

The logo is a red shield with a white border, centered on a grey diamond plate background. The shield contains the text 'TMC' in large white letters, 'TECHNICAL & MAINTENANCE CONFERENCE' in smaller white letters below it, and 'PACCAR & DEALER' at the bottom with a small truck icon above the text.

TMC

TECHNICAL & MAINTENANCE
CONFERENCE

PACCAR & DEALER

2017



RESTRAINING THE LOAD

Chair

Chris Loose - ATA

Panel members

Warwick Norton - NHVR

Mike Robertson - Engistics

Greg Brown - MaxiTRANS

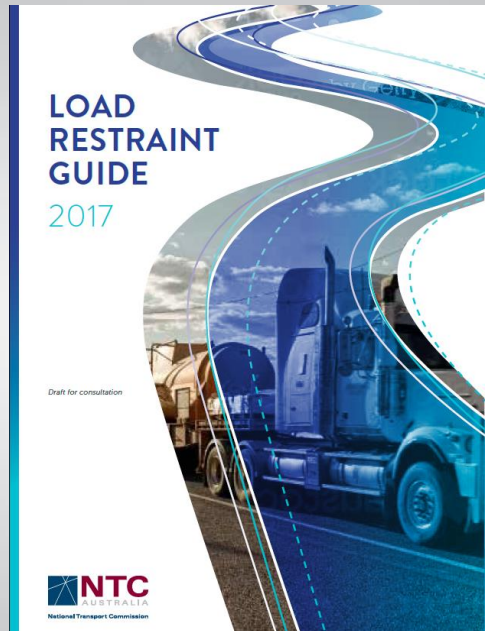
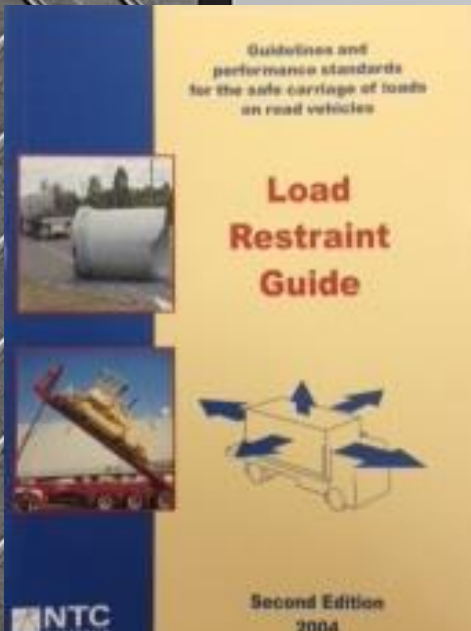


Chris Loose - ATA



THE GUIDE

Plus the performance standards in the law



LOADS

- ✓ Reinforce non-rated blocking surfaces using chains (or similar) wrapped across the face of the blocking surface. **Figure 166 Horizontal Blocking Reinforcement**
- ✓ Pass reinforcing chains through a hollow section welded to the blocking surface. **Forwards Blocking**
- ⓘ Reinforced non-rated blocking surfaces have limited restraint capacity and may fail if used improperly. **Rearwards Blocking**
- ✓ Block loads of three or more abreast bales in the forwards and rearwards directions. **Figure 165 Three Abreast Load/Unload**
- ⚠ Tie-down of bales loaded three abreast may not provide sufficient clamping to the centre bale if tie-down is used on its own. **Figure 163 Limited Clamping on Middle Bale**
- ✓ Split tall loads into two parts and restrain separately to provide additional rigidity. **Figure 164**
- ✓ Load and restrain the first half before loading the second half on top. **Figure 164 Stacks Restrained in Two Stages**

BALES, BAGS AND SACKS

Safe Loads Guide
Load Restraint "Palletised Freight"

ABOUT THIS GUIDE
This guide provides information that applies to the safe loading, securing, restraining and unloading of palletised freight on road vehicles. It is intended for use by those responsible for the safe carriage of palletised freight on road vehicles.

SCOPE OF RESPONSIBILITY
Only the person who has control of a transport operation can be held responsible for any loading, securing, restraining or unloading of palletised freight on road vehicles. This applies to consignors, consignees, loaders, packers, drivers and those responsible for the transport of the load.

