

North American Cargo Securement Standard

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On September 27, 2002 the US federal Motor Carrier Safety Administration issued a Final Rule respecting the implementation of the North American Cargo Securement Standard. The text which follows is based on the Model Regulation Draft 4 (May 1999) with modifications and additions to incorporate, where possible and desirable, provisions introduced by the FMCSA Final Rule.

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Part 1 - Standard Application and Objectives

1.1 Application

Cargo carried by a motor vehicle with a gross vehicle weight, gross vehicle weight rating or gross combination weight rating in excess of 4500 kg (10,000 lb.) must be secured in accordance with the provisions of this standard when the vehicle is operated on a highway.

1.2 Requirement

Cargo must be contained, immobilized or secured so that it may not, leak, spill, blow, fall from, fall through or otherwise become dislodged from the vehicle; or shift upon or within the vehicle to such an extent that the vehicle's stability or maneuverability is adversely affected.

1.3 Performance Criteria

The cargo securement system must withstand the forces that result if the loaded vehicle is subjected separately to each of the following:

- 0.8 g deceleration in a forward direction;
- 0.5 g deceleration in a rearward direction;
- 0.5 g acceleration in either lateral direction.

The cargo securement systems must provide a downward force equivalent to at least 20 percent of the weight of the article of cargo if the article is not fully contained within the structure of the vehicle. Under these conditions, applied separately, each component of the cargo securement system, including parts of the vehicle structure that react to any forces, must not exceed its rating or working load limit.

1.4 Equivalent means of securement

Cargo that is immobilized, or secured in accordance with the applicable requirements of Part 3 and Part 4 is considered as meeting the performance criteria of this section

Part 2 - General Provisions and Requirements

2.1 Application

All devices used to secure cargo to a vehicle must conform to the requirements of this section.

2.1.1 Vehicle Structures and Anchor Points

Vehicle structures, floors, walls, decks, tiedown anchor points, headboards, bulkheads, stakes, posts and associated mounting pockets used to contain or secure cargo must be strong enough to withstand the forces which occur when the vehicle is subjected to the accelerations defined in Part 1.

All these must be in proper working order when used to secure cargo, with no obvious damage, distress, weakened parts or weakened sections.

A cab shield is not part of a cargo securement system.

2.1.2 Securement Method

The securement method chosen must be appropriate for the size, shape, strength and characteristics of the cargo being transported. Articles of cargo, including unitized articles, and articles stacked one upon another, must have sufficient structural integrity to withstand the forces of loading, securement and transportation.

All securing devices must be used in accordance with manufacturer's instructions.

2.1.3 Tiedowns

A tiedown, except for steel strapping, must be designed, constructed, and maintained so that the driver of the vehicle can tighten it. Each tiedown must be attached and secured in a manner that prevents it from becoming loose, unfastening, opening or releasing while the vehicle is in transit.

All components of a tiedown must be in proper working order, with no knots and no obvious damage, distress, weakened parts or weakened sections.

All tiedowns and other components of a cargo securement system must be located inboard of the rub rails when a platform body is equipped with such a device. This requirement does not apply when the width of the load extends to or beyond the rub rails.

Edge protection must be used where a tiedown would be subject to abrasion or cutting at the point where it touches an article of cargo. The edge protection must also resist abrasion, cutting and crushing.

2.1.4 Material for Dunnage, Chocks, Cradles, Blocking and Bracing

Timber used as dunnage, chocks, cradles, or for blocking or bracing, must be strong enough to withstand being split or crushed by the cargo or tiedowns.

2.1.5 Strength Rating for Blocking Systems

The aggregate working load limit of all components used to block an article against forward movement, including tiedowns, must be not less than one-half of the weight of the article being blocked.

2.1.6 Securement System Strength Rating

The Working Load Limit of a tiedown is the lowest working load limit of any of its components, or the working load limit of the anchor points to which it is attached, whichever is least. In the case of a synthetic webbing tiedown, the working load limit is the working load limit of the tiedown assembly or the anchor point to which it is attached, whichever is least.

A component or assembly marked by its manufacturer with a numeric working load limit shall be considered to have a working load limit equal to the marked value.

A component or assembly marked by its manufacturer in accordance with a recognized standard (Part 5) shall be considered to have a working load limit equal to the value provided by that standard.

A component or assembly which is unmarked by its manufacturer shall be considered to have a working load limit as described in Section 2.1.7.

2.1.7 Working Load Limits - Unmarked Components

Any securing device that is not marked by the manufacturer shall be considered to have a working load limit which is that of the lowest grade or classification for the type and size of the component, as provided

in the tables in Part 6, with the following notations and/or exceptions:

Chain

Chain not marked by its manufacturer shall be considered to have a working load limit equal to an equivalent size Grade 3 Proof Coil as indicated in Table 6.1.

Synthetic Webbing

Synthetic webbing not marked by its manufacturer shall be considered to have a working load limit based on its width as provided in Table 6.2.

Wire rope

Wire rope not marked by its manufacturer with a working load limit shall be considered to have a working load limit based on its diameter as provided in Table 6.3.

Manila Rope

Manila rope not marked by its manufacturer with a working load limit shall be considered to have a working load limit based on its diameter as provided in Table 6.4.

Synthetic Cordage

Polypropylene fibre rope, polyester fibre rope, nylon rope and double braided nylon rope not marked by its manufacturer with a working load limit shall be considered to have a working load limit based on its diameter as provided in Table 6.5.

Synthetic cordage which is not marked or labeled to enable its identification of its composition or working load limit shall be considered to have a working load limit based on its diameter as provided in Table 6.5.

Steel Strapping

Steel strapping not marked by its manufacturer with a working load limit shall be considered to have a working load limit based on its width as provided in Table 6.6. 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.

Friction Mats

A friction mat shall be considered to provide resistance to horizontal movement equal to 50% of the weight of the cargo resting upon the mat.

2.2 General Cargo Securement Requirements

2.2.1 Application

The rules in this section apply to the transportation of all types of cargo, except commodities in bulk that lack structure or fixed shape (e.g., liquids, gases, grain, liquid concrete, sand, gravel, aggregates) and are transported in a tank, hopper, box or similar device that forms part of the structure of a commercial motor vehicle..

The rules in this section apply to the cargo types covered by the commodity specific rules of Part 3. The

commodity-specific rules take precedence over the general requirements of this section when additional requirements are given for a commodity listed in those sections.

Cargo that is fully contained within a vehicle of adequate strength is deemed to comply with the requirements of Part 1.

Cargo that is immobilized within a vehicle by structures of adequate strength to prevent it from shifting and tipping is also deemed to comply with the requirements of Part 1.

All other cargo must be immobilized or secured on or within a vehicle by appropriate means, secured by tiedowns, or a combination of these, to prevent shifting and tipping.

2.2.2 Cargo Placement and Restraint

Articles of cargo placed beside each other and secured by transverse tiedowns must either:

- be placed in direct contact with each other, or
- be prevented from shifting towards each other while in transit.

Articles of cargo with a tendency to roll must be restrained by chocks, wedges, a cradle or other equivalent means that prevent rolling. The means of preventing rolling must not be capable of becoming unintentionally unfastened or loose while the vehicle is in transit.

2.2.3 Minimum Strength of Cargo Securement Devices and Systems

The aggregate working load limit of any securement system used to secure an article or group of articles against movement must be at least one-half times the weight of the article or group of articles. The aggregate working load limit is the sum of:

- (1) One-half of the working load limit of each associated connector or attachment mechanism used to secure a part of the article of cargo to the vehicle; and
- (2) One-half of the working load limit for each end section of a tiedown that is attached to an anchor point.

This requirement applies to transportation of all commodities, except where different requirements are prescribed for specific commodities in Part 3.

2.2.3.1 Minimum Number of Tiedowns Required

In addition to the requirements of this Part, the minimum number of tiedowns required to secure an article or group of articles against movement depends on the length of the article(s) being secured, and the requirements of paragraphs (b) and (c) of this section.

