(d) *Special rule for special-purpose vehicles.* The rules in this section do not apply to a vehicle transporting one or more articles which, because of their size, shape, or weight, must be carried on special-purpose vehicles or must be fastened by special methods. However, any article carried on that vehicle must be securely and adequately fastened to the vehicle.

(e) *Special rule for intermodal cargo containers.* Containers designed for the transportation of containerized, intermodal cargo and having integral securement devices must be fastened to the chassis of the motor vehicle with securement devices that prevent them from being unintentionally unfastened. The securement devices must restrain the container from moving more than one-half inch forward, more than one-half inch aft, more than one-half inch to the right, more than one-half inch to the left, or more than one inch vertically when the container is subjected to the following accelerations relative to the vehicle:

Direction of force relative to longitudinal axis of vehicle	Acceleration in G's
Downward	1.70
Upward	0.50
Lateral	0.30
Longitudinal	1.80

(f) *Effective date.* This section is effective on October 1, 1973.

§ 393.102 Securement systems.

(a) *Application and scope of the rules in this section.* The rules in this section apply to tiedown assemblies (including chains, cables, steel straps, and fiber webbing), other securement devices, and attachment or fastening devices used in conjunction therewith, which are used to secure cargo to motor vehicles in transit. All devices which are used to secure cargo to a motor vehicle in transit under the rules in this subpart must conform to the requirements of this section.

(b) *Tiedown assemblies.* Except for integral securement devices of containers designed for the transportation of containerized, intermodal cargo which conform to the rules in § 393.100(e), the aggregate working load limit of the tiedown assemblies used to secure an article against movement in any direction must be at least 1/2 times the weight of the article. With the exception of marking identification, tiedowns used must meet applicable manufacturing standards listed in this paragraph (b).

(1) *Steel strapping.* Steel strapping used as a component of a tiedown assembly must conform to the requirements of the 1991 edition of the American Society for Testing and Materials' Standard Specification for Strapping, Flat Steel and Seals, ASTM D3953–91. Steel strapping which is not marked by the manufacturer with a working load limit, shall be considered to have a working load limit equal to 1/4 of the breaking strength listed in ASTM D3953–91. (See § 393.7(b) for information on the incorporation by reference and availability of this document.) Steel strapping that is one inch wide or wider must have at least two pairs of crimps in each seal and when an end-over-end lap joint is formed, it must be sealed with at least two seals.

(2) *Chain.* Chain used as a component of a tiedown assembly must conform to the requirements of the June 15, 1990, edition of the National Association of Chain Manufacturers' Welded Steel Chain Specifications applicable to all types of chain. (See § 393.7(b) for information on the incorporation by reference and availability of this document.)

(3) *Webbing.* Webbing used as a component of a tiedown assembly must conform to the requirements of the 1991 edition of the Web Sling and Tiedown Association's Recommended Standard Specification for Synthetic Webbing Tiedowns. (See § 393.7(b) for information on the incorporation by reference and availability of this document.)

(4) *Wire rope.* Wire rope used as a component of a tiedown assembly must conform to the requirements of the November 1985 second edition of the Wire Rope Technical Board's Wire Rope Users Manual. Wire rope which is not marked by the manufacturer with a working load limit, shall be considered to have a working load limit equal to ¼ of the nominal strength listed in the Wire Rope Users Manual. (See § 393.7(b) for information on the incorporation by reference and availability of this document.)

(5) *Cordage*. Cordage used as a component of a tiedown assembly, must conform to the applicable Cordage Institute rope standards listed below: PETRS–2, Polyester Fiber Rope, 3-Strand and 8-Strand Constructions, January, 1993; PPRS–2, Polypropylene Fiber Rope, 3-Strand and 8-Strand Constructions, August, 1992; CRS–1, Polyester/Polypropylene Composite Rope Specifications, Three- and Eight-Strand Standard Construction, May 1979; NRS–1, Nylon Rope Specifications, Three- and Eight-Strand Standard Construction, May 1979; C1, Double Braided Nylon Rope Specifications, DBN-January 1984. (See § 393.7(b) for information on the incorporation by reference and availability of these documents.)

