert of the darker color or shade. L1 and L2 are measured perpendicular to the platform surface with illumination provided by a diffuse light and a resulting illuminance of the platform surface of 323 lm/m^2 (30 $lumen/ft^2$).

Platform markings are not required by the Access Board, but standee markings are. All lifts being manufactured are believed to include perimeter marking and could comply with the above requirements with little cost impact. It is proposed that only lifts on transit vehicles would have a designated standing area. Although these may currently be marked in some fashion, they may not meet the SNPRM requirement so there may be a small incremental cost.

13. Platform Lighting (S6.4.11) - Buses and MPVs providing public transportation often operate at night when vision is obscured. Indirect lighting from the vehicle's interior may not be

sufficient to adequately illuminate the platform surface and platform ramp. The agency believes the lift platform should have the capability of being illuminated in dark or dusk ambient lighting conditions to ensure a safe lift operating environment. Buses and MPVs greater than 4,540 kg (10,000 lbs.) GVWR, including school buses, are to have a light source which provides at least 54 lm/m^2 (5 $lumens/ft^2$) of illuminance on all portions of the surface of the lift platform throughout the range of passenger motion. The illuminance measured on all portions of the surface of the lift unloading ramp at grade level is to have at least 11 lm/m^2 (1 $lumen/ft^2$). The light source is to meet the above requirements and also provide glare protection for entering/exiting lift passengers. [The unloading ramp is typically the undeployed outer barrier inclined surface at ground level.] All commercial lift-equipped vehicles are believed to comply with this requirement, except school buses. School buses can be used for extracurricular activities after school involving dusk or evening hours. This requirement does not apply to lifts designed for personal use vehicles <=10,000 lbs. GVWR, trucks, truck tractors, and motor homes.

It is believed that dual handrails and platform illumination are needed to help reduce injury risk to persons in unfamiliar circumstances such as boarding or alighting from a public transportation vehicle. On the other hand, because of owner familiarity and repeated experience with personal lift equipped MPVs/vans and other vehicles, these lifts do not need a hand rail or illumination requirement.

Platform Free-Fall Velocity Limits (S6.6) - During the operation of the lift, a loss of hydraulic pressure/electrical power or a mechanical failure could occur, with the lift at the bus floor level [1,013 - 1,267 mm (40-50 in.) off the ground], in which case the person on the lift may be subject to a free-fall condition. A free-fall from 1,267 mm (50 in.) results in an impact velocity of 5 m/s (11 mph). The Final Rule requires a maximum free-fall velocity or terminal velocity of 305 mm/s (12 in./sec.). Compliance with this requirement is made through engineering analysis assuming a 272 kg mass (600 lbs.) load. In case of a single point failure, the lift platform cannot change angular orientation more than 2 degrees in any direction. This test applies to both primary power source and manual backup operating modes. The free-fall speed is about twice the normal lift operating velocity of 152 mm/s (6 in./sec.). In the event of a power or mechanical failure this speed is safe enough to ensure that impact injuries do not occur. The free-fall velocity limit and no excessive change in platform angle are consistent with the Access Board that prohibits the platform from accelerating to the ground, with a user on-board, due to a single point failure. It is believed that all lift equipment currently on the market will comply. There will be no incremental cost impact.

Control Systems (S6.7) - The FTA-sponsored guidelines indicate that lift operator error contributes to a significant proportion of lift accidents and can also cause maintenance and reliability problems. The requirements for control sequences and standardization is designed to reduce the potential for human error. Several factors have been identified which contribute to operator error: (1) the lack of familiarity with the lift controls, (2) the lack of standardization in the control sequence and types of controls (e.g., different controls for different lifts); and (3) the

lack of follow-up training. NHTSA is trying to eliminate or reduce human error by requiring the lift operator to have a clear view of the lift user and lift at all times. This requirement was designed to accommodate all types of controls and all types of lifts. The ability of an operator to simultaneously operate more than one function at a time (e.g., the lift can not stow when occupied) has been identified as a source of error leading to injury. This possibility has been eliminated, by requiring the sequential operation of each control function. The sequentially operated lift controls functions are to be clearly labeled in English using 2.5 mm (0.1") high letters:

1. "POWER" (on/off switch) control located to avoid inadvertent operation, "DEPLOY" or "FOLD"control, "DOWN" or "LOWER" control, "UP" or "RAISE" control and "STOW" or "FOLD" control.
2. Except for the "POWER" control, these functions are not allowed to operate simultaneously.
3. The lift controls/displays are located near the lift platform so the operator has a clear view of the lift passenger or passenger/mobility aid throughout the range of passenger motion.
4. Lift backup operating procedures (e.g., manual lift operation due to loss of electrical power) are described in English and located on a placard near the lift controls/displays.
5. The lift controls and display board are illuminated for MPVs > 4,540 kg (10,000 lbs.) GVWR and buses, when the headlamps are actuated. For transit vehicles used in the fleet various driver/operators may need to operate various lift designs under various lighting conditions. For personal use vehicles with lifts, the user and the operator are the same, and would be very familiar with their lift controls.
6. A control system single point failure does not prevent operation of the vehicles' interlocks.

Lift manufacturers currently label controls, but may use different size lettering, and NHTSA is uncertain as to how many would comply with the Final Rule control illumination requirements.

Jacking Prevention (S6.8) - The control system or inherent lift design should be such that "jacking" is prevented. This test is to be conducted unloaded and loaded 272 kg mass (600 lbs.).

Jacking is the support or lifting of the bus by the wheelchair lift when the platform is power driven to the ground level. This can cause failure, breakage, or permanent deformation to parts of the lift and could cause jamming and render the lift inoperable when at a bus stop. Some active lifts employ gravity to lower the lift platform in cases where jacking is not a problem. For passive lifts, where power is normally applied to lower the lift, jacking could create a problem It is believed that power-down lifts already employ a contact switch to detect ground contact and to override lift operation. The prevention of jacking is consistent with the FTA-sponsored guidelines and would not apply to the manual backup mode of lift operation. Jacking was not addressed by the Access Board. It is believed that all commercial and personal lift products already comply with this requirement. In the SNPRM the agency also proposed an anti-crush interlock (S5.10.2.7) that would stop the lift's motion if the 3 primary edges of the lift platform contacts an object anywhere along the downward vertical travel path. The agency anticipated that the anti-crush interlock would be based on the anti-jacking sensor, but modified in terms of sensitivity and area. That is, it would be sensitive enough to not crush a baby carriage or a child's foot or leg once contact is made and the sensing area would include the three primary sides of the lift (excluding the side next to the vehicle. Anti-crush interlock requirements were not included in the Final Rule due to cost and function intricacies.

16. Backup Operation (S6.9) - This requirement is designed to allow operators/rescue workers to manually raise and lower the lift when hydraulic or electrical power is lost to the lift system. This must be accomplished unloaded and loaded 272 kg mass (600 lbs.). The operator must be able to raise or lower the lift manually from any point in the lift cycle. Also, the wheelchair retention device and inner roll stop are to be manually deployable in this operating mode and instructions to that effect are to be contained (1) at or near the lift hand controls/display and (2) in the owner's manual. This provides the ability in an emergency to evacuate all lift users following a crash or on-road bus component failure. This involves manually lowering the lift from the stowed position, raising and lowering the lift as well as operating the outer barrier and the inner roll stops. Current lift equipment, on the market, has a manual operating mode (e.g., hand actuated hydraulic pump) for emergency situations so the lift can be cycled many times. This requirement is consistent with the Access Board's final guidelines and should not result in incremental costs to the lift manufacturers.

17. Interlock and FMVSS Safety Features (S6.10) - NHTSA proposed that vehicle lift systems possess ten (10) basic lift/vehicle interface safety features or interlocks involving no human action to ensure fail-safe operation of the lift. The first 5 were proposed in the NPRM and the second 5 were added in the SNPRM. The interlocks are designed to prevent the following:

S6.10.2.1 - Forward/rearward mobility of the host vehicle is prevented unless the lift is stowed. This prevents the host vehicle from being operated inadvertently while someone is on the lift.

S6.10.2.2 - The service brake of the host vehicle must be actuated and transmission lever placed in the "parked" position or neutral (not to be dependent on service brakes or lift access door actuation) before the lift can be deployed from the stowed position.

S6.10.2.3 - The lift can not be stowed if an occupant (with or without mobility aid) is on the platform.

S6.10.2.4 - The lift can not move up or down unless the inner roll stop is deployed in the vertical direction.

S6.10.2.5 - The lift can not move up or down [when the lift is greater than 76 mm (3") above the ground) unless the WC retention device, normally an outer barrier, is deployed in the vertical direction.

S6.10.2.6 - With the lift at ground level, if the lift is equipped with an outer barrier, it can not deploy if occupied by a lift occupant or mobility aid/occupant. This interlock recognizes if a cane, foot or WC/occupant is on the inclined plane that becomes the WC retention device. This eliminates or avoids the accident scenario of tripping an elderly person with a cane or flipping the WC and its occupant over.

S6.10.2.7 - The inner roll stop will not deploy if occupied by a lift occupant or mobility aid/occupant. As with S6.10.2.6, this interlock recognizes that a cane, foot or WC/occupant are in contact with the inner roll stop. This eliminates or avoids the accident scenario of tripping an elderly person with a cane or flipping the WC and its occupant over.

Lift Interlock Rationale

The Final Rule requires that all lift controls be located together and in a position where the control operator has direct unobstructed view of the lift passenger, and/or any wheelchair, throughout the range of lift operation. This is generally the case today. Advertisements for school bus lifts (called active lifts), for example, show the lift operator outside the bus, standing next to the lift passenger, with the lift remote controls in-hand. For a transit bus with a passive lift (front door steps fold to make a platform), the driver is already in full view of the lift user. Although based on anecdotal information, situations have occurred where the operator has improperly operated the lift resulting in lift passenger injuries and fatalities. These cases have been discussed earlier in the report. One theory is that even though the passenger was probably fully visible to the operator, the operator may not have been aware of the passenger's presence.

This "looked but did not see" phenomenon is a frequent cause of motor vehicle crashes. The agency believes this is more likely to happen with commerical lifts than with personal lifts, where the lift passenger is the operator. Therefore, the lift interlocks are expected to help prevent the operator from making errors. The risk of operator error, although anecdotal in nature, dictates the need for safety essential interlocks. However, the agency lacks any formal data by which to rate the interlocks for risk avoidance.

Owner's Manual Requirements (S6.12)

The lift manufacturers are to provide the vehicle manufactures with an Owner's Manual Inserts containing the following information: (1) the lift maintenance schedule based on the number of lift cycles, (2) lift usage instructions some of which is redundant with printed instructions at the control unit including backup or manual operating instructions, etc. (3) for lifts designed for personal use vehicles <4,540 kg (10,000 lbs.) GVWR and without an inner roll stop, a warning to board the lift platform backwards at the ground level (large wheels first). For all lifts on personal use vehicles < 4,540 kg (10,000 lbs.) GVWR, trucks, truck tractors and motor homes, information pertaining to platform lift operating volume must be provided.

Installation Instructions (S6.13)

Under FMVSS No. 403, the lift manufacturers must include with each lift installation instructions. This material supports OEM and vehicle alterer compliance with FMVSS No. 404 and includes the following: (1) the applicable host vehicle GVWR, (2) the applicable host make/models/years, and (3) printed instructions/schematics/ drawings pertinent to installing the

lift in the host vehicle as well as how to install/connect warning signals, platform illumination lamps, the 8 interlocks included in the Final Rule, and the control unit and independent power switch unit. The installation instructions are to include diagnostic checks to ensure that the system is properly installed in the vehicle.

Test Conditions and Procedures (S7.0)

This section includes detailed performance test procedures and specifies the test devices that are necessary to perform the tests. Test devices include:

- Test pallet and load (S7.1.1) - The test palled consists of a rectangular steel plate with sides that measure between 660 mm (26 in) and 686 mm (27 in) which is used to accommodate the standard load. The standard load for public lifts is 272 kg (600 lb). This is in line with Access Board and FTA guidelines, which also apply to public use lifts. The standard load for private lifts is the load specified by the manufacturer or 181 kg (400 lb) whichever is greater. SAE, which also applies to private use lifts, specifies a standard load of 272 kg (600 lb). Due to public comment and the fact that we apply lesser requirements to private use lifts in other areas, we decided to allow the standard load for private use lifts to be the load specified by the manufacturer or 400 lb whichever is greater. This will allow lower capacity lifts designed for children, etc. to continue to exist.
- Wheelchair test device (S7.1.2) - The test device is an unloaded power wheelchair whose size is appropriate for a 95th percentile male. A wheelchair used for the test device must have a cross-braced steel frame, a sling seat, a belt drive, detachable/adjustable footrests that adjust within a specific range, pneumatic rear wheels with a specific diameter, pneumatic front wheels with a specific diameter, a specific wheelbase, a specific center of gravity location and a specific mass. The wheelchair test device is used for the dynamic test of the wheelchair retention device and inner roll stop as well as to simulate occupancy of surfaces during the threshold warning system test and some interlock tests.