When an individual article is not blocked or immobilized to prevent movement in the forward direction by a headboard, bulkhead, other cargo which is also immobilized, or other appropriate blocking device, it must be secured by at least:

- One tiedown for articles up to 1.52 m (5 ft) in length and up to 500 kg (1100 lb.) in weight
- Two tiedowns if the article is:
 - up to 1.52 m (5 ft) in length and more than 500 kg (1100 lb.) in weight
 - longer than 1.52 m (5 ft) but less than or equal to 3.04 m (10 ft) in length irrespective of the

weight

- Two tiedowns if the article is longer than 3.04 m (10 ft), and one additional tiedown for every 3.04 m (10 ft) of article length, or part thereof, beyond the first 3.04 m (10 ft) of length.

When an individual article is blocked or immobilized to prevent movement in the forward direction by a headboard, bulkhead, other articles which are adequately secured or by an appropriate blocking or immobilizing method, it must be secured by at least one tiedown for every 3.04 meters (10 feet) of article length, or fraction thereof.

The preceding requirements apply to transportation of all commodities, except where different requirements are prescribed for specific commodities in Part 3.

2.2.3.2 Special rule for special purpose vehicles

The rules in Section 2.2.3.1 do not apply to a vehicle transporting one or more articles of cargo such as, but not limited to, machinery or fabricated structural items (e.g., steel or concrete beams, crane booms, girders, and trusses, etc.) which, because of their design, size, shape, or weight, must be fastened by special methods. However, any article of cargo carried on that vehicle must be securely and adequately fastened to the vehicle.

2.3 Inspection of Cargo, Cargo Securement Devices and Systems

2.3.1 General

A driver may not operate a commercial motor vehicle and a motor carrier may not require or permit a driver to operate a commercial motor vehicle unless:

- (1) The commercial motor vehicle's cargo is properly distributed and adequately secured.
- (2) The commercial motor vehicle's tailgate, tailboard, doors, tarpaulins, spare tire and other equipment used in its operation, and the means of fastening the commercial motor vehicle's cargo, are secured; and
- (3) The commercial motor vehicle's cargo or any other object does not obscure the driver's view ahead or to the right or left sides (except for drivers of self-steer dollies), interfere with the free movement of his/her arms or legs, prevent his/her free and ready access to accessories required for emergencies, or prevent the free and ready exit of any person from the commercial motor vehicle's cab or driver's compartment.

2.3.2 Inspections

Except as provided in Section 2.3.3, the driver of a truck or truck tractor must:

- (1) Assure himself/herself that the provisions of Section 2.3.1 have been complied with before he/she drives that commercial motor vehicle;
- (2) Inspect the cargo and the devices used to secure the cargo within the first 80 km (50 miles) after beginning a trip and cause any adjustments to be made to the cargo or load securement devices as necessary, including adding more securement devices, to ensure that cargo cannot shift on or within, or fall from the commercial motor vehicle; and
- (3) Reexamine the commercial motor vehicle's cargo and its load securement devices during the course of transportation and make any necessary adjustment to the cargo or load securement devices, including adding more securement devices, to ensure that cargo cannot shift on or within, or fall from,

the commercial motor vehicle. Reexamination and any necessary adjustments must be made whenever:

- (i) The driver makes a change of his/her duty status; or
- (ii) The commercial motor vehicle has been driven for 3 hours; or
- (iii) The commercial motor vehicle has been driven for 240 km (150 miles), whichever occurs first.

2.3.3 Exceptions

The rules in Section 2.3.2 do not apply to the driver of a sealed commercial motor vehicle who has been ordered not to open it to inspect its cargo or to the driver of a commercial motor vehicle that has been loaded in a manner that makes inspection of its cargo impracticable.

Part 3 - Specific Securement Requirements by Commodity Type

3.1 Logs

3.1.1 Applicability

The rules in this section are applicable to the transportation of logs with the following exceptions:

- (1) Logs that are unitized by banding or other comparable means may be transported in accordance with the general cargo securement rules of Part 2 of this standard.
- (2) Loads that consist of no more than four processed logs may be transported in accordance with the general cargo securement rules of Part 2 of this standard
- (3) Firewood, stumps, log debris and other such short logs must be transported in a vehicle or container enclosed on both sides, front, and rear and of adequate strength to contain them. Longer logs may also be so loaded.

3.1.2 Components of a Securement System

Logs must be transported on a vehicle designed and built, or adapted, for transportation of logs. Any such vehicle must be fitted with bunks, bolsters, stakes or standards, or other equivalent means that cradle the logs and prevent them from rolling.

All vehicle components involved in securement of logs must be designed and built to withstand all anticipated operational forces without failure, accidental release or permanent deformation.

Stakes or standards that are not permanently attached to the vehicle must be secured in a manner that prevents unintentional separation from the vehicle in transit.

Tiedowns must be used in combination with the stabilization provided by bunks, stakes or standards and bolsters to secure the load. Any tiedown must have a working load limit not less than 1,800 kg (4000 lb). A tiedown must be tensioned as tightly as possible, but not beyond its working load limit.

3.1.3 Use of a Securement System

Logs must be solidly packed, and the outer bottom logs must be in contact with and resting solidly against the bunks, bolsters, stakes or standards.

Each outside log on the side of a stack of logs must touch at least two stakes, bunks, bolsters, or standards. If one end does not actually touch a stake, it must rest on other logs in a stable manner and must extend beyond the stake, bunk, bolster or standard

The center of the highest outside log on each side or end must be below the top of each stake, bunk or standard.

The upper logs that form the top of the load must be crowned, or each log that is not held in place by contact with other logs or the stakes, bunks or standards must be held in place by a tiedown.

All tiedowns must be tightened at initial loading. The load and all tiedowns must be checked, and adjusted as necessary, at entry onto a public road, in addition to the intervals specified in section 2.3.

Additional tiedowns or securement devices must be used when the species or condition of wood results in such low friction between logs that they are likely to slip upon each other.

3.1.4 Securement of shortwood logs loaded crosswise on frame, rail and flatbed vehicle.

In addition to the requirements of sections 3.1.2 and 3.1.3 of this Part, each stack of logs loaded crosswise must meet the following rules:

- (1) In no case may the end of a log in the lower tier extend more than one third of the log's total length beyond the nearest supporting structure on the vehicle.
- (2) When only one stack of shortwood is loaded crosswise, it must be secured with at least two tiedowns. The tiedowns must attach to the vehicle frame at the front and rear of the load, direction.
- (3) When two tiedowns are used, they must be positioned at approximately one-third and two-thirds of the length of the logs.
- (4) A vehicle that is more than 10 meters (33 feet) long must be equipped with center stakes, or comparable devices, to divide it into sections approximately equal in length. Where a vehicle is so divided, each tiedown must secure the highest log on each side of the center stake, and must be fastened below these logs. It may be fixed at each end and tensioned from the middle, or fixed in the middle and tensioned from each end, or it may pass through a pulley or equivalent device in the middle and be tensioned from one end.
- (5) Any structure or stake that is subjected to an upward force when the tiedowns are tensioned must be anchored to resist that force.

A vehicle built after January 1, 2009 must tension each tiedown with a device that maintains a tension not less than 900 kg (2,000 lb) at all times, and automatically takes up slack in the tiedown as the logs settle.

- (6) If two stacks of shortwood are loaded side-by-side, in addition to meeting the requirements of paragraphs (d)(1) through (d)(5) of this section, they must be loaded so that:
 - (i) There is no space between the two stacks of logs;
 - (ii) The outside of each stack is raised at least 2.5 cm (1 in) within 10 cm (4 in) of the end of the logs or the side of the vehicle;
 - (iii) The highest log is no more than 2.44 m (8 ft) above the deck; and
 - (iv) At least one tiedown is used lengthwise across each stack of logs.

3.1.5 Securement of logs loaded lengthwise on flatbed and frame vehicles

In addition to meeting the requirements of sections 3.1.2 and 3.1.3 of this Part, each stack of logs loaded longitudinally must be secured as follows:

- (1) Each stack of shortwood loaded lengthwise on a frame vehicle or on a flatbed must be secured to the vehicle by at least two tiedowns.
- (2) If all logs in a stack less than 3.04 m (10 ft) in length are blocked in the front by a headboard strong enough to restrain the load, or another stack of logs, and blocked in the rear by another stack of logs or the vehicle's end structure, the stack may be secured with at least one tiedown. If one tiedown is used, it must be positioned about midway between the bunks, stakes or standard;

Each stack of longwood loaded lengthwise on a frame vehicle or on a flatbed must be secured to the vehicle by at least two tiedowns at locations along the load that provide effective securement. Each outside log must be secured by at least two tiedowns; and

- (3) The aggregate working load limit for all tiedowns securing a stack of logs must be no less than one-sixth the weight of the stack of logs.

3.1.6 Securement of logs transported on pole trailers

The load must be secured by at least one tiedown at each bunk, or alternatively, by at least two tiedowns used as wrappers that encircle the entire load at locations along the load that provide effective securement. The most extreme wrappers must be at least 3.04 meters (10 feet) apart.

The front and rear wrappers must be at least 3.04 meters (10 feet) apart.

Large diameter single and double log loads must be immobilized with chock blocks or other equivalent means to prevent shifting.

Large diameter logs that rise above bunks must be secured to the underlying load with at least two additional wrappers.

3.2 Dressed Lumber

3.2.1 Applicability

The rules in this part apply to the transportation of bundles of dressed lumber, packaged lumber, building products such as plywood, gypsum board or other materials of similar shape.

Lumber or building products which are not bundled or packaged should be treated as loose items and transported in accordance with the provisions of Part 2 of this standard.

3.2.2 Positioning of Bundles

For the purpose of this section, "bundle" refers to packages of lumber, building materials or similar products which are unitized for securement as a single item of cargo.

Bundles must be placed side by side in direct contact with each other, or a means must be provided to prevent bundles shifting towards each other.

Bundles carried on one tier must be secured in accordance with the general provisions of the standard (section 2.2.5).

Bundles carried in more than one tier must be either:

- a) blocked against lateral movement by stakes on the sides of the vehicle and secured by tiedowns laid out over the top tier, as outlined in the general provisions of the standard (section 2.2.5), or
- b) restrained from lateral movement by blocking or high friction devices between tiers and secured by tiedowns laid out over the top tier, as outlined in the general provisions of the standard (section 2.2.5), or
- c) placed directly on top of other bundles or on spacers of adequate size and orientation. The length of spacers between bundles must provide support to all pieces in the bottom row of the bundle. The width of individual spacers must be greater than the height. Spacers must provide good interlayer friction. If spacers are comprised of layers of material, the layers must be unitized or fastened together in a manner which ensures that the spacer performs as a single piece of material. The resulting stack of bundles must be:
 - secured by tiedowns over the second tier of bundles, or at 1.85 m (6 ft) above the trailer deck, whichever is greater, or not over 1.85 m (6 ft) above the trailer deck for other multiple tiers in accordance with the general provisions of the standard (section 2.2.5); and
 - secured by tiedowns over the top tier of bundles, in accordance with the general provisions of the standard (section 2.2.5) with a minimum of two tiedowns for bundle(s) longer than 1.52 m (5 ft); or
- d) secured by tiedowns laid out over each tier of bundles, in accordance with the general provisions of the standard (section 2.2.5) with a minimum of two tiedowns over each top bundle(s) longer than 1.52 m (5 ft), in all other circumstances.

3.3 Metal Coils

3.3.1 Applicability

The rules in this section apply to the transportation of one or more metal coils which, individually or together, weigh 2268 kg (5000 pounds) or more.

Shipments of metal coils that weigh less than 2268 kg (5000 pounds) may be secured in accordance with the provisions of Part 2 of this standard.

3.3.2 Securement of Coils Transported With Eyes Vertical on a Flatbed Vehicle, in a Sided Vehicle or Intermodal Container with Anchor Points

3.3.2.1 An Individual Coil

Each coil must be secured by tiedowns arranged in a manner to prevent the coils from tipping in the forward, rearward, and lateral directions. The restraint system must include the following:

1. At least one tiedown attached diagonally from the left side of the vehicle or intermodal container (near the forward-most part of the coil), across the eye of the coil, to the right side of the vehicle or intermodal container (near the rearmost part of the coil);
2. At least one tiedown attached diagonally from the right side of the vehicle or intermodal container (near the forward-most part of the coil), across the eye of the coil, to the left side of the vehicle or intermodal container (near the rearmost part of the coil);

3. At least one tiedown attached transversely over the eye of the coil;
4. Either blocking and bracing, friction mats or tiedowns must be used to prevent longitudinal movement in the forward direction.

3.3.2.2 Coils Grouped in Rows

When coils are grouped and loaded side by side in a transverse or longitudinal row, the each row of coils must be secured by the following:

1. At least one tiedown against the front of the row of coils, restraining against forward motion, and whenever practical, making an angle no more than 45 degrees with the floor of the vehicle or intermodal container when viewed from the side of the vehicle or container;
2. At least one tiedown against the rear of the row of coils, restraining against rearward motion, and whenever practical, making an angle no more than 45 degrees with the floor of the vehicle or intermodal container when viewed from the side of the vehicle or container; and
3. At least one tiedown over the top of each coil or transverse row of coils, restraining against vertical motion. Tiedowns going over the top of a coil(s) must be as close as practicable to the eye of the coil and positioned to prevent the tiedown from slipping or becoming unintentionally unfastened while the vehicle is in transit, and.
4. Tiedowns, blocking or bracing must be arranged to prevent shifting or tipping in the forward, rearward and lateral directions.

3.3.3 Securement of Coils Transported With Eyes Crosswise on a Flatbed Vehicle, in a Sided Vehicle or Intermodal Container with Anchor Points

3.3.3.1 An Individual Coil

Each coil must be secured by the following:

1. A means (e.g., timbers, chocks or wedges, a cradle, etc.) to prevent the coil from rolling. The means of preventing rolling must support the coil off the deck, and must not be capable of becoming unintentionally unfastened or loose while the vehicle is in transit. If timbers, chocks or wedges are used, they must be held in place by coil bunks or similar devices to prevent them from coming loose. The use of nailed blocking or cleats as the sole means to secure timbers, chocks or wedges, or a nailed wood cradle, is prohibited.
2. At least one tiedown through its eye, restricting against forward motion, and whenever practicable, making an angle no more than 45 degrees with the floor of the vehicle or intermodal container when viewed from the side of the vehicle or container;
3. At least one tiedown through its eye, restricting against rearward motion, and whenever practicable, making an angle no more than 45 degrees with the floor of the vehicle or intermodal container when viewed from the side of the vehicle or container.

3.3.3.2 Prohibition on Crossing of Tiedowns When Coils are Transported with Eyes Crosswise

Attaching tiedowns diagonally through the eye of a coil to form an X-pattern when viewed from above the vehicle is prohibited.

3.3.4 Securement of Coils Transported With Eyes Lengthwise on a Flatbed Vehicle, in a Sided Vehicle or Intermodal Container with Anchor Points

3.3.4.1 An Individual Coil - Option 1

Each coil must be secured by:

1. A means (e.g., timbers, chocks or wedges, a cradle, etc.) to prevent the coil from rolling. The means of preventing rolling must support the coil off the deck, and must not be capable of becoming unintentionally unfastened or loose while the vehicle is in transit. If timbers, chocks or wedges are used, they must be held in place by coil bunks or similar devices to prevent them from coming loose. The use of nailed blocking or cleats as the sole means to secure timbers, chocks or wedges, or a nailed wood cradle, is prohibited.
2. At least one tiedown attached diagonally through its eye from the left side of the vehicle or intermodal container (near the forward-most part of the coil), to the right side of the vehicle or intermodal container (near the rearmost part of the coil), making an angle no more than 45 degrees, whenever practicable, with the floor of the vehicle or intermodal container when viewed from the side of the vehicle or container;
3. At least one tiedown attached diagonally through its eye, from the right side of the vehicle or intermodal container (near the forward-most part of the coil), to the left side of the vehicle or intermodal container (near the rearmost part of the coil), making an angle no more than 45 degrees, whenever practicable, with the floor of the vehicle or intermodal container when viewed from the side of the vehicle or container;
4. At least one tiedown transversely over the top of the coil;
5. Either blocking, or friction mats to prevent longitudinal movement in the forward direction.