(6) *Tables of working load limits*. The working load limits listed in the tables in this paragraph are to be used when the tiedown material is not marked by the manufacturer with the working load limit. Tiedown materials which are marked by the manufacturer with working load limits which differ from the table, shall be considered to have a working load limit equal to the value for which they are marked. Synthetic cordage (e.g., nylon, polypropylene, polyester) which is not marked or labeled to enable identification of its composition or working load limit shall be considered to have a working load limit equal to that for polypropylene fiber rope.

TABLES TO § 393.102(B)(6)—WORKING LOAD LIMITS (WLL)

[Chain WLL in pounds (kg)]

Size inch (mm)	Grade 3 proof coil	Grade 4 high test	Grade 7 transport	Grade 8 alloy
1/4 (7)	1300 (590)	2600 (1180)	3150 (1430)	3500 (1590)
5/16 (8)	1900 (860)	3900 (1770)	4700 (2130)	5100 (2310)
3/8 (10)	2650 (1200)	5400 (2450)	6600 (2990)	7100 (3220)
7/16 (11)	3500 (1590)	5800 (2630)	8750 (3970)	.....
1/2 (13)	4500 (2040)	9200 (4170)	11300 (5130)	12000 (5440)
5/8 (16)	6900 (3130)	11500 (5220)	15800 (7170)	18100 (8210)
Chain Mark	PC	HT	.....	T
Examples	3	4	7	8
	30	40	70	80

Synthetic Webbing WLL

Width inch (mm)	WLL pounds (kg)
1-3/4 (45)	1750 (790)
2 (50)	2000 (910)
3 (75)	3000 (1360)
4 (100)	4000 (1810)

Wire Rope (6 X 37, Fiber Core) WLL

Diameter inch (mm)	WLL pounds (kg)
1/4 (7)	1400 (640)
5/16 (8)	2100 (950)
3/8 (10)	3000 (1360)
7/16 (11)	4100 (1860)
1/2 (13)	5300 (2400)
5/8 (16)	8300 (3770)
3/4 (20)	10900 (4940)
7/8 (22)	16100 (7300)
1 (25)	20900 (9480)

Manila Rope WLL

Diameter inch (mm)	WLL pounds (kg)
3/8 (10)	205 (90)
7/16 (11)	265 (120)
1/2 (13)	315 (150)
5/8 (16)	465 (210)
3/4 (20)	640 (290)
1 (25)	1050 (480)

Polypropylene Fiber Rope WLL (3-Strand and 8-Strand Constructions)

Diameter inch (mm)	WLL pounds (kg)
3/8 (10)	400 (180)
7/16 (11)	525 (240)
1/2 (13)	625 (280)
5/8 (16)	925 (420)
3/4 (20)	1275 (580)
1 (25)	2100 (950)

Polyester Fiber Rope WLL (3-Strand and 8-Strand Constructions)

Diameter inch (mm)	WLL pounds (kg)
3/8 (10)	555 (250)
7/16 (11)	750 (340)
1/2 (13)	960 (440)
5/8 (16)	1500 (680)
3/4 (20)	1880 (850)
1 (25)	3300 (1500)

Nylon Rope WLL

Diameter inch (mm)	WLL pounds (kg)
3/8 (10)	278 (130)
7/16 (11)	410 (190)
1/2 (13)	525 (240)
5/8 (16)	935 (420)
3/4 (20)	1420 (640)
1 (25)	2520 (1140)

Double Braided Nylon Rope WLL

Diameter inch (mm)	WLL pounds (kg)
3/8 (10)	336 (150)
7/16 (11)	502 (230)
1/2 (13)	655 (300)
5/8 (16)	1130 (510)
3/4 (20)	1840 (830)
1 (25)	3250 (1470)

Steel Strapping WLL

Width − thickness inch	WLL pounds (kg)
1-1/4 × 0.029	1190 (540)
1-1/4 × 0.031	1190 (540)
1-1/4 × 0.035	1190 (540)
1-1/4 × 0.044	1690 (770)
1-1/4 × 0.050	1690 (770)
1-1/4 × 0.057	1925 (870)
2 × 0.044	2650 (1200)
2 × 0.050	2650 (1200)

(c) *Load binders and hardware.* The strength of load binders and hardware that are part of, or used in conjunction with, a tiedown assembly must be equal to, or greater than the minimum strength specified for that tiedown assembly in paragraph (b) of this section.

