

Module 7:

Securing and protecting the goods



Start Module



Learning objectives

At the end of 'Module 7: Securing and protecting the goods' you will be able to:

1

Explain how to work out the amount of load restraint required

2

Explain the difference between indirect and direct load restraint



3

Describe the requirements for safe indirect and direct load restraint

4

Complete a safety inspection of your load

5

Complete relevant documentation

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Module overview

Earlier modules

Covered how to prepare and load both standard and unusual loads

This module

Different methods of **load restraint** that you can use to secure and protect the load

Any load has the **potential to shift** during transport, if it is **unrestrained** or **not adequately restrained**.

BRAKING ACCELERATING CORNERING HILLY ROADS SLOPED ROADS UNEVEN ROADS AIR FLOW



Loads must be restrained:

- so they are unlikely to fall or be dislodged
- with an appropriate restraint method
- in line with the Load Restraint Guide.

 This module provides **guidance** but **cannot cover all load restraint methods for all types of loads**. Always refer to the Load Restraint Guide and your workplace procedures for information and guidance on load restraint specific to your task and load type.

 [Load Restraint Guide](#)

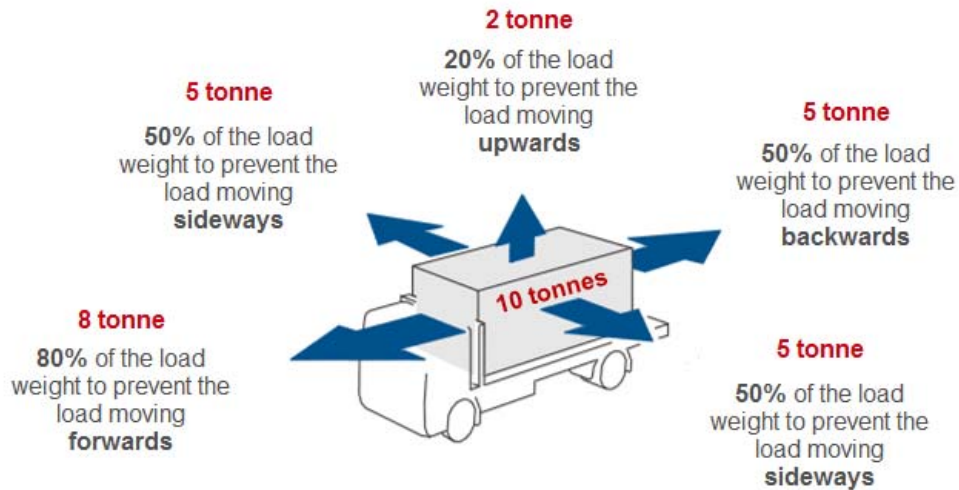
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Minimum load restraint requirements

The amount of **load restraint forces** needed so the load doesn't shift is equal to:



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Types of load restraint

Load restraint forces can be achieved by either using:

INDIRECT RESTRAINT
("TIE-DOWN")



DIRECT RESTRAINT



The load is prevented from moving
by **friction** only



The load is prevented from moving
by **containing, blocking or
attaching** it to the vehicle

**Selecting the type of
load restraint**



Type, weight and
dimensions of your load

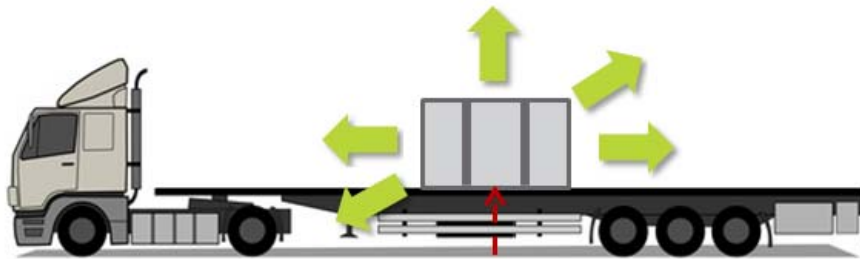


Type of transport vehicle



'Indirect' or 'tie-down' method

The **most common** form of load restraint
Uses a combination of **friction** and **tie-down lashings**



The type of surface of the load and the vehicle

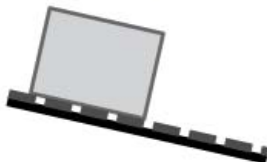
Friction

The force between the surfaces

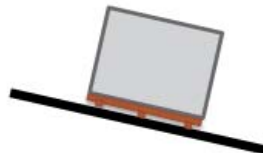
Particles such as dust, grease or oil can make the surface **slippery** and **reduce** the **friction**.

Rough surfaces such as rubber matting or timber can help to **increase** the **friction**.

Steel crate on rubber matting



Wooden pallet on a steel tray



Greasy steel crate on a steel tray



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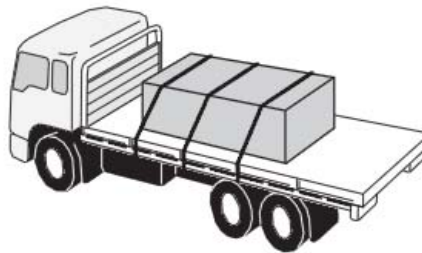
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Tie-down lashings

The tie-down lashings play an **important role** in the 'tie-down' method, as friction alone cannot prevent a load from bouncing **upwards** when travelling over uneven road surfaces.

Types:

- Ropes
- Webbing straps
- Chains



Either:

Passed over the top of a load

Passed through a load



Attached to the vehicle on either side



Pre-tensioned using knots or mechanical tensioners



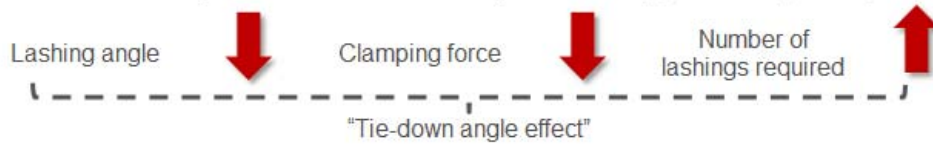
The tie-down method is **not suitable** for **slippery** loads as too many lashings are needed. It is also not suitable for loads that may be **damaged** or **crushed** by the lashings.

(Image © 'The Load Restraint Guide', 2nd edition, 2004)

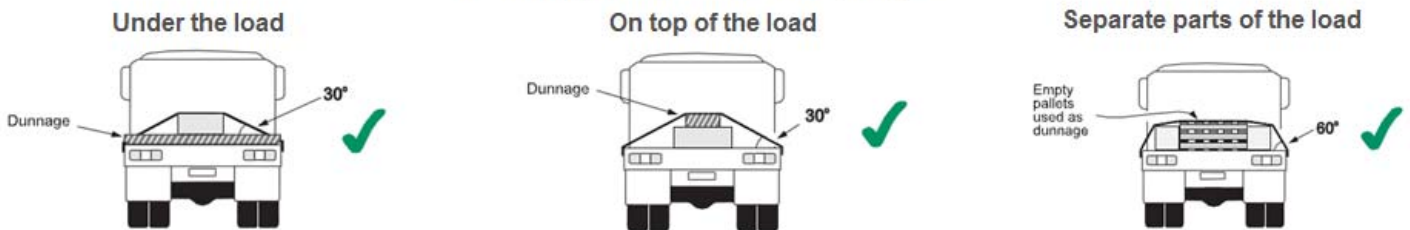


Tie-down lashings: Angles

Tie-down lashings are **most effective** if they are **vertical** (up and down) and **tight**.



Use dunnage to **increase** the lashing **angles**:



(Images © 'The Load Restraint Guide', 2nd edition, 2004)

Tie-down lashings: Pre-tension

The load must always remain in contact with the vehicle and **not bounce upwards**

The tie-down lashings must be **correctly tensioned** at all times

Different lashing **materials** can achieve **different tensions**

Click each type of lashing to find out more.

[Ropes](#)

[Webbing straps](#)

[Chains](#)



Tie-down lashings: Pre-tension

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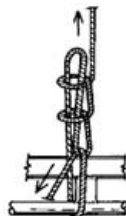
Ropes 

Webbing straps 

Chains 

Single truckies hitch

Pre-tension:
50kgs



Double truckies hitch

Pre-tension:
100kgs



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Tie-down lashings: Pre-tension

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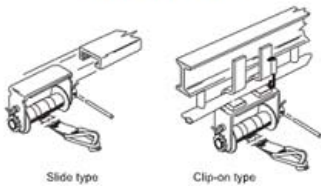
Click each type of lashing to find out more.

Ropes ✓

Webbing straps ✓

Chains ✓

Truck winches



Side type

Clip-on type

Clips onto the tie rails of the tray of the truck or slides into special tracks under the coaming rails

Achieve the necessary tension by winding webbing around a spool with a lever

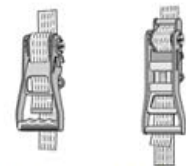


Solid steel binder bar

Handle that pushes up or down



Hand ratchet winches



Push up to operate

Pull down to operate

Attaches to the tie rails using a webbing strap and hook

The **amount** of tension produced depends on the **length** of the **lever** and how **large** the **spool** of webbing becomes during tightening.

25mm hand ratchet



Pre-tension: 100kgs

35mm hand ratchet



Pre-tension: 250kgs

(Images © 'The Load Restraint Guide', 2nd edition, 2004)



Tie-down lashings: Pre-tension

The load must always remain in contact with the vehicle and **not bounce upwards**

The tie-down lashings must be **correctly tensioned** at all times

Different lashing materials can achieve **different tensions**

Click each type of lashing to find out more.

Ropes

Webbing straps

Chains

Over-centre tensioners ('dogs')



Fixed lever dog



Pivoting lever dog

Can injure the operator when applying or releasing the chain tension

Designed to reduce this 'kickback' by limiting the lever movement

Not suitable for tensioning short chains

Pre-tension: 750kgs

(Images © 'The Load Restraint Guide', 2nd edition, 2004)



[Average Pre-tension Guide](#)

Turnbuckles



Ratchet turnbuckle



Sliding lever turnbuckle

Have no kickback when released

Suitable for both short and long chains

Pre-tension: 1000kgs

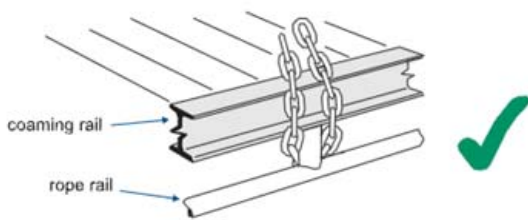
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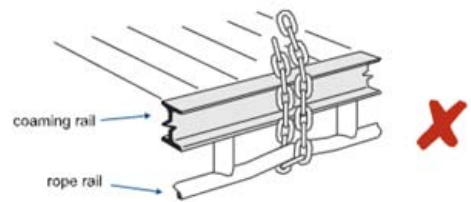
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Tie-down lashings: Tie-down points

When you are attaching any lashing to the tie rails of the tray of the truck, you must secure them either **at or near the tie rail support points**.





If tension is applied at a **non-supported point**, the tie rail may **bend** which will reduce the tension of the lashing.




These support points are secure and can take the tension of the lashing.

When attaching lashings to the tie rails, **ensure that:**

 Webbing straps are not attached by knots

 Hand ratchets and end fittings do not press against the coaming rail or the load

 Chain grab hooks are only attached to chains

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Tie-down lashings: How many?


The number and strength of lashings will depend on:

- whether the load is **blocked or not**
- the **friction** between the load surfaces
- the **weight** of the load
- the **clamping force** from the tie-down lashings.



Remember to **round the answer up** to the next whole number, as you can't have 0.3 of a rope.

(Image © 'The Load Restraint Guide', 2nd edition, 2004)

MAXIMUM WEIGHT RESTRAINED BY ONE LASHING (with no load shift)				
FRONT OF LOAD BLOCKED?	NO		YES	
HOW MUCH FRICTION?	MEDIUM <small>(Smooth Steel on Timber) $\mu = 0.4$</small>	HIGH <small>(Rubber Load Mat) $\mu = 0.6$</small>	MEDIUM <small>(Smooth Steel on Timber) $\mu = 0.4$</small>	HIGH <small>(Rubber Load Mat) $\mu = 0.6$</small>
 $H=L \times 0.85$ or more Lashing angle 60° or more to horizontal				
ROPE - Single Hitch <small>(50 kg average tension)</small>	85 kg	255 kg	340 kg	425 kg
ROPE - Double Hitch <small>(100 kg average tension)</small>	170 kg	510 kg	680 kg	850 kg
WEBBING STRAP <small>(300 kg average tension)</small>	510 kg	1530 kg	2040 kg	2550 kg
CHAIN <small>(750 kg average tension)</small>	1275 kg	3825 kg	5100 kg	6375 kg



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Tie-down lashings: Using ropes safely

Ropes are most suitable for:



Light loads



Crushable loads



Sharp or abrasive loads



Check that your working area is safe



Choose an appropriate rope for the load



Check the other side of the vehicle to ensure it is clear



Throw the rope over the top of the load on the vehicle



Secure the end of the rope to one side of the vehicle



Secure and tension the rope from the other side of the vehicle



Tie-down lashings: Using webbing straps safely

Webbing straps are most suitable for: Heavy individual objects Crushable loads Long loads



Check that your working area is safe



Choose an appropriate webbing strap for the load



Check the other side of the vehicle to ensure it is clear



Secure the webbing strap to one side of the vehicle



Throw the webbing over the top of the load



Secure the webbing strap from the other side of the vehicle



Tension the webbing strap



Double-check the tension



Tie-down lashings: Using chains safely

Chains are most suitable for:



Non-crushable loads



Long loads



Sharp or abrasive loads



Check that your working area is safe



Choose an appropriate chain for the load



Check the other side of the vehicle to ensure it is clear



Throw the chain over or through the load



Secure the end of the chain to one side of the vehicle



Secure and tension the chain from the other side of the vehicle



Secure any loose chain ends



Tie-down lashings: Safety tips

Using any type of lashing involves risk – to **you**, those **around you**, your **load** and your **vehicle**.

Click each heading for some common safety tips.

General safety
tips

Rope safety tips

Webbing strap
safety tips

Chain safety tips



Tie-down lashings: Safety tips

Using any type of lashing involves risk – to **you**, those **around you**, your **load** and your **vehicle**.

Click each heading for some common safety tips.

General safety tips ✓

Rope safety tips ✓

Webbing strap safety tips ✓

Chain safety tips ✓

DO:

- Wear proper hand and eye protection during lashing
- Make sure you have enough lashings that are in good condition and strong enough to secure your load
- Make sure tie-down lashings are as near to vertical as possible
- Attach lashings at tie rail support points
- Try to place every second tensioner on opposite sides of the vehicle or use two tensioners for each lashing
- Check the other side of the vehicle for people and equipment before throwing the lashing over the top
- Secure the loose end of any lashing to prevent contact with rotating wheels and unexpected wheel lock-up
- Check and re-tighten lashings once you're finished
- Inspect lashings and parts regularly and repair or replace

DON'T:

- Use lashings or parts that are worn beyond the manufacturer's limits
- Tie down loads onto greasy or dirty steel decks
- Overextend your arm when throwing lashings over the vehicle



[Lashings Safety Tips List](#)

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Tie-down lashings: Safety tips

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Click each heading for some common safety tips.

General safety tips ✓

Rope safety tips ✓

Webbing strap safety tips ✓

Chain safety tips ✓

DO:

Use corner protectors where the rope and load come into contact so the rope isn't cut on sharp edges

Use an appropriate knot for the load

Avoid injury while tightening a rope using a truckie's hitch by ensuring the rope doesn't break and the knot doesn't slip and undo

Check ropes at regular intervals on long journeys, and re-tighten if necessary



DON'T:

Use ropes that are knotted, frayed or damaged in any way

Use ropes that are not designed for load restraint



[Lashings Safety Tips List](#)

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Tie-down lashings: Safety tips

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Click each heading for some common safety tips.

General safety tips ✓

Rope safety tips ✓

Webbing strap safety tips ✓

Chain safety tips ✓

DO:

Use corner protectors where the strap and load come into contact so the webbing strap isn't cut on sharp or rough edges

Make sure you reel off enough webbing to go over the load and the vehicle

Double-check the tension is correct by giving the webbing a tap with the binder bar. If it springs back, the tension hasn't loosened



DON'T:

Join webbing straps by knots or any other method unless approved by the webbing manufacturer

Use webbing straps with chemicals or at high temperatures unless approved by the manufacturer

Use a cheater bar with a binder bar as they can slip off the end of the binder bar and cause injury



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Tie-down lashings: Safety tips

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General safety tips ✓

Rope safety tips ✓

Webbing strap safety tips ✓

Chain safety tips ✓

DO:

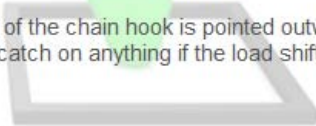
Check the chain has the correct load capacity

Take extreme care when releasing a fixed lever dog to prevent injury from the rotating lever that can release suddenly and unexpectedly

Ensure the lever is locked in the correct position and not obstructed after tensioning the load

Position dogs with the lever rotating downward to tension chains that are placed vertically

Make sure the tip of the chain hook is pointed outwards so it doesn't catch on anything if the load shifts



DON'T:

Join chains with wire, bolts or joining links that don't have the same lashing capacity as the chain assembly

Over-tension the dog

Use a cheater bar that does not meet the chain manufacturer's specifications



[Lashings Safety Tips List](#)

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Direct restraint

We've covered how to safely restrain a load using the **indirect** or '**tie-down**' method



Let's look at the **direct restraint** method



Does **not** use friction at all

It prevents the load from moving by:

Containing

Blocking

Attaching

Best method for securing loads that are difficult to tie down



Direct restraint: Containing

Directly restraining the load **without any securing devices**

Vehicle body



Contain the load within the vehicle body

Designed so that any movement of the load does not reduce the stability of the vehicle

Open bodies designed for loose bulk loads should be fitted with covers

Tarpaulins and nets can be used to provide vertical restraint for light loads

Tank



Equipment that can contain the load

Must have enough strength to restrain the load and keep it contained

Latches, locks and hinges must be strong

Generally require additional restraint methods

Frame



Gates are permanent or removable vertical frames used at the front, sides and rear of the loading deck

Most loading racks and headboards are not strong enough to fully restrain heavy loads

→ Also use the attaching method

Side gates and side curtains can be used to prevent sideways movement

→ Combined with additional load restraint

If the side curtain is not certified, the load must be restrained using other restraint methods

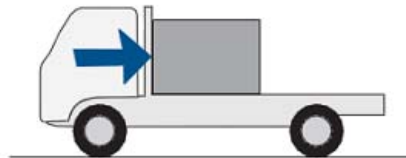
Stanchions are large upright fixtures attached to the side of a vehicle



Direct restraint: Blocking

Directly restraining the load by **blocking it against vehicle structures**

Barriers can also be used to **separate** the load into two parts to maintain axle weight limits.



Blocking is commonly used in **combination** with the **tie-down method** as it often requires additional sideways, rearward and vertical restraint.

When the load **cannot be blocked directly** against the headboard or loading rack **dunnage** can be placed **between the load and the headboard**.



Other **load separators** such as tyres, empty pallets and carpet can be used to **restrain** individual items within the load and to **protect** fragile items.

Cradles, chocks, a-frames and trestles can also be used to **block items** of the load.



Cradles

Frame placed on a vehicle that is shaped to prevent cylindrical items from rolling



Chocks

Wedge shaped blocks used to prevent movement of an item



A-frames/Trestles

Used to support and block items

Must be separately lashed or attached to the vehicle or load

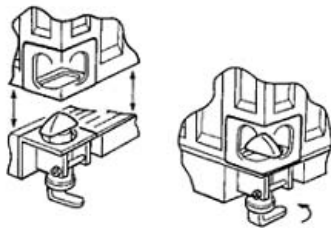
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Direct restraint: Attaching

Directly restraining the load by **attaching it to the vehicle**

Mechanical locking devices

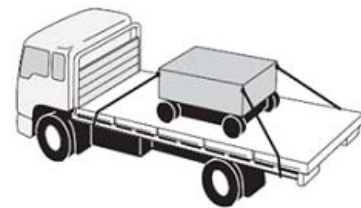


Most common locking device is the **twist lock**

A rotating head which **interlocks** with a corner casting on the load to secure it to the vehicle

Commonly used to attach **shipping containers, demountable tanks** and other containment bodies to the vehicle

Direct lashings



Include **ropes, webbing straps** and **chains**

Suitable for restraining most loads, but particularly **slippery loads** and **loads on wheels**

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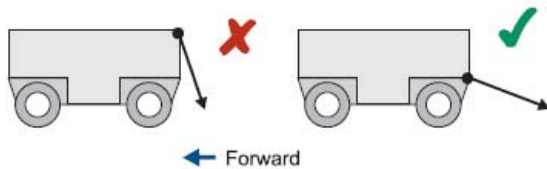
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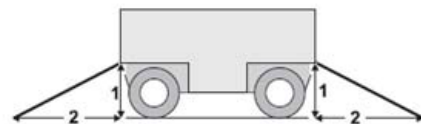
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Direct restraint: Attaching angles

Lashings must be angled in directions **opposite** to any expected load movement and at a much **more horizontal** angle than used for tie-down lashings



Recommended angle for direct lashings is a **slope of 1 in 2 to the horizontal**



Loads with rubber tyres:

Lashings do not need to be angled sideways if the friction between the tyres and the deck provides the necessary sideways restraint

Forward and rear lashings should be angled at no more than 25° to minimise bouncing

Alternatively, the wheels can be removed during transport

Loads with steel wheels or tracks:

Lashings will need to be angled sideways, forwards and rearwards

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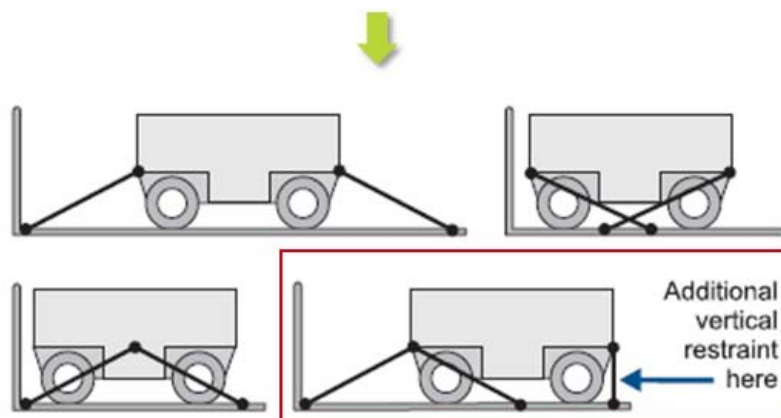
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Direct restraint: Attaching positions

Lashings can be attached at **any position** along the load

Usually **different** ways to achieve the **same** restraint

Four different ways to position the lashings on a rubber tyred load to provide forwards and rearwards restraint



(Image © 'The Load Restraint Guide', 2nd edition, 2004)

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Direct restraint: How many lashings?

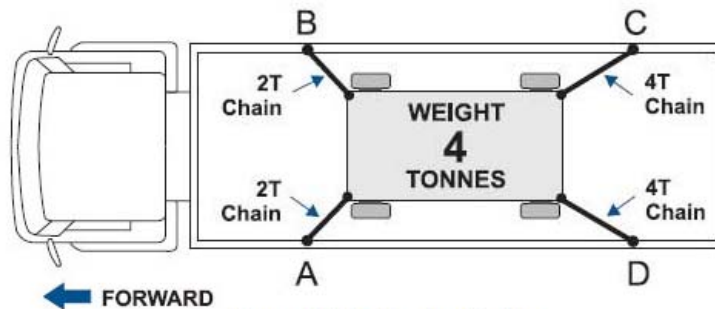
Number of lashings = Weight of the load + Strength of the lashings + Their angle and direction

Simple rule



The weight of the load in the sideways direction

The weight of the load in the rearward direction



Twice the weight of the load in the forward direction

The weight of the load in the sideways direction

(Image © 'The Load Restraint Guide', 2nd edition, 2004)

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Direct restraint: Safety tips

In addition to the safety tips covered earlier for ropes, webbing straps and chains, you should follow these additional tips.

DO:

Combine direct restraint with tie-down restraint where necessary to achieve maximum restraint

Regularly inspect all containing, blocking and attaching equipment and repair or replace them if there is any doubt about their safety

Ensure that all locking and latching mechanisms are fully functional when being used for load restraint purposes

Angle direct lashings in directions opposite to any expected load movement

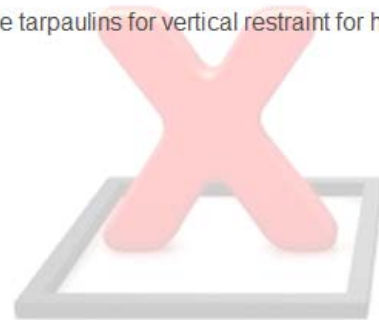
Angle direct lashings at a much more horizontal angle than that used for tie-down lashings

Ensure cradles, chocks, a-frames and trestles are separately lashed or attached to the vehicle or load

DON'T:

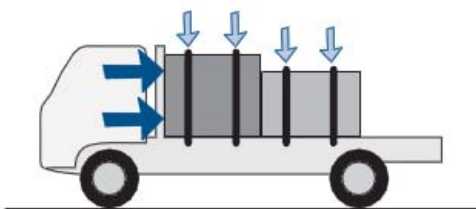
Use un-certified side curtains or gates for sideways restraint

Use tarpaulins for vertical restraint for heavy loads



Combining tie-down and direct restraint

To achieve maximum restraint, it is often necessary to **combine** the **tie-down method** with the **direct restraint method**.

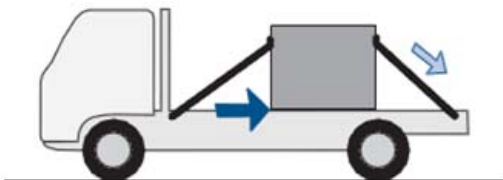


Tie-down



Blocking

- **Friction** force from the **weight** of the load
- **Friction** force from tie-down lashings
- Direct restraint from **blocking** by the headboard



Tie-down



Attaching

- **Friction** force from the **weight** of the load
- **Friction** force from the downward force from the **lashings**
- **Direct restraint** from **lashings** that are attached to the load

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Common load types and restraint methods

Let's look at some common load types and an **example** of their appropriate restraint method.

Light pallets and boxes



Tie-down with ropes or webbing straps or also combine with blocking

Heavier pallets and boxes



Tie-down with webbing straps or chains or also combine with blocking and containing

Vertical cylinders



Tie-down of at least one rope or webbing strap per cylinder or also combine with blocking and containing

Horizontal cylinders on cradles



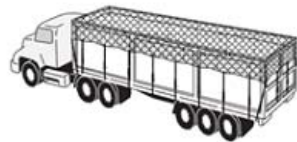
Tie-down of at least one rope, strap or chain for each cradle and cylinder, or also combine with blocking and containing

Long cylinders



Tie-down with straps or chains or also combine with containing by adding stanchions

Loose bulk load



Containing within the body of the vehicle and use tarpaulins, load covers or nets to restrain loose particles or objects

Containers and tanks



Attaching to the vehicle with twist locks

Vehicles and mobile equipment



Attaching to the vehicle with direct lashings

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Complete or interpret documentation

As part of your loading activities, you may be required to **complete** or **interpret** specific documentation based on your load.

These documents will **differ in each workplace** and may include:



**Loading
plan**

Can include:

- Characteristics of the load
- Appropriate load restraint methods
- Labelling requirements
- A sketch of the loading area
- Signature of the loader



**Consignment
note**

- Used when a transport company is being used
- Attached to the goods
- Description of the items
- Dimensions and weight
- Sender and receiver address
- Transport charges



**Packing
slips,
delivery
notes or
manifests**

- Very similar documents
- Attached to the goods
- Type of goods
- Number ordered and delivered
- Any back orders
- Do not usually contain the value or price

**Contains
dangerous
goods?**



**Dangerous
goods
transport
document**

- Such as the number of containers and total quantity
- Check that the completed transport document and emergency information (if needed) are provided to the driver



Perform a safety inspection

It is important to perform a **safety inspection** of your load
Click each heading on the checklist to find out more.

- 
- Vehicle selection and condition
 - Load position
 - Load segregation and labelling
 - Load security
 - Load restraint
 - Documentation



[Safety Inspection Checklist](#)

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Perform a safety inspection

It is important to perform a **safety inspection** of your load

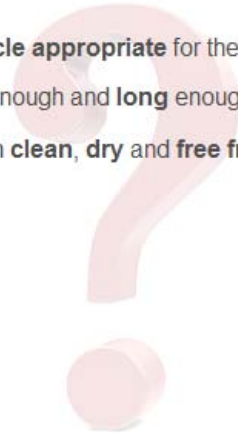
Click each heading on the checklist to find out more.



Is the **vehicle appropriate** for the load?

Is the load platform **wide** enough and **long** enough to support the load?

Is the load platform **clean, dry** and **free from grease**?



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Perform a safety inspection

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Click each heading on the checklist to find out more.



Are the mass of the total vehicle and the mass over each individual axle **within** the **legal limits**?

Is the load **positioned evenly** across the vehicle?

Is the load **projecting** from the **front, sides** or **rear** of the vehicle within the legal limits?

Is the load **not projecting or positioned dangerously** in case of sudden braking or an accident?

Have the handling instruction **cargo symbols** been followed?



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Perform a safety inspection

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Have any **dangerous goods** been **segregated** appropriately based on the Australian Dangerous Goods Code?

Have the **dangerous goods** and the vehicle been **placarded** appropriately?



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Has the load been checked for any **suspicious items**?

(For example, unmarked or mislabelled goods, goods with no return address, or goods with obviously incorrect weight, dimensions or descriptions on their label or documentation)

Have any identified suspicious items been **isolated** and **reported** to management?



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- Has a suitable **load restraint method** been used?
- Has **enough** load restraint equipment been used that is **strong enough** for the load?
- Is the load restraint equipment in **good condition** and not damaged?
- Have lashings been **tensioned**?
- Have lashings been **checked** to ensure they haven't loosened since they were tensioned?
- Have the **loose ends** of lashings been **secured** so they are not hanging loose?



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Perform a safety inspection

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Has all relevant **load documentation** been completed?
(For example, the Dangerous Goods Transport Document and Emergency Information, loading plans, consignment notes, packing slips, delivery notes, manifests etc)



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Summary

Congratulations! You have now completed 'Module 7: Securing and protecting the goods'.

You should now be able to:

- ✔ Explain how to work out the amount of load restraint required
- ✔ Explain the difference between indirect and direct load restraint
- ✔ Describe the requirements for safe indirect and direct load restraint
- ✔ Complete a safety inspection of your load
- ✔ Complete relevant documentation



You can now return to the home page and move on to the next module which will look at unloading the goods.