3.3.4.2 An Individual Coil - Option 2

Each coil must be secured by:

1. A means (e.g., timbers, chocks or wedges, a cradle, etc.) to prevent the coil from rolling. The means of preventing rolling must support the coil off the deck, and must not be capable of becoming unintentionally unfastened or loose while the vehicle is in transit. If timbers, chocks or wedges are used, they must be held in place by coil bunks or similar devices to prevent them from coming loose. The use of nailed blocking or cleats as the sole means to secure timbers, chocks or wedges, or a nailed wood cradle, is prohibited.
2. At least one tiedown attached straight through its eye from the left side of the vehicle or intermodal container (near the forward-most part of the coil), to the left side of the vehicle or intermodal container (near the rearmost part of the coil), and whenever practicable, making an angle no more than 45 degrees with the floor of the vehicle or intermodal container when viewed from the side of the vehicle or container;
3. At least one tiedown attached straight through its eye, from the right side of the vehicle or intermodal container (near the forward-most part of the coil), to the right side of the vehicle or intermodal container (near the rearmost part of the coil), and whenever practicable, making an angle no more than 45 degrees with the floor of the vehicle or intermodal container when viewed from the side of the vehicle or container;
4. At least one tiedown transversely over the top of the coil;

5. Either blocking, or friction mats to prevent longitudinal movement in the forward direction.

3.3.4.3 An Individual Coil - Option 3

Each coil must be secured by:

1. A means (e.g., timbers, chocks or wedges, a cradle, etc.) to prevent the coil from rolling. The means of preventing rolling must support the coil off the deck, and must not be capable of becoming unintentionally unfastened or loose while the vehicle is in transit. If timbers, chocks or wedges are used, they must be held in place by coil bunks or similar devices to prevent them from coming loose. The use of nailed blocking or cleats as the sole means to secure timbers, chocks or wedges, or a nailed wood cradle, is prohibited.
2. At least one tiedown over the top of the coil, located near the forward-most part of the coil;
3. At least one tiedown over the top of the coil located near the rearmost part of the coil;
4. Either blocking or friction mats to prevent longitudinal movement in the forward direction.

3.3.4.4 Rows of Coils

Each transverse row of coils having approximately equal outside diameters must be secured with:

1. A means (e.g., timbers, chocks or wedges, a cradle, etc.) to prevent each coil in the row of coils from rolling. The means of preventing rolling must support each coil off the deck, and must not be capable of becoming unintentionally unfastened or loose while the vehicle is in transit. If timbers, chocks or wedges are used, they must be held in place by coil bunks or similar devices to prevent them from coming loose. The use of nailed blocking or cleats as the sole means to secure timbers, chocks or wedges, or a nailed wood cradle, is prohibited.
2. At least one tiedown over the top of each coil or transverse row, located near the forward-most part of the coil;
3. At least one tiedown over the top of each coil or transverse row, located near the rearmost part of the coil; and
4. Either blocking, bracing or friction mats to prevent longitudinal movement in the forward direction for each coil

3.3.5 Securement of Coils Transported in a Sided Vehicle or Intermodal Container Without Anchor Points

Metal coils transported in a vehicle with sides without anchor points or an intermodal container without anchor points must be loaded in a manner to prevent shifting and tipping. The coils may also be secured using a system of blocking and bracing, friction mats, tiedowns, or a combination of these to prevent any horizontal movement and tipping.

3.4 Paper Rolls

3.4.1 Applicability

The rules in this part apply to shipments of paper rolls which, individually or together, weigh 2268 kg (5000 lb) or more.

Shipments of paper rolls that weigh less than 2268 kg (5000 lb), and paper rolls that are unitized on a pallet, may either be secured in accordance this section or with the provisions of Part 2 of this standard.

3.4.2 Securement of Paper Rolls Transported With Eyes Vertical in a Sided Vehicle

Paper rolls must be placed tightly against the front and walls of the vehicle, other paper rolls, or other cargo, for mutual support in transit.

If there are insufficient paper rolls in the shipment to reach the walls of the vehicle, lateral movement must be prevented by filling the void, blocking, bracing, tiedowns or friction mats. The paper rolls may also be banded together.

When any void behind a group of paper rolls, including that at the rear of the vehicle, exceeds the diameter of the paper rolls, rearward movement must be prevented by friction mats, blocking, bracing, tiedowns, or banding to other rolls.

If a paper roll is not prevented from tipping or falling sideways or rearwards by vehicle structure or other cargo, and its width is more than 2 times its diameter, it must be prevented from tipping or falling by banding it to other rolls, bracing, or tiedowns.

If the forwardmost roll(s) in a group of paper rolls is not prevented from tipping or falling forwards by vehicle structure or other cargo and it is restrained against forward movement by friction mat(s) alone, and its width is more than 1.75 times its diameter, it must be prevented from tipping or falling forwards by banding it to other rolls, bracing, or tiedowns. Otherwise, when a paper roll or the forwardmost roll in groups of rolls that are not prevented from tipping or falling forwards by vehicle structure or other cargo and its width exceeds 1.25 times its diameter it must be prevented from tipping or falling by banding to other rolls, bracing or tiedowns.

If paper rolls are banded together, the rolls must be placed tightly against each other to form a stable group. The bands must be applied tightly, and must be secured so that they cannot fall off the rolls or to the deck.

A friction mat used to provide the principal securement for a paper roll must protrude from beneath the roll in the direction in which it is providing that securement.

3.4.3 Securement of split loads of paper rolls transported with eyes vertical in a sided vehicle

If a paper roll in a split load is not prevented from forward movement by vehicle structure or other cargo, it must be prevented from forward movement by filling the open space, or by blocking, bracing, tiedowns, friction mats, or some combination of these.

A friction mat used to provide the principal securement for a paper roll must protrude from beneath the roll in the direction in which it is providing that securement

3.4.4 Securement of stacked loads of paper rolls transported with eyes vertical in a sided vehicle

Paper rolls must not be loaded on a layer beneath unless that layer extends to the front of the vehicle.

Paper rolls in the second and subsequent layers must be prevented from forward, rearward or lateral movement by means as allowed for the bottom layer, or by use of a blocking roll from a lower layer. The blocking roll must be at least 38 mm (1.5 in) taller than other rolls, or must be raised at least 38 mm (1.5 in) using dunnage.

A roll in the rearmost row of any layer must not be raised using dunnage.

3.4.5 Securement of paper rolls transported with eyes crosswise in a sided vehicle

The paper rolls must be prevented from rolling or shifting longitudinally by contact with vehicle structure or other cargo, by chocks, wedges or blocking and bracing of adequate size, or by tiedowns. Chocks, wedges or blocking must be held securely in place by some means in addition to friction, so they cannot become unintentionally unfastened or loose while the vehicle is in transit.

The rearmost roll must not be secured using the rear doors of the vehicle or intermodal container, or by blocking held in place by those doors.

If there is more than a total of 203 mm (8 in) of space between the ends of a paper roll, or a row of rolls, and the walls of the vehicle, void fillers, blocking, bracing, friction mats, or tiedowns must be used to prevent the roll from shifting towards either wall.

3.4.6 Securement of stacked loads of paper rolls transported with eye crosswise in a sided vehicle

Rolls must not be loaded in a second layer unless the bottom layer extends to the front of the vehicle. Rolls must not be loaded in a higher layer unless all wells in the layer beneath are filled.

The foremost roll in each upper layer, or any roll with an empty well in front of it, must be secured against forward movement by:

- banding it to other rolls, or
- blocking against an adequately secured eye-vertical blocking roll resting on the floor of the vehicle which is at least 1.5 times taller than the diameter of the roll being blocked, or
- placing it in a well formed by two rolls on the lower row whose diameter is equal to or greater than that of the roll on the upper row

The rearmost roll in each upper layer must be secured by banding it to other rolls if it is located in either of the last two wells formed by the rearmost rolls in the layer below.

Rolls must be secured against lateral movement by the same means allowed for the bottom layer when there is more than a total of 203 mm (8 in) of space between the ends of a paper roll, or a row of rolls, and the walls of the vehicle.

3.4.7 Securement of paper rolls transported with the eyes lengthwise in a sided vehicle

Each roll must be prevented from forward movement by contact with vehicle structure, other cargo, blocking or tiedowns.

Each roll must be prevented from rearward movement by contact with other cargo, blocking, friction mats or tiedowns.

The paper rolls must be prevented from rolling or shifting laterally by contact with the wall of the vehicle or other cargo, or by chocks, wedges or blocking of adequate size. Chocks, wedges or blocking must be held securely in place by some means in addition to friction, so they cannot become unintentionally unfastened or loose while the vehicle is in transit.

3.4.8 Securement of stacked loads of paper rolls transported with the eye lengthwise in a sided vehicle

Rolls must not be loaded in a higher layer if another roll will fit in the layer beneath.