(d) *Attachment to the vehicle.* The hook, bolt, weld, or other connector by which a tiedown assembly is attached to a vehicle, and the mounting place and means of mounting the connector, must be at least as strong as the tiedown assembly when that connector is loaded in any direction in which the tiedown assembly may load it.

(e) *Winches or other fastenings.* The anchorages of a winch or other fastening device mounted on a vehicle and used in conjunction with a tiedown assembly must have a combined tensile strength equal to, or greater than, the strength of the tiedown assembly.

(f) *Adjustability.* A tiedown assembly and its associated connectors and attachment devices must be designed,

constructed, and maintained so that the driver of an in-transit vehicle can tighten them. However, the rules in this paragraph do not apply to a securement system in which the tiedown assembly consists of steel strapping or to a tiedown assembly which is not required by the rules in this section.

(49 U.S.C. 304, 1655; 49 CFR 1.48(b) and 301.60)

[38 FR 23522, Aug. 31, 1973, as amended at 47 FR 47837, Oct. 28, 1982; 59 FR 34718, July 6, 1994; 59 FR 43898, Aug. 25, 1994]

§ 393.104 Blocking and bracing.

(a) *Protection against longitudinal movement.* When a motor vehicle carries cargo that is not firmly braced against a front-end structure that conforms to the requirements of § 393.106, the cargo must be secured so that, when the vehicle decelerates at a rate of 20 feet per second per second, the cargo will remain on the vehicle and will not penetrate the vehicle's front-end structure.

(b) *Protection against lateral movement.* When a vehicle carries cargo that may shift sideways in transit, the cargo must either be securely blocked or braced against the sides, sideboards, or stakes of the vehicle or be secured by devices that conform to the requirements of paragraph (b)(2), (b)(3), or (b)(4) of § 393.100.

(c) *Effective date.* This section is effective on October 1, 1973.

[38 FR 23522, Aug. 31, 1973, as amended at 38 FR 25183, Sept. 12, 1973]

§ 393.106 Front-end structure.

(a) *General rule.* (1) Except as provided in paragraph (g) of this section, every cargo-carrying motor vehicle must be equipped with a headerboard or similar device of sufficient strength to prevent load shifting and penetration or crushing of the driver's compartment.

(2) On and after the effective dates specified in paragraph (h) of this section, every cargo-carrying motor vehicle must have a front-end structure that conforms to the rules in this section.

(b) *Location.* The front-end structure must be located between the vehicle's cargo and the vehicle's driver.

(c) *Height and width.* The front-end structure must extend either to a height of 4 feet above the floor of the vehicle or to a height at which it blocks forward movement of any item of cargo being carried on the vehicle, whichever is lower. The front-end structure must have a width which is at least equal to the width of the vehicle or which blocks forward movement of any item of cargo being transported on the vehicle, whichever is narrower.

(d) *Strength.* The front-end structure must be capable of withstanding the horizontal forward static load specified in either paragraph (d) (1) or (2) of this section.

(1) For a front-end structure less than 6 feet in height, a horizontal forward static load equal to one half (½) of the weight of the cargo being transported on the vehicle uniformly distributed over the entire portion of the front-end structure that is within 4 feet above the vehicle's floor or that is at or below a height above the vehicle's floor at which it blocks forward movement of any item of the vehicle's cargo, whichever is less.

(2) For a front-end structure 6 feet in height or higher, a horizontal forward static load equal to four-tenths (0.4) of the weight of the cargo being transported on the vehicle uniformly distributed over the entire front-end structure.

(e) *Penetration resistance.* The front-end structure must be designed, constructed and maintained so that it is capable of resisting penetration by any item of cargo that contacts it when the vehicle decelerates at a rate of 20 feet per second per second. The front-end structure must have no aperture large enough to permit any item of cargo in contact with the structure to pass through it.

(f) *Substitute devices.* The requirements of this section may be met by the use of devices performing the same functions as a front-end structure, if the devices are at least as strong as, and provide protection against shifting cargo at least equal to, a front-end structure which conforms to those requirements.

(g) *Exemptions.* The following motor vehicles are exempt from the rules in this section: