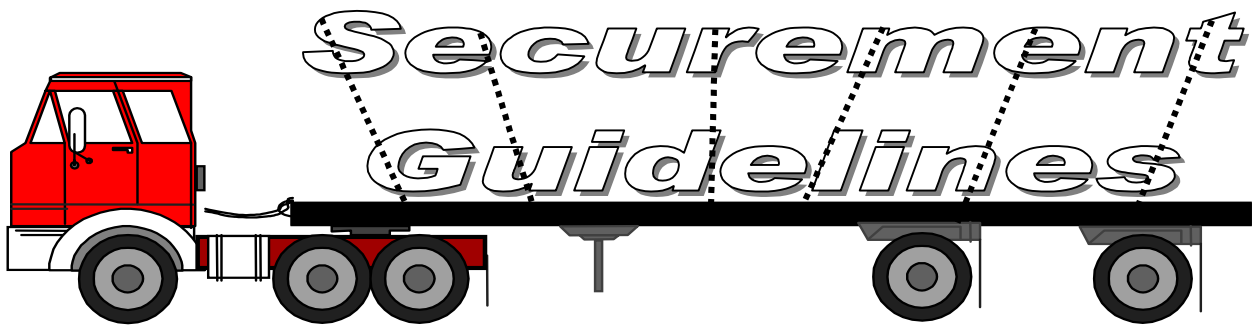




Safety Department
2740 N. Mayfair Avenue
Springfield, MO 65803

(417) 866-0001



**FLATBED CARGO SECUREMENT
PROJECT**

DECEMBER 2003

1. Application and Objectives

The Federal Motor Carrier Safety Administration has revised its regulations concerning protection against shifting and falling cargo for commercial motor vehicles (CMV's) engaged in interstate commerce. The new rules require carriers to change the way they use cargo securement devices to prevent articles from shifting on or within, or falling from, CMV's.

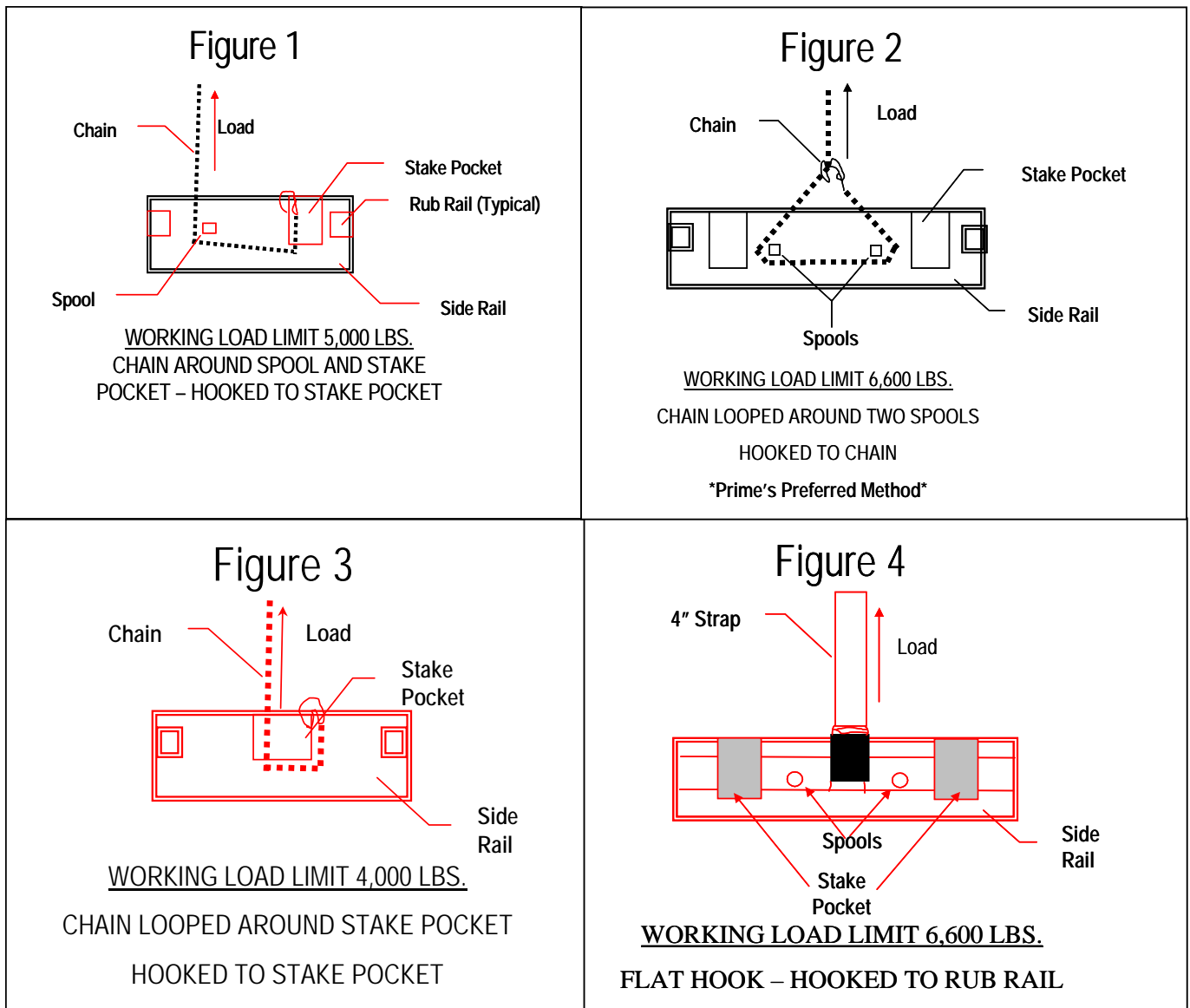
In some instances, the changes may require operators to increase the number of tie-downs used to secure certain types of cargoes. However, these regulations do not prohibit the use of tie-downs or cargo securement devices currently in use. The intent of this rulemaking is to reduce the number of accidents caused by cargo shifting or falling from CMV's in interstate commerce.

This handout will serve as a guideline for Prime Operators to follow in order to be in accordance with the securement regulations.

These load securement changes went into effect January 1, 2004.

2. Equipment

- A. Prime Inc., Flatbed Division, uses all Reitnouer Trailers. The dimensions of the trailers are 48 foot in length, with both 96 and 102 inches wide. All trailers have a 10'2" spread axle with sliding winches on both sides. The capacity rating in a 4-foot area is 52,000 lbs. Below are some diagrams showing Reitnouer's cargo securement guidelines for securing straps and chains to anchor points on the trailer. Each diagram has the working load limit (capacity) for the anchor points provided by Reitnouer.



B. The following list is the minimum requirements operators must possess for load securement equipment and operators will be required to have this on their tractor before leaving the yard:

- | | |
|--------------------------------------|---|
| (1) winch bar | (4) 30'x2" ratchet straps (WLL 3,335 lbs.) |
| (10) ratchet binders | (16) 30'x4" straps (WLL 5,000 lbs.) |
| (20) chain protectors | (10) chains -- 20' (grade 7 transport--WLL 4,700 lbs) |
| (8) 4"x5" bevel timber | (50) tarp strap (21" bungee cords) |
| (20) rubber corner protectors | (8) coil rack pads (belting) |
| (8) coil racks | (1) hard hat |
| (1) smoke tarp 12x12' | (1) safety glasses |
| (1) tarp black steel 16x24 - 4' drop | (2) tarp blue end lumber 24x18 - 8' drop |
| (1) tarp blue middle 24x18 - 8' drop | |

Optional equipment to purchase:

Strap winder
V-boards
Tarp repair kit
Tarp guard
White plastic corner protectors

NOTE: An operator can have more securement equipment than what is listed. Also all securement equipment (straps/chains/binders) must have manufacture's rating on each piece of equipment.

3. Performance Criteria for Cargo Securement Devices and Systems (393.104)

- A. Prohibition on the use of damaged securement devices. All vehicle structures, systems, parts, and components (i.e. rub rails/stake pockets) used to secure cargo must be in proper working order when used to perform that function with no damaged or weakened components that will adversely effect their performance for cargo securement purposes, including reducing the working load limit, and must not have any cracks or cuts.
- B. Material for dunnage, chocks, cradles, blocking and bracing must not have damage or defects that would compromise the effectiveness of the securement system.
- C. Tie-down assemblies (including chains, wire rope, steel strapping, synthetic webbing, and cordage) must conform to the following standards:
 - (1) Tie-downs and securing devices must not contain knots.
 - (2) If a tie-down is repaired, it must be repaired in accordance with manufacturer's instructions.
 - (3) Each tie-down must be attached and secured in a manner that prevents it from becoming loose, unfastening, opening or releasing while the vehicle is in transit.
 - (4) All tie-downs and other components of a cargo securement system used to secure loads on trailer equipped with rub rails, must be located inboard of the rub rails, whenever practicable.
 - (5) Edge protection must be used whenever a tie-down would be subject to abrasion or cutting at the point where it touches an article of cargo. The edge protection must resist abrasion, cutting and crushing.

4. Determining the Number of Securement Devices Needed

A. Working Load Limit (393.108)

The method of applying the working load limit, to determine the number of securement devices needed for the weight of the load, is as follows: The aggregate static workload limit (WLL) of the tie-down assemblies used to secure an article against movement in any direction must be equal to at least 1/2 (.5) times the weight of the article. The working load limit can be taken from the charts below or from tags or labels on tie-down assembly.

Simply stated, the above paragraph can be stated as:

$$NT = \frac{(\text{Weight of load})(.5)}{WLL}$$

NT = Number of tie-downs needed

Load = Weight of the load to be secured

WLL = Working Load Limit of tie-downs

The working load limits of tie-downs may be determined by using either the tie down manufacturer's markings or by using the tables in this section. The working load limits listed in the tables are to be used when the tie-down devices are not marked by the manufacturer with the working load limit. Tie-down materials which are marked by the manufacturer with working load limits that differ from the tables, shall be considered to have a working load limit equal to the value for which they are marked (393.108 b).

Welded steel chain which is not marked or labeled to enable identification of its grade or working load limit shall be considered to have a working load limit equal to that for grade 3

Chain (NACM 6-15-90) *	Working Load Limit Lbs (kg)			
	Grade 3 Proof Coil	Grade 4 High Test	Grade 7 Transport	Grade 8 Alloy
Size Inches (mm)				
1/4 (7)	1300 (580)	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 (3200)
7/16 (12)	3500 (1590)	5800 (2630)	8750 (3970)	-----
1/2 (13)	4500 (2040)	9200 (4170)	11300 (5130)	12000 (5400)
5/8 (16)	6900 (3130)	11500 (5220)	15800 (7170)	18100 (8200)

*NOTE: chain used as a component of a tie-down assembly must conform to the June 15, 1990 edition of the National Association of Chain Manufacturer's Welded Steel Chain Specifications applicable to all types of chain. Information and copies of these specifications may be secured by writing to:

**National Association of Chain Manufacturers
P.O. Box 3143
York, PA 17402-0143**

Referring to straps, if no tag is attached to the strap or the tag is unreadable, the WLL will default to the chart below.

Working Load Limits (WLL) for typical tie-down strap assemblies should be, but are not limited to: (Generally WLL is 1000 lbs. (455 kg) per inch of width.)

Width		Working Load Limit (WLL)	
Inches	(mm)	Lbs.	(kg)
1 ¾	(45)	1750	(795)
2	(50)	2000	(910)
3	(75)	3000	(1360)
4	(100)	4000	(1815)

B. Length of Load (393.110)

The minimum number of tie-downs required to secure an article or group of articles against movement depends upon the length of article or articles. The minimum requirements below must be followed:

1. Two tie-downs must be used within the first 10 feet of a load.
2. One tie-down for every 10 feet or fraction thereafter.

Example: object is 23' feet long. You need 2 tie-downs for the first 10 feet, an additional tie-down for the next 10 feet, then one tie-down for the last 3 feet.

5. Inspection of Cargo Securement Devices (392.9)

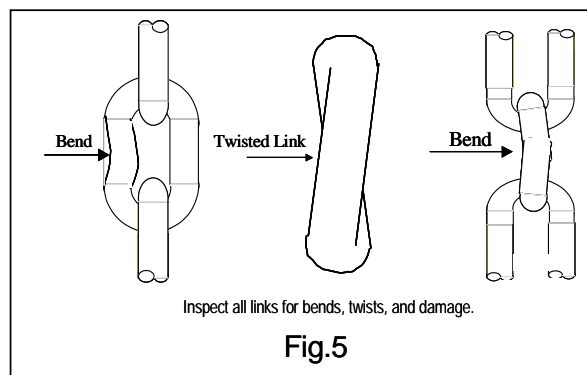
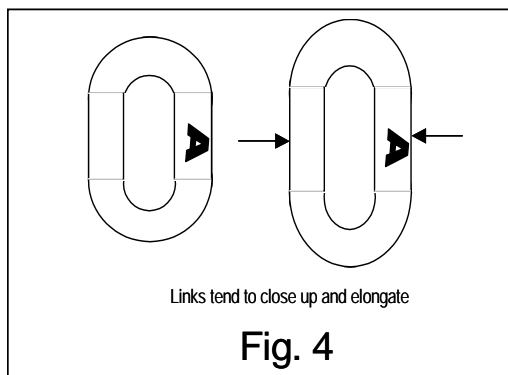
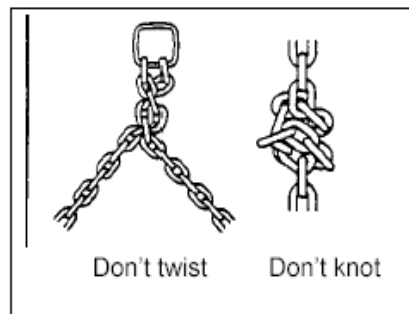
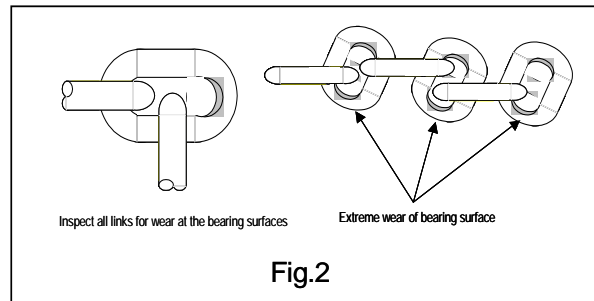
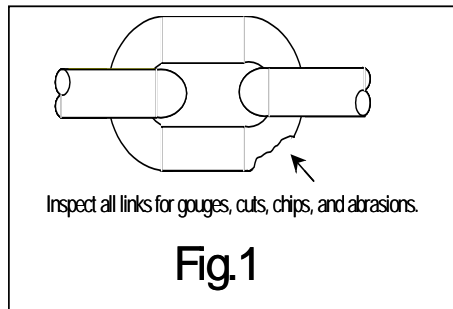
- A. A driver may not operate a commercial motor vehicle (CMV) and a motor carrier may not require or permit a driver to operate a CMV unless:
1. The cargo is properly distributed and adequately secured.
 2. The CMV doors, tarpaulins, spare tire, and other equipment used in its operation are secured.
 3. The CMV cargo does not obscure the drivers view ahead or to the left or right sides.
- B. Drivers of trucks and truck tractors must:
1. Assure himself/herself that the requirements above have been complied with before driving.
 2. Inspect the cargo and the devices used to secure the cargo within the first 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 CMV.
 3. Reexamine the CMV 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 cargo that cargo cannot shift on or within, or fall from CMV. Reexamination and any necessary adjustments must be made whenever:
 - (i) The driver makes a change of his/her duty status; or
 - (ii) The CMV has been driven for 3 hours; or
 - (iii) The CMV has been driven for 150 miles, whichever occurs first.

6. Out of Service (OOS) Criteria for Securement Devices

A. Chain

Distress found in the load-bearing portion of the tie-down as follows:

1. Broken links or cracks in links (see Fig. 1)
2. Nicks, gouges, abrasion or wear (see Fig. 1 and 2)
3. Twisted, bent or stretched links (see Fig. 4)
4. Knots (see Fig. 3)

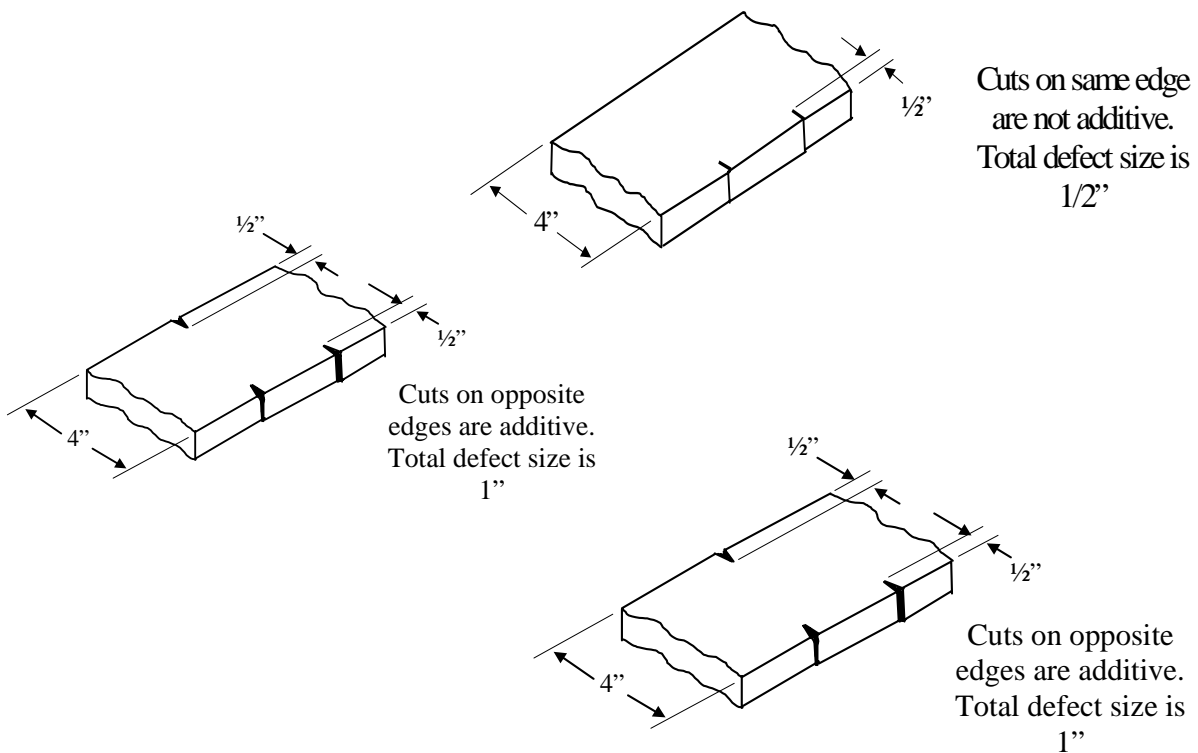


B. Synthetic Webbing

Distress found in the load-bearing portion of the tie-down as follows:

1. The tie-down contains cuts, burns, and/or holes through the webbing, which total more than that shown in the table below.
2. The tie-down contains separation of its load carrying stitch pattern in excess of $\frac{1}{4}$ of the stitch area.
3. The tie-down contains any broken or non-functioning fitting, tension device or hardware. The tie-down contains any fitting, tensioning device or hardware that is obviously sprung, bent, twisted or contains visible cracks or significant nicks or gouges.
4. The tie-down contains knotted webbing, splices or other repair.
5. The tie-down contains any other apparent defects (e.g., crushed areas, damaged loop ends, severe abrasion, etc.)

Web Size		Out-of-Service Range		
Inch	(mm)	Larger than	Inch	(mm)
4	(100)		$\frac{3}{4}$	(19)
3	(75)		$\frac{5}{8}$	(16)
2	(50)		$\frac{3}{8}$	(10)
1.75	(45)	$\frac{3}{8}$	(10)	



7. Specific Securement Requirement by Commodity Type

Any cargo or items placed on or under a trailer needs to be secured. Securement needs to immobilize the cargo, meaning that cargo cannot move forward, rearward, lateral, or up from the floor of the trailer. The use of bungee cords for securement purposes or for securing dunnage, timbers, tarps, etc. is prohibited. Below is a list of specific securement instructions for certain types of cargo as specified in the regulations.

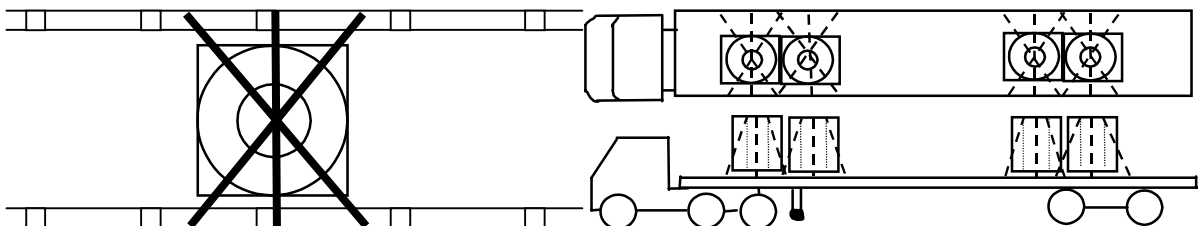
A. Securing Dressed Lumber or Similar Building Products

1. **Applicability.** The rules in this section apply to the transportation of bundles of dressed lumber, packaged lumber, building products such as plywood, gypsum board or other materials of similar shape. For the purpose of this section, “bundle” refers to packages of lumber, building materials or similar products that are unitized for securement as a single article of cargo.
2. **Positioning of bundles.** Bundles must be placed side by side in direct contact with each other, or a means must be provided to prevent bundles from shifting towards each other.
3. **Securement of bundles transported using no more than one tier** must be immobilized from moving in all directions. Also the working load limit and length requirements must be met to determine the minimum # of securement devices that is needed.
4. **Securement of bundles transported using more than one tier.** The requirements from above (#3) must be met as well as:
 - (i) Blocked against lateral movement by stakes on the sides of the vehicle and secured by tie-downs laid out over the top tier.
 - (ii) Restrained from lateral movement by blocking or high friction devices between tiers.
 - (iii) Placed directly on top of other bundles or on spacers and secured in accordance with the following:
 - (a) The length of spacers between bundles must provide support to all pieces in the bottom row of the bundle.
 - (b) The width of individual spacers must be equal to or greater than the height.
 - (c) If the spacers are comprised of layers of material, the layers must be unitized or fasten together in a manner which ensures that the spacer performs as a single piece of material.
 - (d) The arrangement of the tie-downs for the bundles must be:
 - 1) Secured by tie-downs over the top tier of bundles, with a minimum of two (2) tie-downs per bundle; and

- 2) Secured by tie-downs over the second tier or over a middle tier of a maximum of six (6) feet above the trailer deck, with a minimum of two (2) tie-downs per bundle, for each stack of bundles composed of more than two tiers;
- 3) Secured by tie-downs over each tier of bundles, using a minimum of two (2) tie-downs over each of the top bundles.

B. Securing Metal Coils

1. Applicability--The rules in this section apply to the transportation of one or more metal coils.
2. Securement of coils transported with eyes vertical ("**Eye to the sky**") on a flatbed vehicle.
 - (i) Individual coil. Each coil must be secured by tie-downs arranged in a manner to prevent the coils from tipping in the forward, rearward, and lateral directions. The restrain system must include the following:
 - a. At least one tie-down attached diagonally from the left side of the vehicle (near the forward-most part of the coil), across the eye of the coil, to the right side of the vehicle (near the rearmost part of the coil).
 - b. At least one tie-down attached diagonally from the right side of the vehicle (near the forward-most part of the coil), across the eye of the coil, to the left side of the vehicle (near the rear-most part of the coil).
 - c. At least one tie-down attached transversely over the eye of the coil; and
 - d. Either blocking and bracing, friction mats or tie-downs must be used to prevent forward direction movement.



Eye Vertical

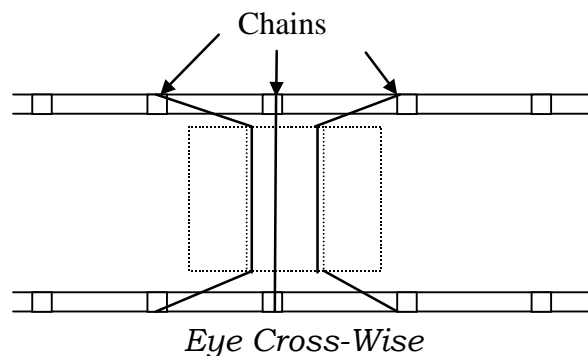
(ii) Coils grouped in rows. When coils are grouped and loaded side by side in a transverse or longitudinal row, each row of coils must be secured by the following:

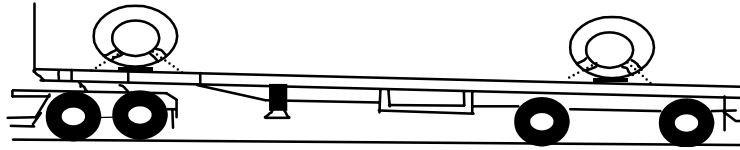
- a. At least one tie-down attached to the front of the row of coils, restraining against forward motion, and whenever practicable, making an angle no more than 45 degrees with the floor of the vehicle when viewed from the side of the vehicle;
- b. At least one tie-down attached to the rear of the row of coils, restraining against rearward motion, and whenever practicable, making an angle no more than 45 degrees with the floor of the vehicle when viewed from the side of the vehicle.
- c. At least one tie-down over the top of each coil or transverse row of coils, restraining against vertical motion. Tie-downs 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 tie-down from slipping or becoming unintentionally unfastened while the vehicle is in transit; and
- d. Tie-downs must be arranged to prevent shifting or tipping in the forward, rearward, lateral directions.

3. Securement of coils with eyes crosswise ("**suicide**") on a flatbed trailer.

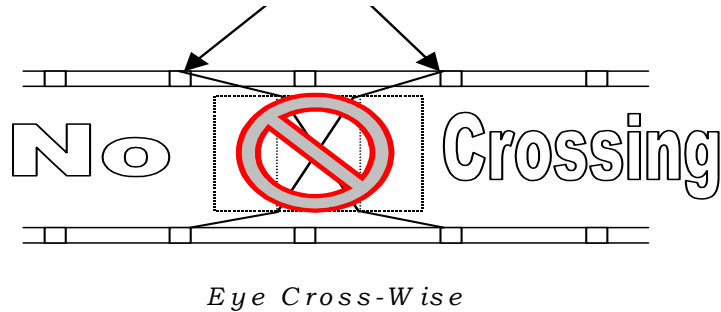
(i) An individual coil must be secured by the following:

- a. A means (e.g., timbers, chocks, wedges, 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;
- b. At least one tie-down through its eye, restricting against forward motion, and whenever practicable, making an angle no more than 45 degrees with the floor of the vehicle when viewed from the side of the vehicle;
- c. At least one tie-down through its eye, restricting against rearward motion, and whenever practicable, making an angle no more than 45 degrees with the floor of vehicle when viewed from the side of the vehicle.



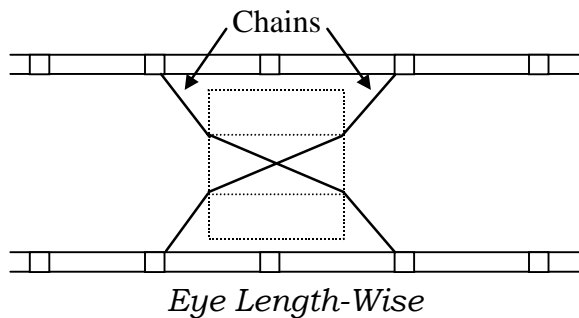


- (ii) Prohibition on crossing of tie-downs when coils are transported with eyes crosswise. Attaching tie-downs diagonally through the eye of a coil to form an X-pattern when viewed from above the vehicle is prohibited.



4. Securement of coils transported with eyes lengthwise ("**shotgun**") on a flatbed trailer.

- (i) An individual coil, option 1, must be secured by:
 - a. A means (e.g., timbers, chocks, wedges, 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 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.

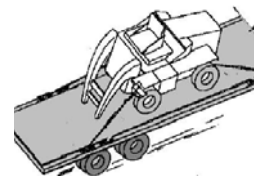


- b. At least one tie-down attached diagonally through its eye from the left side of the vehicle (near the forward-most part of the coil), to the right side of the vehicle (near the rearmost part of the coil), making an angle no more than 45 degrees, whenever practicable, with the floor of the vehicle when viewed from the side of vehicle.

- c. At least one tie-down attached transversely over the top of the coil; and
- d. Either blocking, or friction mats to prevent longitudinal movement.

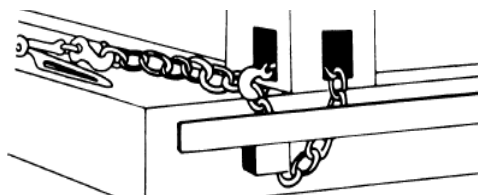
C. Securing Heavy Vehicles, Equipment, and Machinery

1. **Applicability.** The rules in this section apply to the transportation of heavy vehicles; equipment and machinery that operate on wheels or tracks, such as front-end loaders, bulldozers, tractors, and power shovels and which weigh individually weigh 10,000 lbs or more.
2. **Preparation of equipment being transported.** Accessory equipment, such as hydraulic shovels, must be completely lowered and secured to the vehicle.
3. **Articulated vehicles shall be restrained in a manner that prevents articulation while in transit.**
4. **Heavy equipment or machinery with crawler tracks or wheels must be restrained against movement in the lateral, forward, rearward, and vertical direction using a minimum of four tie-downs.**
 - (i) Each of the tie-downs must be affixed as close as practicable to the front and rear of the vehicle, or mounting points on the vehicle that have been specifically designed for that purpose.



D. Securing Intermodal Containers

1. **Securement of intermodal containers transported on vehicles.**
 - (i) 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.
 - (ii) Each container must be secured to the vehicle by:
 - (a) Chains, wire ropes or integral devices which are fixed to all lower corners; or
 - (b) Crossed chains which are fixed to all upper corners; and,
 - (iii) The front and rear of the container must be secured independently. Each chain, wire rope, or integral locking device must be secured attached to the container in a manner that prevents it from being unintentionally unfastened while the vehicle is in transit.



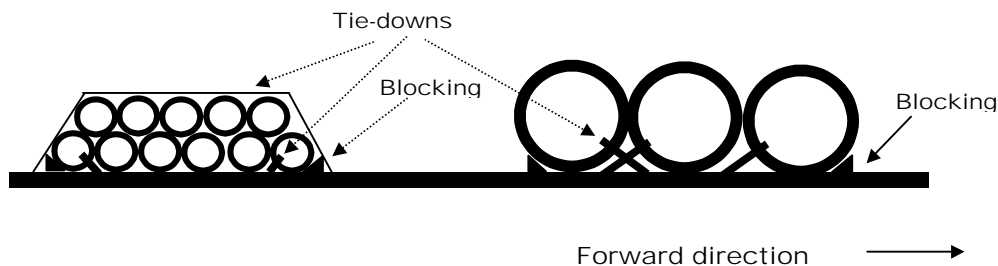
E. Securing Concrete Pipe

1. When transporting on flatbed trailers and lowboy trailers if the pipe is tightly bundled together must meet working load requirements and length requirements.
2. Blocking
 - (i) May be one or more pieces placed symmetrically about the center of pipe.
 - (ii) One piece must extend at least half the distance from the center to each end of the pipe and two pieces must be placed on the opposite side, one at each end of the pipe.
 - (iii) Blocking must be placed firmly against the pipe and must be secured to prevent it from moving out from under the pipe.
 - (iv) Timber blocking must have minimum dimensions of at least 4 x 6 inches.



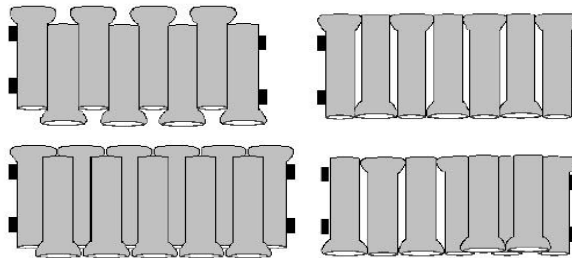
3. Arranging the load

- (i) Pipe with a different diameter loaded on a vehicle. Groups of pipe must be formed with the same size for each group and separately secured.
- (ii) Arranging the 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.
- (iii) 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.



4. Arranging bell pipe

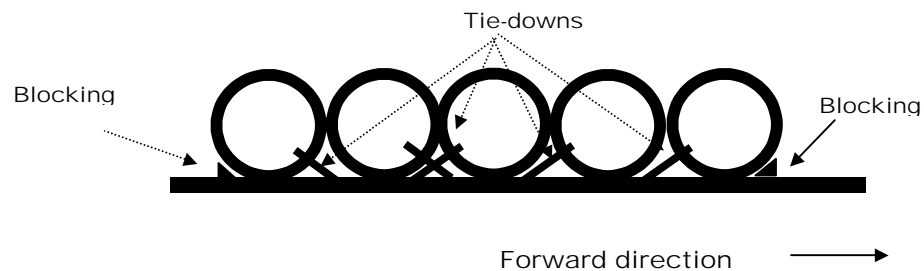
- (i) Bell pipe must be loaded on at least two longitudinal spacers of sufficient height to ensure that the bell is clear of the deck.
 - (a) Bell pipe loaded in one tier must have the bells alternating on opposite sides of the trailer.
 - (b) The ends of consecutive pipe must be staggered, if possible within the allowable width, otherwise they must be aligned.
 - (c) Bell pipe loaded in more than one tier must have the bells of the bottom tier all the same side of the trailer.
 - (d) Pipe in every upper tier must be loaded with bells on the opposite side of the vehicle to the bells of the tier below.
 - (e) If the second tier is not complete, pipe in the bottom tier, which does not support a pipe above, must have their bells alternating on opposite sides of the trailer.



5. Securing pipe with an inside diameter up to 45 inches. In addition to the requirements of number 1,2,3 above, the following rules must be followed.

- (i) Stabilizing the bottom tier.
 - (a) The bottom tier must be immobilized longitudinally (length) at each end by blocking, vehicle end structure, stakes, or other equivalent means.
 - (b) Other pipe in the bottom tier may also be held in place by blocks and/or wedges.
 - (c) Every pipe in the bottom tier must also be held firmly in contact with adjacent pipe by tie-downs through the front and rear pipes. Tie-downs must run at an angle not more than 45 degrees through the front and rear pipes, whenever practicable.
- (ii) Use of tie-downs
 - (a) Each pipe should be secured individually with tie-downs through the pipe.
 - (b) There are guidelines for using 3/8-inch chain going over the group of pipes. See section 393.124.

6. Securing large pipe with an inside diameter over 45 inches. In addition to the requirements of number 1,2,3 above, the following rules must be followed.
- (i) The front and rear pipe must be immobilized by blocking, wedges, vehicle end structure, stakes, or other equivalent means.
 - (ii) Each pipe must be secured by tie-downs through the pipe.
 - (a) At least one tie-down through each pipe in the front half of the load, which includes the middle one if there is an odd number, and tie-downs must run rearward at an angle not more than 45 degrees with the horizontal, whenever practicable.
 - (b) At least one tie-down 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 in contact with the vehicle end structure, stakes, or other equivalent means, at least two tie-downs positioned as described in (a) & (b) above, must be used through that pipe.
 - (iii) If only one pipe is transported, or if several pipes are transported without contact between other pipes, the requirements in this paragraph apply to each pipe as a single front and rear article.



8. Definitions

Anchor point - Part of the structure, fitting or attachment on a vehicle or article of cargo, which a tie-down is attached.

Blocking - A structure, device or another substantial article placed against or around an article of cargo to prevent horizontal movement of the article of cargo.

Bracing - A structure, device, or another substantial article placed against an article of cargo to prevent it from tipping, also can prevent it from shifting.

Coil Rack - A device that keeps timbers supporting a metal coil in place.

Dunnage - All loose materials used to support and protect cargo.

Edge protector - A device placed on the exposed edge of an article to distribute tie-down pressure over a larger area of cargo than the tie-down itself, to protect the tie-down and/or cargo from damage.

Friction mat - A device placed between the deck of a vehicle and article of cargo, or between articles of cargo, intended to provide greater friction than exists naturally between these surfaces.

Rub rail – A rail along the side of a vehicle that protects the side of the vehicle from impacts.

Tie-down - A combination of securing devices which forms an assembly that attaches articles of cargo to, or restrains articles of cargo on, a vehicle or trailer and is attached to anchor point(s).

Void filler - Material used to fill a space between articles of cargo and the structure of the vehicle that has sufficient strength to prevent movement of the articles of cargo.

Well - Depression between two cylinder articles of cargo.

Winch – A device for tensioning a webbing tie-down 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.