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TITLE 49--TRANSPORTATION

Subtitle A--Office of the Secretary of Transportation

PART 38--AMERICANS WITH DISABILITIES ACT (ADA) ACCESSIBILITY SPECIFICATIONS  
FOR TRANSPORTATION vehicles

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Subpart A--General

Sec. 38.1 Purpose.

This provides minimum guidelines and requirements for accessibility standards in 37 of this title for required to be accessible by the With Disabilities Act (ADA) of 1990 (42 U.S.C. 1201 et seq.).

Sec. 38.2 Equivalent facilitation.

Departures from particular technical and scoping requirements of these guidelines by use of other designs and technologies are permitted where the alternative designs and technologies used will provide substantially equivalent or greater access to and usability of the vehicle. Departures are to be considered on a case-by-case basis

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under procedures set forth in Sec. 37.7 of this title.

Sec. 38.3 Definitions.

See Sec. 37.3 of this title.

Sec. 38.4 Miscellaneous instructions.

(a) Dimensional conventions. Dimensions that are not noted as minimum or maximum are absolute.

(b) Dimensional tolerances. All dimensions are subject to conventional engineering tolerances for material properties and field conditions, including normal anticipated wear not exceeding accepted

industry-wide standards and practices.

(c) Notes. The text of these guidelines does not contain notes or footnotes. Additional information, explanations, and advisory materials are located in the Appendix.

(d) General terminology. (1) Comply with means meet one or more specification of these guidelines.

(2) If or if \* \* \* then denotes a specification that applies only when the conditions described are present.

(3) May denotes an option or alternative.

(4) Shall denotes a mandatory specification or requirement.

(5) Should denotes an advisory specification or recommendation.

#### Subpart B--Buses, Vans and Systems

##### Sec. 38.21 General.

(a) New, used or remanufactured buses and vans (except over-the-road buses covered by subpart G of this ), to be considered accessible by regulations in 37 of this title shall comply with the applicable provisions of this subpart.

(b) If portions of the vehicle are modified in a way that affects or could affect accessibility, each such portion shall comply, to the extent practicable, with the applicable provisions of this subpart. This provision does not require that inaccessible buses be retrofitted with lifts, ramps or other boarding devices.

##### Sec. 38.23 Mobility aid accessibility.

(a) General. All covered by this subpart shall provide a level-change mechanism or boarding device (e.g., lift or ramp) complying with paragraph (b) or (c) of this section and sufficient clearances to permit a wheelchair or other mobility aid user to reach a securement location. At least two securement locations and devices, complying with paragraph (d) of this section, shall be provided on in excess of 22 feet in length; at least one securement location and device, complying with paragraph (d) of this section, shall be provided on 22 feet in length or less.

(b) Vehicle lift--(1) Design load. The design load of the lift shall be at least 600 pounds. Working parts, such as cables, pulleys, and shafts, which can be expected to wear, and upon which the lift depends for support of the load, shall have a safety factor of at least six, based on the ultimate strength of the material. Nonworking parts, such as platform, frame, and attachment hardware which would not be expected to wear, shall have a safety factor of at least three, based on the ultimate strength of the material.

(2) Controls--(i) Requirements. The controls shall be interlocked with the vehicle brakes, transmission, or door, or shall provide other appropriate mechanisms or systems, to ensure that the vehicle cannot be moved when the lift is not stowed and so the lift cannot be deployed unless the interlocks or systems are engaged. The lift shall deploy to all levels (i.e., ground, curb, and intermediate positions) normally encountered in the operating environment. Where provided, each control for deploying, lowering, raising, and stowing the lift and lowering the roll-off barrier shall be of a momentary contact type requiring continuous manual pressure by the operator and shall not allow improper lift sequencing when the lift platform is occupied. The controls shall allow reversal of the lift operation sequence, such as raising or lowering a platform that is way down, without allowing an occupied platform to fold or retract into the stowed position.

(ii) Exception. Where the lift is designed to deploy with its long dimension parallel to the vehicle axis and which pivots into or out of the vehicle while occupied (i.e., ``rotary lift''), the

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requirements of this paragraph prohibiting the lift from being stowed while occupied shall not apply if the stowed position is within the passenger compartment and the lift is intended to be stowed while occupied.

(3) Emergency operation. The lift shall incorporate an emergency

method of deploying, lowering to ground level with a lift occupant, and raising and stowing the empty lift if the power to the lift fails. No emergency method, manual or otherwise, shall be capable of being operated in a manner that could be hazardous to the lift occupant or to the operator when operated according to manufacturer's instructions, and shall not permit the platform to be stowed or folded when occupied, unless the lift is a rotary lift and is intended to be stowed while occupied.

(4) Power or equipment failure. Platforms stowed in a vertical position, and deployed platforms when occupied, shall have provisions to prevent their deploying, falling, or folding any faster than 12 inches/second or their dropping of an occupant in the event of a single failure of any load carrying component.

(5) Platform barriers. The lift platform shall be equipped with barriers to prevent any of the wheels of a wheelchair or mobility aid from rolling off the platform during its operation. A movable barrier or inherent design feature shall prevent a wheelchair or mobility aid from rolling off the edge closest to the vehicle until the platform is in its fully raised position. Each side of the lift platform which extends beyond the vehicle in its raised position shall have a barrier with a minimum  $1\frac{1}{2}$  inches high. Such barriers shall not interfere with maneuvering into or out of the aisle. The loading-edge barrier (outer barrier) which functions as a loading ramp when the lift is at ground level, shall be sufficient when raised or closed, or a supplementary system shall be provided, to prevent a power wheelchair or mobility aid from riding over or defeating it. The outer barrier of the lift shall automatically raise or close, or a supplementary system shall automatically engage, and remain raised, closed, or engaged at all times that the platform is more than 3 inches above the roadway or sidewalk and the platform is occupied. Alternatively, a barrier or system may be raised, lowered, opened, closed, engaged, or disengaged by the lift operator, provided an interlock or inherent design feature prevents the lift from rising unless the barrier is raised or closed or the supplementary system is engaged.

(6) Platform surface. The platform surface shall be free of any protrusions over  $\frac{1}{4}$  inch high and shall be slip resistant. The platform shall have a minimum clear width of  $28\frac{1}{2}$  inches at the platform, a minimum clear width of 30 inches measured from 2 inches above the platform surface to 30 inches above the platform, and a minimum clear length of 48 inches measured from 2 inches above the surface of the platform to 30 inches above the surface of the platform. (See Fig. 1)

(7) Platform gaps. Any openings between the platform surface and the raised barriers shall not exceed  $\frac{5}{8}$  inch in width. When the platform is at vehicle floor height with the inner barrier (if applicable) down or retracted, gaps between the forward lift platform edge and the vehicle floor shall not exceed  $\frac{1}{2}$  inch horizontally and  $\frac{5}{8}$  inch vertically. Platforms on semi-automatic lifts may have a hand hold not exceeding  $1\frac{1}{2}$  inches by  $4\frac{1}{2}$  inches located between the edge barriers.

(8) Platform entrance ramp. The entrance ramp, or loading-edge barrier used as a ramp, shall not exceed a slope of 1:8, measured on level ground, for a maximum rise of 3 inches, and the transition from roadway or sidewalk to ramp may be vertical without edge treatment up to  $\frac{1}{4}$  inch. Thresholds between  $\frac{1}{4}$  inch and  $\frac{1}{2}$  inch high shall be beveled with a slope no greater than 1:2.

(9) Platform deflection. The lift platform (not including the entrance ramp) shall not deflect more than 3 degrees (exclusive of vehicle roll or pitch) in any direction between its unloaded position and its position when loaded with 600 pounds applied through a 26 inch by 26 inch test pallet at the centroid of the platform.

(10) Platform movement. No of the platform shall move at a rate exceeding 6 inches/second during lowering and lifting an occupant, and shall not exceed 12 inches/second during deploying

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or stowing. This requirement does not apply to the deployment or stowage cycles of lifts that are manually deployed or stowed. The maximum platform horizontal and vertical acceleration when occupied shall be

0.3g.

(11) Boarding direction. The lift shall permit both inboard and outboard facing of wheelchair and mobility aid users.

(12) Use by standees. Lifts shall accommodate persons using walkers, crutches, canes or braces or who otherwise have difficulty using steps. The platform may be marked to indicate a preferred standing position.

(13) Handrails. Platforms on lifts shall be equipped with handrails on two sides, which move in tandem with the lift, and which shall be graspable and provide support to standees throughout the entire lift operation. Handrails shall have a usable component at least 8 inches long with the lowest portion a minimum 30 inches above the platform and the highest portion a maximum 38 inches above the platform. The handrails shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. The handrail shall have a cross-sectional diameter between  $1\frac{1}{4}$  inches and  $1\frac{1}{2}$  inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than  $\frac{1}{8}$  inch. Handrails shall be placed to provide a minimum  $1\frac{1}{2}$  inches knuckle clearance from the nearest adjacent surface. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the vehicle.

(c) Vehicle ramp--(1) Design load. Ramps 30 inches or longer shall support a load of 600 pounds, placed at the centroid of the ramp distributed over an area of 26 inches by 26 inches, with a safety factor of at least 3 based on the ultimate strength of the material. Ramps shorter than 30 inches shall support a load of 300 pounds.

(2) Ramp surface. The ramp surface shall be continuous and slip resistant; shall not have protrusions from the surface greater than  $\frac{1}{4}$  inch high; shall have a clear width of 30 inches; and shall accommodate both four-wheel and three-wheel mobility aids.

(3) Ramp threshold. The transition from roadway or sidewalk and the transition from vehicle floor to the ramp may be vertical without edge treatment up to  $\frac{1}{4}$  inch. Changes in level between  $\frac{1}{4}$  inch and  $\frac{1}{2}$  inch shall be beveled with a slope no greater than 1:2.

(4) Ramp barriers. Each side of the ramp shall have barriers at least 2 inches high to prevent mobility aid wheels from slipping off.

(5) Slope. Ramps shall have the least slope practicable and shall not exceed 1:4 when deployed to ground level. If the height of the vehicle floor from which the ramp is deployed is 3 inches or less above a 6-inch curb, a maximum slope of 1:4 is permitted; if the height of the vehicle floor from which the ramp is deployed is 6 inches or less, but greater than 3 inches, above a 6-inch curb, a maximum slope of 1:6 is permitted; if the height of the vehicle floor from which the ramp is deployed is 9 inches or less, but greater than 6 inches, above a 6-inch curb, a maximum slope of 1:8 is permitted; if the height of the vehicle floor from which the ramp is deployed is greater than 9 inches above a 6-inch curb, a slope of 1:12 shall be achieved. Folding or telescoping ramps are permitted provided they meet all structural requirements of this section.

(6) Attachment. When in use for boarding or alighting, the ramp shall be firmly attached to the vehicle so that it is not subject to displacement when loading or unloading a heavy power mobility aid and that no gap between vehicle and ramp exceeds  $\frac{5}{8}$  inch.

(7) Stowage. A compartment, securement system, or other appropriate method shall be provided to ensure that stowed ramps, including portable ramps stowed in the passenger area, do not impinge on a passenger's wheelchair or mobility aid or pose any hazard to passengers in the event of a sudden stop or maneuver.

(8) Handrails. If provided, handrails shall allow persons with disabilities to grasp them from outside the vehicle while starting to board, and to continue to use them throughout the boarding process, and shall have the top between 30 inches and 38 inches above the ramp surface. The handrails

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shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. The handrail shall have a cross-sectional diameter between  $1\frac{1}{4}$  inches and  $1\frac{1}{2}$  inches or shall provide an

equivalent grasping surface, and have eased edges with corner radii of not less than  $\frac{1}{8}$  inch. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the vehicle.

(d) Securement devices--(1) Design load. Securement systems on with GVWRs of 30,000 pounds or above, and their attachments to such , shall restrain a force in the forward longitudinal direction of up to 2,000 pounds per securement leg or clamping mechanism and a minimum of 4,000 pounds for each mobility aid. Securement systems on with GVWRs of up to 30,000 pounds, and their attachments to such , shall restrain a force in the forward longitudinal direction of up to 2,500 pounds per securement leg or clamping mechanism and a minimum of 5,000 pounds for each mobility aid.