MINIMUM LOAD RESTRAINT REQUIREMENTS
All loads must be restrained in accordance with the relevant requirements of the Code of Practice for the Safe Carriage of Palletised Freight on Road Vehicles. This includes the use of appropriate restraint systems, such as chains, ratchet straps, and other approved restraint devices, to secure the load to the vehicle and to the vehicle's structure.

DIFFERENT TYPES OF LOADS
This guide is intended to be used in conjunction with the relevant requirements of the Code of Practice for the Safe Carriage of Palletised Freight on Road Vehicles. It is not intended to be used as a standalone guide.

Developed by The ATA Industry Technical Council
First edition - March 2017

Certified load restraint curtain systems

ATA
AUSTRALIAN TRANSPORT ASSOCIATION

Technical Advisory Procedure

vicroads

Guide to restraining concrete panels and beams

keeping vehicles contained

BlueScope Steel

Guidelines for storage and handling BlueScope Steel's products

safe work australia

Effective load restraint

This website discusses how to effectively restrain loads on heavy vehicles to protect the safety of workers and the users of public roads. It describes the systems that BlueScope Steel uses to ensure its products are delivered safely.

Other formats

- Learn on YouTube!
- Download our Load Restraint PDF
- Effective load restraint training DVD's

<https://www.safeworkaustralia.gov.au/effective-load-restraint>



EXAMPLES





2ND EDITION LOAD RESTRAINT GUIDE

Section I - 2.2 Direct Restraint System
(Attachment, Blocking, Containment), Page 327.

The integrity of a pack which is strapped or wrapped, or uses tie-down to unitise the individual items, should be checked by restraining the base and tilting it to the equivalent angles of the Performance Standards (also see Section F.5 page 200).

All direct restraint systems, where movement is permitted (see Section F.1, page 186) Performance Standards, **should be physically tested**.

Where containment systems are used without any tie-down, the load(s) should be placed on rollers or similar for testing, to negate the effect of friction under and between parts of the load. In a containment system where there is no tie-down, it must be assumed friction is zero as the load can leave the deck over bumps.





HVNL Loading Requirements

Warwick Norton





LOADING REQUIREMENTS

Heavy Vehicle (Mass, Dimension and Loading)

National Regulation

Schedule 7

- 1 Loading
 - (1) A load on a heavy vehicle must not be placed in a way that makes the vehicle unstable or unsafe.
 - (2) A load on a heavy vehicle must be secured so it is unlikely to fall or be dislodged from the vehicle.
 - (3) An appropriate method must be used to restrain the load on a heavy vehicle.
- Note—

See the Load Restraint Guide mentioned in section 115 of the Law and the evidentiary effect under the section of evidence that a load on a heavy vehicle was not restrained in a way that met a performance standard stated in the guide.



EVIDENTIARY PROVISION

Heavy Vehicle National Law

Section 115 Proof of contravention of loading requirement

- (1) In a proceeding for an offence against Division 1—
 - (a) evidence that a load on a heavy vehicle was not placed, secured or restrained in a way that met a performance standard stated in the Load Restraint Guide as in force at the time of the offence is evidence the load was not placed, secured or restrained in compliance with a loading requirement applying to the vehicle

LOAD RESTRAINT GUIDE



Performance Standards pg 186

Loads must be restrained to prevent unacceptable movement during all expected conditions of operation. The load restraint system must, therefore, satisfy the following requirements:

- i. The load should not become dislodged from the vehicle.
- ii. Any load movement should be limited, such that in all cases where movement occurs, the vehicle's stability and weight distribution cannot be adversely affected and the load cannot become dislodged from the vehicle.

Loads that are permitted to move relative to the vehicle include loads that are effectively contained within the sides or enclosure of the vehicle body such as:

- a) Loads which are restrained from moving horizontally (limited vertical movement is permissible);
- b) Very lightweight objects or loose bulk loads (limited horizontal and vertical movement is permissible);
- c) Bulk liquids (limited liquid movement is permissible).



To achieve this, the load restraint system must be capable of withstanding the forces that would result if the laden vehicle were subjected to each of the following separately:

0.8 'g' deceleration in a forward direction,

0.5 'g' deceleration in a rearward direction,

0.5 'g' acceleration in a lateral direction,

and to 0.2 'g' acceleration relative to the load in a vertical direction.



NTC LOAD RESTRAINT GUIDE REVIEW

NTC is currently reviewing the Load Restraint Guide.