- Clearance test block (S7.1.3) - The test block is made of a rigid material and is 16 x 16 x 100 mm (0.625 x 0.625 x 4.0 in) with all corners having a 1.6 mm (0.0625 in radius. The test block is used to check gaps, transitions and openings relative to the platform surface for maximum size.
- Test device for simulating platform occupancy (S7.1.4) - Platform occupancy is simulated using a 151 x 152 x 305 mm (6 x 6 x 12 in) rigid box having a weight of 22.7 kg (50 lb). The device is employed while testing the interlock described in S6.10.2.3, which prevents the platform from stowing while occupied.

Performance tests include:

- Slip Resistance test (S7.2) - Assures that the coefficient of friction is above a specified minimum to prevent occupants from slipping on the platform.
- Environmental test (S7.3) - Assures that components and hardware are resistant to corrosion.
- Threshold warning signal test (S7.4) - Tests the operation of the threshold warning system which is actuated when one front wheel of the wheelchair test device is on the threshold area and the lift platform is greater than 25 mm (1 in) below the vehicle floor reference plane.
- Test to determine occupancy of outer barrier and interlock function (S7.5) - This test determines compliance with two interlock requirements (S6.10.2.5 and S6.10.2.6). It assures that the platform stops if the wheelchair retention device is not deployed and the platform is greater than 76 mm (3 in) off of the ground. In the cases where the wheelchair retention device is in the form of an outer barrier, it assures that the outer barrier will not deploy when occupied by portions of the passenger's body or mobility aid.
- Test to determine occupancy of inner roll stop and interlock function (S7.6) - This test assures that the platform stops if the inner roll stop does not deploy when specified. It also assures that the inner roll stop will not deploy when occupied.
- Wheelchair retention device impact test (S7.7) - This is a dynamic test using the wheelchair test device, which measures the wheelchair retention device's ability to keep a wheelchair entirely on the platform surface.

- Inner roll stop test (S7.8) - This is a dynamic test using the wheelchair test device, which measures the inner roll stop's ability to keep a wheelchair entirely on the platform surface.
- Static load tests (S7.9) (S7.11) (S7.14) - There are three static load tests, which test the strength of the lift structure. Static load I requires that the lift be deployed, lowered (loaded), raised (unloaded), lowered (unloaded), raised loaded then stowed. This sequence is referred to partially or in its entirety as a test procedure for several requirements. It also must be repeated after the Static II test. The Static II test is a proof test. When the lift is loaded with three times the standard load for two minutes, it must not suffer separation, fracture or breakage and must remain operational after the test. The Static III test is the ultimate load test. When the lift is loaded with four times the standard load for two minutes, it must not suffer separation, fracture or breakage. It is not required that the lift be operational after the Static III test.
- Fatigue endurance test (S7.10) - This test assures a minimum endurance of working parts by cycling the lift in a fashion that represents normal usage.
- Handrail test - Assures that handrails will not exhibit breakage or excessive deformation when loads similar to those experienced during normal usage are applied.
- Wheelchair retention device overload test - Tests for a minimum strength of the wheelchair retention device.

The test devices specified above can be easily obtained or constructed at a minimum of expense. The majority of the test procedures are from existing standards and therefore most lifts should already be in compliance.

In all, 44 specific requirements of FMVSS No. 403 are assessed using the Static Load Test I. Following Static Load Test I , a Static Load Test II (S7.8) is conducted. A static load of 816 kg mass (1,800 lbs.), representing a factor of safety of 3 with respect to lift strength, is applied to the 660 to 686 mm (26" to 27") square pallet through the platform centroid for a period of not less than 2 minutes. After this load is removed, a visual inspection is to be conducted per S6.5,

Structural Integrity, to identify platform structure, support structure, or mechanism linkage separations, fractures or breakage. The platform lift should still be operable when unloaded and loaded with 272 kg mass (600 lbs.) following this test. Finally, the Static Load I test sequence is repeated a second time per S7.9.

NHTSA requires a maximum test load of 816 kg mass (1,800 lbs.) to determine the overall safety of the lift and its supporting structural members (e.g., hardware used to install the lift in the bus body). The design of a wheelchair lift dictates the space required for installation, and the lift manufacturer has the responsibility to determine compatibility between the bus structural design and the selected lift. The structural interface between the lift and bus body should be capable of withstanding the application of an 1800 lbs. load to the centroid of the lift platform. NHTSA's requirement is consistent with the Access Board's guidelines. All of the lift equipment currently on the market is expected to be able to meet the 816 kg mass (1,800 lbs.) static load requirement as well as the second set of component tests without added costs.

The FTA specifies the 816 kg mass (1,800 lbs.) static load and requires that the lift should function properly after the test. In addition, the vertical operational range of the lift, the operation of the control system and interlock system, is to be the same as before the Static Load Test II was conducted. It is believed that all the manufacturer's lift equipment can comply with the requirements as currently designed, including the second set of component tests.

Vehicle Tests vs. Fixture Tests - Some requirements are lift/vehicle interface related and so certification tests must be conducted on the test vehicle itself (e.g., roll stop pinch test, Static Load I, fatigue endurance, Static Test Load II, platform deflection, etc.), whereas some requirements are lift-only related (independent of the test vehicle) [e.g., slip resistance, environmental resistance, inner and outer barrier dynamic tests, hand rail strength test, outer barrier over load test, platform marking contrast, 1,088 kg mass (2,400 lbs.) Static Test III, etc.] can be conducted on a static fixture or jig. The latter approach using jigs/fixtures is an option of the lift manufacturers can use to certify.

Note: The Access Board did not specify tests, but rather performance and design guidelines. To facilitate FMVSS objectivity NHTSA added a platform deflection test, a static load test, an inner roll stop test, a dynamic outer barrier retention test and a slip resistance test among many others.

OTHER APPLICABILITY CONSIDERATIONS

WC Lifts vs. Ramps - A large proportion of vans used for paratransit purposes are ramp equipped (driver operated) and many personal minivans are equipped with power operated ramps. In 1996, over 75 percent of the transit buses subsidized with federal funds by FTA were low floor/ramp equipped. Although a ramp may be considerably less expensive compared to a lift, the incremental cost of a lower floor bus would probably offset any savings. According to 1997 APTA data, 7.2 percent of new buses purchased in 1995 included ramps as a means of WC accessibility. WC ramps are not subject to the requirements of FMVSS No.403/404.

NHTSA assumes that the large, full-size vans would be equipped with vertical lifts because they are higher off the ground and would be subject to FMVSS 404. However, minivans (with lowered floors) would tend to be equipped with power ramps, which would not be subject to any FMVSS. The proportion of lift vs. ramps used in minivans is unknown.

Some large vans are less than 4,540 kg mass (10,000 lbs.) GVWR and some with the same body style exceed 4,540 kg mass (10,000 lbs.) GVWR - given different suspension options. This implies two different FMVSS equipped lifts would be needed for the same vehicle. MPVs >4,540 kg (10,000 lbs.) are used as commercial or public vehicles. Most MPVs <= 4,540 kg mass are for private use. There is some overlap between these groups, but the extent of overlap is unknown. All other vehicle types, trucks, truck-tractors, trailers, motor homes or passenger cars which occasionally have lifts installed, or may have lifts installed in the future, are considered private, personal use vehicles.

ADA vs. Non-ADA Affected Vehicles - FMVSS No. 404, the vehicle standard, requires that ADA affected and non-ADA affected vehicles be equipped with lifts that conform to FMVSS No. 403. The ADA affected vehicles include transit buses, paratransit buses, paratransit vans, and OTRBs used for public and commercial transportation. These vehicles must be equipped with lifts per the ADA. The Rehabilitation Act of 1973 imposes similar requirements on school bus lifts. All of these vehicles are categorized in FMVSS No. 403 as MPVs >4,540 kg mass (10,000 lbs.) GVWR and buses. FMVSS No. 403 is consistent with the ADA guidelines for these vehicles. The non-ADA affected vehicles in the subject rulemaking are personal vehicles

e.g., MPVs <= 4,540 kg mass (10,000 lbs.) GVWR, trucks, truck tractors, and motor homes. NHTSA is not mandating that these vehicles be equipped with lifts. Because of the need for economies of scale, for the same make/model lift, the manufacturers will not make some lifts that do comply, and make some lifts which do not comply, with FMVSS No. 403. Therefore, if lifts are installed on these personally-licensed vehicles they will probably be FMVSS No. 403 compliant. However, FMVSS No. 403 places a lesser burden on lifts installed on these vehicles.

"As New" vs. "After First Sale" - NHTSA's safety standards apply to new vehicles and, as such, FMVSS No. 404 will apply to transit buses (3,000-4,000), paratransit buses (287-382), school buses (2,478-3,413), OTRB buses (2,200) or a range of 7,965 - 9,996 vehicles. [Figures in brackets are estimates of annual lift-equipped sales.] Personal vehicles with lifts installed prior to "first sale" would also be required to comply with FMVSS No. 404. However, the agency believes this to be a small number of vehicles. The majority of lifts on personal vans are installed "aftermarket." This is done by converters and vehicle modifiers to which FMVSS No 404 will not apply. This latter population is estimated to be 9,123-17,430 [(8,800+323) + (17,000+430)] per year. The agency's rationale for requiring an equipment standard and a vehicle standard, therefore, is primarily to (1) to regulate all lifts regardless of whether they are on a new vehicle or not and (2) extend FMVSS remedy and, indirectly, recall to the "aftermarket" population of modified vehicles of which is clearly 50 percent or more of the total affected vehicles. Alternatively, if NHTSA had a vehicle-based standard only, less than 50 percent of the affected vehicles could be required to comply. Therefore, the two standards together affected the largest population.

V. BENEFITS

Serious injuries and fatalities have occurred due to the improper operation of wheelchair lifts. Some manufacturers have already analyzed these injuries and improved their current lift equipment with new designs. VRTC laboratory tests revealed that the outer barriers on many lifts manufactured today are insufficiently high to prevent WC climbing. The required WC lift dynamic tests will significantly reduce the potential for accidents or injuries resulting from a wheelchair inadvertently driving over the outer barrier. It is known that operator error, and the independent functioning of the outer barrier and inner roll stop, has contributed to wheelchair occupant injuries. Although it is believed that most lift equipment has been modified to prevent this from happening, the Final Rule assures that all lifts are as fail-safe as possible with respect to inner and outer barrier operation. It is also known that independent, rather than sequential, Function switch operation contributed to the accidental stowage of a lift with a wheelchair occupant on the lift. Again, the agency believes that lift equipment, in general, has been modified to prevent this from happening, but the requirements of the Final Rule assures that all equipment will be built to the same minimum level of safety.

From a review of the 1986-1990 non-fatal crash data from CPSC's, National Electronic Surveillance System (NEISS), the agency estimates that malfunctioning hydraulic lift accidents account for 14 (521/3,774) percent of projected wheelchair accidents during that 5 year period. For these accidents there were no serious injuries requiring hospitalization. The NEISS Death Certificate file indicated the occurrence of two wheelchair fatalities related to hydraulic lifts from 1973 to 1991. It was not possible to extrapolate from these two cases to the national level. In

1991-5, the number of malfunctioning hydraulic lift incidences has increased to 19 percent (1,366/7,121). This probably reflects increased public transit ridership and not a decrease in WC lift safety. During the 1991-5 period, 71.6% of the lift injury incidences involved van/MPVs and 19.5% involved buses. From 1973-91, five lift or ramp-related fatalities occurred. No fatalities were recorded for lifts or ramps between 1991 and 1995. Of the lift-related incidences in which injury occurred in 1991-1995; 27.3% were minor, 69.5% were moderate, and 3.1% were serious and of those only 4.4% required hospitalization. The annual number of persons injured in lift-equipped bus and van incidences in NEISS is small - 248 [(1,238)/5] per year.[1] The agency believes these were predominantly older persons. The agency notes that 73% percent of the NEISS wheelchair/motor vehicle incidences involved disabled persons at least 60 years. NHTSA is very concerned about the safety of older and elderly persons.

Based on Access Board performance and design guidelines, the agency has developed objective test specifications for the following items: a platform lift deflection test, a static load test, an inner roll stop test, a dynamic outer barrier test and a slip resistance test. These are considered NHTSA "value added" improvements.

There are several areas where NHTSA developed performance requirements in direct support of the ADA guidelines or developed requirements undefined by the ADA (e.g., design load, the WC

[1] Table III-1 has a total of 1,366 cases involving hydraulic lifts. The agency believes that the "Auto" or passenger car and ambulance/ambulette categories may involve lift equipment other than the type being regulated in FMVSS No. 403. Subtracting these categories, the total number of relevant cases over 5 years may be 1238.

retention strength test, CG and other requirements for a WC Test Device, platform slip resistance test, hard rail strength test, dynamic inner roll stop test, inner roll stop pinch test, and lift acceleration filter (CFC) specification. Some of these are areas in which the ATBCB specifically deferred to NHTSA's expertise and for which VRTC conducted tests and research.

The Final Rule has adopted requirements from WC lift standards such as industry standards (SAE recommended practices and procedures), government procurement requirements (DVA) and government guidelines (FTA). Some of the new requirements not originally included in the NPRM include: S5.3 - standardized quality, durability and reliability of mechanical, electrical and hydraulic components/sub-systems, S5.4 - environmental corrosion resistance, S6.7 - fatigue endurance and S5.12 - a mechanical counter to support life cycle maintenance.

The Final Rule requires several new hardware improvements to lift operating systems [e.g., for MPVs >4,540 kg mass (10,000 lbs.). GVWR and buses] including; 4-way hazard warning lights, upgraded outer barrier, high contrast standee markings, controls lettering size and illumination, threshold warning device, occupied outer barrier interlock, and occupied inner barrier interlock (the 2 interlocks prevent inadvertent flipping of the WC and its occupant). For vans/MPVs <= 4,540 kg mass (10,000 lbs.) trucks, truck tractors and motor homes, NHTSA is requiring several new hardware improvements to lift operating systems; platform unfold warning signal, 4-way hazard lights warning, high contrast platform standee markings, vehicle motion interlock, occupied platform interlock, operational counter and the same 2 lift interlocks as described as above.

Many of the Final Rule requirements lack a demonstrated safety need and are based on logic, common sense and engineering judgment. Some of the requirements are based on anecdotal information shared with the agency staff. Although NHTSA examined the NEISS wheelchair incidence data for lifts, no information was contained in the file pertaining to cause and effect. Therefore, the requirements of the Final Rule can not be matched with incidence data.

A number of commenters (e.g. Flexible, Mobile-Tech, St. Paul Public Schools, and the Iowa Department of Education) pointed out that they have no record of mishaps or injuries due to people getting caught in folding mechanisms or entangled in moving lift parts. In those cases where injuries or death are known to have occurred, and the cause was known, requirements that address those causes have been included in the Final Rule (e.g., interlocks that prevent stowage if an occupant is on the lift, interlocks that prevent the outer barrier from flipping the WC and its occupant over, and a dynamic WC retention test that will prevent WC climbing or plowing-through the outer barrier).

FMVSS No. 403 will allow the agency to remove defective lifts from the market (e.g., in effect DOT's recall and remedy authority is extended to WC lifts). This is not the case with ADA and voluntary standards such as FTA and SAE.

Most of the requirements in the Final Rule are based on other standards, however, in many cases these standards did not provide an objective means of determining compliance. The Final Rule has addressed this issue extensively by describing as many requirements as possible in

objective terms which should lead to less ambiguity for the manufacturers and more effective and efficient federal enforcement (recall and remedy) action on behalf of the consumer.

The agency has not been able to quantify the benefits associated with the Final Rule because the NEISS accident data lacks adequate and sufficient descriptive information needed to pinpoint the probable cause of injury. However, there are a number of qualitative benefits associated with the Final Rule that incorporates the most relevant requirements of industry standards and guidelines (e.g., DVA, SAE and FTA.) Thus, manufacturers need only comply with one standard rather than several, which will provide a consistent level of safety for all lift users. The Final Rule sets minimum safety standards for lifts. In addition, the Final Rule addresses the injury mechanisms that have been identified by the agency.

VI. COST

This section of the regulatory evaluation discusses the following consumer costs: (1) incremental cost per lift due to FMVSS hardware modifications and associated variable engineering design/production labor, (2) incremental variable cost per lift for compliance certification testing labor and (3) one-time capital equipment cost for new certification equipment and new manufacturing tools such as jigs/fixtures.

The agency further assumes that lift equipment will be the primary level change device employed by MPVs > 4,540 kg mass (10,000 lbs.) GVWR and buses (e.g., transit, paratransit, school and OTRB buses) to comply with the Access Board guidelines. The cost of extending the minimum performance requirements to lift-equipped MPVs <=4,540 kg mass (10,000 lbs.) GVWR, trucks, truck tractors and motor homes is also estimated. The latter vehicles are not covered by the Access Board guidelines.

Vehicle and Lift Population Estimates

Transit Buses - The American Public Transit Association (APTA) estimated in 1984-9 that the average annual demand for transit buses was between 3,000 to 4,000 units per year, and that 100 percent were used for public transportation.[1] These annual sales figures are believed to include leased and remanufactured transit buses also subject to the ADA. The APTA statistics for 1995 verify the estimate is still valid. The APTA estimates that 64 percent of in-use transit buses are accessible, and over 90 percent are lift-equipped. Only buses used for public transportation are

[1] 1990 and 1997 Transit Fact Book, American Public Transit Association (APTA), Research and Statistics Division, 1201 New York Avenue, Washington, DC 20005, (202) 898-4000.

subject to the ADA requirements and will need to be equipped with lifts and only buses with lifts are subject to the FMVSS requirements.

The APTA estimated that there were 60,250 transit buses in operation in 1989 and of these approximately 11.4 percent (6,869) were remanufactured. Assuming that the annual remanufactured bus sales are equal to the proportion of their in-use population (11.4 percent), the agency estimates that 342 - 456 [.114 X (3000 to 4000)] of the transit buses sold annually are remanufactured. The proportion of leased transit buses is unknown. The APTA also estimates that in 1995, 92.6 percent of the new transit bus sales were lift-equipped.[2] The APTA statistics exclude school buses and intercity buses. Therefore, for 1995 transit bus sales, NHTSA estimates 2,778-3,704 [.926 X (3000 to 4000)] were lift-equipped. However, for purposes of cost analysis, NHTSA assumes 100 percent will be lift-equipped in future years.

Paratransit Buses - The 1997 APTA Fact Book estimates that in 1995 in the U.S. there were 28,750 paratransit/ demand-response type vehicles in operation. The APTA estimates that the ratio of paratransit vehicles to transit buses in operation was 28,750:67,275 or .43.[3] The agency assumes that annual paratransit vehicle sales are proportional to their in-use population, which would be approximately 43 percent of annual transit bus sales. Thus, annual paratransit vehicle sales are estimated to be 1,290-1,720 [.43 X (3,000 to 4000)] units per year.

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[2] 1997 Transit Fact Book, American Public Transit Association, percent lift-equipped see page 82, page 85 - Table 50, page 89 - Table 54, New Bus Market data.

[3] 1997 Transit Fact Book, APTA, Page 83, Table 46, Active Passenger Vehicles by Mode and discussions with FTA staff.

Based on the 1995 APTA data, and similar to transit buses, NHTSA assumes that 92.6 percent of paratransit buses sold are lift equipped.[4] However, for purposes of cost analysis and to account for future paratransit bus lift installations, the agency is assuming 100 percent are lift equipped.

The 1996 distribution of demand response vehicles in-use estimated by FTA was; MPVs (50%), automobiles (27.78%) and buses (22.22%).[5] NHTSA assumes that demand response vehicle sales are proportional to the in-use distribution. Applying these proportions to the above annual estimate of 1,290-1,720 paratransit vehicles yields; 645-860 MPVs, 358-478 automobiles, and 287-382 buses sold annually. For purposes of analysis, NHTSA assumes only 50% of the vans/MPVs are lift-equipped with GVWR >4,540 kg (10,000 lbs.) and that 100 percent of the paratransit buses are lift-equipped for a total of 610 - 812 paratransit units per year [e.g., .5(323 to 430 MPVs + 1.0(287 to 382) buses] that would be affected by the subject rule annually.[6] Paratransit automobiles are excluded from the analysis since they would be equipped with roof, trunk, or rear bumper mounted lifts that do not lift the occupant.

School Buses - The agency does not how many school buses are lift-equipped. Type II school buses [also known as Type A (<10,000 lbs. GVWR) and Type B (>10,000 lbs.)] are designated for use by disabled and special education students. Over the last 6 years, school bus sales have

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[4] 1997 Transit Fact Book, APTA, see page 82, page 85 - Table 50 and page 89 - Table 54.

[5] FTA is the Federal Transit Administration, U.S. Department of Transportation.

[6] The proportion of MPVs >4,540 kg mass (10,000 lbs.) GVWR which are lift-equipped vs those that are ramp-equipped is unknown. NHTSA assumes a 50/50 split.

averaged 35,000 units per year, of which 16 percent are estimated to be small, Type-A school buses and 84 percent are estimated to be large Type B, C and D school buses. Based on 1993 School Bus Fleet magazine data, it is estimated that between 18 to 20 percent of the Type-A school buses are lift-equipped or 1,008 - 1,120 [(.16)(.18 to .20)(35,000)] units per year. For the large, Type-B, C and D buses, it is estimated from the same School Bus Fleet magazine report that 5 to7.8 percent are lift-equipped or 1,470-2,293 [(.84)(.05 to .078)(35,000)] units per year [7] Therefore, combining the Type A, B, C and D lift-equipped school bus estimates together yields 2,478-3,413 total lift-equipped units per year. The Access Board's guidelines apply to school buses implicitly due to the Rehabilitation Act of 1973, which mirrors the ADA. NHTSA is not mandating that school buses be equipped with lifts. But if they are voluntarily equipped with lifts they must meet FMVSS No. 404 and install an FMVSS No. 403 compliant lift.

Over-the-Road Buses (OTRBs)

The ADA accessibility requirements do apply to OTRBs or what are commonly called interstate buses or motor coaches. A recent departmental final rule requires that 50 percent of the OTRB fleet be accessible by 2006 and 100 percent by 2012.[8] It is expected that accessibility would be accomplished by a level change device - primarily WC lifts. NHTSA's FMVSS Nos. 403/404 standards would apply to OTRBs. According to the OST Regulatory Analysis (PRA) September 28, 1998, 3,000 units are sold annually of which 400 are exported and 400 are converted to

[7] School Bus Fleet, December/January 1993 issue, Bobit Research Department, Bobit Publications, 2512 Artesia Blvd., Redondo Beach, CA. 90278-3296.

[8] Transportation of Individuals with Disabilities; Accessibility of Over-the-Road Buses, Final Rulemaking, Regulatory Analysis (PRA), September, 1998. Also see 63 FR 51670, September 28, 1998, ATBCB 36 CFR Part 1192, 49 CFR Part 38, Americans with Disabilities Act Accessibility Guidelines for Transportation Vehicles, Over-the-Road-Buses; Joint Final Rule.

private motor home use. Therefore, NHTSA assumes the remaining 2,200 units would be subject to FMVSS 403/404 annually, particularly the requirements applicable to vehicles >4,540kg (10,000 lbs.) GVWR.

MPVs <=4,540 Kg mass (10,000 lbs.) GVWR, Trucks, Truck Tractors and Motor Homes

MPVs with lifts which are not used for paratransit are normally personally-licensed vans with GVWR less than or equal to 4,540 kg mass (10,000 lbs.). Lifts are installed in these vans by small companies who specialize in modifying vehicles to make them accessible to persons with disabilities. The agency assumes that in most cases, the vehicle modifiers will perform all modifications, including lift installation, prior to the first retail sale of the vehicle. In this case, the modifier becomes the alterer. In other cases, individuals will bring newly purchased or used vehicles to the modifier to have the modifications and lift installation done. Lifts installed in van/MPV-type vehicles "after first sale" or "aftermarket," do not fall under the purview of FMVSS 404 because they are not new vehicles. However, FMVSS 403, the lift equipment standard would apply to the lifts on these vehicles. Therefore, for the purposes of estimating the population of vehicles subject to FMVSS No. 404, all MPVs with lifts having a GVWR less than or equal to 4,540 kg mass (10,000 lbs.) will not be counted. However, the lifts on these vehicles will add to the population for which FMVSS No. 403 applies. NHTSA is not aware of any published data related to the number of personally licensed MPVs with lifts. The companies which supply most of the lifts to this market (Braun, Ricon, Crow River and Mobile Tech) are privately held and not required to provide data on the number of lifts sold and the percentage of total market share.

In order to make an estimate of personally licensed MPVs with lifts, the following information was used. The 1990 census estimated the U.S. population at 248.7 million. Officials at the Texas Rehabilitation Commission estimate that they fund approximately 150 lift installations annually and that this constitutes about 1/4 of the total number installed in Texas, in personally licensed vehicles. The population of Texas was 6.8 percent of the U.S. population in 1990. Extrapolating the estimated number of lifts installed in Texas to the U.S. population results in 8,800 [150X4/0.068]. Officials in Louisiana estimate that their Vocational Rehabilitation Agency funds 50 lift installations annually and that this represents 1/5 of the total number installed in Louisiana, in personally licensed vehicles. The population of Louisiana was 1.7 percent of the U.S. population in 1990.[9] Extrapolation of this data results in an estimate of 15,000 [50X5/0.017] for the U.S. Finally, officials at the Department of Veterans Affairs (DVA) reported that in Fiscal Year 1994 they funded modifications to 1,846 vans. It is valid to assume that nearly all of these modification involved a lift installation. The total veteran population of the U.S. is about 11 percent of the total population. It may be reasonable to assume that the veteran population contains a higher level of persons with disabilities than the overall population due to injuries incurred during wartime. Extrapolating the estimated lift installations in the DVA to the entire U.S. population should result in a value that defines the upper end of the likely range of lift installations. This extrapolation results in a value of 17,000 [1846/0.11] lifts.

[9] Although the magnitude of the U.S. population has increased to an estimated 272 million people, the agency assumes the Texas and Louisiana population proportions are about the same.

Table VI-1 Annual Number of Vehicles Equipped with Lifts by Vehicle Type

>4,540 kg GVWR	No. of Vehicles	Installed by OEM or AM
Transit Buses	3,000-4,000	OEM [1] (403/404)
Paratransit Buses	287- 382	OEM (403/404)
Paratransit MPVs/Vans [2]	323- 430	OEM (403/404)
School Buses	2,478-3,413	OEM (403/404)
OTRB	2,200	OEM (403/404)
Sub-Total	8,288-10,425	
<=4,540 kg GVWR		
MPVs/Vans [3]	8,800-17,000	AM (403 only)
Total	17,088-27,425	

1/ OEM = lifts installed prior to first commercial sale. FMVSS No. 403/404 apply.

2/ NHTSA assumes the paratransit MPVs/vans exceed 4,540 kg GVWR for analysis purposes.

3/ Only FMVSS No.403 applies here. Due to the economies of scale, the aftermarket (AM) would be installing FMVSS No.403 complaint lifts. The variation in the range of MPVs <=4,540 kg mass (10,000 lbs.) GVWR accommodates trucks, truck tractors and motor homes for which exact counts are unavailable, but for which the lighter, personal lifts would be used. The total compliance costs associated with trucks, truck tractors and motor homes is assumed to be very small because of the very small number of lifts involved.

Based on the data from Texas, Louisiana and the DVA, the number of personally licensed MPVs with lifts installed annually is estimated to be from 8,800 to 17,000. As shown in Table VI-1, the total number of lifts subject to FMVSS No.403 under the SNPRM is between 17,088 and 27,425. The total number of vehicles subject to FMVSS No. 404 e.g., requiring a FMVSS No. 403 lift, is between 8,288 and 10,425. Table VI-1 summarizes the estimated range of vehicle population with lifts by vehicle type, GVWR, and whether FMVSS 403 or both 403/404 would apply.

Cost Estimates

New Lift Hardware Costs - As discussed earlier in Section IV. NHTSA's Supplemental Notice of Proposed Rulemaking, it is believed that most of the lift equipment on the market designed for MPVs > 4,540 kg (10,000 lbs.) GVWR and buses, already meet the proposed minimum performance requirements, except for those items in Table VI-2. The SNPRM proposed additional lift safety features that incur incremental consumer costs. These include: an outer barrier (S5.4.7), standee platform markings (S5.4.10), control system lettering size and illumination per FMVSS No.101 (S5.7), threshold warning device (S5.1., S5.1.1 and S5.1.2), as well as several interlocks [e.g., Anti-Crush Interlock (S5.10.2.7), Occupied Outer Barrier Interlock (S5.10.2.8), Occupied Roll Stop Interlock (S5.10.2.9) and Occupied Bridging Device Interlock (S5.10.2.10)]. A relay switch would have to be added as well to the lift control system in order to process the lift interlock signals. The lift interlock signals essentially override the operator's controls and stop the lift. In the Final Rule, the requirements for the Anti-Crush Interlock and the Occupied Bridging Device Interlock were omitted due to cost and feasibility considerations.

Table VI-2 - Hardware Improvements to Existing Lift Designs to Comply with FMVSS 403 and Incremental Consumer Cost per Unit (2001$)*
MPVs>4,540 kg (10,000 lbs.) GVWR and Buses

	Omitted Requirements	Final Rule Requirements
1. Outer Barrier Redesign (S5.4.7) Additional 2"-3" of Height		$32.85
2. High Contrast Standee Platform Marking (S5.4.10)		$5.48
3.Control System Lettering Size and FMVSS 101 Illumination (S5.7)		$16.43
4. Threshold Warning Device (S5.1) + Visual/Audible Signal		$65.70
5. Anti-Crush Interlock (S5.10.2.7)	$65.70	
6. Occupied Outer Barrier Interlock Device (5.10.2.8)[10]		$32.85
7. Occupied Inner Roll Stop Interlock Device (S5.10.2.9)		$32.85
8. Occupied Bridging Interlock Device (S5.10.2.10)	$32.85	
9. Lift Interlocks Relay Switch		$21.90
Incremental Consumer Cost per Lift		+$208.06

* Cost includes permanent silk screened FMVSS label @ $1.00/unit.
1997$ to 2001$ by conversion factor of 1.0746

Table VI-2 contains several rough estimates based on engineering judgment such as the lift interlock relay switch. NHTSA contacted Tapeswitch Corporation (Farmingdale, NY) for simple contact switch hardware costs analogous to the hardware required for the threshold warning device and anti-crush interlocks as well as outer barrier, inner roll stop and bridging device interlocks.[11] Tapeswitch Corp. manufactures industrial quality floor mats of various sizes and areas with imbedded contact switch technology requiring low amps and <=24 volts for operation. The mats are about 3/32" high and require about 5 lbs. of force anywhere on the mat surface to

[10] A load cell manufacturer/supplier, Gagetek, Inc., 11470 Sunrise Gold Circle, Rancho Cordova, CA 95742, estimates about $30 each 1997$ for the inner roll stop, outer barrier and bridging device sensors. These would be highly sensitive to load, and possess high durability, high shock resistance, weather resistance, low voltage, and require 20,000 unit sales/yr.

[11] Mr. Rick Nemeck, Sales, Tapeswitch Corp., 100 Schmitt Blvd., Farmingdale, NY 11735. FAX 516-630-0454 and 1-800-234-8273.

close a circuit and send a signal to the relay switch. This type of technology is a good analog for estimating the cost of the approximate 450-600 mm (18" X 24") threshold warning contact surface, and the approximate 150-575 mm (6" X 23") outer barrier, inner roll stop and bridging device contact surface areas. Similarly, for the anti-crush interlock, a ribbon switch (about 2,200 mm or 88" long) including mounting hardware would be added around 3-sides of the perimeter/ periphery of the platform's bottom surface. The Tapeswitch ribbon switch has a 12 ounce contact pressure requirement. A relay switch would have to be added to the lift control system to process the various interlock signals. The cost of a threshold warning signal lamp (and red lenses) or audible warning signal has also been incorporated into Table VI-2.

Certification Equipment Cost - NHTSA has specified many of the lift requirements in objective, quantitative terms so that performance can be measured in the laboratory. The certification cost analysis assumes that the lift manufacturers have a test laboratory with complementary computer, software, and printer/plotter capability and that they own most of the necessary test tools. The agency believes that most lift companies already use a fixture capable of a 2,400 lbs. ultimate test load. So, this would not be a new cost. The dynamic outer barrier test and inner barrier loading tests, using the WC test device, will require speed sensing equipment in order to establish WC control settings. The lift ambient noise levels, warning sound levels and platform lighting tests, for example, will require audiometer and light intensity measurement equipment. A set of dead weights, with loading pallet, up to 2,400 lbs. will be needed for Static Test I (600 lbs.), II (1,800 lbs.) and III (2,400 lbs.). In other areas, a hand-held force gauge or pneumatic/ hydraulic piston and load cell may be needed. In addition, string potentiometers (displacement transducers) may

be needed to measure and record deflection. Force and deflection levels would have to be plotted and documented for compliance purposes.

Despite the measurement of coefficient of friction (COF) being a simple Block Test, a special equipment set-up will be required to apply, measure and record loads for a number of repeat tests. For the dynamic outer barrier test and inner barrier quasi-static loading test with the WC Test Device (e.g., a powered cross-braced wheelchair meeting prescribed requirements such as mass, CG location, front wheel/ rear tire diameter, etc.) would have to be purchased at $4,000-$5,000 along with spare parts. Although they already have most of the equipment they need in order to meet existing requirements, the added cost of certification test equipment is estimated to be in the range of $20K-$40K for both personal lifts and commercial lifts.[12] This one-time capital equipment cost would normally be amortized over the first years production and passed on to the consumer. However, for analysis purposes and simplicity, the 141 lift certification equipment costs will be amortized or averaged over a 10 year lift production cycle. Similarly, the associated tool and die costs, which are one-time capital equipment costs, will be amortized or averaged over a 10 year lift production cycle and passed on to the consumer.

Certification Labor Cost

The certification test labor hours estimated for the proposed FMVSS No. 403 are 80 hours for an Engineer ($35 /hour) and 100 hours for an Engineering Technician ($15/hour) or $4,300 [80 X $35 + (100 X $15)] (1997$) per lift. The labor hours are itemized in Table VI-3.

[12] This is a rough estimate. NHTSA does not have a cost study to support this.

FMVSS No. 141 Lift Certification Labor Hours of the Preliminary Regulatory Evaluation and Regulatory Analysis Platform Lifts for Motor Vehicles FMVSS Nos. 141 and 142 on page VI-14 to VI-16.

Lift Improvement Hardware Labor Cost

There will also be design engineering/production engineering labor costs as well as one-time tool and die capital equipment cost for the new lift hardware components. The variable design/production engineering labor costs are estimated to be about $20K - $40K per lift manufacturer to modify two (2) existing lifts and includes owners manual inserts and installation instruction upgrades. The certification labor cost and the design engineering/ production engineering labor cost per unit is passed on to the consumer. The tool and die costs are estimated at $5K - $10K per 2 lift designs. The one-time tool and die capital equipment costs are amortized over a 10 year lift production cycle and are passed to the consumer in higher lift costs. These costs are added to the incremental hardware improvement costs.

Total Labor or Variable Cost per Lift - There are at least 10 known lift manufacturers namely: Braun, Lift-U, Ricon, Mobile-Tech, Crow River, T.E.S./Provost, Stewart & Stevenson, Environmental Equipment Corporation, Collins and Champion. There may be other unknown lift manufacturers. The assumption is made that about 6 manufacturers will have 2 basic lift designs to certify over the next 10 years for (Public-Use) MPVs and buses >4,540 kg (10,000 lbs.) GVWR. The total certification labor cost for these manufacturers is estimated to be $52,000 = (2 X 6 X $4,300).

Total Capital or Fixed Cost

The certification test equipment cost per lift for (Public-Use) manufacturer is estimated to be about $20K-$40K per manufacturer and the total industry cost for test equipment will be $120,000-$240,000 [(6 X $20K) to (6 X $40K)]. There will also be a one-time capital equipment cost [e.g., lift improvement hardware) for tooling of $5K-$10K per lift manufacturer (based on 2 lift designs) for the hardware items listed in Table VI-1] or $30,000-$60,000 [(6 X $5K) to (6 X $10K)] for the industry. The lift manufacturers are considered low volume manufacturers making about 5-8 hand assembled lifts per day per manufacturer, on the average. The tools for assembly to meet the new FMVSS are low-tech jigs and fixtures used for drilling holes. The total capital equipment cost for 6 lift manufacturers would be $150,000-$300,000 [($120K-$240K)+ ($30K-$60K)] for test equipment and tool/dies. Table VI-4 shows an approximate $5 cost amortized on a 10 year production cycle that is passed on to consumer in higher lift costs.

Table VI-4 Variable and Fixed Incremental Cost per Lift over 10 Year Production Cycle
MPVs >4,540 Kg (10,000 lbs.) GVWR and Buses

Cost Category	Amount (2001$)	# of Designs, # of Manufacturers
Certification Labor	$55,897 (2 X 6 X $4,621)	2 Lift designs, 6 Manufacturers.
Certification Equipment	$128,952-$257,904	6 Manufacturers
Design/Production Labor	$128,952-$257,904	2 Lift designs, 6 Manufacturers
Tool and Dies	$32,238-$64,476	2 Lift designs, 6 Manufacturers
Tot. Variable + Fixed Costs	$346,021-$636,163	
Cost per Unit Range Average Cost per Unit	$3.32 - $7.67 $5.50	

* 10 years of production for MPVs > 4,540 kg GVWR = [(8,288-10,425) X 10] = 82,880-104,250
1997$ to 2001$ by conversion factor of 1.0746

Total Cost for Public-Use Lifts = Hardware Cost + Capital Fixed Costs $213 = ($208 + $5)

Costs of Minimum Lift Requirements for MPVs <= 4,540 kg (10,000 lbs.)

NHTSA believes that the majority of features and levels of performance placed on lifts installed on MPVs < = 4,540 kg (10,000 lbs.) GVWR already exist in commercial lifts designed to comply with the SAE Standard. However, the private use lighter duty lifts do not require the additional height on the outer barrier and the inner roll stop interlock, which reduces the overall cost of a private use vs. public use lift by about $64. Thus, the agency estimates the increased hardware cost of private use lifts to meet FMVSS No, 403 would be $142. And similarly to Public-Use, Total Cost for Private-Use Lifts = Hardware Cost + Capital Fixed Costs $147 = ($142 + $5).

Total FMVSS Consumer Cost (Compliance Cost) - Total annual cost of the Final Rule including transit buses, paratransit buses and vans/MPVs, OTRBs, school buses and personal vans/MPVs including the approximate capital cost is shown in Table VI-5.

Table VI-5 Summary of Incremental Consumer Costs for Lifts Certified to FMVSS No. 403

Vehicle Type	Cost per Vehicle (2001$)	Total Consumer Cost (2001$)
Transit Buses	$213	$639,000 – 852,000
Paratransit Buses	$213	$61,131 – 77,106
Paratransit Vans/MPVs	$213	$68,799 – 91,590
OTRB	$213	$468,600
School Buses	$213	$527,814 -726,969
Total Private Use Vehicles		$1,765,344 – 2,216,265
Personal Use Vans/MPVs	$147	$1,293,600 – 2,499,000
Total		$3,058,944 – 4,715,265$

The total consumer cost (compliance cost) of the FMVSS 403 is estimated to be $3.1M - $4.7M per year. The FMVSS No. 404 vehicle certification costs related to S5.12 - Owner's Manual, S5.13 - Installation Instructions and S5.7 -Control Systems are assumed to be minimal.

VII. LEADTIME

Since the lift-equipped bus requirements are based on existing standards and manufacturing specifications, for the most part, NHTSA does not anticipate any lead time problems. Some existing lift components may need to be modified (e.g., make the outer barrier higher by 2-3 inches or add lift interlock sensors) which would involve design and production engineering labor. An inner roll stop will be added to public-use lifts designed for vehicles<= 4,540 kg (10,000 lbs.) GVWR. Several new lift interlock devices will be integrated into existing lift equipment, as well as other modifications (e.g., threshold warning device, lift illumination, high contrast platform foot markings, sections for owners manual revised, existing installation instructions upgraded, etc.) will require design and engineering labor. Sufficient time is allowed after the Final Rule is issued for the lift manufacturers to certify their equipment to the additional test requirements (e.g., deflection tests, static tests I, II and III). For this reason, the agency believes an effective date of 2 years following publication of the Final Rule provides adequate leadtime.

VIII. REGULATORY FLEXIBILITY ANALYSIS

The Regulatory Flexibility Act of 1980 (Public Law 96-354) requires each agency to evaluate the potential effects of a proposed rule on small businesses (SB), small organizations (SO) and small governmental jurisdictions (SGJ). The businesses and organizations likely to be affected by a rulemaking concerning "Lift Systems for Accessible Motor Vehicles" are:

- Transit, paratransit, intercity, and school bus manufacturers (SB),
- Lift manufacturers (SB),
- Public/private transit and paratransit bus owners and operators (e.g., municipal transit authorities) (SO/SB),
- Public/private and city/county school bus operators (SB/SO/SGJ),
- School bus manufacturers that make/sell their own lift equipment (SB),
- Dealers and distributors of school buses (SB), and
- Companies that remanufacture buses (SB).

The Small Business Administration (SBA) defines a manufacturer of Motor Vehicle Bodies (NAICS code 336211) and All Other Motor Vehicle Parts (NAICS code 336399) as a small business if the company has less than 1,000 and 750 employees, respectively. As shown in Table VIII-1, NHTSA performed an analysis of SBA status for the affected manufacturers and determined that many small business and small entities will be affected by the subject rule. As shown, many of the platform lift and bus manufacturers are small business entities. The small businesses, small organizations, etc., that buy these products will pay more as any incremental FMVSS cost increases will be passed on to the consumer. The agency has concluded that there may be a significant cost impact on a substantial number small businesses, small organizations and small governmental jurisdictions.

Table VIII-1 SUMMARY OF SBA STATUS (<= 1,00 employees)

1. Transit Bus and Paratransit Bus Manufacturers (Required by ADA)
Large –14 Small -10 Unk - 4
(Includes remanufactured transit buses and school bus manufacturers that make transit buses)

2. Intercity Buses, Motor Coaches, Over-the-Road Buses (Required By the ADA)
Large –3 Small –2 Unk -5
Some double counting may occur between #1 and #2 as some motor coach makers also manufacturer transit buses.

3. Paratransit Vans (ADA required) and Personal Vans (Not ADA required) According to NMEDA there are 450 adaptive equipment dealers.[1] The majority, if not all, are small businesses. Some percentage of these such as van modifiers, converters and alterers install lifts/ramps. Personal vans lifts would be installed "after first sale." Vehicle FMVSS No. 404 would not applicable, but equipment FMVSS No. 403 would be. This ensures FMVSS applicability to personal MPVs and paratransit MPVs.

4. Wheelchair Lift Manufacturers (Required By ADA)
Large - 2 Stewart & Stevenson, Collins Industry
Small - 5 Braun, Champion, EEC and Lift-U, Ricon
Unk - 3

5. School Bus Manufacturers (Not required By ADA)
Large - 5 Thomas, Blue Bird, AmTran, Carpenter, Navistar
Small -1 Collins
Unk -6

(Some double counting may occur with transit/paratransit bus manufacturers as some school bus makers also make paratransit and transit buses e.g. Collins, Blue Bird, Thomas, Carpenter, AmTran and Navistar.)

6. School Bus Dealers/Distributors
465 dealers/distributors - small businesses based on dollar volume and CFR 121

NHTSA is requiring minimum lift performance requirements to lift-equipped school buses, but NHTSA is not requiring that all school buses be equipped with lifts, only those lifts voluntarily purchased are required to meet the minimum specifications of the Final Rule. All school bus

[1] National Mobility Equipment Dealers Association (NMEDA)

manufacturers offer optional lift equipment and, in some cases, lifts are standard equipment. Similarly, for personal MPVs/vans, trucks, truck tractors and motor homes, NHTSA is not mandating or requiring lift equipment. However, if these vehicles are lift-equipped they must meet FMVSS No. 403.

The SBA defines New and Used Car Dealers (NAICS 441110 and 441120) with less than $21M and $17M in receipts respectively as small businesses. The SBA also defines All Other Motor Vehicle Dealers (NAICS 441229) with less than $5M in receipts as a small business. There are approximately 465 school bus dealers and distributors in the United States. During the last 6 years, about 35,000 (avg.) school buses were sold annually, or about 75 buses per dealer on average. In order to achieve $5M in sales receipts, the average dealer would have to sell about 83 buses annually assuming a cost of $60,000 per bus.[13] Thus, most bus dealers probably are small businesses.

Although some federal funds were initially made available via FTA (formerly UMTA) demonstration projects to implement the lift provisions of the ADA, public transit municipalities and paratransit companies across the U.S. will bear the economic burden of the Final Rule. Their annual revenues are made up of passenger fares, state and local resources, Federal resources and other earnings. Depending on the future level of State and Federal subsidies, passenger fare increases may be necessary to implement the wheelchair accessibility requirements of the ADA. Per the definitions of the Regulatory Flexibility Act, it is believed that many transit authorities and many paratransit operators are considered small organizations/businesses. There are also

many private transit bus operators which provide public transportation. The American Public Transit Association indicates that there are over 6,000 transit and paratransit bus operations in the U.S. which provide public/private transportation.

DOT regulation requires that over-the-road buses required by public entites (or a contractor to a public entity) must also provide a level change mechanism or boarding device for wheelchair and other mobility aid users. NHTSA is requiring that lift-equipped over-the-road buses meet the FMVSS No. 403/404 requirements of the Final Rule.

The Regulatory Flexibility Act of 1980 (Public Law 96-354) requires agencies to evaluate the potential effects of their proposed rules on small businesses, small organizations and small governmental entities. Section 603 of the Act requires agencies to prepare and make available for public comment an initial Regulatory Flexibility Analysis (RFA) describing the impact of rules on small entities. Section 603(b) of the Act specifies the following content for the RFA:

o A description of the reasons why action by the agency is being taken;

o A succinct statement of the objectives of, and legal basis for, the Final Rule;

o A description of and, where feasible, an estimate of the number of small entities to which the Final Rule will apply;

o A description of the reporting, record keeping and other compliance requirements of the Final Rule including an estimate of the classes of small entities which will be subject to the requirement and the types of professional skills necessary for preparation of the report or record;

o An identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap, or conflict with the Final Rule;

o Each initial regulatory flexibility analysis shall also contain a description of any significant alternatives to the Final Rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the proposed rule on small entities.

The following is the agency's Final Regulatory Flexibility Analysis for the Final Rule:

A. A description of the reasons why action by the agency is being taken.

The objectives of the Final Rule are to support the Americans with Disabilities Act (ADA) safety requirements for wheelchair lifts on vehicles such as transit, paratransit buses and school buses.

B. A succinct statement of the objectives of, and legal basis for, the Final Rule.

The objectives of the Final Rule are to support the requirements of the ADA specifically the Architectural and Transportation Barriers Compliance Board, 36 CFR Part 1192 (Part III), Americans with Disabilities Act (ADA) Accessibility Guidelines for Transportation Vehicles, Final Guidelines. (See 56 FR 45558, September 6, 1991). NHTSA's NPRM was issued (58 FR 11562, February 26, 1993) in support of these requirements and proposed incorporating many proven wheelchair lift safety and design features prescribed by the ADA, FTA (formerly UMTA) and the Department of Veteran Affairs into a Federal Motor Vehicle Safety Standard. Several new NHTSA initiated safety requirements were also proposed. An SNPRM was issued to make these tests more objective and repeatable from a test procedure point of view. Other new wheelchair lift improvements such as 3 new lift safety interlock features, durability cycle testing and corrosion resistance requirements were included in the Final Rule.

C. A description of and an estimate, if feasible, of the number of small entities to which the Final Rule will apply.

Many hundreds of small business entities will be affected as well as numerous other small organizations and small governmental jurisdictions. There are a number of small organizations and small government jurisdictions that will have to pay more for a wheelchair lift. The agency does not have an estimate of their number. The affects will be direct and indirect. The requirements are being proposed in the form of a wheelchair lift equipment standard (FMVSS No. 403) and a vehicle-based standard FMVSS No. 404. Many of the lift manufacturers which are small businesses would be directly affected as would many of the transit/paratransit bus manufacturers, school bus manufacturers, and van converters/modifiers which alter minivans and full-size vans for personal use or paratransit use.

The lift manufacturers would directly incur the added design and manufacturing expenses needed to modify their equipment to meet the new FMVSS requirements, if necessary, as well as incur the added costs of conducting certification testing, identifying the applicable vehicles that their lift designs fit and providing installation instructions/documentation for each configuration. The incremental FMVSS consumer cost is estimated to be $285-$305 for a wheelchair lift designed for MPVs >4,540 kg (10,00 lbs.) GVWR and buses, and $233 for wheelchair lifts designed for MPVs<= 4,540 kg (10,000 lbs.) GVWR, trucks, truck tractors and motor homes. (NOTE: MPVs<= 4,540 kg (10,000 lbs.) GVWR generally include minivans, which are lower to the ground by design, and can be equipped with power ramps for personal vans or mechanical ramps for paratransit minivans. MPVs greater than >4,540 kg (10,000 lbs.) GVWR include full heavy duty full-size vans in which the vertical distance above the ground necessitates a vertical lift device.] The OEM manufacturers of lift-equipped transit/paratransit buses must comply with

FMVSS No. 404 (e.g., vehicle must have a lift conforming to FMVSS No. 403). The lift manufacturers will pass on any incremental FMVSS compliance costs on to the consumer (e.g., OEM's, alterers, modifiers, converters, etc.)

FMVSS No. 403 does not apply to ramps that might be used on minivans but it would apply to lifts on minivans and full-size vans. GM, Ford and Dodge do not modify vans for their disabled customers, and as such, are not subject to FMVSS No. 404 because customers must take their van "after first sale" to a recommended aftermarket adaptive equipment dealer/modifier. Many of these dealers install lifts, but the current number is unknown. The van modifier or converter, putting a lift on a new vehicle, must install the lift per the lift manufacturer's instructions in order to ensure FMVSS No. 404 certification and must follow OEM pass-through certification rules. In this case, the installer would be a vehicle alterer. If a FMVSS No. 403 compliant lift is installed in the "aftermarket" (after first sale), FMVSS No. 404 is not applicable. The lift manufacturers will pass on the incremental FMVSS cost to aftermarket (AM) converters and alterers that modify vans for disabled persons. The vans may be personally-licensed in which case the disabled person will be charged a higher incremental FMVSS consumer cost or a private contractor operating paratransit vans, many of which are small businesses, will be charged a higher incremental FMVSS consumer cost.

Small Businesses include the wheelchair lift manufacturers, transit/ paratransit bus manufacturers, school bus and school bus dealers (public and private schools), multi-stage manufacturers (e.g., vehicle converters and alterers) that install lifts/ramps and modify vans w th

adaptive driving equipment for personal use or public transportation paratransit use.

Other small businesses included are the makers of remanufactured buses subject to the ADA, the makers of FTA Section 18 vehicles. Also, senior citizen facilities and nursing homes that operate shuttle buses, public and private transportation contractors, etc., may be small businesses. There are small non-profit organizations that would be affected by a price increase such as churches, synagogues, veterans groups, etc. There may be small public and private educational institutions that employ wheelchair lift-equipped shuttle buses that would be affected. There also may be small governmental jurisdictions that operate public shuttle bus transportation at airport facilities or community public transportation services. Thus, there are potentially hundreds of small businesses, small organizations and small governmental jurisdictions affected.

The agency has concluded that as a result of this rule, there may be a significant economic impact ($233-$305 incremental consumer cost), direct and indirect, on a substantial number of small businesses, small organizations and small governmental jurisdictions.

D. A description of the projected reporting, record keeping and other compliance requirements of the Final Proposed Rule including an estimate of the classes of small entities which will be subject to the requirement and the types of professional skills necessary for preparation of the report or record.

There are no applicable reporting requirements. Each lift manufacturer must identify in its installation instructions the appropriate and suitable vehicle population by make/model and this is reported in the installation instructions with each lift. The lift manufacturer has the burden of certifying compliance with FMVSS No. 403. The OEM vehicle manufactures must certify to FMVSS No. 404. Lift manufacturer certification is passed-through if the OEM and multi-stage manufacturers follows the installation instructions. Multi-stage manufacturers, when installing the lifts in minivans and full-size must ensure that van OEM certification envelopes for other FMVSS requirements (e.g., FMVSS Nos. 208, 214, 201) are not violated in the process.

E. An identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap, or conflict with the Final Rule.

The ADA has duplicate requirements in many areas and the FTA has duplicate requirements in some areas.

F. Each Final Regulatory Flexibility Analysis shall also contain a description of any significant alternatives to the Final Rule which accomplish the stated objectives of applicable statutes and which minimize any significant economic impact of the Final Rule on small entities.

There is one alternative that might minimize any significant impact of the Final Rule on small entities. This alternative would be for manufacturers to install manual or power ramps, rather than power lifts, as these probably would be much less expensive. According to a 1997 APTA

Facts Book, 7.2 percent of the new bus sales in 1995 met accessibility requirements via ramps with 12.8 percent ramp-equipped orders in 1996 and 27.5 percent ramp-equipped planned in future orders. In 1996, about 75 percent of the buses ordered with FTA funds were low floor/ramp equipped buses. Apparently the ramps take up less space and allow more maneuverability for wheelchairs. Many minivans are equipped with folding power ramps, but the floor may have to be lowered. Many, if not all, of the requirement costs could be eliminated, but some of the vehicle interlock requirements might remain along with slip resistance, illumination, foot markings, etc

CONCLUSIONS

FMVSS No. 403/404 is not major within the meaning of E.O. 12866, but is a "significant" rulemaking within the DOT Regulatory Policies and Procedures. No benefits, significant or otherwise, have been quantified although there are qualitative benefits. NHTSA has studied the number of small business entities, small organizations, and small governmental jurisdictions involved and determined that this Final Rule may have a significant impact on a substantial number of small business entities at the $233-$305 incremental consumer cost level. The aggregate consumer cost is $4.46M-$7.00M.

The Unfunded Mandates Reform Act

The Unfunded Mandates Reform Act of 1995 (P.L. 104-4) requires agencies to prepare a written assessment of the costs, benefit and other effects of proposed or final rules that include a federal mandate likely to result in the expenditure of State, local and tribal government funds, in the

aggregate, or by the private sector, of more than $100 Million annually. This Final Rule is not that costly.

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16. 49 CFR 571.210; Standard No. 210; Seat Belt Assembly Anchorages.

17. 49 CFR 571.207; Standard No. 207; Seating Systems.

18. 49 CFR 571.208; Standard No. 208; Occupant Crash Protection. Also see Docket No. 90-05-N01-005 for Canadian Standards and 90-05-N02-004, 005,and 007, for dynamic standards of the 11th National Standards Conference on School Transportation, the British Dept. of Transport and the AZ Dept. of Transportation.

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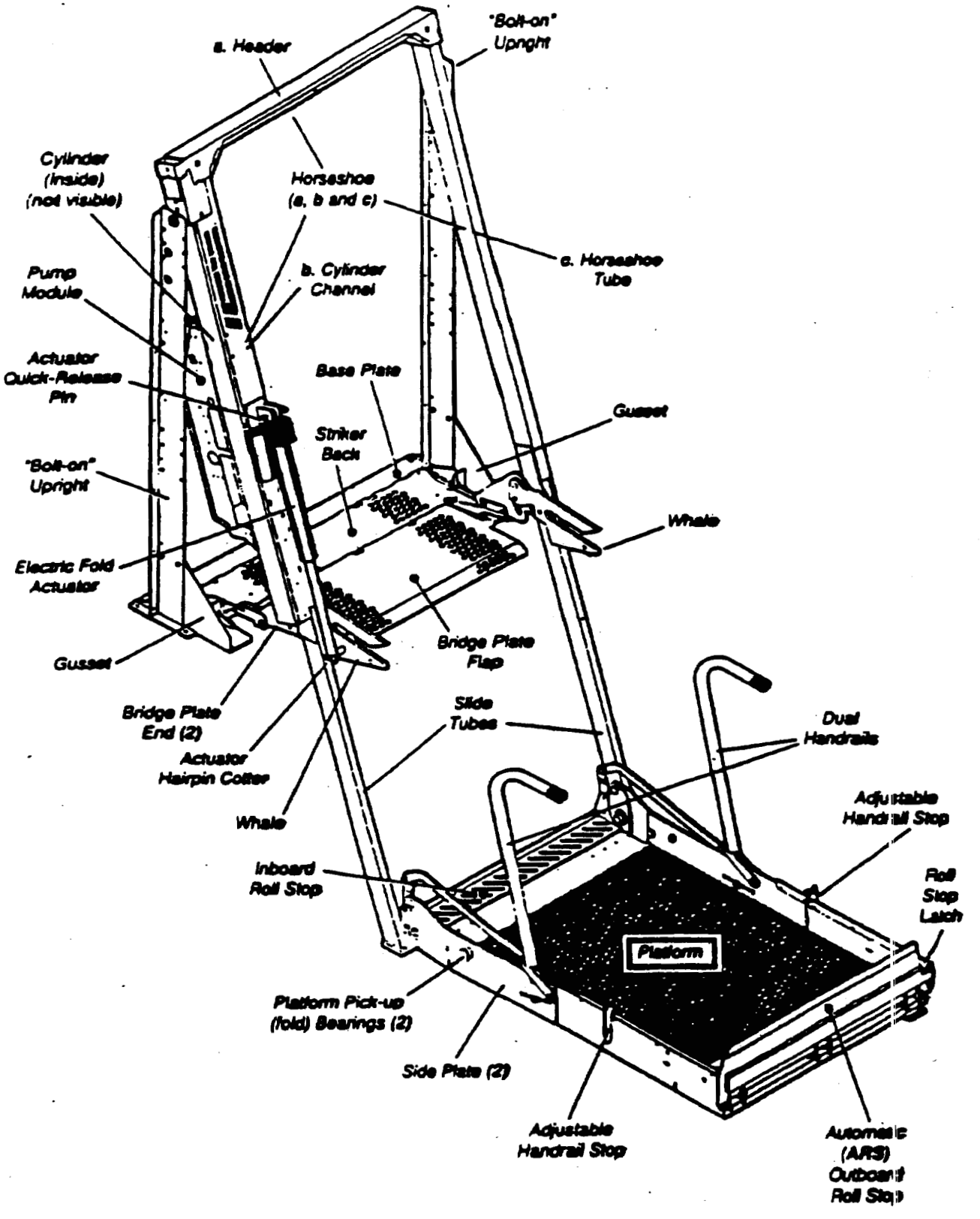
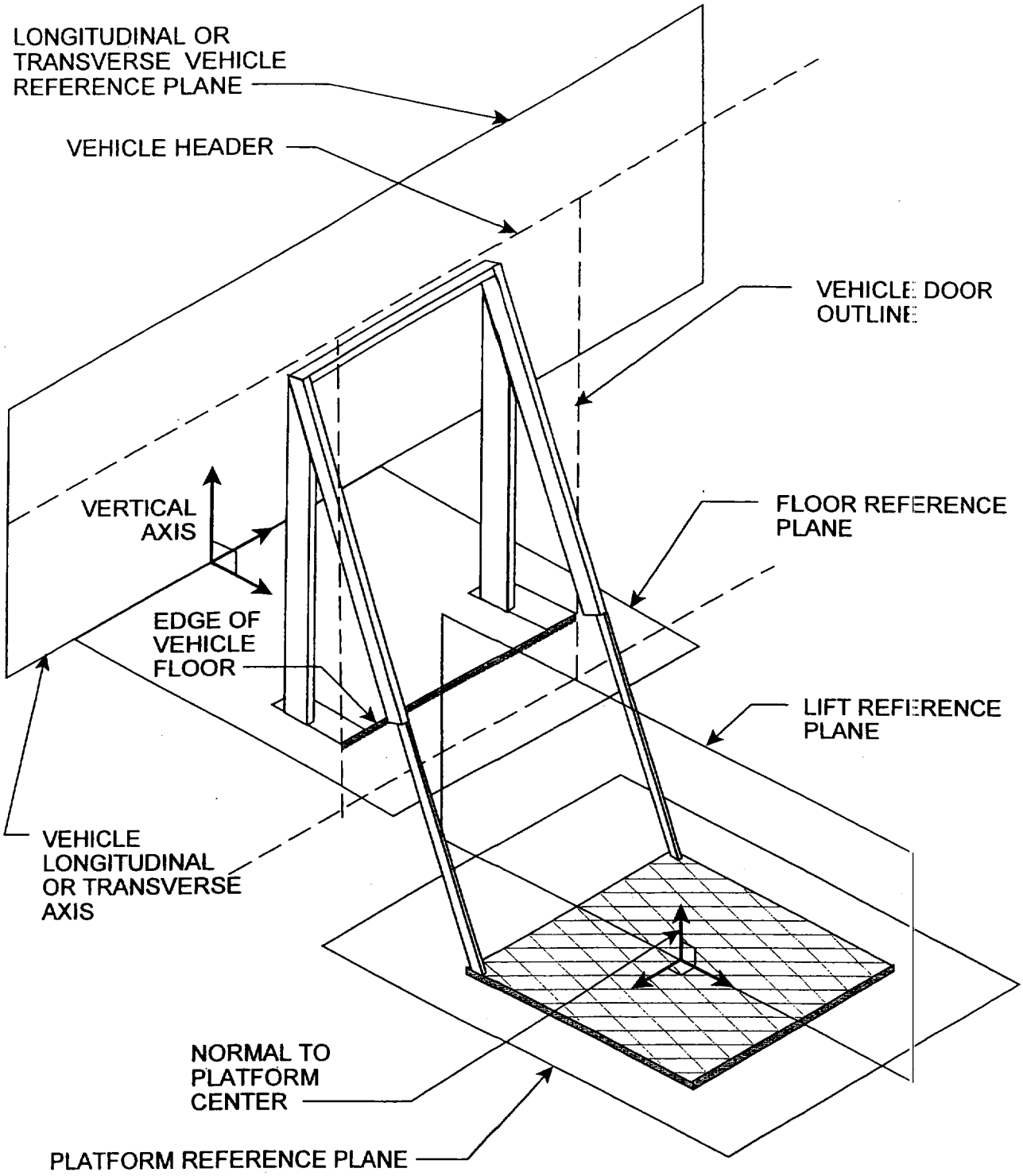


Figure 1 **Diagram Showing the Parts of the Braun Lift**
Copied from Owner's/Service Manual of L211UARS Ultra IV Series Commercial Wheelchair Lift by the Braun Corporation (Reference [2])