(2) Location and size. The securement system shall be placed as near to the accessible entrance as practicable and shall have a clear floor area of 30 inches by 48 inches. Such space shall adjoin, and may overlap, an access path. Not more than 6 inches of the required clear floor space may be accommodated for footrests under another seat provided there is a minimum of 9 inches from the floor to the lowest of the seat overhanging the space. Securement areas may have fold-down seats to accommodate other passengers when a wheelchair or mobility aid is not occupying the area, provided the seats, when folded up, do not obstruct the clear floor space required. (See Fig. 2)

(3) Mobility aids accommodated. The securement system shall secure common wheelchairs and mobility aids and shall either be automatic or easily attached by a person familiar with the system and mobility aid and having average dexterity.

(4) Orientation. In excess of 22 feet in length, at least one securement device or system required by paragraph (a) of this section shall secure the wheelchair or mobility aid facing toward the front of the vehicle. Additional securement devices or systems shall secure the wheelchair or mobility aid facing forward, or rearward with a padded barrier, extending from a height of 38 inches from the vehicle floor to a height of 56 inches from the vehicle floor with a width of 18 inches, laterally centered immediately in back of the seated individual. In 22 feet in length or less, the required securement device may secure the wheelchair or mobility aid either facing toward the front of the vehicle or facing rearward, with a padded barrier as described. Additional securement locations shall be either forward or rearward facing with a padded barrier. Such barriers need not be solid provided equivalent protection is afforded.

(5) Movement. When the wheelchair or mobility aid is secured in accordance with manufacturer's instructions, the securement system shall limit the movement of an occupied wheelchair or mobility aid to no more than 2 inches in any direction under normal vehicle operating conditions.

(6) Stowage. When not being used for securement, or when the securement area can be used by standees, the securement system shall not interfere with passenger movement, shall not present any hazardous condition, shall be reasonably protected from vandalism, and shall be readily accessed when needed for use.

(7) Seat belt and shoulder harness. For each wheelchair or mobility aid securement device provided, a passenger seat belt and shoulder harness, complying with all applicable provisions of 571 of this title, shall also be provided for use by wheelchair or mobility aid users. Such seat belts and shoulder harnesses shall not be used in lieu of a device which secures the wheelchair or mobility aid itself.

#### Sec. 38.25 Doors, steps and thresholds.

(a) Slip resistance. All aisles, steps, floor areas where people walk and floors in securement locations shall have slip-resistant surfaces.

(b) Contrast. All step edges, thresholds and the boarding edge of ramps or

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lift platforms shall have a band of color(s) running the full width of the step or edge which contrasts from the step tread and riser, or lift or ramp surface, either light-on-dark or dark-on-light.

(c) Door height. For in excess of 22 feet in length, the overhead clearance between the top of the door opening and the raised lift platform, or highest point of a ramp, shall be a minimum of 68 inches. For of 22 feet in length or less, the overhead clearance between the top of the door opening and the raised lift platform, or highest point of a ramp, shall be a minimum of 56 inches.

#### Sec. 38.27 Priority seating signs.

(a) Each vehicle shall contain sign(s) which indicate that seats in the front of the vehicle are priority seats for persons with disabilities, and that other passengers should make such seats available to those who wish to use them. At least one set of forward-facing seats shall be so designated.

(b) Each securement location shall have a sign designating it as such.

(c) Characters on signs required by paragraphs (a) and (b) of this section shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10, with a minimum character height (using an upper case 'X') of  $\frac{5}{8}$  inch, with 'wide' spacing (generally, the space between letters shall be  $\frac{1}{16}$  the height of upper case letters), and shall contrast with the background either light-on-dark or dark-on-light.

#### Sec. 38.29 Interior circulation, handrails and stanchions.

(a) Interior handrails and stanchions shall permit sufficient turning and maneuvering space for wheelchairs and other mobility aids to reach a securement location from the lift or ramp.

(b) Handrails and stanchions shall be provided in the entrance to the vehicle in a configuration which allows persons with disabilities to grasp such assists from outside the vehicle while starting to board, and to continue using such assists throughout the boarding and fare collection process. Handrails shall have a cross-sectional diameter between  $1\frac{1}{4}$  inches and  $1\frac{1}{2}$  inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than  $\frac{1}{8}$  inch. Handrails shall be placed to provide a minimum  $1\frac{1}{2}$  inches knuckle clearance from the nearest adjacent surface. Where on-board fare collection devices are used on in excess of 22 feet in length, a horizontal passenger assist shall be located across the front of the vehicle and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the boarding procedure. Passengers shall be able to lean against the assist for security while paying fares.

(c) For in excess of 22 feet in length, overhead handrail(s) shall be provided which shall be continuous except for a gap at the rear doorway.

(d) Handrails and stanchions shall be sufficient to permit safe boarding, on-board circulation, seating and standing assistance, and alighting by persons with disabilities.

(e) For in excess of 22 feet in length with front-door lifts or ramps, vertical stanchions immediately behind the driver shall either terminate at the lower edge of the aisle-facing seats, if applicable, or be 'dog-legged' so that the floor attachment does not impede or interfere with wheelchair footrests. If the driver seat platform must be passed by a wheelchair or mobility aid user entering the vehicle, the platform, to the maximum extent practicable, shall not extend into the aisle or vestibule beyond the wheel housing.

(f) For in excess of 22 feet in length, the minimum interior height along the path from the lift to the securement location shall be 68 inches. For of 22 feet in length or less, the minimum interior height from lift to securement location shall be 56 inches.

#### Sec. 38.31 Lighting.

(a) Any stepwell or doorway immediately adjacent to the driver shall have, when the door is open, at least 2 foot-candles of illumination

measured on the step tread or lift platform.

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(b) Other stepwells and doorways, including doorways in which lifts or ramps are installed, shall have, at all times, at least 2 foot-candles of illumination measured on the step tread, or lift or ramp, when deployed at the vehicle floor level.

(c) The vehicle doorways, including doorways in which lifts or ramps are installed, shall have outside light(s) which, when the door is open, provide at least 1 foot-candle of illumination on the street surface for a distance of 3 feet perpendicular to all points on the bottom step tread outer edge. Such light(s) shall be located below window level and shielded to protect the eyes of entering and existing passengers.

#### Sec. 38.33 Fare box.

Where provided, the farebox shall be located as far forward as practicable and shall not obstruct traffic in the vestibule, especially wheelchairs or mobility aids.

#### Sec. 38.35 Public information system.

(a) in excess of 22 feet in length, used in multiple-stop, fixed-route service, shall be equipped with a public address system permitting the driver, or recorded or digitized human speech messages, to announce stops and provide other passenger information within the vehicle.

(b) [Reserved]

#### Sec. 38.37 Stop request.

(a) Where passengers may board or alight at multiple stops at their option, in excess of 22 feet in length shall provide controls adjacent to the securement location for requesting stops and which alerts the driver that a mobility aid user wishes to disembark. Such a system shall provide auditory and visual indications that the request has been made.

(b) Controls required by paragraph (a) of this section shall be mounted no higher than 48 inches and no lower than 15 inches above the floor, shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbf (22.2 N).

#### Sec. 38.39 Destination and route signs.

(a) Where destination or route information is displayed on the exterior of a vehicle, each vehicle shall have illuminated signs on the front and boarding side of the vehicle.

(b) Characters on signs required by paragraph (a) of this section shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10, with a minimum character height (using an upper case 'X') of 1 inch for signs on the boarding side and a minimum character height of 2 inches for front 'headsigs', with 'wide' spacing (generally, the space between letters shall be 1/16 the height of upper case letters), and shall contrast with the background, either dark-on-light or light-on-dark.

### Subpart C--Rapid Rail and Systems

#### Sec. 38.51 General.

(a) New, used and remanufactured rapid rail, to be considered accessible by regulations in 37 of this title, shall comply with this subpart.

(b) If portions of the vehicle are modified in a way that affects or could affect accessibility, each such portion shall comply, to the extent practicable, with the applicable provisions of this subpart. This provision does not require that inaccessible be retrofitted with lifts, ramps or other boarding devices.



(c) Existing which are retrofitted to comply with the ``one-car-per-train rule'' of Sec. 37.93 of this title shall comply with Secs. 38.55, 38.57(b), 38.59 of this and shall have, in new and key stations, at least one door complying with Secs. 38.53 (a)(1), (b) and (d) of this . Removal of seats is not required. previously designed and manufactured in accordance with the accessibility requirements of 609 of this title or the Secretary of regulations implementing section 504 of the Rehabilitation Act of 1973 that were in effect before October 7, 1991, and which can be entered and used from stations in which they are to be operated, may be used to satisfy the requirements of Sec. 37.93 of this title.

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#### Sec. 38.53 Doorways.

(a) Clear width. (1) Passenger doorways on vehicle sides shall have clear openings at least 32 inches wide when open.

(2) If doorways connecting adjoining cars in a multi-car train are provided, and if such doorway is connected by an aisle with a minimum clear width of 30 inches to one or more spaces where wheelchair or mobility aid users can be accommodated, then such doorway shall have a minimum clear opening of 30 inches to permit wheelchair and mobility aid users to be evacuated to an adjoining vehicle in an emergency.

(b) Signage. The International Symbol of Accessibility shall be displayed on the exterior of accessible operating on an accessible rapid rail system unless all are accessible and are not marked by the access symbol. (See Fig. 6.)

(c) Signals. Auditory and visual warning signals shall be provided to alert passengers of closing doors.

(d) Coordination with boarding platform--(1) Requirements. Where new will operate in new stations, the design of shall be coordinated with the boarding platform design such that the horizontal gap between each vehicle door at rest and the platform shall be no greater than 3 inches and the height of the vehicle floor shall be within plus or minus  $\frac{5}{8}$  inch of the platform height under all normal passenger load conditions. Vertical alignment may be accomplished by vehicle air suspension or other suitable means of meeting the requirement.

(2) Exception. New operating in existing stations may have a floor height within plus or minus  $1\frac{1}{2}$  inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

(3) Exception. Retrofitted shall be coordinated with the platform in new and key stations such that the horizontal gap shall be no greater than 4 inches and the height of the vehicle floor, under 50% passenger load, shall be within plus or minus 2 inches of the platform height.

#### Sec. 38.55 Priority seating signs.

(a) Each vehicle shall contain sign(s) which indicate that certain seats are priority seats for persons with disabilities, and that other passengers should make such seats available to those who wish to use them.

(b) Characters on signs required by paragraph (a) of this section shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10, with a minimum character height (using an upper case ``X'') of  $\frac{5}{8}$  inch, with ``wide'' spacing (generally, the space between letters shall be  $\frac{1}{16}$  the height of upper case letters), and shall contrast with the background, either light-on-dark or dark-on-light.

#### Sec. 38.57 Interior circulation, handrails and stanchions.

(a) Handrails and stanchions shall be provided to assist safe boarding, on-board circulation, seating and standing assistance, and alighting by persons with disabilities.

(b) Handrails, stanchions, and seats shall allow a route at least 32

inches wide so that at least two wheelchair or mobility aid users can enter the vehicle and position the wheelchairs or mobility aids in areas, each having a minimum clear space of 48 inches by 30 inches, which do not unduly restrict movement of other passengers. Space to accommodate wheelchairs and mobility aids may be provided within the normal area used by standees and designation of specific spaces is not required. Particular attention shall be given to ensuring maximum maneuverability immediately inside doors. Ample vertical stanchions from ceiling to seat-back rails shall be provided. Vertical stanchions from ceiling to floor shall not interfere with wheelchair or mobility aid user circulation and shall be kept to a minimum in the vicinity of doors.

(c) The diameter or width of the gripping surface of handrails and stanchions shall be 1\1/4\ inches to 1\1/2\ inches or provide an equivalent gripping surface and shall provide a minimum 1\1/2\ inches knuckle clearance from the nearest adjacent surface.

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#### Sec. 38.59 Floor surfaces.

Floor surfaces on aisles, places for standees, and areas where wheelchair and mobility aid users are to be accommodated shall be slip-resistant.

#### Sec. 38.61 Public information system.

(a)(1) Requirements. Each vehicle shall be equipped with a public address system permitting system personnel, or recorded or digitized human speech messages, to announce stations and provide other passenger information. Alternative systems or devices which provide equivalent access are also permitted. Each vehicle operating in stations having more than one line or route shall have an external public address system to permit system personnel, or recorded or digitized human speech messages, to announce train, route, or line identification information.

(2) Exception. Where station announcement systems provide information on arriving trains, an external train speaker is not required.

(b) [Reserved]

#### Sec. 38.63 Between-car barriers.

(a) Requirement. Suitable devices or systems shall be provided to prevent, deter or warn individuals from inadvertently stepping off the platform between cars. Acceptable solutions include, but are not limited to, pantograph gates, chains, motion detectors or similar devices.

(b) Exception. Between-car barriers are not required where platform screens are provided which close off the platform edge and open only when trains are correctly aligned with the doors.

### Subpart D--Light Rail and Systems

#### Sec. 38.71 General.

(a) New, used and remanufactured light rail, to be considered accessible by regulations in 37 of this title shall comply with this subpart.

(b)(1) intended to be operated solely in light rail systems confined entirely to a dedicated right-of-way, and for which all stations or stops are designed and constructed for revenue service after the effective date of standards for design and construction in Sec. 37.21 and Sec. 37.23 of this title shall provide level boarding and shall comply with Sec. 38.73(d)(1) and Sec. 38.85 of this .

(2) designed for, and operated on, pedestrian malls, city streets, or other areas where level boarding is not practicable shall provide wayside or car-borne lifts, mini-high platforms, or other means of access in compliance with Sec. 38.83 (b) or (c) of this .

(c) If portions of the vehicle are modified in a way that affects or could affect accessibility, each such portion shall comply, to the

extent practicable, with the applicable provisions of this subpart. This provision does not require that inaccessible be retrofitted with lifts, ramps or other boarding devices.

(d) Existing retrofitted to comply with the ``one-car-per-train rule'' at Sec. 37.93 of this title shall comply with Sec. 38.75, Sec. 38.77(c), Sec. 38.79(a) and Sec. 38.83(a) of this and shall have, in new and key stations, at least one door which complies with Secs. 38.73 (a)(1), (b) and (d) of this . previously designed and manufactured in accordance with the accessibility requirements of 609 of this title or the Secretary of regulations implementing section 504 of the Rehabilitation Act of 1973 that were in effect before October 7, 1991, and which can be entered and used from stations in which they are to be operated, may be used to satisfy the requirements of Sec. 37.93 of this title.

#### Sec. 38.73 Doorways.

(a) Clear width--(1) All passenger doorways on vehicle sides shall have minimum clear openings of 32 inches when open.

(2) If doorways connecting adjoining cars in a multi-car train are provided, and if such doorway is connected by an aisle with a minimum clear width of 30 inches to one or more spaces where wheelchair or mobility aid users can be accommodated, then such doorway shall have a minimum clear opening of 30 inches to permit wheelchair and mobility aid users to be evacuated to an adjoining vehicle in an emergency.

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(b) Signage. The International Symbol of Accessibility shall be displayed on the exterior of each vehicle operating on an accessible light rail system unless all are accessible and are not marked by the access symbol (see fig. 6).

(c) Signals. Auditory and visual warning signals shall be provided to alert passengers of closing doors.

(d) Coordination with boarding platform--(1) Requirements. The design of level-entry shall be coordinated with the boarding platform or mini-high platform design so that the horizontal gap between a vehicle at rest and the platform shall be no greater than 3 inches and the height of the vehicle floor shall be within plus or minus  $\frac{5}{8}$  inch of the platform height. Vertical alignment may be accomplished by vehicle air suspension, automatic ramps or lifts, or any combination.

(2) Exception. New operating in existing stations may have a floor height within plus or minus  $1\frac{1}{2}$  inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

(3) Exception. Retrofitted shall be coordinated with the platform in new and key stations such that the horizontal gap shall be no greater than 4 inches and the height of the vehicle floor, under 50% passenger load, shall be within plus or minus 2 inches of the platform height.

(4) Exception. Where it is not operationally or structurally practicable to meet the horizontal or vertical requirements of paragraphs (d) (1), (2) or (3) of this section, platform or vehicle devices complying with Sec. 38.83(b) or platform or vehicle mounted ramps or bridge plates complying with Sec. 38.83(c) shall be provided.

#### Sec. 38.75 Priority seating signs.

(a) Each vehicle shall contain sign(s) which indicate that certain seats are priority seats for persons with disabilities, and that other passengers should make such seats available to those who wish to use them.

(b) Where designated wheelchair or mobility aid seating locations are provided, signs shall indicate the location and advise other passengers of the need to permit wheelchair and mobility aid users to occupy them.

(c) Characters on signs required by paragraphs (a) or (b) of this section shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10, with a minimum

character height (using an upper case ``X'') of  $\frac{5}{8}$  inch, with ``wide'' spacing (generally, the space between letters shall be  $\frac{1}{16}$  the height of upper case letters), and shall contrast with the background, either light-on-dark or dark-on-light.

Sec. 38.77 Interior circulation, handrails and stanchions.

(a) Handrails and stanchions shall be sufficient to permit safe boarding, on-board circulation, seating and standing assistance, and alighting by persons with disabilities.

(b) At entrances equipped with steps, handrails and stanchions shall be provided in the entrance to the vehicle in a configuration which allows passengers to grasp such assists from outside the vehicle while starting to board, and to continue using such handrails or stanchions throughout the boarding process. Handrails shall have a cross-sectional diameter between  $\frac{1}{4}$  inches and  $\frac{1}{2}$  inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than  $\frac{1}{8}$  inch. Handrails shall be placed to provide a minimum  $\frac{1}{2}$  inches knuckle clearance from the nearest adjacent surface. Where on-board fare collection devices are used, a horizontal passenger assist shall be located between boarding passengers and the fare collection device and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the door through the boarding procedure. Passengers shall be able to lean against the assist for security while paying fares.

(c) At all doors on level-entry , and at each entrance accessible by

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lift, ramp, bridge plate or other suitable means, handrails, stanchions, passenger seats, vehicle driver seat platforms, and fare boxes, if applicable, shall be located so as to allow a route at least 32 inches wide so that at least two wheelchair or mobility aid users can enter the vehicle and position the wheelchairs or mobility aids in areas, each having a minimum clear space of 48 inches by 30 inches, which do not unduly restrict movement of other passengers. Space to accommodate wheelchairs and mobility aids may be provided within the normal area used by standees and designation of specific spaces is not required. Particular attention shall be given to ensuring maximum maneuverability immediately inside doors. Ample vertical stanchions from ceiling to seat-back rails shall be provided. Vertical stanchions from ceiling to floor shall not interfere with wheelchair or mobility aid circulation and shall be kept to a minimum in the vicinity of accessible doors.

Sec. 38.79 Floors, steps and thresholds.

(a) Floor surfaces on aisles, step treads, places for standees, and areas where wheelchair and mobility aid users are to be accommodated shall be slip-resistant.

(b) All thresholds and step edges shall have a band of color(s) running the full width of the step or threshold which contrasts from the step tread and riser or adjacent floor, either light-on-dark or dark-on-light.

Sec. 38.81 Lighting.

(a) Any stepwell or doorway with a lift, ramp or bridge plate immediately adjacent to the driver shall have, when the door is open, at least 2 foot-candles of illumination measured on the step tread or lift platform.

(b) Other stepwells, and doorways with lifts, ramps or bridge plates, shall have, at all times, at least 2 foot-candles of illumination measured on the step tread or lift or ramp, when deployed at the vehicle floor level.

(c) The doorways of not operating at lighted station platforms shall have outside lights which provide at least 1 foot-candle of illumination on the station platform or street surface for a distance

of 3 feet perpendicular to all points on the bottom step tread. Such lights shall be located below window level and shielded to protect the eyes of entering and exiting passengers.

Sec. 38.83 Mobility aid accessibility.

(a)(1) General. All new light rail, other than level entry, covered by this subpart shall provide a level-change mechanism or boarding device (e.g., lift, ramp or bridge plate) complying with either paragraph (b) or (c) of this section and sufficient clearances to permit at least two wheelchair or mobility aid users to reach areas, each with a minimum clear floor space of 48 inches by 30 inches, which do not unduly restrict passenger flow. Space to accommodate wheelchairs and mobility aids may be provided within the normal area used by standees and designation of specific spaces is not required.

(2) Exception. If lifts, ramps or bridge plates meeting the requirements of this section are provided on station platforms or other stops required to be accessible, or mini-high platforms complying with Sec. 38.73(d) of this are provided, the vehicle is not required to be equipped with a car-borne device. Where each new vehicle is compatible with a single platform-mounted access system or device, additional systems or devices are not required for each vehicle provided that the single device could be used to provide access to each new vehicle if passengers using wheelchairs or mobility aids could not be accommodated on a single vehicle.

(b) Vehicle lift--(1) Design load. The design load of the lift shall be at least 600 pounds. Working parts, such as cables, pulleys, and shafts, which can be expected to wear, and upon which the lift depends for support of the load, shall have a safety factor of at least six, based on the ultimate strength of the material. Nonworking parts, such as platform, frame, and attachment hardware which would not be expected to wear, shall have a safety factor of at least three, based on the ultimate strength of the material.

(2) Controls--(i) Requirements. The controls shall be interlocked with the vehicle brakes, propulsion system, or door, or shall provide other appropriate

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mechanisms or systems, to ensure that the vehicle cannot be moved when the lift is not stowed and so the lift cannot be deployed unless the interlocks or systems are engaged. The lift shall deploy to all levels (i.e., ground, curb, and intermediate positions) normally encountered in the operating environment. Where provided, each control for deploying, lowering, raising, and stowing the lift and lowering the roll-off barrier shall be of a momentary contact type requiring continuous manual pressure by the operator and shall not allow improper lift sequencing when the lift platform is occupied. The controls shall allow reversal of the lift operation sequence, such as raising or lowering a platform that is way down, without allowing an occupied platform to fold or retract into the stowed position.

(ii) Exception. Where physical or safety constraints prevent the deployment at some stops of a lift having its long dimension perpendicular to the vehicle axis, the entity may specify a lift which is designed to deploy with its long dimension parallel to the vehicle axis and which pivots into or out of the vehicle while occupied (i.e., ``rotary lift''). The requirements of paragraph (b)(2)(i) of this section prohibiting the lift from being stowed while occupied shall not apply to a lift design of this type if the stowed position is within the passenger compartment and the lift is intended to be stowed while occupied.

(iii) Exception. The brake or propulsion system interlocks requirement does not apply to a station platform mounted lift provided that a mechanical, electrical or other system operates to ensure that do not move when the lift is in use.

(3) Emergency operation. The lift shall incorporate an emergency method of deploying, lowering to ground level with a lift occupant, and raising and stowing the empty lift if the power to the lift fails. No emergency method, manual or otherwise, shall be capable of being operated in a manner that could be hazardous to the lift occupant or to

the operator when operated according to manufacturer's instructions, and shall not permit the platform to be stowed or folded when occupied, unless the lift is a rotary lift intended to be stowed while occupied.

(4) Power or equipment failure. Lift platforms stowed in a vertical position, and deployed platforms when occupied, shall have provisions to prevent their deploying, falling, or folding any faster than 12 inches/second or their dropping of an occupant in the event of a single failure of any load carrying component.