Input sought from Industry Bodies and Load Restraint Specialists

RMIT report.

Draft Load Restraint Guide released June 2017

Public consultation conducted June – August 2017

Industry workshops conducted in capital cities June – July 2017

Revised Guide is to be published by NTC subsequent to approval

NHVR has been heavily involved in providing content analysis and feedback



AWARENESS CAMPAIGN

The NHVR regularly conducts communication campaigns to ensure industry awareness of new content and to support industry to transition during changes to existing laws or procedures. Recent campaigns include the release of:

- *National Heavy Vehicle Inspection Manual (NHVIM)*
- *Vehicle Standards Bulletin 6 (VSB6)*

The NHVR will undertake a communication campaign to support the release of the *NTC Load Restraint Guide*.

It is expected the campaign will:

- Commence mid-2018, subject to approval of the Guide
- Utilise existing NHVR channels including
 - ❖ NHVR website
 - ❖ Media and social media
 - ❖ Databases and newsletter
 - ❖ Collateral, fact sheets, charts, digital information

NHVR will not be providing training on how to design a load restraint system

CHAIN OF RESPONSIBILITY



Positive Duty

The basis for the new law is the establishment of a positive duty:

an obligation to eliminate and minimise public risks by doing everything reasonable to ensure transport related activities are safe.

Seek advice from a qualified person if you are unsure if you are meeting your HVNL loading requirements



Mike Robertson – ENGISTICS PTY LTD

Basics

- Explain Appendix F1 (and its successor with 3rd Edition changes), including 0.2g upwards misunderstandings
- Explain 4 methods of load restraint
- Common misunderstandings
 - Blocking and gaps with containment
 - Direct restraint must have a component in each direction



Load Restraint is a **SAFETY** Issue

(Not just a compliance problem)

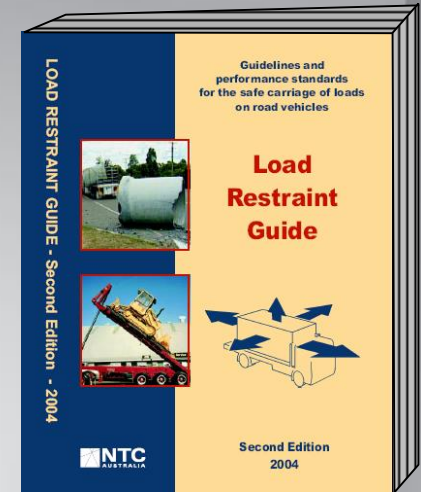
1 minute Video to go here

(but it is 28Mb, so too big to email)



Understanding the Existing LR Guide

- Good news
 - *Exactly* the same in All States
 - The law is sensible
 - Legal compliance generally means acceptable safety
- The NTC Guide is a relatively practical reference (*at least compared to O'seas*)
- The laws are performance based
 - Tell you the forces to restrain against
 - Not how to restrain
 - No methods are Mandatory, but.... Why not?
 - Allow for innovative restraint



Appendix F1 is the Law (Mandatory)



Appendix F1 is worded:

Loads must be restrained to prevent unacceptable movement during all expected conditions of operation. The load restraint system must, therefore, satisfy the following requirements:

- i. The load should not become dislodged from the vehicle.*
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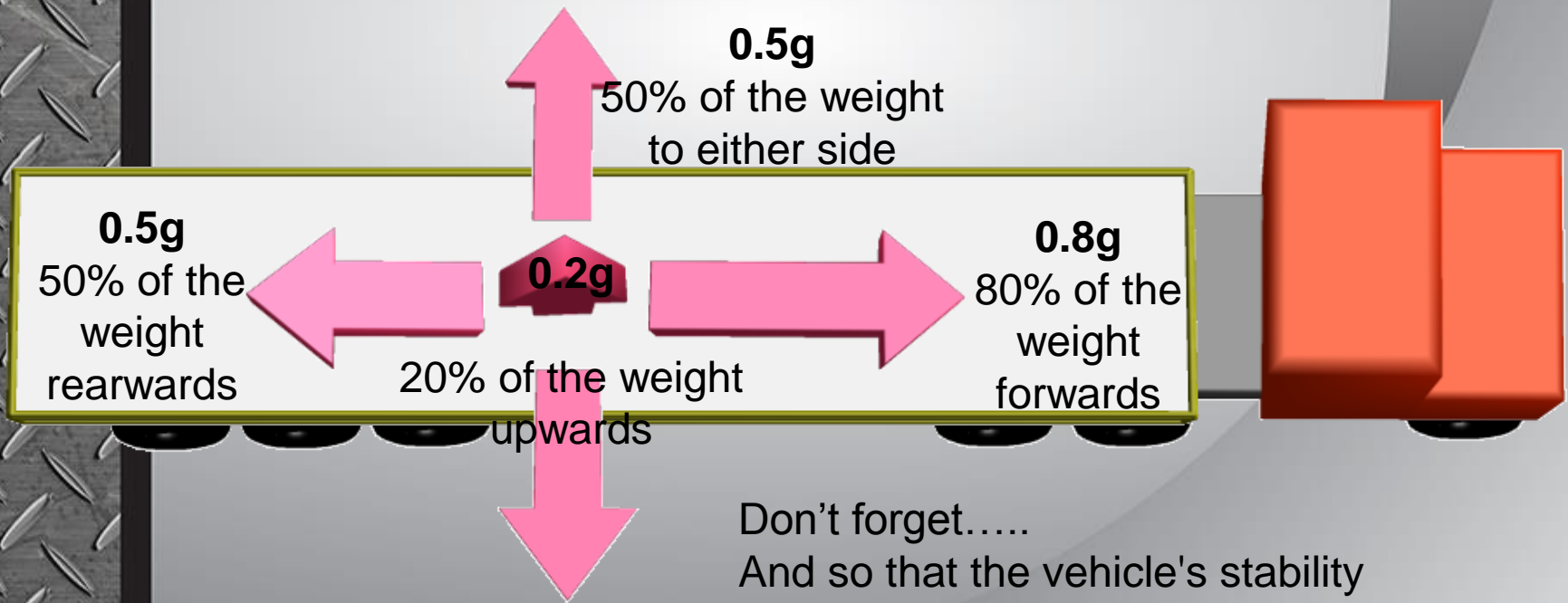
c) Bulk liquids (limited liquid movement is permissible);

Appendix F1 is the Law (Mandatory)



The “Expected Conditions” are defined as:

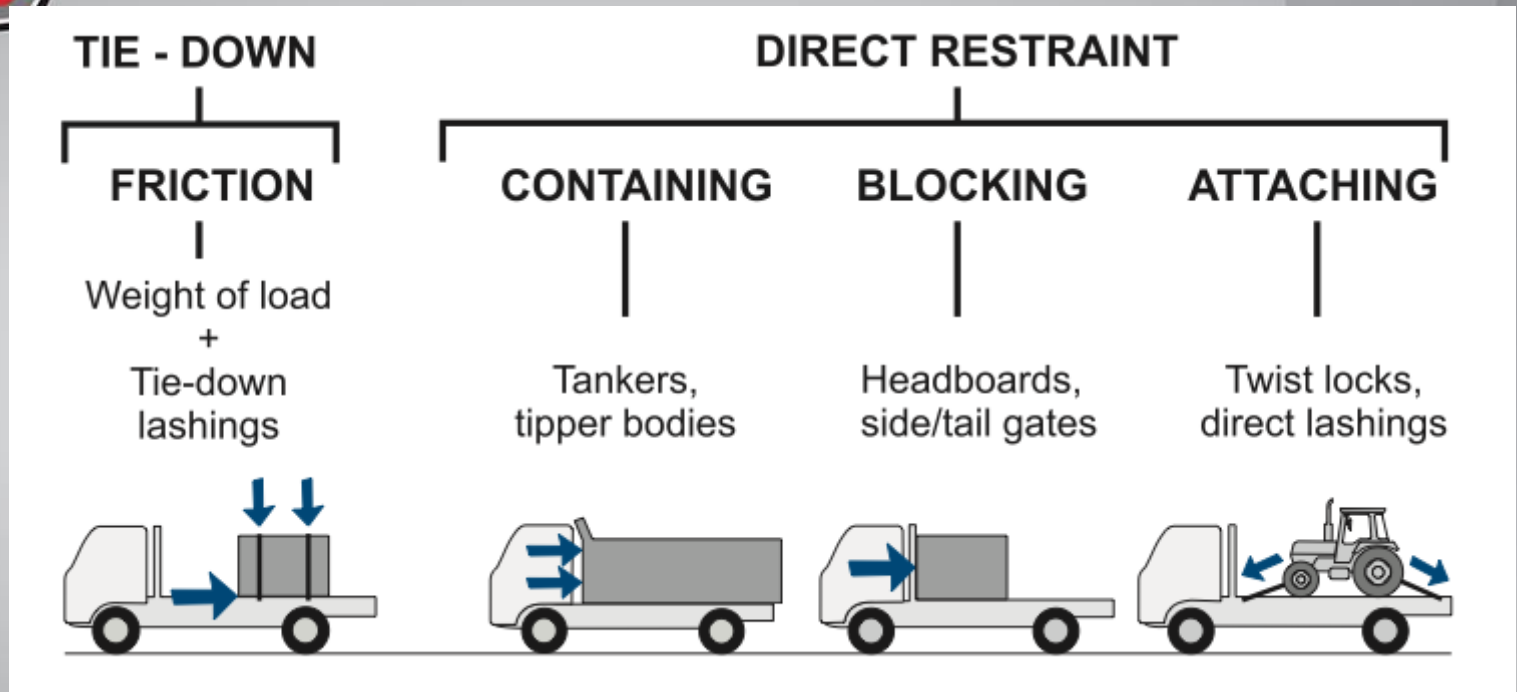
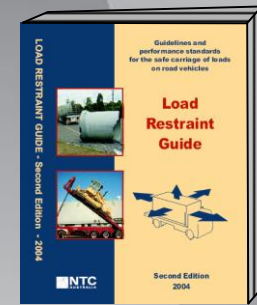
- G-Forces roughly = car/truck crash
- Each direction separately
- Upwards not required if contained



Don't forget.....
And so that the vehicle's stability
is not adversely affected



The 4 Methods of Load Restraint



Courtesy of *The Load Restraint Guide*, NTC

- Many loads in Australia use tie-down
- Friction is critical for the tie-down method
(*Greg Brown will explain*)





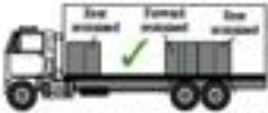




Common Faults

- Contained Loads (especially rated curtains) with part loads & gaps

Load Restraint Using Rated Curtains

Good Loads, Mistakes & Solutions

 Whole load in single stop	 Multi-stop, rear restrained for 0.5 g of load
 Gaps Curtains only restrain sideways. Rear and forward also need restraint	 Load blocked front and rear with pallets. Total gaps must be less than 200 mm forwards, 100 mm sideways
 Cross-linkage against forward & rearward forces	
 Upper pallet will require load restraint to stop forward and rearward movement	

ALU-100-11000 Rev. 1 - 06/08/11 Copyright © A.U. and Ugnias, Pty Ltd Page 3 of 4



*Don't cry over 20 tonnes of spilt milk?
Pogo sticks are very weak!*

Common Faults



- Direct restraint which ignores one direction

Enough lashings must be applied at angles to suit ALL directions!



Angled forwards and backwards but NIL sideways?



Guess who got it wrong!



Greg Brown

MaxiTRANS

Details

- Tie down explained
 - Low friction
 - Low angles
 - Pre-tension only for most situations
- Rated curtains
- Tie down tables in the 2nd edition
- Gaps in load and Ratings explained

LEGAL OBLIGATIONS



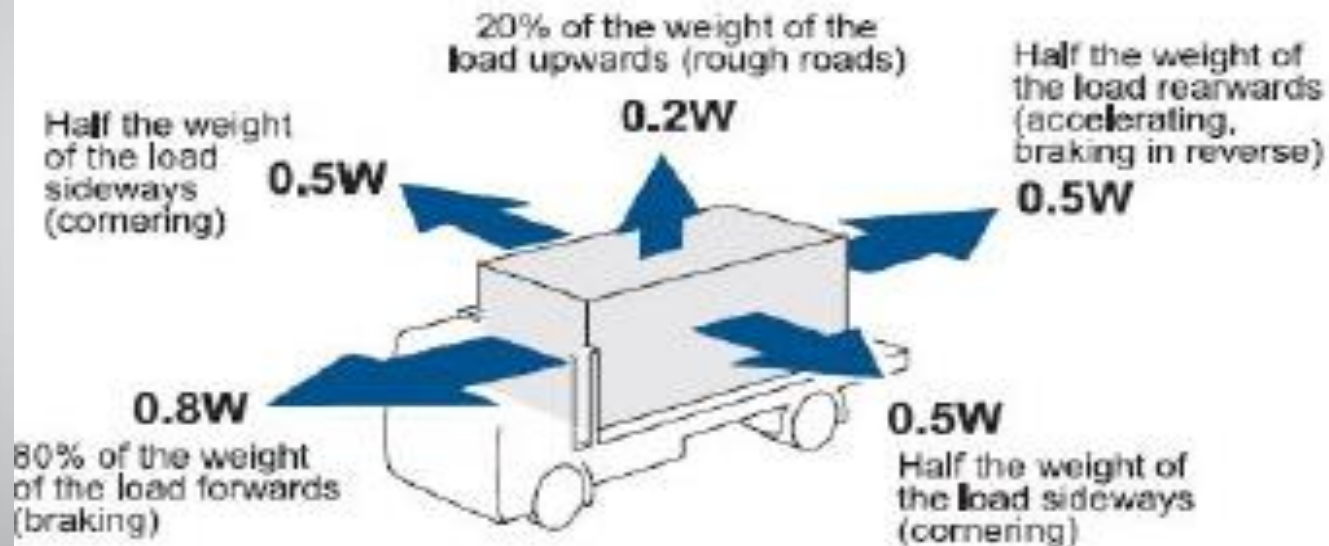
Rules on load restraint

- You are legally responsible for restraining your load so that:
 - **It does not come off your vehicle** under normal driving conditions, including heavy braking and minor collisions. If it comes off, this is evidence you have breached the law.
 - **It does not negatively impact the stability of the vehicle**, which can cause the vehicle to roll over or swerve uncontrollably, and cause an accident.
 - **It does not stick out of the vehicle** in a way that could injure people, damage property or obstruct others' path.
- **You must pick up any fallen load** if it is safe to do so, or arrange for someone to retrieve it.



PERFORMANCE STANDARD

The Performance Standards set out the minimum amount of force a restraint system must be able to withstand in each direction. For heavy vehicles, these are:



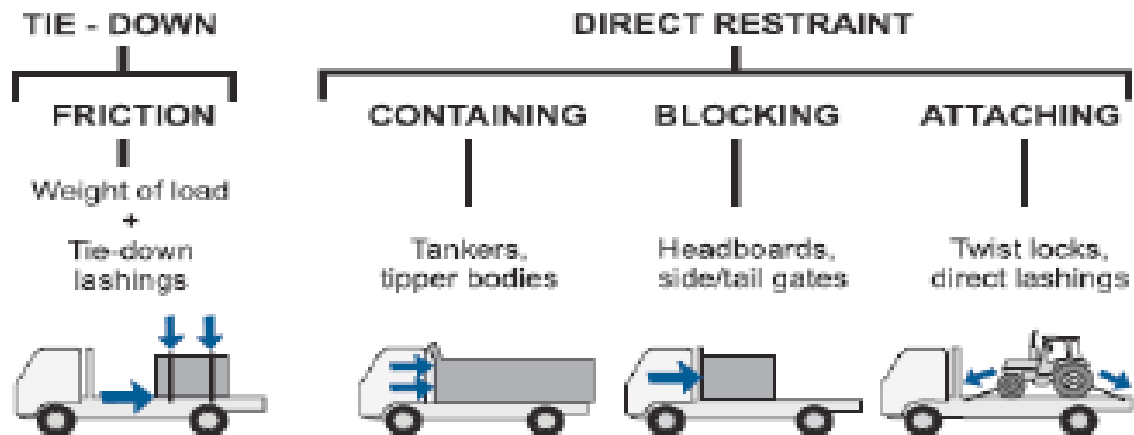
(W = Weight of the load)



TYPES OF RESTRAINT

Loads can be restrained by two basic methods: **tie-down** and **direct restraint** (i.e. **containing, blocking and attaching**).

The following diagram shows the different restraint methods for controlling load movement in the forward direction. The same principles apply to backward and sideways movement.

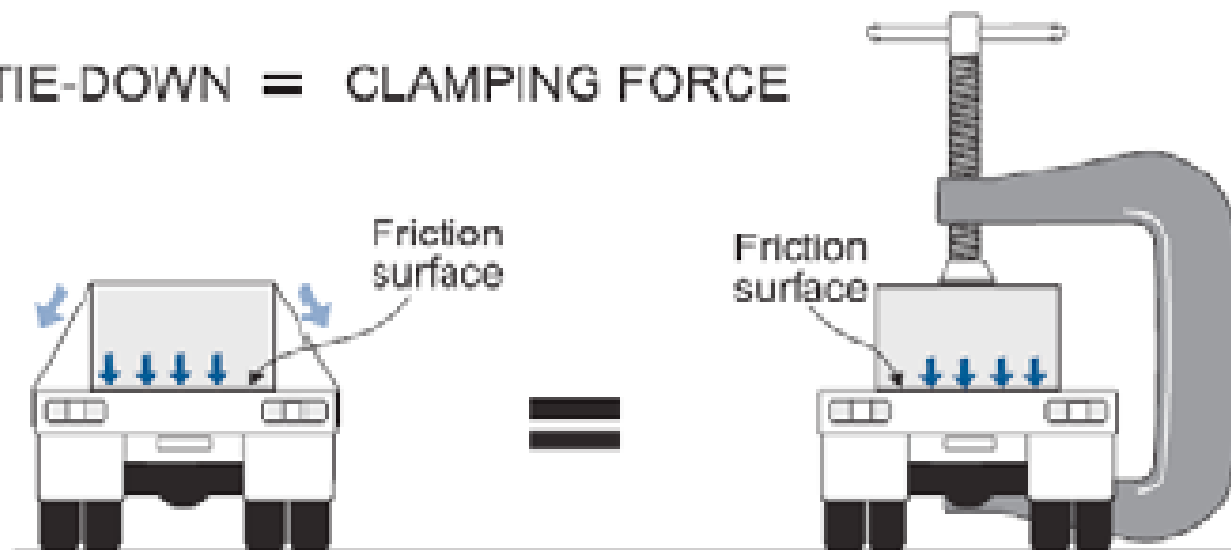




TIE DOWN

- Under this method, friction stops the load from moving forwards, sideways and backwards. **Friction force comes from both the weight of the load and the clamping force of tie down lashings.**
- For tie-down to be effective, the load must be in contact with the vehicle throughout its journey. Tie-down lashings clamp the load to the vehicle to maintain friction.

TIE-DOWN = CLAMPING FORCE



FRICTION



TYPICAL FRICTION LEVELS

Load	Friction
Wet or greasy steel on steel	VERY LOW
Smooth steel on smooth steel	LOW
Smooth steel on rusty steel	LOW TO MEDIUM
Smooth steel on timber	MEDIUM
Smooth steel on conveyor belt	MEDIUM
Rusty steel on rusty steel	MEDIUM TO HIGH
Rusty steel on timber	HIGH
Smooth steel on rubber load mat	HIGH



TYPICAL FRICTIONS

TYPICAL STATIC FRICTION COEFFICIENT LEVELS

Load	Static Friction coefficient
Wet or greasy steel on steel	0.01 – 0.1
Smooth steel on smooth steel	0.1 – 0.2
Smooth steel on rusty steel	0.2 – 0.4
Smooth steel on timber	0.3 – 0.4
Smooth steel on conveyor belt	0.3 – 0.4
Rusty steel on rusty steel	0.4 – 0.7
Rusty steel on timber	0.6 – 0.7
Smooth steel on rubber load mat	0.6 – 0.7

PRETENSION



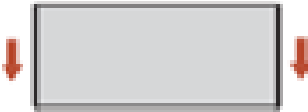

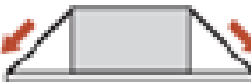


AVERAGE PRE-TENSION

Lashing	Size	Tensioner	Pre-tension
Rope	10mm & 12mm	Single hitch	50kg
		Double hitch	100kg
Webbing	25mm	Hand ratchet	100kg
	35mm	Hand ratchet	250kg
	50mm	Truck winch	300kg
	50mm	Hand ratchet (push up)	300kg
	50mm	Hand ratchet (pull down)	600kg
Chain	7mm & above	Turnbuckle	1000kg



THE ANGLE EFFECT

- Tie down lashings are most effective if they are vertical and tight. The more a lashing is angled away from the load, the less the clamping force. This is called the angle effect:

	APPROX. ANGLE	TIE-DOWN ANGLE EFFECT	TIE-DOWN EFFECTIVENESS
	90°	1.00	100%
	60°	0.85	85%
	45°	0.70	70%
	30°	0.50	50%
	15°	0.25	25%



Tie-Down – Number of Lashings

A 2,500kgf strap does not hold 2,500kg of freight...