PLANES OF REFERENCE

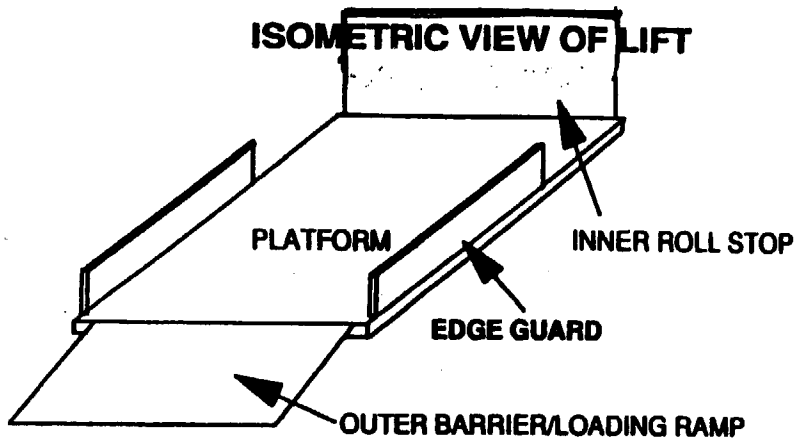


Figure 2. Isometric View of Platform

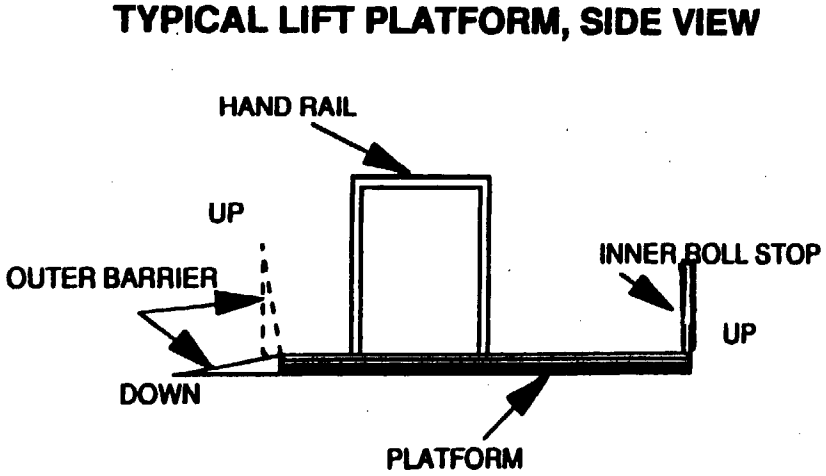


Figure 3. Side View of Lift Platform

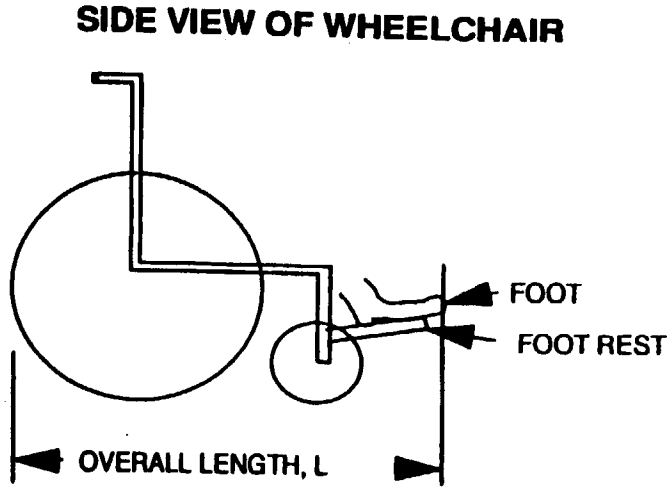


Figure 4. Side View of Typical Wheelchair

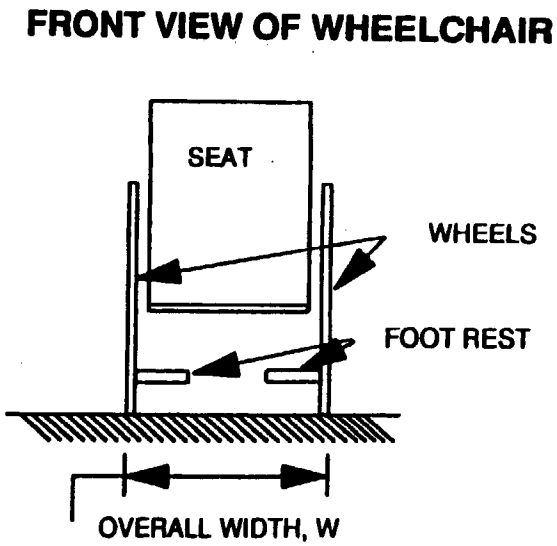
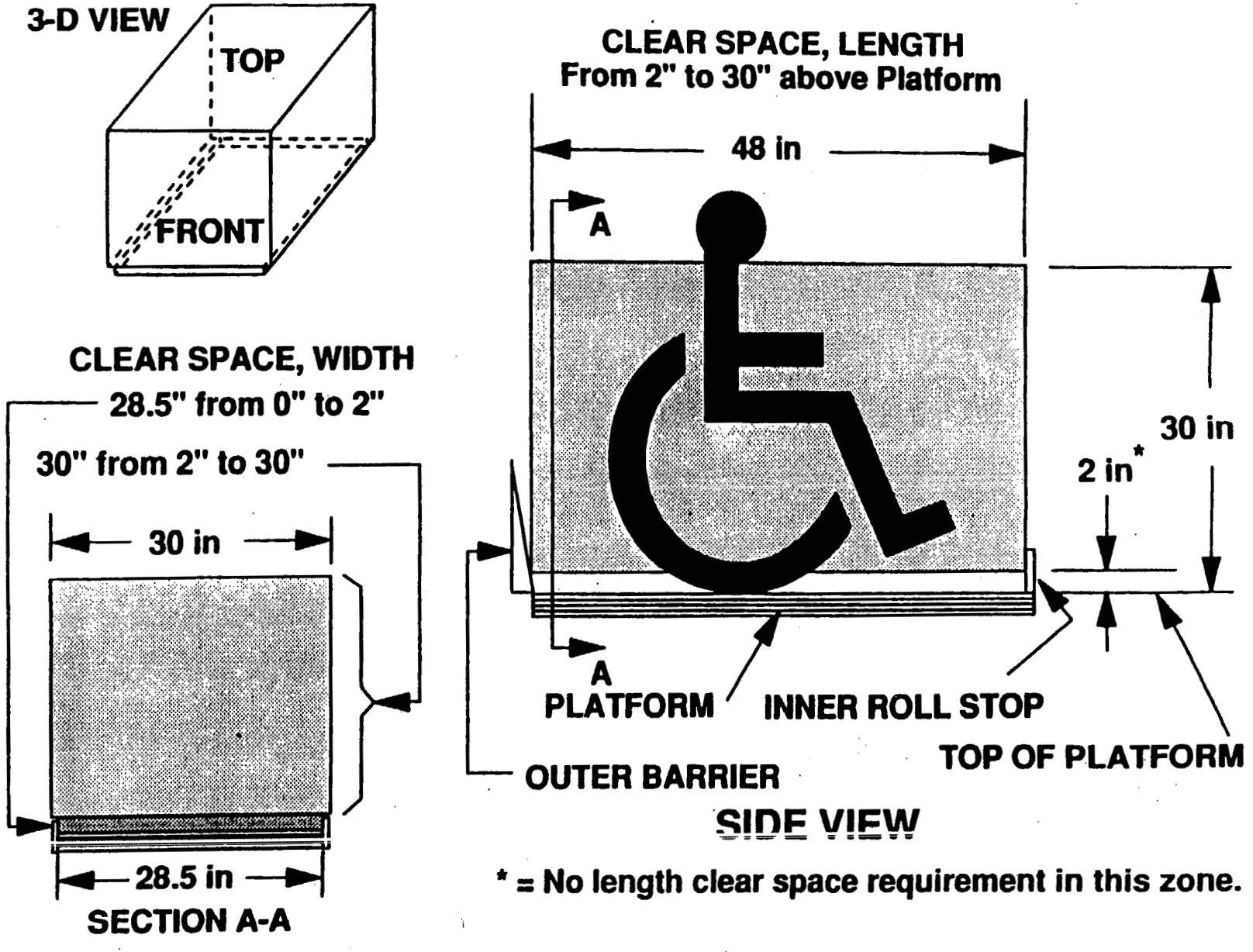


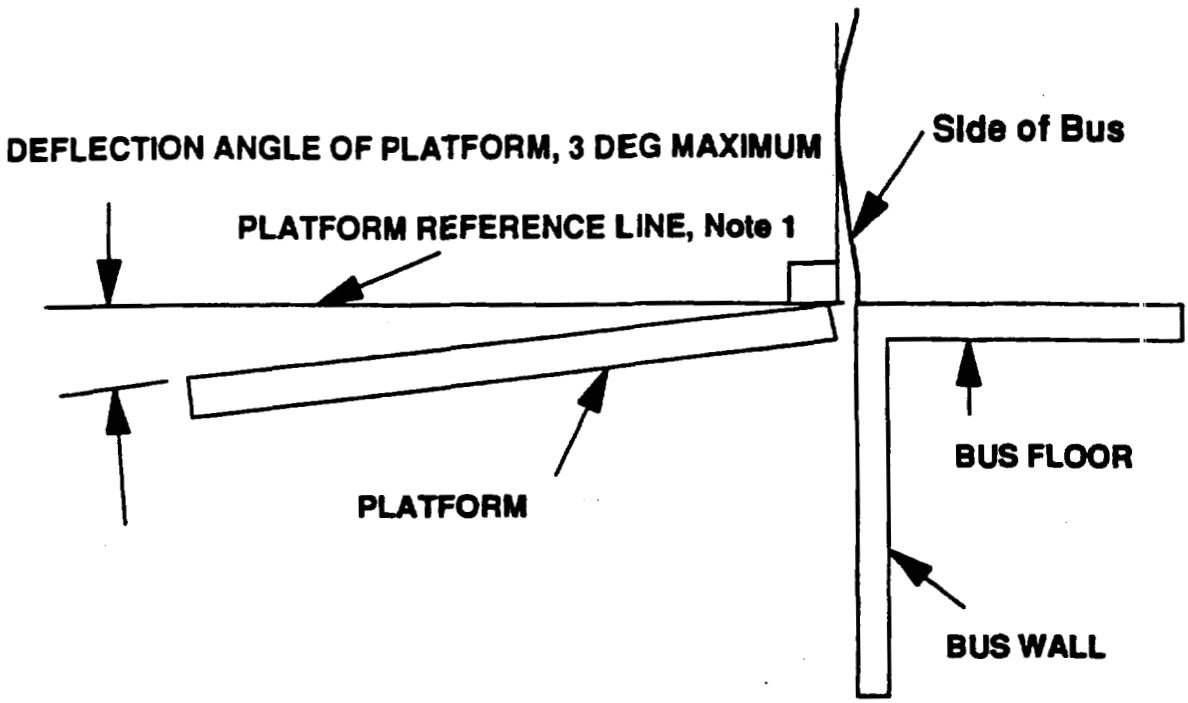
Figure 5. Front View of Typical Wheelchair

FIGURE 6.

LIFT PLATFORM CLEAR SPACE REQUIREMENTS



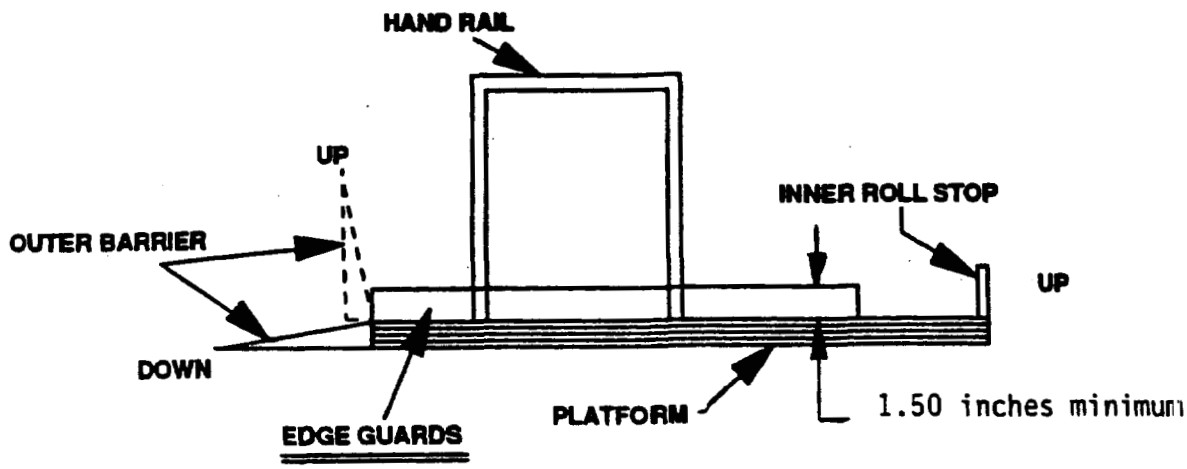
PLATFORM DEFLECTION ANGLE



Note 1. Platform Reference Line Is Measured from the Side of the Vehicle Before and After the Load Is Applied to the Platform.