(5) Platform barriers. The lift platform shall be equipped with barriers to prevent any of the wheels of a wheelchair or mobility aid from rolling off the lift during its operation. A movable barrier or inherent design feature shall prevent a wheelchair or mobility aid from rolling off the edge closest to the vehicle until the lift is in its fully raised position. Each side of the lift platform which extends beyond the vehicle in its raised position shall have a barrier a minimum  $1\frac{1}{2}$  inches high. Such barriers shall not interfere with maneuvering into or out of the aisle. The loading-edge barrier (outer barrier) which functions as a loading ramp when the lift is at ground level, shall be sufficient when raised or closed, or a supplementary system shall be provided, to prevent a power wheelchair or mobility aid from riding over or defeating it. The outer barrier on the outboard of the lift shall automatically rise or close, or a supplementary system shall automatically engage, and remain raised, closed, or engaged at all times that the lift is more than 3 inches above the station platform or roadway and the lift is occupied. Alternatively, a barrier or system may be raised, lowered, opened, closed, engaged or disengaged by the lift operator provided an interlock or inherent design feature prevents the lift from rising unless the barrier is raised or closed or the supplementary system is engaged.

(6) Platform surface. The lift platform surface shall be free of any protrusions over  $\frac{1}{4}$  inch high and shall be slip resistant. The lift platform shall have a minimum clear width of  $28\frac{1}{2}$  inches at the platform, a minimum clear width of 30 inches measured from 2 inches above the lift platform surface to 30

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inches above the surface, and a minimum clear length of 48 inches measured from 2 inches above the surface of the platform to 30 inches above the surface. (See Fig. 1)

(7) Platform gaps. Any openings between the lift platform surface and the raised barriers shall not exceed  $\frac{5}{8}$  inch wide. When the lift is at vehicle floor height with the inner barrier (if applicable) down or retracted, gaps between the forward lift platform edge and vehicle floor shall not exceed  $\frac{1}{2}$  inch horizontally and  $\frac{5}{8}$  inch vertically. Platforms on semi-automatic lifts may have a hand hold not exceeding  $1\frac{1}{2}$  inches by  $4\frac{1}{2}$  inches located between the edge barriers.

(8) Platform entrance ramp. The entrance ramp, or loading-edge barrier used as a ramp, shall not exceed a slope of 1:8 measured on level ground, for a maximum rise of 3 inches, and the transition from the station platform or roadway to ramp may be vertical without edge treatment up to  $\frac{1}{4}$  inch. Thresholds between  $\frac{1}{4}$  inch and  $\frac{1}{2}$  inch high shall be beveled with a slope no greater than 1:2.

(9) Platform deflection. The lift platform (not including the entrance ramp) shall not deflect more than 3 degrees (exclusive of vehicle roll) in any direction between its unloaded position and its position when loaded with 600 pounds applied through a 26 inch by 26 inch test pallet at the centroid of the lift platform.

(10) Platform movement. No part of the platform shall move at a rate exceeding 6 inches/second during lowering and lifting an occupant, and shall not exceed 12 inches/second during deploying or stowing. This requirement does not apply to the deployment or stowage cycles of lifts that are manually deployed or stowed. The maximum platform horizontal and vertical acceleration when occupied shall be 0.3g.

(11) Boarding direction. The lift shall permit both inboard and outboard facing of wheelchairs and mobility aids.

(12) Use by standees. Lifts shall accommodate persons using walkers, crutches, canes or braces or who otherwise have difficulty using steps. The lift may be marked to indicate a preferred standing position.

(13) Handrails. Platforms on lifts shall be equipped with handrails, on two sides, which move in tandem with the lift which shall be graspable and provide support to standees throughout the entire lift operation. Handrails shall have a usable component at least 8 inches long with the lowest portion a minimum 30 inches above the platform and the highest portion a maximum 38 inches above the platform. The handrails shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. Handrails shall have a cross-sectional diameter between  $1\frac{1}{4}$  inches and  $1\frac{1}{2}$  inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than  $\frac{1}{8}$  inch. Handrails shall be placed to provide a minimum  $1\frac{1}{2}$  inches knuckle clearance from the nearest adjacent surface. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the vehicle.

(c) Vehicle ramp or bridge plate.--(1) Design load. Ramps or bridge plates 30 inches or longer shall support a load of 600 pounds, placed at the centroid of the ramp or bridge plate distributed over an area of 26 inches, with a safety factor of at least 3 based on the ultimate strength of the material. Ramps or bridge plates shorter than 30 inches shall support a load of 300 pounds.

(2) Ramp surface. The ramp or bridge plate surface shall be continuous and slip resistant, shall not have protrusions from the surface greater than  $\frac{1}{4}$  inch, shall have a clear width of 30 inches, and shall accommodate both four-wheel and three-wheel mobility aids.

(3) Ramp threshold. The transition from roadway or station platform and the transition from vehicle floor to the ramp or bridge plate may be vertical without edge treatment up to  $\frac{1}{4}$  inch. Changes in level between  $\frac{1}{4}$  inch and  $\frac{1}{2}$  inch shall be beveled with a slope no greater than 1:2.

(4) Ramp barriers. Each side of the ramp or bridge plate shall have barriers at least 2 inches high to prevent mobility aid wheels from slipping off.

(5) Slope. Ramps or bridge plates shall have the least slope practicable. If the

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height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is 3 inches or less above the station platform a maximum slope of 1:4 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is 6 inches or less, but more than 3 inches, above the station platform a maximum slope of 1:6 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is 9 inches or less, but more than 6 inches, above the station platform a maximum slope of 1:8 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is greater than 9 inches above the station platform a slope of 1:12 shall be achieved. Folding or telescoping ramps are permitted provided they meet all structural requirements of this section.

(6) Attachment--(i) Requirement. When in use for boarding or alighting, the ramp or bridge plate shall be attached to the vehicle, or otherwise prevented from moving such that it is not subject to displacement when loading or unloading a heavy power mobility aid and that any gaps between vehicle and ramp or bridge plate, and station platform and ramp or bridge plate, shall not exceed  $\frac{5}{8}$  inch.

(ii) Exception. Ramps or bridge plates which are attached to, and deployed from, station platforms are permitted in lieu of vehicle devices provided they meet the displacement requirements of paragraph (c)(6)(i) of this section.

(7) Stowage. A compartment, securement system, or other appropriate method shall be provided to ensure that stowed ramps or bridge plates, including portable ramps or bridges plates stowed in the passenger area, do not impinge on a passenger's wheelchair or mobility aid or pose any hazard to passengers in the event of a sudden stop.

(8) Handrails. If provided, handrails shall allow persons with disabilities to grasp them from outside the vehicle while starting to board, and to continue to use them throughout the boarding process, and shall have the top between 30 inches and 38 inches above the ramp

surface. The handrails shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. The handrail shall have a cross-sectional diameter between 1 1/4 inches and 1 1/2 inches or shall provide an equivalent grasping surface, and have "eased" edges with corner radii of not less than 1/8 inch. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the vehicle.

Sec. 38.85 Between-car barriers.

Where operate in a high-platform, level-boarding mode, devices or systems shall be provided to prevent, deter or warn individuals from inadvertently stepping off the platform between cars. Appropriate devices include, but are not limited to, pantograph gates, chains, motion detectors or other suitable devices.

Sec. 38.87 Public information system.

(a) Each vehicle shall be equipped with an interior public address system permitting system personnel, or recorded or digitized human speech messages, to announce stations and provide other passenger information. Alternative systems or devices which provide equivalent access are also permitted.

(b) [Reserved]

Subpart E--Commuter Rail Cars and Systems

Sec. 38.91 General.

(a) New, used and remanufactured commuter rail cars, to be considered accessible by regulations in 37 of this title, shall comply with this subpart.

(b) If portions of the car are modified in such a way that it affects or could affect accessibility, each such portion shall comply, to the extent practicable, with the applicable provisions of this subpart. This provision does not require that inaccessible cars be retrofitted with lifts, ramps or other boarding devices.

(c)(1) Commuter rail cars shall comply with Secs. 38.93(d) and 38.109 of this title for level boarding wherever structurally and operationally practicable.

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(2) Where level boarding is not structurally or operationally practicable, commuter rail cars shall comply Sec. 38.95 of this title.

(d) Existing retrofitted to comply with the "one-car-per-train rule" at Sec. 37.93 of this title shall comply with Secs. 38.93(e), 38.95(a) and 38.107 of this title and shall have, in new and key stations at least one door on each side from which passengers board which complies with Sec. 38.93(d) of this title. previously designed and manufactured in accordance with the program accessibility requirements of section 504 of the Rehabilitation Act of 1973, or implementing regulations of the Secretary of that were in effect before October 7, 1991; and which can be entered and used from stations in which they are to be operated, may be used to satisfy the requirements of Sec. 37.93 of this title.

Sec. 38.93 Doorways.

(a) Clear width. (1) At least one door on each side of the car from which passengers board opening onto station platforms and at least one adjacent doorway into the passenger coach compartment, if provided, shall have a minimum clear opening of 32 inches.

(2) If doorways connecting adjoining cars in a multi-car train are provided, and if such doorway is connected by an aisle with a minimum clear width of 30 inches to one or more spaces where wheelchair or mobility aid users can be accommodated, then such doorway shall have, to the maximum extent practicable in accordance with the regulations issued under the Federal Railroad Safety Act of 1970 (49 CFR parts 229 and



231), a clear opening of 30 inches.

(b) Passageways. A route at least 32 inches wide shall be provided from doors required to be accessible by paragraph (a)(1) of this section to seating locations complying with Sec. 38.95(d) of this . In cars where such doorways require passage through a vestibule, such vestibule shall have a minimum width of 42 inches. (See Fig. 3.)

(c) Signals. If doors to the platform close automatically or from a remote location, auditory and visual warning signals shall be provided to alert passengers or closing doors.

(d) Coordination with boarding platform--(1) Requirements. Cars operating in stations with high platforms, or mini-high platforms, shall be coordinated with the boarding platform design such that the horizontal gap between a car at rest and the platform shall be no greater than 3 inches and the height of the car floor shall be within plus or minus  $\frac{5}{8}$  inch of the platform height. Vertical alignment may be accomplished by car air suspension, platform lifts or other devices, or any combination.

(2) Exception. New operating in existing stations may have a floor height within plus or minus  $1\frac{1}{2}$  inches of the platform height. At key stations, the horizontal gap between at least one accessible door of each such vehicle and the platform shall be no greater than 3 inches.

(3) Exception. Where platform set-backs do not allow the horizontal gap or vertical alignment specified in paragraph (d)(1) or (d)(2) of this section, car, platform or portable lifts complying with Sec. 38.95(b) of this , or car or platform ramps or bridge plates, complying with Sec. 38.95(c) of this , shall be provided.

(4) Exception. Retrofitted shall be coordinated with the platform in new and key stations such that the horizontal gap shall be no greater than 4 inches and the height of the vehicle floor, under 50% passenger load, shall be within plus or minus 2 inches of the platform height.

(e) Signage. The International Symbol of accessibility shall be displaced on the exterior of all doors complying with this section unless all cars are accessible and are not marked by the access symbol (see Fig. 6). Appropriate signage shall also indicate which accessible doors are adjacent to an accessible restroom, if applicable.

#### Sec. 38.95 Mobility aid accessibility.

(a)(1) General. All new commuter rail cars, other than level entry cars, covered by this subpart shall provide a level-change mechanism or boarding device (e.g., lift, ramp or bridge plate) complying with either paragraph (b) or (c) of this section; sufficient clearances to permit a wheelchair or mobility aid user to reach a seating location; and at

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least two wheelchair or mobility aid seating locations complying with paragraph (d) of this section.

(2) Exception. If portable or platform lifts, ramps or bridge plates meeting the applicable requirements of this section are provided on station platforms or other stops required to be accessible, or mini-high platforms complying with Sec. 38.93(d) are provided, the car is not required to be equipped with a car-borne device. Where each new car is compatible with a single platform-mounted access system or device, additional systems or devices are not required for each car provided that the single device could be used to provide access to each new car if passengers using wheelchairs or mobility aids could not be accommodated on a single car.

(b) Car Lift--(1) Design load. The design load of the lift shall be at least 600 pounds. Working parts, such as cables, pulleys, and shafts, which can be expected to wear, and upon which the lift depends for support of the load, shall have a safety factor of at least six, based on the ultimate strength of the material. Nonworking parts, such as platform, frame, and attachment hardware which would not be expected to wear, shall have a safety factor of at least three, based on the ultimate strength of the material.