An upper layer must be formed by placing paper rolls in the wells formed by the rolls beneath.

A roll in an upper layer must be secured against forward and rearward movement by any of the means allowed for the bottom layer, by use of a blocking roll, or by banding to other rolls.

3.4.9 Securement of Paper Rolls Transported on a Flatbed Vehicle or in a Curtain Sided Vehicle

3.4.9.1 Paper Rolls with Eyes Vertical or with Eyes Horizontal and Lengthwise

The paper rolls must be loaded and secured as described for a sided vehicle, and the entire load must be secured by tiedowns in accordance with the provisions of Part 2 of this standard.

Stacked loads of paper rolls with eyes vertical are prohibited.

3.4.9.2 Paper Rolls with Eyes Crosswise

The paper rolls must be prevented from rolling or shifting longitudinally by contact with vehicle structure or other cargo, by chocks, wedges or blocking and bracing of adequate size, or by tiedowns.

Chocks, wedges or blocking must be held securely in place by some means in addition to friction so that they cannot become unintentionally unfastened or loose while the vehicle is in transit.

Tiedowns must be used in accordance with the requirements of Section 2.2.3.1 to prevent lateral movement.

3.5 Concrete Pipe

3.5.1 Applicability

The rules in this section apply to the transportation of concrete pipe on a platform trailer or vehicle.

Concrete pipe bundled tightly together into a single rigid article that has no tendency to roll, and concrete pipe loaded in a sided vehicle or container must be secured in accordance with the provisions of Part 2 of this standard.

Other concrete pipe loaded transversely on a vehicle must be secured in accordance with this section.

3.5.2 General Specifications for Tiedowns

The aggregate working load limit of all tiedowns on any group of pipe must not be less than half the total weight of all pipe in the group.

A transverse tiedown through a pipe in an upper tier or over longitudinal tiedowns is considered to secure all those pipe beneath on which that tiedown causes pressure.

3.5.3 Blocking

Blocking may be one or more pieces placed symmetrically about the center of a pipe. One piece must extend at least half the distance from the center to each end of the pipe, and two pieces must be placed at the outside quarter points. Blocking must be placed firmly against the pipe, and must be secured to prevent it moving out from under the pipe. Timber blocking must have a minimum nominal dimension of at least 10 x 15 cm (4 x 6 in).

3.5.4 Arranging the Load

3.5.4.1 Pipe of Different Diameter

If pipe of more than one diameter are loaded on a vehicle, groups must be formed that consist of pipe of only one size, and each group must be separately secured.

3.5.4.2 Arranging a bottom tier

The bottom tier must be arranged to cover the full length of the vehicle, or as a partial tier in one group or two groups.

3.5.4.3 Arranging an upper tier

Pipe must be placed only in the wells formed by adjacent pipes in the tier beneath. A third or higher tier must not be started unless all wells in the tier beneath are filled.

3.5.4.4 Arranging the top tier

The top tier must be arranged as a complete tier, a partial tier in one group, or a partial tier in two groups.

3.5.4.5 Arranging Bell Pipe

Bell pipe must be loaded on at least two longitudinal spacers of sufficient height to ensure that the bell is clear of the deck. Bell pipe loaded in one tier must have the bells alternating on opposite sides of the vehicle. The ends of consecutive pipe must be staggered, if possible within the allowable width, otherwise they must be aligned.

Bell pipe loaded in more than one tier must have the bells of the bottom tier all on the same side of the vehicle. Pipe in every upper tier must be loaded with bells on the opposite side of the vehicle to the bells of the tier below.

If the second tier is not complete, pipe in the bottom tier which do not support a pipe above must have their bells alternating on opposite sides of the vehicle.

3.5.5 Securing Pipe with an Inside Diameter up to 1143 mm (45 in)

3.5.5.1 Stabilizing the bottom tier

In addition to the requirements of Sections 3.5.2 through 3.5.4, the following rules must be satisfied:

The front pipe and the rear pipe must be immobilized by blocking, wedges, vehicle end structure, stakes, locked pipe unloader, or other equivalent means. The bottom tier must be immobilized longitudinally at each end by blocking, vehicle end structure, stakes, a locked pipe unloader, or other equivalent means. Other pipe in the bottom tier may also be held in place by blocks and/or wedges; and

Every pipe in the bottom tier must also be held firmly in contact with the adjacent pipe by tiedowns though the front and rear pipes.

- At least one tiedown through the front pipe of the bottom tier must run aft at an angle not more than 45 degrees with the horizontal, whenever practicable.
- At least one tiedown through the rear pipe of the bottom tier must run forward at an angle not more than 45 degrees with the horizontal, whenever practicable.

3.5.5.2 Use of Tiedowns

Each pipe may be secured individually with a tiedown through the pipe

If each pipe is not secured individually with a tiedown, then:

- Either one 1/2-inch diameter chain or wire rope, or two 3/8-inch diameter chain or wire rope must be placed longitudinally over the group of pipes;
- One transverse tiedown must be used for every 3.0 m (10 ft) of load length. The transverse tiedowns may be placed through a pipe, or over both longitudinal tiedowns between two pipes on the top tier.

If the first pipe of a group in the top tier is not placed in the first well formed by the pipes at the front of the tier beneath, it must be secured by an additional tiedown that runs rearward at an angle not more than 45 degrees to the horizontal, whenever practicable. This tiedown must pass either through the front pipe of the upper tier, or outside it and over both longitudinal tiedown.

If the last pipe of a group in the top tier is not placed in the last well formed by the pipes at the rear of the tier beneath, it must be secured by an additional tiedown that runs forward at an angle not more than 45 degrees to the horizontal, whenever practicable. This tiedown must pass either through the rear pipe of the upper tier or outside it and over both longitudinal tiedowns.

3.5.6 Securing Large Pipe, with an Inside Diameter over 1143 mm (45 in)

In addition to the requirements of Section 3.5.2 through 3.5.4, the following rules must be satisfied:

The front pipe and the rear pipe must be immobilized by blocking, wedges, vehicle end structure, stakes, locked pipe unloader, or other equivalent means. All other pipe may be secured by blocking or wedges pushed firmly under the pipe.

Each pipe must be secured by tiedowns through the pipe.

- a) At least one tiedown through each pipe in the front half of the load, which includes the middle one if there are an odd number, and must run rearward at an angle not more than 45 degrees with the horizontal, whenever practicable.
- b) At least one tiedown through each pipe in the rear half of the load, and must run forward at an angle not more than 45 degrees with the horizontal, whenever practicable, to hold each pipe firmly in contact with adjacent pipe.
- c) If the front or rear pipe is not also in contact with vehicle end structure, stakes, a locked pipe unloader, or other equivalent means, at least two tiedowns positioned as described in Sections 3.5.6 a) and 3.5.6 b) must be used through that pipe.

If only one pipe is transported, or if several pipes are transported without contact between other pipes, the requirements of this section apply to each pipe as a single front and rear article must be used through that pipe.

3.5.7 Conditions of Low Friction

Ice must be removed from concrete pipe before it is loaded

3.6 Intermodal Containers

3.6.1 Applicability

The rules in this section apply to the transportation of intermodal containers.

Cargo contained within an intermodal container must be secured in accordance with the provisions of Part 2 of this standard.

3.6.2 Securement of Intermodal Containers Transported on Container Chassis Vehicle(s)

Each intermodal container must be secured to the container chassis with securement devices or integral locking devices that cannot unintentionally become unfastened while the vehicle is in transit. The securement devices must restrain the container from moving more than 1.27 cm (1/2 in) forward, more than 1.27 cm (1/2 in) aft, more than 1.27 cm (1/2 in) to the right, more than 1.27 cm (1/2 in) to the left, or more than 2.54 cm (1 in) vertically. The front and rear of the container must be secured independently.

3.6.3 Securement of Intermodal Containers Transported on Vehicles other than Container Chassis Vehicle(s)

All lower corners of the intermodal container must rest upon the vehicle, or the corners must be supported by a structure capable of bearing the weight of the container and that support structure must be independently secured to the motor vehicle.

Each container must be secured to the vehicle by:

- Chains, wire ropes or integral devices which are fixed to all lower corners; or
- Crossed chains which are fixed to all upper corners; and,

The front and rear of the container must be secured independently.

Each chain, wire rope, or integral locking device must be attached to the container in a manner that prevents it from being unintentionally unfastened while the vehicle is in transit.

3.6.4 Securement of empty intermodal containers transported on vehicles other than container chassis vehicle(s).

Empty intermodal containers transported on vehicles other than container chassis vehicles do not have to have all lower corners of the intermodal container resting upon the vehicle, or have all lower corners supported by a structure capable of bearing the weight of the empty container, provided:

- The empty intermodal container is balanced and positioned on the vehicle in a manner such that the container is stable before the addition of tiedowns or other securement equipment; and,
- The amount of overhang for the empty container on the trailer does not exceed 1.5 m (5 ft) on either the front or rear of the trailer;
- The empty intermodal container must not interfere with the vehicle's maneuverability; and,
- The empty intermodal container is secured to prevent lateral, longitudinal, or vertical shifting.

3.7 Automobiles, Light Trucks and Vans

3.7.1 Applicability

The rules in this section apply to the transportation of automobiles, light trucks, and vans which individually weigh 4500 kg. (10,000 lb.) or less.

Vehicles which are heavier than 4500 kg (10,000 lb.) must be secured in accordance with the provisions of section 3.8 of this standard.

3.7.2 Securement of Automobiles Light Trucks and Vans

1. Automobiles, light trucks, and vans shall be restrained at both the front and rear in the lateral, forward, rearward, and vertical direction using a minimum of two tiedowns.
2. Tiedowns that are designed to be affixed to the structure of the automobile, light truck, or van shall use the mounting points on those vehicles that have been specifically designed for that purpose.
3. Tiedowns that are designed to fit over or around the wheels of an automobile, light truck, or van shall provide restraint in the lateral, longitudinal and vertical directions.
4. Edge protectors are not required for synthetic webbing at points where the webbing comes in contact with the tires.

3.8 Heavy Vehicles, Equipment and Machinery

3.8.1 Applicability

The rules in this section apply to the transportation of heavy vehicles, equipment and machinery which operate on wheels or tracks, such as front end loaders, bulldozers, tractors, and power shovels and which individually weigh 4500 kg. (10,000 lb.) or more.

Vehicles, equipment and machinery which is lighter than 4500 kg (10,000 lb.) may also be secured in accordance with the provisions of this section, with Section 3.7, or in accordance with the provisions of Part 2 of this standard.

3.8.2 Preparation of Equipment being Transported

Accessory equipment such as hydraulic shovels must be completely lowered and secured to the vehicle.

Articulated vehicles shall be restrained in a manner that prevents articulation while in transit.

3.8.2.1 Securement of Heavy Vehicles, Equipment or Machinery with Crawler Tracks or Wheels

In addition to the requirements of Section 3.8.2, heavy equipment or machinery with crawler tracks or wheels shall be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tiedowns each having a working load limit of at least 2268 kg (5000 pounds).

Each of the tiedowns shall be affixed at the front and rear of the vehicle, or mounting points on the vehicle that have been specifically designed for that purpose.

3.9 Flattened or Crushed Vehicles

3.9.1 Applicability

The rules in this section apply to the transportation of vehicles such as automobiles, light trucks, and vans which have been flattened or crushed.

3.9.2 Requirements

Flattened or crushed vehicles must be transported in such a manner that:

- the cargo does not shift upon the transport vehicle while in transit, and
- loose parts from the flattened vehicles do not become dislodged and fall from the transport vehicle.

The use of synthetic webbing to secure flattened or crushed vehicles is prohibited.

3.9.2.1 Securement of Flattened or Crushed Vehicles

Flattened or crushed vehicles must be transported on vehicles which have:

- Containment walls or comparable means on four sides which extend to the full height of the load which extend to the height of the load and which block against movement of the cargo in the forward, rearward and lateral directions; or,
- Containment walls or comparable means on three sides which extend to the full height of the load and which block against movement of the cargo in the forward, rearward and one lateral direction and a minimum of two tiedowns are required per vehicle stack with every tiedown having a minimum working load limit 2268 kg (5000 pounds); or,
- Containment walls or comparable means on two sides which extend to the full height of the load and which block against movement of the cargo in the forward and rearward directions, and a minimum of three tiedowns are required per vehicle stack with every tiedown having a minimum working load limit 2268 kg (5000 pounds); or,
- a minimum of four tiedowns per vehicle stack with every tiedown having a minimum working load limit 2268 kg (5000 pounds)

3.9.2.2 Containment of Loose Parts

In addition to the requirements of Section 3.9.2.1, the following rules must be satisfied:

- Vehicles used to transport flattened or crushed vehicles must be equipped with a means to prevent loose parts from falling from all four sides of the vehicle and which extends to the full height of the cargo.
- The means used to contain loose parts may consist of structural walls, sides or sideboards, or suitable covering material, alone or in combinations.

The use of synthetic material for containment of loose parts is permitted.

3.10 Roll-on/Roll-off Containers

3.10.1 Applicability

The rules in this section apply to the transportation of roll-on/roll-off and hook lift containers.

3.10.2 Securement of a Roll-On/Roll-Off and Hook Lift Container

Each roll-on/roll-off container and hook lift container carried on a vehicle which is not equipped with an Integral Securement System must be:

- blocked against forward movement by the lifting device, stops, a combination of both or other suitable restraint mechanism,
- secured to the front of the vehicle by the lifting device or other suitable restraint against lateral and vertical movement,
- secured to the rear of the vehicle with at least one of the following mechanisms:
 - one tiedown attached to both the vehicle chassis and the container chassis
 - two tiedowns installed lengthwise, each securing one side of the container to one of the vehicle's side rails; or
 - two hooks, or an equivalent mechanism, securing both sides of the container to the vehicle chassis at least as effectively as the tiedowns in the two previous items.

The mechanisms used to secure the rear end of a roll-on/roll off or hook lift container must be installed no more than 2 m (6.5 ft) from the rear of the container. In addition, each mechanism must have a Working Load Limit of at least 2268 kg (5000 lb.) and be kept taut by adequate devices.

In the event that one or more of the front stops or lifting devices are missing, damaged or not compatible, additional manually installed tiedowns must be used to secure the container to the vehicle, providing the same level of securement as the missing, damaged or incompatible components.

3.11 Large Boulders

3.11.1 Applicability

The rules in this section applies to the transportation of any large piece of natural, irregularly shaped rock weighing in excess of 5 000 kg (11,000 lb.) or with a volume in excess of 2 cubic-meters on an open vehicle, or in a vehicle whose sides are not designed and rated to contain such cargo.

Pieces of rock weighing more than 100 kg (220 lb), but less than 5000 kg (11,000 lb.) must be secured either in accordance with this section, or in accordance with the provisions of Part 2 of this standard, including:

- contained within a vehicle which is designed to carry such cargo, or;
- secured individually by tiedowns, provided each piece can be stabilized and adequately secured.

Rock which has been formed or cut to a shape and which provides a stable base for securement must also be secured in accordance with the provisions of this section, or in accordance with the provisions of Part 2 of this standard.

3.11.2 General Requirements for Positioning of Boulders on the Vehicle

Each boulder must be placed with its flattest and /or largest side down.

Each boulder must be supported on at least two pieces of hard wood blocking at least 10 cm x 10 cm (4 x 4 in) nominal side dimensions extending the full width of the boulder. Hardwood blocking pieces must be placed as symmetrically as possible under the boulder and should support at least 3/4 of the length of the boulder.

If the flattest side of a boulder is rounded or partially rounded, so that the boulder may roll, it must be placed in a crib made of hardwood timber fixed to the deck of the vehicle so that the boulder rests on both the deck and the timber, with at least three well-separated points of contact that prevent its tendency to roll in any direction.

If a boulder is tapered, the narrowest end must point towards the front of the vehicle.

3.11.3 General Tiedown Requirements

Only chain may be used as tiedowns to secure large boulders.

Tiedowns which are in contact with the boulder should, where possible, be located in valleys or notches across the top of the boulder, and must be arranged to prevent sliding across the rock surface.

3.11.3.1 Securement of a Cubic Shaped Boulder

In addition to the requirements of Sections 3.11.2 and 3.11.3, the following rules must be satisfied:

- Each boulder must be secured individually with at least two chain tiedowns placed transversely across the vehicle.
- The aggregate working load limit of the tiedowns must be at least half the weight of the boulder.
- The tiedowns must be placed as closely as possible to the wood blocking used to support the boulder.

3.11.3.2 Securement of a Non-Cubic Shaped Boulder - with a stable base

In addition to the requirements of Sections 3.11.2 and 3.11.3, the following rules must be satisfied:

- The boulder must be secured individually with at least two chain tiedowns forming an "X" pattern over the boulder.
- The aggregate working load limit of the tiedowns must be at least half the weight of the boulder.
- The tiedowns must pass over the center of the boulder and must be attached to each other at the intersection by a shackle or other connecting device.

3.11.3.3 Securement of a Non-Cubic Shaped Boulder - with an unstable base

In addition to the requirements of Sections 3.11.2 and 3.11.3, each boulder must be secured by a combination of chain tiedowns as follows:

- One chain must surround the top of the boulder (at a point between one half and two thirds of its height). The working load limit of the chain must be at least half the weight of the boulder.
- Four chains must be attached to the surrounding chain and the vehicle to form a blocking mechanism

which prevents any horizontal movement. Each chain must have a working load limit of at least 1/4 the weight of the boulder. Whenever practicable, the angle of the chain must not exceed 45 degrees from the horizontal.

Part 4 - Definitions

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| Aggregate Working Load Limit | The summation of the working load limits or restraining capacity of all devices used to secure an article on a vehicle. |
| Anchor point | Part of the structure, fitting or attachment on a vehicle or cargo to which a tiedown is attached. |
| Article of cargo | A unit of cargo, other than a liquid, gas or aggregate that lacks physical structure (eg. grain, gravel etc), including articles grouped together so that they can be handled as a single unit or unitized by wrapping, strapping, banding or edge protection device(s). |
| Banding | A strip of material that may be used to unitize articles and is tensioned and clamped or crimped back upon itself. (<i>same as "Strapping"</i>) |
| Bell Pipe Concrete | Pipe whose flanged end is of larger diameter than its barrel |
| Binder | A device used to tension a tiedown or combination of tiedowns. |
| Blocking | A structure, device or another substantial article placed against or around an article to prevent horizontal movement of the article. |
| Bolster | A transverse load bearing structural component, particularly a part of a log bunk. |
| Boulder | A large piece of natural rock that may be rounded if it has been exposed to weather and water, or is rough if it has been quarried. |
| Bracing | A structure, device or another substantial article placed against an article to prevent it from tipping, that may also prevent it from shifting. |
| Bulkhead | A vertical barrier across a vehicle to prevent forward movement of cargo. |
| Bundle | A group of articles of that has been unitized for securement as a single article. |
| Bunk | A horizontal bolster fitted with a stake at each end that together support and contains a stack of logs, and is installed transversely across a vehicle. |
| Bunk unit | A front bunk and a rear bunk that together cradle a stack of logs. |
| Cab shield | A vertical barrier placed directly behind the cab of a tractor to protect the cab in the event cargo should shift forward. |
| Cargo | All articles or material carried by a vehicle, including those used in operation of the vehicle |
| Chock | A tapered or wedge-shaped piece used to secure round articles against rolling. |
| Cleat | A short piece of material, usually wood, nailed to the deck to reinforce blocking. |
| Coil bunk | A device that keeps timbers supporting a metal coil in place. |
| Contained | Cargo is contained if it fills a sided vehicle, and every article is in contact with or sufficiently close to a wall or other articles so that it cannot shift or tip if those other articles are also unable to shift or tip. |
| Container Chassis Vehicle | A vehicle especially built and fitted with locking devices for the |

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| | transport of intermodal containers. |
| Cradle | A device or structure that holds a circular article to prevent it from rolling. |
| Crosswise | <i>Same as "Lateral".</i> |
| Crown | The rounded profile of the top of a stack of logs, when viewed from the ends of the stack. |
| Cut-to-length logs | Included in shortwood. |
| Deck | The load carrying area of a truck, trailer or intermodal container. |
| Direct tiedown | A tiedown that is intended to provide direct resistance to potential shift of an article. |
| Dunnage | All loose materials used to support and protect cargo. |
| Dunnage bag | An inflatable bag intended to fill otherwise empty space between articles of cargo, or between articles of cargo and the wall of the vehicle. |
| Edge protector | A device placed on the exposed edge of an article to distribute tiedown forces over a larger area of cargo than the tiedown itself, to protect the tie-down and/or cargo from damage, and to allow the tiedown to slide freely when being tensioned. |
| Eye (of a cylindrical object) | The hole through the centre of the article. |
| Flatbed vehicle | A vehicle with a deck but no permanent sides. |
| Frame vehicle | A vehicle with skeletal structure fitted with one or more bunk units for transporting logs. A bunk unit consists of a front bunk and a rear bunk that together cradle logs. The bunks are welded, gusseted or otherwise firmly fastened to the vehicle's main beams, and are an integral part of the vehicle |
| Friction mat | A device placed between the deck of a vehicle and cargo, or between articles of cargo, intended to provide greater friction than exists naturally between these surfaces. |
| g | The acceleration due to gravity, 9.823 m/sec ² (32.2 ft/sec ²) |
| Gross Combination Weight Rating | The value specified for the vehicle by the "Manufacturer" as being the maximum of the sum of the "Gross Vehicle Mass" of the drawing vehicle plus the sum of the "Axle Loads" of all vehicles being drawn. |
| Gross Vehicle Weight Rating | The maximum laden weight of a motor vehicle as specified by the "Manufacturer". |
| Headboard | A vertical barrier across the front of the deck of a vehicle to prevent forward movement of cargo. |
| Hook-lift Container | A specialized container, primarily used to contain and transport materials in the waste, recycling, construction/demolition and scrap industries which are used in conjunction with specialized vehicles, in which the container is loaded and unloaded onto a tilt frame body by an articulating hook-arm. |
| Indirect tiedown | A tiedown whose tension is intended to increase the pressure of an article or stack of articles on the deck of the vehicle. |
| Integral Locking Device | A device which is purposely designed and used to restrain an article of cargo on a vehicle by connecting and locking attachment point(s) |

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| | on the article to anchor point(s) on the vehicle. |
| Integral Securement System | A feature of roll-on/roll-off containers and hook-lift containers and their related transport vehicles in which compatible front and rear hold down devices are mated to provide securement of the complete vehicle and its cargo |
| Intermodal Container | A reusable, transportable enclosure that is especially designed with integral locking devices that secure it to a container chassis trailer to facilitate the efficient and bulk shipping and transfer of goods by, or between various modes of transport, such as highway, rail, sea and air. |
| Lateral | Sideways, transverse, crosswise or across a vehicle. |
| Lengthwise | <i>Same as "Longitudinal"</i> |
| Lift | A tier of dressed timber, steel or other materials. |
| Load binder | A binder incorporating an over-centre locking action. |
| Load capacity | The weight of cargo that a vehicle can carry when loaded to its allowable gross vehicle weight in a particular jurisdiction. |
| Logs | Include all natural wood that retains the original shape of the bole of the tree, whether raw, partially or fully processed. Raw logs include all tree species that have been harvested, with bark, and may have been trimmed or cut to some length. Partially processed logs have been fully or partially debarked, or further reduced in length. Fully processed logs include utility poles, treated poles, and log cabin building components. |
| Longitudinal | Lengthwise or along the length of a vehicle. |
| Longwood | All logs that are not shortwood, so are over 4.9 m (16 feet) long. Such logs are usually described as long logs or treelength. |
| Pallet | A platform or tray on which cargo is placed so that it can be handled as an article (<i>Same as "Skid"</i>) |
| Pole Trailer | A trailer whose body consists simply of a drawbar by which the trailer is drawn. |
| Rail vehicle | A vehicle whose skeletal structure is fitted with stakes at the front and rear to contain logs loaded crosswise. |
| Restrained | An article that is not contained but is prevented from tipping or shifting. |
| Rub Rail | A rail along the side of a vehicle that protects the side of the vehicle from impacts. |
| Secured | Means that cargo is contained or restrained |
| Securing Device | Any device specifically manufactured as a means to attach or secure cargo to a vehicle or trailer. |
| Shackle | A U-shaped metal coupling link closed by a bolt. |
| Shift | A change in the longitudinal or lateral position or orientation of an article |
| Shoring bar | A structural section placed transversely between the walls of a vehicle to prevent cargo from tipping or shifting |
| Shortwood | All logs typically up to 4.9 m (16 feet) long. Such logs are often described as cut-up logs, cut-to-length logs, bolts or pulpwood. |

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| | Shortwood may be loaded lengthwise or crosswise, though that loaded crosswise is usually no more than 2.6 m (102 inches) long. |
| Sided Vehicle | A vehicle whose cargo compartment is enclosed on all four sides by walls of sufficient strength to contain cargo, where the walls may include latched openings for loading and unloading, and includes vans and dump bodies, and includes a sided intermodal container carried by a vehicle. |
| Skid | A platform or tray on which cargo is placed so that it can be handled as an article. <i>(Same as "Pallet")</i> |
| Spacer | Material placed beneath an article, or between tiers of articles, to facilitate loading and unloading. |
| Stack | A single column of articles placed one above another. |
| Stack of logs | Means logs aligned parallel and heaped one upon others. |
| Stake | A member mounted close to vertical on a vehicle frame or as part of a bunk that serves to immobilize cargo placed against it. <i>(Same as "Standard")</i> |
| Stake Pocket | A female housing fixed to the side or ends of a vehicle to receive a stake or peg, and may also be used as an anchor point. |
| Standard | A member mounted close to vertical on a vehicle frame or as part of a bunk that serves to immobilize cargo placed against it. <i>(Same as "Stake")</i> |
| Strapping | A strip of material that may be used to unitize articles and is tensioned and clamped or crimped back upon itself <i>(Same as "Banding")</i> |
| Tarpaulin (tarp) | A waterproof sheet used to cover cargo. |
| Tiedown | A combination of securing devices which form an assembly that attaches cargo to, or restrains cargo on, a vehicle or trailer, and is attached to anchor point(s). |
| Tiedown assembly | <i>(Same as "Tiedown")</i> . |
| Tier | One layer of articles that are stacked one upon another. |
| Tip | An article falls over |
| Track | A set of plates on a tractor wheel that provide mobility for a tracked vehicle. |
| Tractor-pole trailer | A vehicle that carries logs lengthwise so that they form the body of the vehicle. The logs are supported by a bunk located on the rear of the tractor, and another bunk on the skeletal trailer. The bunks may rotate about a vertical axis, and the trailer may have a fixed, scoping, or cabled reach, or other mechanical freedom, to allow it to turn. |
| Transverse | <i>(Same as "Lateral")</i> |
| Twist lock | A device designed to support and fasten one corner of an intermodal container to a container chassis vehicle. |
| Unitized load | A number of articles grouped together with sufficient structural integrity that they can be handled, transported and secured as a single article. |
| Vehicle | A truck, a truck tractor, a trailer or a semitrailer individually or in combination. |

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| Void Filler | Material used to fill a void between articles of cargo and the structure of the vehicle that has sufficient strength to prevent movement of the articles of cargo. |
| Wedge | A tapered piece of material, thick at one end and thin at the other. |
| Well | The depression formed between two cylindrical articles when they are laid with their eyes horizontal and parallel against each other. |
| Winch | A device for tensioning a webbing or wire rope tiedown that is fitted with means to lock the initial tension. |
| Working load limit (WLL) | The maximum load that may be applied to a component of a cargo securement system during normal service, usually assigned by the manufacturer of the component. |

Part 5 - Cargo Securement Components: Referenced Standards

5.1 Vehicle Structure

Truck Trailer Manufacturers Association - RP 47

5.2 Anchor Points

Canadian Motor Vehicle Safety Standard (pending)

Truck Trailer Manufacturers Association - RP47

5.3 Platform Bodies (Flatdecks)

Truck Trailer Manufacturers Association - RP47

5.4 Van, Sided & Dump Bodies

Truck Trailer Manufacturers Association - RP47

Web Sling and Tiedown Association

Recommended Standard Specification for Interior Van Securement WSTDA-T5

5.5 Tiedowns

Web Sling and Tiedown Association

Recommended Standard Specification for Synthetic Webbing Tiedowns WSTDA-T1

Recommended Standard Specification for Winches Used With Synthetic Web Tiedowns
WSTDA-T3

Recommended Standard Specification for Interior Van Securement WSTDA-T5

5.6 Webbing Assemblies

Web Sling and Tiedown Association

Recommended Standard Specification for Synthetic Webbing Tiedowns WSTDA-T1

Recommended Operating, Care and Inspection Manual for Synthetic Web Tiedowns WSTDA-T2

Recommended Standard Specification for Synthetic Webbing Used for Tiedowns WSTDA-T4

5.7 Chain Assemblies

National Association of Chain Manufacturers

Welded Steel Chain Specifications

5.8 Wire Rope and Attachments

Wire Rope Technical Board

Wire Rope Users Manual

5.9 Synthetic Rope and Attachments

Cordage Institute:

CI-1301-96 Polyester Fiber Rope, 3 and 8 Strand Constructions

CI-1302A-96 Polyester/Polyolefin Dual Fiber Rope, 3 Strand Construction

CI-1302B-99 Polyester/Polyolefin Dual Fiber Rope, 8 Strand Construction

CI-1304-96 Polyester Fiber Rope, 3 and 8 Strand Constructions

CI-1305-96 Single Braided Polyester Fiber Rope, 12 Strand Construction

CI-1307-96 Polyester Fiber Rope, Double Braid Construction

CI-1307-96 Polyester Fiber Rope, High Performance Double Braid Construction

CI-1303-96 Nylon (Polyamide) Fiber Rope, 3 and 8 Strand Constructions

CI-1307-96 Nylon (Polyamide) Fiber Rope, Double Strand Construction

CI-1307-96 Nylon (Polyamide) Fiber Rope, High Performance Double Braid Construction

5.10 Strapping

American Society for Testing and Materials

Standard Specification for Strapping, Flat Steel and Seals (ASTM D3953-91)

5.11 Clamps and Latches

International Standards Organization - 668.

5.12 Roll-on/Roll-off Containers

American National Standards Institute

Mobile Wastes and Recyclable Materials Collection, Transportation, and Compaction Equipment - Safety Requirements (ASC Z245.1 -1999)

Waste Containers - Safety Requirements (ASC Z245.30 -1999)

Waste Containers - Compatibility Requirements (ASC Z245.60 -1999)

Part 6 - Default Working Load Limits for Unmarked Tiedowns

6.1 Chain

| Size | Working Load Limit |
|-----------------|--------------------|
| 7 mm (1/4 in) | 590 kg (1300 lb.) |
| 8 mm (5/16 in) | 860 kg (1900 lb.) |
| 10 mm (3/8 in) | 1200 kg (2650 lb.) |
| 11 mm (7/16 in) | 1590 kg (3500 lb.) |
| 13 mm (1/2 in) | 2040 kg (4500 lb.) |
| 16 mm (5/8 in) | 3130 kg (6900 lb.) |
| Chain Mark | PC |
| Examples | 3 30 |

6.2 Synthetic Webbing

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

6.3 Wire Rope (6 x 37, Fiber Core)

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

6.4 Manila Rope

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

6.5 Synthetic Fiber Rope

| Diameter | WLL |
|-----------------|-------------------|
| 10 mm (3/8 in) | 185 kg (410 lb.) |
| 11 mm (7/16 in) | 240 kg (530 lb.) |
| 13 mm (1/2 in) | 285 kg (630 lb.) |
| 16 mm (5/8 in) | 420 kg (930 lb.) |
| 20 mm (3/4 in) | 580 kg (1280 lb.) |
| 25 mm (1 in) | 950 kg (2100 lb.) |

6.6 Steel Strapping

| Width-thickness inch | WLL |
|-----------------------------|--------------------|
| 1-1/4 x 0.029 | 540 kg (1190 lb.) |
| 1-1/4 x 0.031 | 540 kg (1190 lb.) |
| 1-1/4 x 0.035 | 540 kg (1190 lb.) |
| 1-1/4 x 0.044 | 770 kg (1690 lb.) |
| 1-1/4 x 0.050 | 770 kg (1690 lb.) |
| 1-1/4 x 0.057 | 870 kg (1925 lb.) |
| 2 x 0.044 | 1200 kg (2650 lb.) |
| 2 x 0.050 | 1200 kg (2650 lb.) |