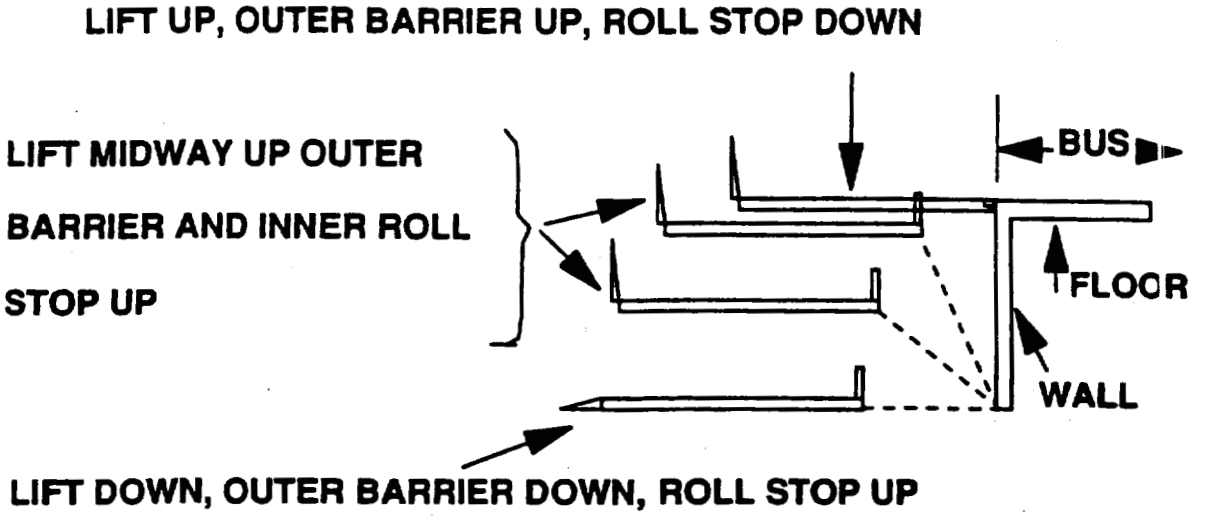
Platform Deflection

EDGE GUARDS

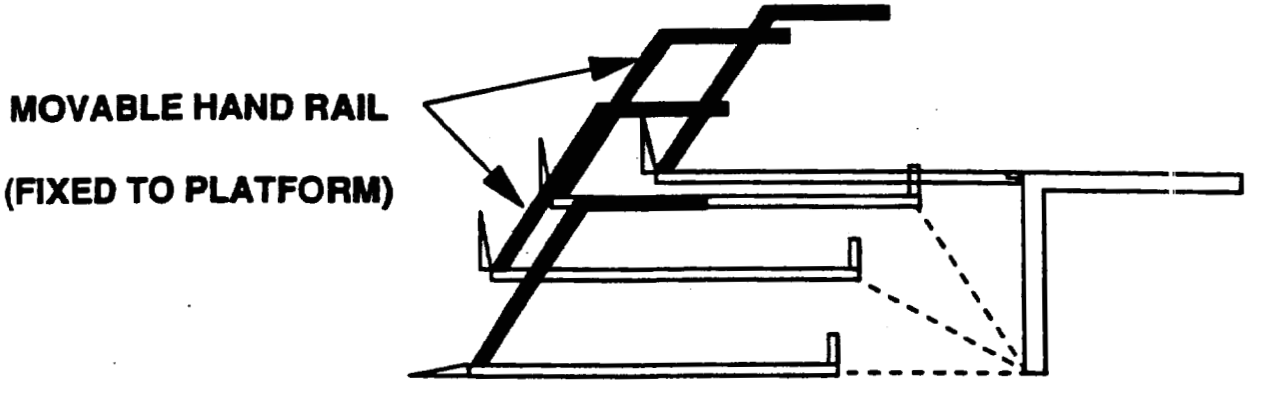


Edge Guards

ARC TYPE LIFT

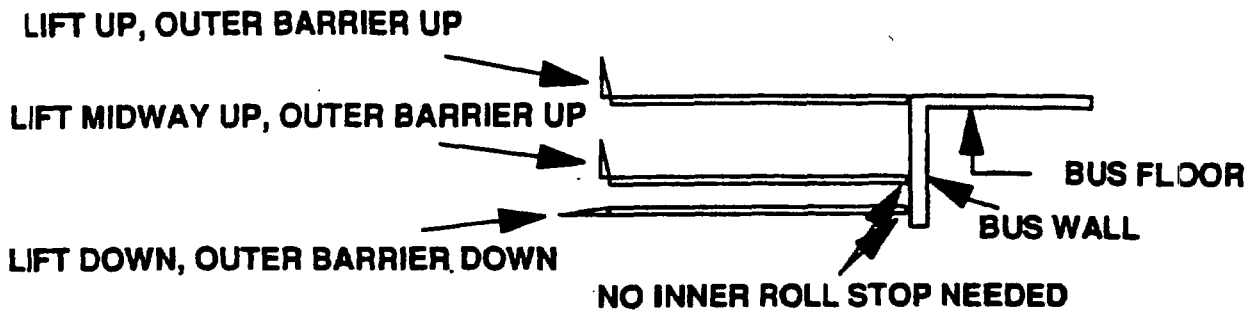


Handrail Detail for Arc Lifts

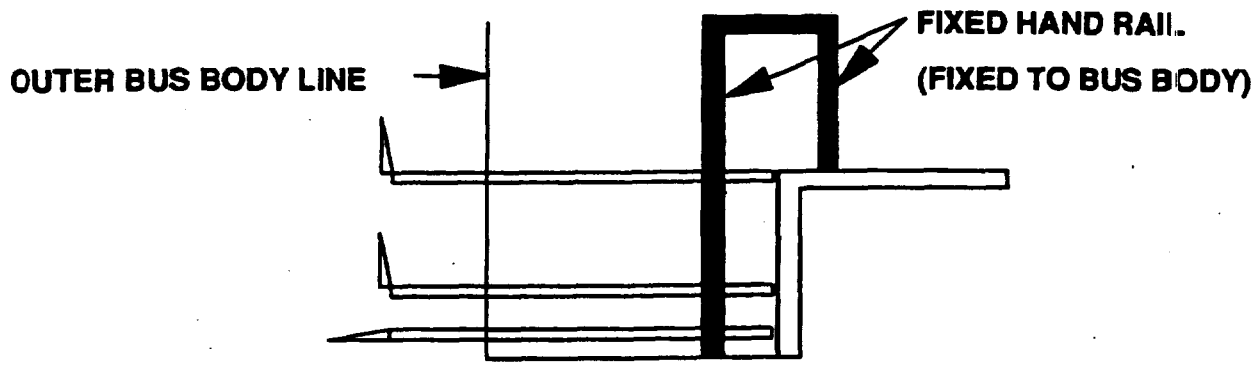


Typical Arc Type Lift

ELEVATOR TYPE LIFT

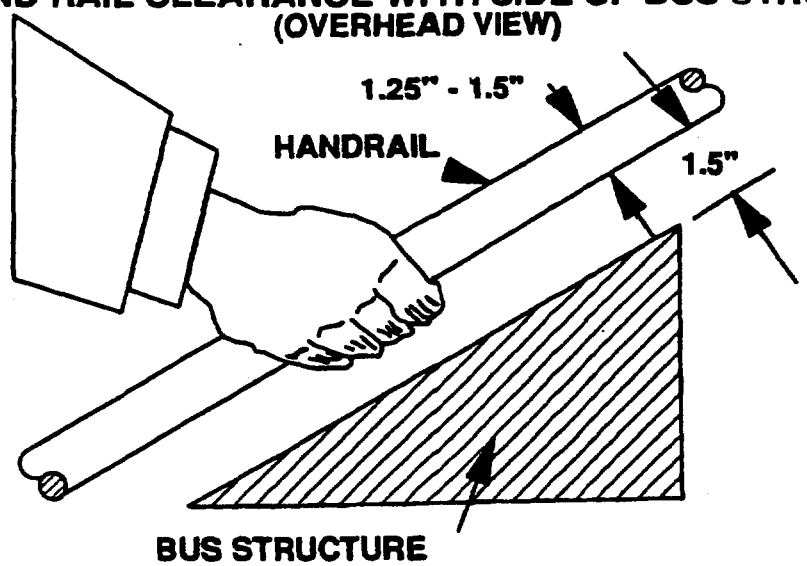


Handrail Detail



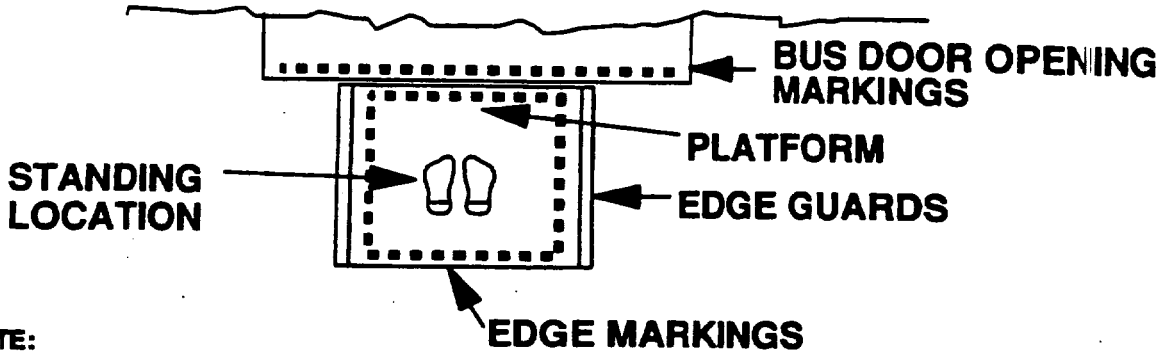
Typical Elevator Type Lift

HAND RAIL CLEARANCE WITH SIDE OF BUS STRUCTURE
(OVERHEAD VIEW)



Handrail Clearance

PLATFORM AND BUS FLOOR MARKINGS



NOTE:
OUTER BARRIER AND INNER ROLL STOP NOT SHOWN

Typical Lift Markings.

DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

GOVERNMENT ESTIMATE

(NHTSA ORDER 422-1)

REQUISITION NUMBER

Initiated by _____ Date 2/15/99 Ext 62586

Reviewed by _____ Date _____

Project Title or Description:
COMPLIANCE TEST
FMVSS NO. 141
WHEELCHAIR LIFT

DETAIL DESCRIPTION	ESTIMATED HOURS	RATE/HOUR	TOTAL ESTIMATED COST (Dollars)
1. DIRECT LABOR *(Specify)*			
MANAGER	30	$46	$ 1380
SENIOR ENGINEER	80	$35	$ 2800
SENIOR TECHNICIAN	100	$15	$ 1500
CLERK TYPIST	40	$8	$ 320
TOTAL DIRECT LABOR			$ 6000.00

2. BURDEN *(Overhead - specify)* DEPARTMENT OR COST CENTER	BURDEN RATE	X BASE =	BURDEN ($)	
	100%	6,000	6,000	
TOTAL BURDEN				$6000.00

3. DIRECT MATERIAL	
PARTS + Materials	500.00
TOTAL MATERIAL	$ 500.00
4. SPECIAL TESTING *(Including field work at Government installations)*	
TOTAL SPECIAL TESTING	
5. SPECIAL EQUIPMENT *(If direct charge - specify in Exhibit A on reverse)*	
6. TRAVEL *(If direct charge)*	
A. TRANSPORTATION	
B. PER DIEM OR SUBSISTENCE	
TOTAL TRAVEL	
7. CONSULTANTS *(Identity - purpose-rate)*	
TOTAL CONSULTANTS	
8. SUBCONTRACTS	
9. OTHER DIRECT COSTS *(Specify in Exhibit A on reverse - explain royalty costs, if any)*	
10. TOTAL DIRECT COST AND BURDEN	
11. GENERAL AND ADMINISTRATIVE EXPENSE *(Rate 25 % of item nos.)*	$ 1625.00
12. TOTAL ESTIMATED COST	
13. FIXED FEE OR PROFIT *(State basis for amount in proposal)* 12%	$ 780.00
14. TOTAL ESTIMATED COST AND FIXED FEE OR PROFIT	$ 14,905

HS Form 68
Aug. 1971

(EDITION OF 11/70 MAY BE USED).

Tapeswitch CORPORATION
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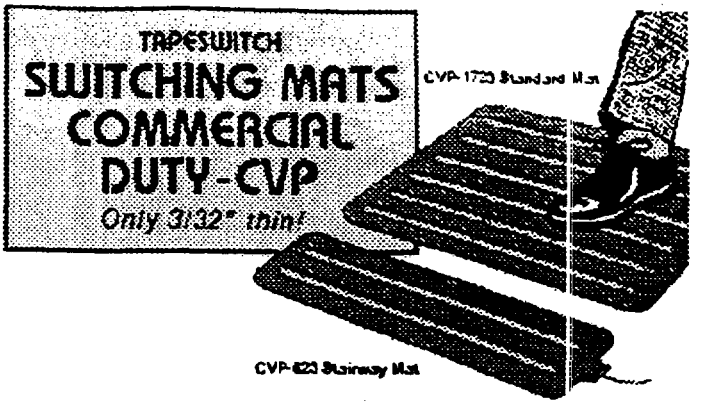
Tapeswitch Home Page
OTHER INDUSTRIAL SAFETY PRESENCE SENSING SWITCHING MATS
CONTROL MATS · ARMOR MATS
TRACTION OPTIMIZER · ANNUNCIATOR KITS



CVP-1723 Standard Mat • CVP-623 Stairway Mat

Thin, flexible water resistant switching at low cost.
CVP Switching Mats solve those control and signaling problems which require area switching with minimum thickness, maximum durability and low cost. These units are flexible and water resistant. **Color: Olive green.**
Tapeswitch Mats use field-proven ribbon switch technology which eliminates the need for plates or screen mesh switching elements. They require only 5 pounds to operate and are good for millions of activations.

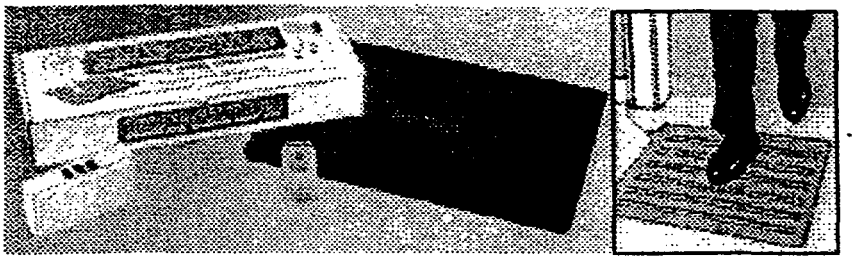
ADVANTAGES
CVP Mats are normally open switches than can control relays, lights or alarms from a low voltage source. They can serve as hidden switches by being placed under carpeting or matting. For heavy duty applications, they can be placed under plywood or Masonite.

ELECTRICAL RATING
All units are tested at 1 ampere, 117 volts AC. For floor switching, however, 24 volts or lower is recommended. Leads 22 AWG, 6 feet long. CVP623 has 18 inch lead.

APPLICATIONS:
- Stairway lighting control
- Pedestrian counting
- Foyer lighting control
- Display advertising lighting
- Elevator call systems
- Entrance annunciators for stores, offices, shops
- Burglar and intrusion alarms
- Cash register protection
- Stairway burglar alarm
- Safe protection
- Aged invalid alarm
- Check cashing photography
- Confessional booth signaling

AVAILABLE SIZES
CVP623* 6" x 23"
CVP1723* 17" x 23"
CVP2335* 23" x 35"
CVP3032* 30" x 32"
*UL Listed Call factory for Fail-Safe four wire supervised circuits and other sizes.

TS-1 ANNUNCIATOR KIT



For Commercial, Residential and Industrial Entrance Signaling

A distinctive chime signals the arrival of customers, guests, intruders, etc. The thin 3/32 inch flexible switching mat is easily concealed under carpet, matting overlay, plywood, or masonite. Perfect for use in reception rooms, lobbies, entrances, display sales counters or show exhibits.

KIT INCLUDES:
- CVP 1723 (17" x 23") switching mat
- Dual-tone chime
- Plug-in impulse power pack (110 VAC/plug-in 60C)
- Lead wire, 25 ft. long
- Easy to follow installation instructions.