(2) Controls--(i) Requirements. The controls shall be interlocked with the car brakes, propulsion system, or door, or shall provide other

appropriate mechanisms or systems, to ensure that the car cannot be moved when the lift is not stowed and so the lift cannot be deployed unless the interlocks or systems are engaged. The lift shall deploy to all platform levels normally encountered in the operating environment. Where provided, each control for deploying, lowering, raising, and stowing the lift and lowering the roll-off barrier shall be of a monetary contact type requiring continuous manual pressure by the operator and shall not allow improper lift sequencing when the lift platform is occupied. The controls shall allow reversal of the lift operation sequence, such as raising or lowering a platform that is way down, without allowing an occupied platform to fold or retract into the stowed position.

(ii) Exception. Where physical or safety constraints prevent the deployment at some stops of a lift having its long dimension perpendicular to the car axis, the entity may specify a lift which is designed to deploy with its long dimension parallel to the car axis and which pivots into or out of the car while occupied (i.e., ``rotary lift''). The requirements of paragraph (b)(2)(i) of this section prohibiting the lift from being stowed while occupied shall not apply to a lift design of this type if the stowed position is within the passenger compartment and the lift is intended to be stowed while occupied.

(iii) Exception. The brake or propulsion system interlock requirement does not apply to a platform mounted or portable lift provided that a mechanical, electrical or other system operates to ensure that cars do not move when the lift is in use.

(3) Emergency operation. The lift shall incorporate an emergency method of deploying, lowering to ground or platform level with a lift occupant, and raising and stowing the empty lift if the power to the lift fails. No emergency method, manual or otherwise, shall be capable of being operated in a manner that could be hazardous to the lift occupant or to the operator when operated according to manufacturer's instructions, and shall not permit the platform to be stowed or folded when occupied, unless the lift is a rotary lift intended to be stowed while occupied.

(4) Power or equipment failure. Platforms stowed in a vertical position, and deployed platforms when occupied, shall have provisions to prevent their deploying, falling, or folding any faster than 12 inches/second or their dropping of an occupant in the event of a single failure of any load carrying component.

(5) Platform barriers. The lift platform shall be equipped with barriers to prevent any of the wheels of a wheelchair or mobility aid from rolling off the lift during its operation. A movable barrier or inherent design feature shall prevent a wheelchair or mobility aid from rolling off the edge closest to the car until the lift is in its fully raised position. Each side of the lift platform which, in its raised position, extends

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beyond the car shall have a barrier a minimum 1\1/2\ inches high. Such barriers shall not interfere with maneuvering into or out of the car. The loading-edge barrier (outer barrier) which functions as a loading ramp when the lift is at ground or station platform level, shall be sufficient when raised or closed, or a supplementary system shall be provided, to prevent a power wheelchair or mobility aid from riding over or defeating it. The outer barrier of the lift shall automatically rise or close, or a supplementary system shall automatically engage, and remain raised, closed, or engaged at all times that the lift platform is more than 3 inches above the station platform and the lift is occupied. Alternatively, a barrier or system may be raised, lowered, opened, closed, engaged or disengaged by the lift operator provided an interlock or inherent design feature prevents the lift from rising unless the barrier is raised or closed or the supplementary system is engaged.

(6) Platform surface. The lift platform surface shall be free of any protrusions over \1/4\ inch high and shall be slip resistant. The lift platform shall have a minimum clear width of 28\1/2\ inches at the platform, a minimum clear width of 30 inches measured from 2 inches above the lift platform surface to 30 inches above the surface, and a minimum clear length of 48 inches measured from 2 inches above the

surface of the platform to 30 inches above the surface. (See Fig. 1)

(7) Platform gaps. Any openings between the lift platform surface and the raised barriers shall not exceed  $\frac{5}{8}$  inch wide. When the lift is at car floor height with the inner barrier down (if applicable) or retracted, gaps between the forward lift platform edge and car floor shall not exceed  $\frac{1}{2}$  inch horizontally and  $\frac{5}{8}$  inch vertically.

(8) Platform entrance ramp. The entrance ramp, or loading-edge barrier used as a ramp, shall not exceed a slope of 1:8, when measured on level ground, for a maximum rise of 3 inches, and the transition from station platform to ramp may be vertical without edge treatment up to  $\frac{1}{4}$  inch. Thresholds between  $\frac{1}{4}$  inch and  $\frac{1}{2}$  inch high shall be beveled with a slope no greater than 1:2.

(9) Platform deflection. The lift platform (not including the entrance ramp) shall not deflect more than 3 degrees (exclusive of vehicle roll) in any direction between its unloaded position and its position when loaded with 600 pounds applied through a 26 inch by 26 inch test pallet at the centroid of the lift platform.

(10) Platform movement. No of the platform shall move at a rate exceeding 6 inches/second during lowering and lifting an occupant, and shall not exceed 12 inches/second during deploying or stowing. This requirement does not apply to the deployment or stowage cycles of lifts that are manually deployed or stowed. The maximum platform horizontal and vertical acceleration when occupied shall be 0.3g.

(11) Boarding direction. The lift shall permit both inboard and outboard facing of wheelchairs and mobility aids.

(12) Use by standees. Lifts shall accommodate persons using walkers, crutches, canes or braces or who otherwise have difficulty using steps. The lift may be marked to indicate a preferred standing position.

(13) Handrails. Platforms on lifts shall be equipped with handrails, on two sides, which move in tandem with the lift which shall be graspable and provide support to standees throughout the entire lift operation. Handrails shall have a usable component at least 8 inches long with the lowest portion a minimum 30 inches above the platform and the highest portion a maximum 38 inches above the platform. The handrails shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. The handrail shall have a cross-sectional diameter between  $1\frac{1}{4}$  inches and  $1\frac{1}{2}$  inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than  $\frac{1}{8}$  inch. Handrails shall be placed to provide a minimum  $1\frac{1}{2}$  inches knuckle clearance from the nearest adjacent surface. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the car.

(c) Car ramp or bridge plate--(1) Design load. Ramps or bridge plates 30 inches or longer shall support a load of 600

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pounds, placed at the centroid of the ramp or bridge plate distributed over an area of 26 inches by 26 inches, with a safety factor of at least 3 based on the ultimate strength of the material. Ramps or bridge plates shorter than 30 inches shall support a load of 300 pounds.

(2) Ramp surface. The ramp or bridge plate surface shall be continuous and slip resistant, shall not have protrusions from the surface greater than  $\frac{1}{4}$  inch high, shall have a clear width of 30 inches and shall accommodate both four-wheel and three-wheel mobility aids.

(3) Ramp threshold. The transition from station platform to the ramp or bridge plate and the transition from car floor to the ramp or bridge plate may be vertical without edge treatment up to  $\frac{1}{4}$  inch. Changes in level between  $\frac{1}{4}$  inch and  $\frac{1}{2}$  inch shall be beveled with a slope no greater than 1:2.

(4) Ramp barriers. Each side of the ramp or bridge plate shall have barriers at least 2 inches high to prevent mobility aid wheels from slipping off.

(5) Slope. Ramps or bridge plates shall have the least slope practicable. If the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is 3 inches or less above the station platform a maximum slope of 1:4 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is

deployed is 6 inches or less, but more than 3 inches, above the station platform a maximum slope of 1:6 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is 9 inches or less, but more than 6 inches, above the station platform a maximum slope of 1:8 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is greater than 9 inches above the station platform a slope of 1:12 shall be achieved. Folding or telescoping ramps are permitted provided they meet all structural requirements of this section.

(6) Attachment--(i) Requirement. When in use for boarding or alighting, the ramp or bridge plate shall be attached to the vehicle, or otherwise prevented from moving such that it is not subject to displacement when loading or unloading a heavy power mobility aid and that any gaps between vehicle and ramp or bridge plate, and station platform and ramp or bridge plate, shall not exceed  $\frac{5}{8}$  inch.

(ii) Exception. Ramps or bridge plates which are attached to, and deployed from, station platforms are permitted in lieu of car devices provided they meet the displacement requirements of paragraph (c)(6)(i) of this section.

(7) Stowage. A compartment, securement system, or other appropriate method shall be provided to ensure that stowed ramps or bridge plates, including portable ramps or bridge plates stowed in the passenger area, do not impinge on a passenger's wheelchair or mobility aid or pose any hazard to passengers in the event of a sudden stop.

(8) Handrails. If provided, handrails shall allow persons with disabilities to grasp them from outside the car while starting to board, and to continue to use them throughout the boarding process, and shall have the top between 30 inches and 38 inches above the ramp surface. The handrails shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. The handrail shall have a cross-sectional diameter between  $1\frac{1}{4}$  inches and  $1\frac{1}{2}$  inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than  $\frac{1}{8}$  inch. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the car.

(d) Mobility aid seating location. Spaces for persons who wish to remain in their wheelchairs or mobility aids shall have a minimum clear floor space 48 inches by 30 inches. Such spaces shall adjoin, and may overlap, an accessible path. Not more than 6 inches of the required clear floor space may be accommodated for footrests under another seat provided there is a minimum of 9 inches from the floor to the lowest of the seat overhanging the space. Seating spaces may have fold-down or removable seats to accommodate other passengers when a wheelchair or mobility aid user is not occupying the area, provided the seats, when folded up, do

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not obstruct the clear floor space required. (See Fig. 2.)

Sec. 38.97 Interior circulation, handrails and stanchions.

(a) Where provided, handrails or stanchions within the passenger compartment shall be placed to permit sufficient turning and maneuvering space for wheelchairs and other mobility aids to reach a seating location, complying with Sec. 38.95(d) of this , from an accessible entrance. The diameter or width of the gripping surface of interior handrails and stanchions shall be  $1\frac{1}{4}$  inches to  $1\frac{1}{2}$  inches or shall provide an equivalent gripping surface. Handrails shall be placed to provide a minimum  $1\frac{1}{2}$  inches knuckle clearance from the nearest adjacent surface.

(b) Where provided, handrails or stanchions shall be sufficient to permit safe boarding, on-board circulation, seating and standing assistance, and alighting by persons with disabilities.

(c) At entrances equipped with steps, handrails or stanchions shall be provided in the entrance to the car in a configuration which allows passengers to grasp such assists from outside the car while starting to board, and to continue using such assists throughout the boarding process, to the extent permitted by 231 of this title.

Sec. 38.99 Floors, steps and thresholds.

(a) Floor surfaces on aisles, step treads, places for standees, and areas where wheelchair and mobility aid users are to be accommodated shall be slip-resistant.

(b) All thresholds and step edges shall have a band of color(s) running the full width of the step or threshold which contrasts from the step tread and riser or adjacent floor, either light-on-dark or dark-on-light.

Sec. 38.101 Lighting

(a) Any stepwell or doorway with a lift, ramp or bridge plate shall have, when the door is open, at least 2 footcandles of illumination measured on the step tread, ramp, bridge plate, or lift platform.

(b) The doorways of cars not operating at lighted station platforms shall have outside lights which, when the door is open, provide at least 1 footcandle of illumination on the station platform surface for a distance of 3 feet perpendicular to all points on the bottom step tread edge. Such lights shall be shielded to protect the eyes of entering and exiting passengers.

Sec. 38.103 Public information system.

(a) Each car shall be equipped with an interior public address system permitting system personnel, or recorded or digitized human speech messages, to announce stations and provide other passenger information. Alternative systems or devices which provide equivalent access are also permitted.

(b) [Reserved]

Sec. 38.105 Priority seating signs.

(a) Each car shall contain sign(s) which indicate that certain seats are priority seats for persons with disabilities and that other passengers should make such seats available to those who wish to use them.

(b) Characters on signs required by paragraph (a) shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10, with a minimum character height (using an upper case 'X') of  $\frac{5}{8}$  inch, with 'wide' spacing (generally, the space between letters shall be  $\frac{1}{16}$  the height of upper case letters), and shall contrast with the background either light-on-dark or dark-on-light.

Sec. 38.107 Restrooms.

(a) If a restroom is provided for the general public, it shall be designed so as to allow a person using a wheelchair or mobility aid to enter and use such restroom as specified in paragraphs (a) (1) through (5) of this section.

(1) The minimum clear floor area shall be 35 inches by 60 inches. Permanently installed fixtures may overlap this area a maximum of 6 inches, if the lowest portion of the fixture is a minimum of 9 inches above the floor, and may overlap a maximum of 19 inches, if the lowest portion of the fixture is a minimum of 29 inches above the floor, provided such fixtures do not interfere with access to the water closet. Fold-down or retractable seats or shelves may overlap the clear floor space at a

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lower height provided they can be easily folded up or moved out of the way.

(2) The height of the water closet shall be 17 inches to 19 inches measured to the top of the toilet seat. Seats shall not be sprung to return to a lifted position.

(3) A grab bar at least 24 inches long shall be mounted behind the water closet, and a horizontal grab bar at least 40 inches long shall be

mounted on at least one side wall, with one end not more than 12 inches from the back wall, at a height between 33 inches and 36 inches above the floor.

(4) Faucets and flush controls shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbf (22.2 N). Controls for flush valves shall be mounted no more than 44 inches above the floor.

(5) Doorways on the end of the enclosure, opposite the water closet, shall have a minimum clear opening width of 32 inches. Doorways on the side wall shall have a minimum clear opening width of 39 inches. Door latches and hardware shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

(b) Restrooms required to be accessible shall be in close proximity to at least one seating location for persons using mobility aids and shall be connected to such a space by an unobstructed path having a minimum width of 32 inches.

#### Sec. 38.109 Between-car barriers.

Where operate in a high-platform, level-boarding mode, and where between-car bellows are not provided, devices or systems shall be provided to prevent, deter or warn individuals from inadvertently stepping off the platform between cars. Appropriate devices include, but are not limited to, pantograph gates, chains, motion detectors or other suitable devices.

### Subpart F--Intercity Rail Cars and Systems

#### Sec. 38.111 General.

(a) New, used and remanufactured intercity rail cars, to be considered accessible by regulations in 37 of this title shall comply with this subpart to the extent required for each type of car as specified below.

(1) Single-level rail passenger coaches and food service cars (other than single-level dining cars) shall comply with Secs. 38.113 through 38.123 of this . Compliance with Sec. 38.125 of this shall be required only to the extent necessary to meet the requirements of paragraph (d) of this section.

(2) Single-level dining and lounge cars shall have at least one connecting doorway complying with Sec. 38.113(a)(2) of this connected to a car accessible to persons using wheelchairs or mobility aids, and at least one space complying with Secs. 38.125(d) (2) and (3) of this , to provide table service to a person who wishes to remain in his or her wheelchair, and space to fold and store a wheelchair for a person who wishes to transfer to an existing seat.

(3) Bi-level dining cars shall comply with Secs. 38.113(a)(2), 38.115(b), 38.117(a), and 38.121 of this .

(4) Bi-level lounge cars shall have doors on the lower level, on each side of the car from which passengers board, complying with Sec. 38.113, a restroom complying with Sec. 38.123, and at least one space complying with Sec. 38.125(d) (2) and (3) to provide table service to a person who wishes to remain in his or her wheelchair and space to fold and store a wheelchair for a person who wishes to transfer to an existing seat.

(5) Restrooms, complying with Sec. 38.123 shall be provided in single-level rail passenger coaches and food services cars adjacent to the accessible seating locations required by paragraph (d) of this section. Accessible restrooms are required in dining and lounge cars only if restrooms are provided for other passengers.

(6) Sleeper cars shall comply with Secs. 38.113 (b) through (d), 38.115 through 38.121, and 38.125, of this , and have at least one compartment which can be entered and used by a person using a wheelchair or mobility aid and complying with Sec. 38.127 of this .

(b)(1) If physically and operationally practicable, intercity rail cars shall comply with Sec. 38.113(d) of this for level boarding.

(2) Where level boarding is not structurally or operationally practicable,

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intercity rail cars shall comply with Sec. 38.125.

(c) If portions of the car are modified in a way that it affects or could affect accessibility, each such portion shall comply, to the extent practicable, with the applicable provisions of this subpart. This provision does not require that inaccessible cars be retrofitted with lifts, ramps or other boarding devices.

(d) Passenger coaches or food service cars shall have the number of spaces complying with Sec. 38.125(d)(2) of this and the number of spaces complying with Sec. 38.125(d)(3) of this , as required by Sec. 37.91 of this title.

(e) Existing cars retrofitted to meet the seating requirements of Sec. 37.91 of this title shall comply with Sec. 38.113(e), Sec. 38.123, Sec. 38.125(d) of this and shall have at least one door on each side from which passengers board complying with Sec. 38.113(d) of this . Existing cars designed and manufactured to be accessible in accordance with the Secretary of regulations implementing section 504 of the Rehabilitation Act of 1973 that were in effect before October 7, 1991, shall comply with Sec. 38.125(a) of this .

Sec. 38.113 Doorways.

(a) Clear width. (1) At least one doorway, on each side of the car from which passengers board, of each car required to be accessible by Sec. 38.111(a) and where the spaces required by Sec. 38.111(d) of this are located, and at least one adjacent doorway into coach passenger compartments shall have a minimum clear opening width of 32 inches.

(2) Doorways at ends of cars connecting two adjacent cars, to the maximum extent practicable in accordance with regulations issued under the Federal Railroad Safety Act of 1970 (49 CFR parts 229 and 231), shall have a clear opening width of 32 inches to permit wheelchair and mobility aid users to enter into a single-level dining car, if available.

(b) Passageway. Doorways required to be accessible by paragraph (a) of this section shall permit access by persons using mobility aids and shall have an unobstructed passageway at least 32 inches wide leading to an accessible sleeping compartment complying with Sec. 38.127 of this or seating locations complying with Sec. 38.125(d) of this . In cars where such doorways require passage through a vestibule, such vestibule shall have a minimum width of 42 inches. (see Fig. 4)

(c) Signals. If doors to the platform close automatically or from a remote location, auditory and visual warning signals shall be provided to alert passengers of closing doors.

(d) Coordination with boarding platforms.--(1) Requirements. Cars which provide level-boarding in stations with high platforms shall be coordinated with the boarding platform or mini-high platform design such that the horizontal gap between a car at rest and the platform shall be no greater than 3 inches and the height of the car floor shall be within plus or minus  $\frac{5}{8}$  inch of the platform height. Vertical alignment may be accomplished by car air suspension, platform lifts or other devices, or any combination.

(2) Exception. New cars operating in existing stations may have a floor height within plus or minus  $1\frac{1}{2}$  inches of the platform height.

(3) Exception. Where platform set-backs do not allow the horizontal gap or vertical alignment specified in paragraph (d) (1) or (2), platform or portable lifts complying with Sec. 38.125(b) of this , or car or platform bridge plates, complying with Sec. 38.125(c) of this , may be provided.

(4) Exception. Retrofitted shall be coordinated with the platform in existing stations such that the horizontal gap shall be no greater than 4 inches and the height of the vehicle floor, under 50% passenger load, shall be within plus or minus 2 inches of the platform height.

(e) Signage. The International Symbol of accessibility shall be displayed on the exterior of all doors complying with this section unless all cars and doors are accessible and are not marked by the access symbol (see fig. 6). Appropriate signage shall also indicate which accessible doors are adjacent to an accessible restroom, if applicable.

[56 FR 45756, Sept. 6, 1991, as amended at 58 FR 63103, Nov. 30, 1993]

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Sec. 38.115 Interior circulation, handrails and stanchions.

(a) Where provided, handrails or stanchions within the passenger compartment shall be placed to permit sufficient turning and maneuvering space for wheelchairs and other mobility aids to reach a seating location, complying with Sec. 38.125(d) of this , from an accessible entrance. The diameter or width of the gripping surface of interior handrails and stanchions shall be 1\1/4\ inches to 1\1/2\ inches or shall provide an equivalent gripping surface. Handrails shall be placed to provide a minimum 1\1/2\ inches knuckle clearance from the nearest adjacent surface.

(b) Where provided, handrails and stanchions shall be sufficient to permit safe boarding, on-board circulation, seating and standing assistance, and alighting by persons with disabilities.

(c) At entrances equipped with steps, handrails or stanchions shall be provided in the entrance to the car in a configuration which allows passengers to grasp such assists from outside the car while starting to board, and to continue using such assists throughout the boarding process, to the extent permitted by 231 of this title.

Sec. 38.117 Floors, steps and thresholds.

(a) Floor surfaces on aisles, step treads and areas where wheelchair and mobility aid users are to be accommodated shall be slip-resistant.

(b) All step edges and thresholds shall have a band of color(s) running the full width of the step or threshold which contrasts from the step tread and riser or adjacent floor, either light-on-dark or dark-on-light.

Sec. 38.119 Lighting.

(a) Any stepwell, or doorway with a lift, ramp or bridge plate, shall have, when the door is open, at least 2 foot-candles of illumination measured on the step tread, ramp, bridge plate or lift platform.

(b) The doorways of cars not operating at lighted station platforms shall have outside lights which, when the door is open, provide at least 1 foot-candle of illumination on the station platform surface for a distance of 3 feet perpendicular to all points on the bottom step tread edge. Such lights shall be shielded to protect the eyes of entering and exiting passengers.

Sec. 38.121 Public information system.

(a) Each car shall be equipped with a public address system permitting system personnel, or recorded or digitized human speech messages, to announce stations and provide other passenger information. Alternative systems or devices which provide equivalent access are also permitted.

(b) [Reserved]

Sec. 38.123 Restrooms.

(a) If a restroom is provided for the general public, and an accessible restroom is required by Sec. 38.111 (a) and (e) of this , it shall be designed so as to allow a person using a wheelchair or mobility aid to enter and use such restroom as specified in paragraphs (a) (1) through (5) of this section.

(1) The minimum clear floor area shall be 35 inches by 60 inches. Permanently installed fixtures may overlap this area a maximum of 6 inches, if the lowest portion of the fixture is a minimum of 9 inches above the floor, and may overlap a maximum of 19 inches, if the lowest portion of the fixture is a minimum of 29 inches above the floor. Fixtures shall not interfere with access to and use of the water closet. Fold-down or retractable seats or shelves may overlap the clear floor



space at a lower height provided they can be easily folded up or moved out of the way.

(2) The height of the water closet shall be 17 inches to 19 inches measured to the top of the toilet seat. Seats shall not be sprung to return to a lifted position.

(3) A grab bar at least 24 inches long shall be mounted behind the water closet, and a horizontal grab bar at least 40 inches long shall be mounted on at least one side wall, with one end not more than 12 inches from the back wall, at a height between 33 inches and 36 inches above the floor.

(4) Faucets and flush controls shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbf (22.2 N). Controls for

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flush valves shall be mounted no more than 44 inches above the floor.

(5) Doorways on the end of the enclosure, opposite the water closet, shall have a minimum clear opening width of 32 inches. Doorways on the side wall shall have a minimum clear opening width of 39 inches. Door latches and hardware shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

(b) Restrooms required to be accessible shall be in close proximity to at least one seating location for persons using mobility aids complying with Sec. 38.125(d) of this and shall be connected to such a space by an unobstructed path having a minimum width of 32 inches.

#### Sec. 38.125 Mobility aid accessibility.

(a)(1) General. All intercity rail cars, other than level entry cars, required to be accessible by Secs. 38.111 (a) and (e) of this subpart shall provide a level-change mechanism or boarding device (e.g., lift, ramp or bridge plate) complying with either paragraph (b) or (c) of this section and sufficient clearances to permit a wheelchair or other mobility aid user to reach a seating location complying with paragraph (d) of this section.

(2) Exception. If portable or platform lifts, ramps or bridge plates meeting the applicable requirements of this section are provided on station platforms or other stops required to be accessible, or mini-high platforms complying with Sec. 38.113(d) are provided, the car is not required to be equipped with a car-borne device.

(b) Car Lift--(1) Design load. The design load of the lift shall be at least 600 pounds. Working parts, such as cables, pulleys, and shafts, which can be expected to wear, and upon which the lift depends for support of the load, shall have a safety factor of at least six, based on the ultimate strength of the material. Nonworking parts, such as platform, frame, and attachment hardware which would not be expected to wear, shall have a safety factor of at least three, based on the ultimate strength of the material.

(2) Controls--(i) Requirements. The controls shall be interlocked with the car brakes, propulsion system, or door, or shall provide other appropriate mechanisms or systems, to ensure that the car cannot be moved when the lift is not stowed and so the lift cannot be deployed unless the interlocks or systems are engaged. The lift shall deploy to all platform levels normally encountered in the operating environment. Where provided, each control for deploying, lowering, raising, and stowing the lift and lowering the roll-off barrier shall be of a monetary contact type requiring continuous manual pressure by the operator and shall not allow improper lift sequencing when the lift platform is occupied. The controls shall allow reversal of the lift operation sequence, such as raising or lowering a platform that is way down, without allowing an occupied platform to fold or retract into the stowed position.

(ii) Exception. Where physical or safety constraints prevent the deployment at some stops of a lift having its long dimension perpendicular to the car axis, the entity may specify a lift which is designed to deploy with its long dimension parallel to the car axis and which pivots into or out of the car while occupied (i.e.,

rotary lift'). The requirements of paragraph (b)(2)(i) of this section prohibiting the lift from being stowed while occupied shall not apply to a lift design of this type if the stowed position is within the passenger compartment and the lift is intended to be stowed while occupied.

(iii) Exception. The brake or propulsion system interlocks requirement does not apply to platform mounted or portable lifts provided that a mechanical, electrical or other system operates to ensure that cars do not move when the lift is in use.

(3) Emergency operation. The lift shall incorporate an emergency method of deploying, lowering to ground or station platform level with a lift occupant, and raising and stowing the empty lift if the power to the lift fails. No emergency method, manual or otherwise, shall be capable of being operated in a manner that could be hazardous to the lift occupant or to the operator when operated according to manufacturer's instructions, and shall not permit the platform to be stowed or

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folded when occupied, unless the lift is a rotary lift and is intended to be stowed while occupied.

(4) Power or equipment failure. Platforms stowed in a vertical position, and deployed platforms when occupied, shall have provisions to prevent their deploying, falling, or folding any faster than 12 inches/second or their dropping of an occupant in the event of a single failure of any load carrying component.

(5) Platform barriers. The lift platform shall be equipped with barriers to prevent any of the wheels of a wheelchair or mobility aid from rolling off the lift during its operation. A movable barrier or inherent design feature shall prevent a wheelchair or mobility aid from rolling off the edge closest to the car until the lift is in its fully raised position. Each side of the lift platform which, in its raised position, extends beyond the car shall have a barrier a minimum 1½ inches high. Such barriers shall not interfere with maneuvering into or out of the car. The loading-edge barrier (outer barrier) which functions as a loading ramp when the lift is at ground or station platform level, shall be sufficient when raised or closed, or a supplementary system shall be provided, to prevent a power wheelchair or mobility aid from riding over or defeating it. The outer barrier of the lift shall automatically rise or close, or a supplementary system shall automatically engage, and remain raised, closed, or engaged at all times that the lift platform is more than 3 inches above the station platform and the lift is occupied. Alternatively, a barrier or system may be raised, lowered, opened, closed, engaged or disengaged by the lift operator provided an interlock or inherent design feature prevents the lift from rising unless the barrier is raised or closed or the supplementary system is engaged.

(6) Platform surface. The lift platform surface shall be free of any protrusions over ¼ inch high and shall be slip resistant. The lift platform shall have a minimum clear width of 28½ inches at the platform, a minimum clear width of 30 inches measured from 2 inches above the lift platform surface to 30 inches above the surface, and a minimum clear length of 48 inches measured from 2 inches above the surface of the platform to 30 inches above the surface. (See Fig. 1.)

(7) Platform gaps. Any openings between the lift platform surface and the raised barriers shall not exceed ⅝ inch wide. When the lift is at car floor height with the inner barrier (if applicable) down or retracted, gaps between the forward lift platform edge and car floor shall not exceed ½ inch horizontally and ⅝ inch vertically.

(8) Platform entrance ramp. The entrance ramp, or loading-edge barrier used as a ramp, shall not exceed a slope of 1:8, when measured on level ground, for a maximum rise of 3 inches, and the transition from station platform to ramp may be vertical without edge treatment up to ¼ inch. Thresholds between ¼ inch and ½ inch high shall be beveled with a slope no greater than 1:2.

(9) Platform deflection. The lift platform (not including the entrance ramp) shall not deflect more than 3 degrees (exclusive of car roll) in any direction between its unloaded position and its position when loaded with 600 pounds applied through a 26 inch by 26 inch test

pallet at the centroid of the lift platform.

(10) Platform movement. No of the platform shall move at a rate exceeding 6 inches/second during lowering and lifting an occupant, and shall not exceed 12 inches/second during deploying or stowing. This requirement does not apply to the deployment or stowage cycles of lifts that are manually deployed or stowed. The maximum platform horizontal and vertical acceleration when occupied shall be 0.3g.

(11) Boarding direction. The lift shall permit both inboard and outboard facing of wheelchairs and mobility aids.

(12) Use by standees. Lifts shall accommodate persons using walkers, crutches, canes or braces or who otherwise have difficulty using steps. The lift may be marked to indicate a preferred standing position.

(13) Handrails. Platforms on lifts shall be equipped with handrails, on two sides, which move in tandem with the lift, and which shall be graspable and provide support to standees throughout the entire lift operation.

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Handrails shall have a usable component at least 8 inches long with the lowest portion a minimum 30 inches above the platform and the highest portion a maximum 38 inches above the platform. The handrails shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. The handrail shall have a cross-sectional diameter between  $1\frac{1}{4}$  inches and  $1\frac{1}{2}$  inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than  $\frac{1}{8}$  inch. Handrails shall be placed to provide a minimum  $1\frac{1}{2}$  inches knuckle clearance from the nearest adjacent surface. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the car.

(c) Car ramp or bridge plate--(1) Design load. Ramps or bridge plates 30 inches or longer shall support a load of 600 pounds, placed at the centroid of the ramp or bridge plate distributed over an area of 26 inches by 26 inches, with a safety factor of at least 3 based on the ultimate strength of the material. Ramps or bridge plates shorter than 30 inches shall support a load of 300 pounds.

(2) Ramp surface. The ramp or bridge plate surface shall be continuous and slip resistant, shall not have protrusions from the surface greater than  $\frac{1}{4}$  inch high, shall have a clear width of 30 inches and shall accommodate both four-wheel and three-wheel mobility aids.

(3) Ramp threshold. The transition from station platform to the ramp or bridge plate and the transition from car floor to the ramp or bridge plate may be vertical without edge treatment up to  $\frac{1}{4}$  inch. Changes in level between  $\frac{1}{4}$  inch and  $\frac{1}{2}$  inch shall be beveled with a slope no greater than 1:2.

(4) Ramp barriers. Each side of the ramp or bridge plate shall have barriers at least 2 inches high to prevent mobility aid wheels from slipping off.

(5) Slope. Ramps or bridge plates shall have the least slope practicable. If the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is 3 inches or less above the station platform a maximum slope of 1:4 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is 6 inches or less, but more than 3 inches, above the station platform a maximum slope of 1:6 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is 9 inches or less, but more than 6 inches, above the station platform a maximum slope of 1:8 is permitted; if the height of the vehicle floor, under 50% passenger load, from which the ramp is deployed is greater than 9 inches above the station platform a slope of 1:12 shall be achieved. Folding or telescoping ramps are permitted provided they meet all structural requirements of this section.

(6) Attachment--(i) Requirement. When in use for boarding or alighting, the ramp or bridge plate shall be attached to the vehicle, or otherwise prevented from moving such that it is not subject to displacement when loading or unloading a heavy power mobility aid and that any gaps between vehicle and ramp or bridge plate, and station platform and ramp or bridge plate, shall not exceed  $\frac{5}{8}$  inch.

(ii) Exception. Ramps or bridge plates which are attached to, and deployed from, station platforms are permitted in lieu of car devices provided they meet the displacement requirements of paragraph (c)(6)(i) of this section.

(7) Stowage. A compartment, securement system, or other appropriate method shall be provided to ensure that stowed ramps or bridge plates, including portable ramps or bridge plates stowed in the passenger area, do not impinge on a passenger's wheelchair or mobility aid or pose any hazard to passengers in the event of a sudden stop.

(8) Handrails. If provided, handrails shall allow persons with disabilities to grasp them from outside the car while starting to board, and to continue to use them throughout the boarding process, and shall have the top between 30 inches and 38 inches above the ramp surface. The handrails shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. The handrail shall have a cross-sectional diameter between 1 1/4 inches and

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1 1/2 inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than 1/8 inch. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the car.

(d) Seating--(1) Requirements. All intercity rail cars required to be accessible by Secs. 38.111 (a) and (e) of this subpart shall provide at least one, but not more than two, mobility aid seating location(s) complying with paragraph (d)(2) of this section; and at least one, but not more than two, seating location(s) complying with paragraph (d)(3) of this section which adjoin or overlap an accessible route with a minimum clear width of 32 inches.

(2) Wheelchair or mobility aid spaces. Spaces for persons who wish to remain in their wheelchairs or mobility aids shall have a minimum clear floor space 48 inches by 30 inches. Such spaces shall adjoin, and may overlap, an accessible path. Not more than 6 inches of the required clear floor space may be accommodated for footrests under another seat provided there is a minimum of 9 inches from the floor to the lowest of the seat overhanging the space. Seating spaces may have fold-down or removable seats to accommodate other passengers when a wheelchair or mobility aid user is not occupying the area, provided the seats, when folded up, do not obstruct the clear floor space provided (See Fig. 2).

(3) Other spaces. Spaces for individuals who wish to transfer shall include a regular coach seat or dining car booth or table seat and space to fold and store the passenger's wheelchair.

[56 FR 45756, Sept. 6, 1991, as amended at 58 FR 63103, Nov. 30, 1993]

Sec. 38.127 Sleeping compartments.

(a) Sleeping compartments required to be accessible shall be designed so as to allow a person using a wheelchair or mobility aid to enter, maneuver within and approach and use each element within such compartment. (See Fig. 5.)

(b) Each accessible compartment shall contain a restroom complying with Sec. 38.123(a) which can be entered directly from such compartment.

(c) Controls and operating mechanisms (e.g., heating and air conditioning controls, lighting controls, call buttons, electrical outlets, etc.) shall be mounted no more than 48 inches, and no less than 15 inches, above the floor and shall have a clear floor area directly in front a minimum of 30 inches by 48 inches. Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

#### Subpart G--Over-the-Road Buses and Systems

Sec. 38.151 General.

(a) New, used and remanufactured over-the-road buses, to be considered accessible by regulations in 37 of this title, shall

comply with this subpart.

(b) Over-the-road buses covered by Sec. 37.7 (c) of this title shall comply with Sec. 38.23 and this subpart.

#### Sec. 38.153 Doors, steps and thresholds.

(a) Floor surfaces on aisles, step treads and areas where wheelchair and mobility aid users are to be accommodated shall be slip-resistant.

(b) All step edges shall have a band of color(s) running the full width of the step which contrasts from the step tread and riser, either dark-on-light or light-on-dark.

(c) To the maximum extent practicable, doors shall have a minimum clear width when open of 30 inches, but in no case less than 27 inches.

#### Sec. 38.155 Interior circulation, handrails and stanchions.

(a) Handrails and stanchions shall be provided in the entrance to the vehicle in a configuration which allows passengers to grasp such assists from outside the vehicle while starting to board, and to continue using such handrails or stanchions throughout the boarding process. Handrails shall have a cross-sectional diameter between 1 1/4 inches and 1 1/2 inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than 1/8 inch. Handrails shall be placed to provide a minimum 1 1/2 inches knuckle clearance from the nearest adjacent surface. Where on-board fare

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collection devices are used, a horizontal passenger assist shall be located between boarding passengers and the fare collection device and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the door through the boarding procedure. Passengers shall be able to lean against the assist for security while paying fares.

(b) Where provided within passenger compartments, handrails or stanchions shall be sufficient to permit safe on-board circulation, seating and standing assistance, and alighting by persons with disabilities.

#### Sec. 38.157 Lighting.

(a) Any stepwell or doorway immediately adjacent to the driver shall have, when the door is open, at least 2 foot-candles of illumination measured on the step tread.

(b) The vehicle doorway shall have outside light(s) which, when the door is open, provide at least 1 foot-candle of illumination on the street surface for a distance of 3 feet perpendicular to all points on the bottom step tread outer edge. Such light(s) shall be located below window level and shielded to protect the eyes of entering and exiting passengers.

#### Sec. 38.159 Mobility aid accessibility. [Reserved]

#### Subpart H--Other and Systems

#### Sec. 38.171 General.

(a) New, used and remanufactured and conveyances for systems not covered by other subparts of this , to be considered accessible by regulations in 37 of this title shall comply with this subpart.

(b) If portions of the vehicle or conveyance are modified in a way that affects or could affect accessibility, each such portion shall comply, to the extent practicable, with the applicable provisions of this subpart. This provision does not require that inaccessible be retrofitted with lifts, ramps or other boarding devices.

(c) Requirements for and systems not covered by this shall be determined on a case-by-case basis by the Department of

in consultation with the U.S. Architectural and Barriers Compliance Board (Access Board).

Sec. 38.173 Automated guideway transit and systems.

(a) Automated Guideway Transit (AGT) and systems, sometimes called ``people movers'', operated in airports and other areas where AGT travel at slow speed (i.e., at a speed of no more than 20 miles per hour at any location on their route during normal operation), shall comply with the provisions of Sec. 38.53 (a) through (c), and Secs. 38.55 through 38.61 of this for rapid rail and systems.

(b) Where the vehicle covered by paragraph (a) will operate in an accessible station, the design of shall be coordinated with the boarding platform design such that the horizontal gap between a vehicle door at rest and the platform shall be no greater than 1 inch and the height of the vehicle floor shall be within plus or minus  $\frac{1}{2}$  inch of the platform height under all normal passenger load conditions. Vertical alignment may be accomplished by vehicle air suspension or other suitable means of meeting the requirement.

(c) In stations where open requirements are not protected by platform screens, a suitable device or system shall be provided to prevent, deter or warn individuals from stepping off the platform between cars. Acceptable devices include, but are not limited to, pantograph gates, chains, motion detectors or other appropriate devices.

(d) Light rail and rapid rail AGT and systems shall comply with subparts D and C of this , respectively. AGT systems whose travel at a speed of more than 20 miles per hour at any location on their route during normal operation are covered under this paragraph rather than under paragraph (a) of this section.

[56 FR 45756, Sept. 6, 1991, as amended at 61 FR 25416, May 21, 1996]

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Sec. 38.175 High-speed rail cars, monorails and systems.

(a) All cars for high-speed rail systems, including but not limited to those using ``maglev'' or high speed steel-wheel-on-steel rail technology, and monorail systems operating primarily on dedicated rail (i.e., not used by freight trains) or guideway, in which stations are constructed in accordance with 37, subpart C of this title, shall be designed for high-platform, level boarding and shall comply with Sec. 38.111(a) of this for each type of car which is similar to intercity rail, Secs. 38.111(d), 38.113 (a) through (c) and (e), 38.115 (a) and (b), 38.117 (a) and (b), 38.121 through 38.123, 38.125(d), and 38.127 (if applicable) of this . The design of cars shall be coordinated with the boarding platform design such that the horizontal gap between a car door at rest and the platform shall be no greater than 3 inches and the height of the car floor shall be within plus or minus  $\frac{5}{8}$  inch of the platform height under all normal passenger load conditions. Vertical alignment may be accomplished by car air suspension or other suitable means of meeting the requirement. All doorways shall have, when the door is open, at least 2 footcandles of illumination measured on the door threshold.

(b) All other high-speed rail cars shall comply with the similar provisions of subpart F of this .

Sec. 38.177 Ferries, excursion boats and other vessels. [Reserved]

Sec. 38.179 Trams, and similar , and systems

(a) New and used trams consisting of a tractor unit, with or without passenger accommodations, and one or more passenger trailer units, including but not limited to providing shuttle service to remote parking areas, between hotels and other public accommodations, and between and within amusement parks and other recreation areas, shall comply with this section. For purposes of determining applicability of 49 CFR 37.101, 37.103, or 37.105 the capacity of such a vehicle or ``train'' shall consist of the total combined seating capacity of all

units, plus the driver, prior to any modification for accessibility.

(b) Each tractor unit which accommodates passengers and each trailer unit shall comply with Sec. 38.25 and Sec. 38.29 of this . In addition, each such unit shall comply with Sec. 38.23 (b) or (c) and shall provide at least one space for wheelchair or mobility aid users complying with Sec. 38.23(d) of this unless the complete operating unit consisting of tractor and one or more trailers can already accommodate at least two wheelchair or mobility aid users.

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#### Appendix to 38--Guidance Material

This appendix contains materials of an advisory nature and provides additional information that should help the reader to understand the minimum requirements of the standards or to design for greater accessibility. Each entry is applicable to all subparts of this except where noted. Nothing in this appendix shall in any way obviate any obligation to comply with the requirements of the standards themselves.

##### I. Slip Resistant Surface--Aisles, Steps, Floor Areas Where People Walk, Floor Areas in Securement Locations, Lift Platforms, Ramps

Slip resistance is based on the frictional force necessary to keep a shoe heel or crutch tip from slipping on a walking surface under conditions likely to be found on the surface. While the dynamic coefficient of friction during walking varies in a complex and non-uniform way, the static coefficient of friction, which can be measured in several ways, provides a close approximation of the slip resistance of a surface. Contrary to popular belief, some slippage is necessary to walking, especially for persons with restricted gaits; a truly "non-slip" surface could not be negotiated.

The Occupational Safety and Health Administration recommends that walking surfaces have a static coefficient of friction of 0.5. A research project sponsored by the Architectural and Barriers Compliance Board (Access Board) conducted tests with persons with disabilities and concluded that a higher coefficient of friction was needed by such persons. A static coefficient of friction of 0.6 is recommended for steps, floors, and lift platforms and 0.8 for ramps.

It is recognized that the coefficient of friction varies considerably due to the presence of contaminants, water, floor finishes, and other factors not under the control of transit providers and may be difficult to measure. Nevertheless, many common materials suitable for flooring are now labeled with information on the static coefficient of friction. While it may not be possible to compare one product directly

with another, or to guarantee a constant measure, transit operators or vehicle designers and manufacturers are encouraged to specify materials with appropriate values. As more products include information on slip resistance, improved uniformity in measurement and specification is likely. The Access Board's advisory guidelines on Slip Resistant Surfaces provides additional information on this subject.

## II. Color Contrast--Step Edges, Lift Platform Edges

The material used to provide contrast should contrast by at least 70%. Contrast in percent is determined by:

$$\text{Contrast} = \frac{B - b}{B} \times 100$$

Where B=light reflectance value (LRV) of the lighter area  
and b=light reflectance value (LRV) of the darker area.

Note that in any application both white and black are never absolute; thus, B never equals 100 and b is always greater than 0.

## III. Handrails and Stanchions

In addition to the requirements for handrails and stanchions for rapid, light, and commuter rail, consideration should be given to the proximity of handrails or stanchions to the area in which wheelchair or mobility aid users may position themselves. When identifying the clear floor space where a wheelchair or mobility aid user can be accommodated, it is suggested that at least one such area be adjacent or in close proximity to a handrail or stanchion. Of course, such a handrail or stanchion cannot encroach upon the required 32 inch width required for the doorway or the route leading to the clear floor space which must be at least 30 by 48 inches in size.

## IV. Priority Seating Signs and Other Signage

A. Finish and Contrast. The characters and background of signs should be eggshell, matte, or other non-glare finish. An eggshell finish (11 to 19 degree gloss on 60 degree glossimeter) is recommended. Characters and symbols shall contrast with their background--either light characters on a dark background or dark characters on a light background. Research indicates that signs are more legible for persons with low vision when characters contrast with their background by at least 70 percent. Contrast in percent shall be determined by:

$$\text{Contrast} = \frac{B - b}{B} \times 100$$

Where B=light reflectance value (LRV) of the lighter area  
and b=light reflectance value (LRV) of the darker area.

Note that in any application both white and black are never absolute; thus, B never equals 100 and b is always greater than 0.

The greatest readability is usually achieved through the use of light-colored characters or symbols on a dark background.

B. Destination and Route Signs. (The following **specifications**, which are required for buses (Sec. 38.39), are recommended for other types of, particularly light rail, where appropriate.)

1. Where destination or route information is displayed on the exterior of a vehicle, each

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vehicle shall have illuminated signs on the front and boarding side of the vehicle.

2. Characters on signs required by paragraph IV.B.1 of this appendix shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10, with a minimum character height (using an upper case 'X') of 1 inch for signs on the boarding side and a minimum character height of 2 inches for front 'headsings,' with 'wide' spacing (generally, the space between letters shall be 1/



16\ the height of upper case letters), and shall contrast with the background, either dark-on-light or light-on-dark, or as recommended above.

C. Designation of Accessible . The International Symbol of accessibility should be displayed as shown in Figure 6.

#### V. Public Information Systems

This section has been reserved and there currently is no requirement that be equipped with an information system which is capable of providing the same or equivalent information to persons with hearing loss. While the Department assesses available and soon-to-be available technology during a study to be conducted during Fiscal Year 1992, entities are encouraged to employ whatever services, signage or alternative systems or devices that provide equivalent access and are available. Two possible types of devices are visual display systems and listening systems. However, it should be noted that while visual display systems accommodate persons who are deaf or are hearing impaired, assistive listening systems aid only those with a partial loss of hearing.

A. Visual Display Systems. Announcements may be provided in a visual format by the use of electronic message boards or video monitors.

Electronic message boards using a light emitting diode (LED) or ``flip-dot'' display are currently provided in some transit stations and terminals and may be usable in . These devices may be used to provide real time or pre-programmed messages; however, real time message displays require the availability of an employee for keyboard entry of the information to be announced.

Video monitor systems, such as visual paging systems provided in some airports (e.g., Baltimore-Washington International Airport), are another alternative. The Architectural and Barriers Compliance Board (Access Board) can provide technical assistance and information on these systems (``Airport TDD Access: Two Case Studies,' (1990)).

B. Assistive Listening Systems. Assistive listening systems (ALS) are intended to augment standard public address and audio systems by providing signals which can be received directly by persons with special receivers or their own hearing aids and which eliminate or filter background noise. Magnetic induction loops, infra-red and radio frequency systems are types of listening systems which are appropriate for various applications.

An assistive listening system appropriate for transit , where a group of persons or where the specific individuals are not known in advance, may be different from the system appropriate for a particular individual provided as an auxiliary aid or as of a reasonable accommodation. The appropriate device for an individual is the type that individual can use, whereas the appropriate system for a station or vehicle will necessarily be geared toward the ``average'' or aggregate needs of various individuals. Earphone jacks with variable volume controls can benefit only people who have slight hearing loss and do not help people who use hearing aids. At the present time, magnetic induction loops are the most feasible type of listening system for people who use hearing aids equipped with ``T-coils'', but people without hearing aids or those with hearing aids not equipped with inductive pick-ups cannot use them without special receivers. Radio frequency systems can be extremely effective and inexpensive. People without hearing aids can use them, but people with hearing aids need a special receiver to use them as they are presently designed. If hearing aids had a jack to allow a by-pass of microphones, then radio frequency systems would be suitable for people with and without hearing aids. Some listening systems may be subject to interference from other equipment and feedback from hearing aids of people who are using the systems. Such interference can be controlled by careful engineering design that anticipates feedback sources in the surrounding area.

The Architectural and Barriers Compliance Board (Access Board) has published a pamphlet on Assistive Listening Systems which lists demonstration centers across the country where technical assistance can be obtained in selecting and installing appropriate systems. The State of New York has also adopted a detailed technical specification which may be useful.