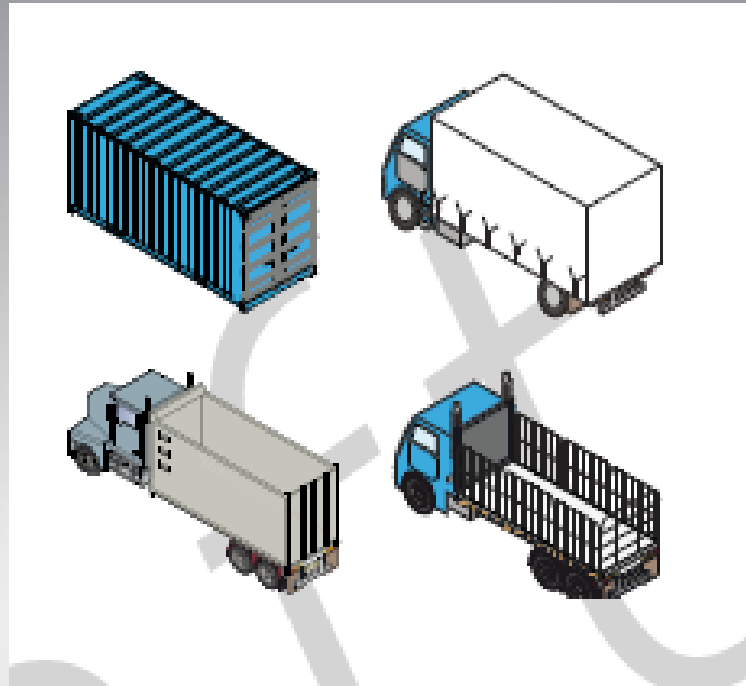
Notes:

1. **Unblocked** loads need a lot of lashings. Even with reasonable friction, *because Table is based on STATIC friction & only pre-tension in straps.*
2. **Improved friction** helps a lot.
3. **Blocking forward** is great if you can do it.
4. Caution if **lashing angles** are **low**.

Table is from 2nd edition

MAXIMUM WEIGHT EACH 50 mm WEBBING STRAP CAN RESTRAIN					
FRONT OF LOAD BLOCKED?		NO		YES	
HOW MUCH FRICTION?		MEDIUM $\mu = 0.4$ (Smooth Steel on Timber)	HIGH $\mu = 0.6$ (Rubber Load Mat)	MEDIUM $\mu = 0.4$ (Smooth Steel on Timber)	HIGH $\mu = 0.6$ (Rubber Load Mat)
Minimum average strap tension 300 kg.					
STRAP ANGLE	ANGLE EFFECT (E)				
90°	1.0	600 kg	1800 kg	2400 kg	3000 kg
approx. 60° to 90°	0.85 to 1.0	1 510 kg	2 1530 kg	3 2040 kg	2550 kg
approx. 45° to 60°	0.70 to 0.84	420 kg	1260 kg	1680 kg	2100 kg
approx. 30° to 45°	0.50 to 0.69	300 kg	900 kg	1200 kg	1500 kg
approx. 15° to 30°	0.25 to 0.49	4 150 kg	450 kg	600 kg	750 kg

Table F5, from the 2nd Ed NTC Load Restraint Guide



Contained loads include loads transported in containers, tippers, pantech and T/liner vehicles, flat top vehicles with gates, and tankers



CURTAIN CONTAINMENT

0.2 G UPWARDS NOT REQUIRED





TYPICAL RATING CERTIFICATE



5/11/14

This is to certify that the loading system on this Freighter T/liner Load Hold has been examined and tested and complies with the "Load Restraint Guide 2ed. 2004". Ref test report LR001.

Maximum weight per pallet or 1200mm X 1200mm pallet space is 1850 kg with post centers up to 2800 mm centers. The load can be a "stable single load" or "stacked load" eg. cartons on pallets. The load height of adjacent pallets must be of similar height. The load per pallet space includes double stacked or second deck pallets.

The curtains are designed as containment/blocking configuration up to 0.5g in the sideways direction, which negates the need for any further restraint requirements, including 0.2 g vertical restraint, providing the load space length is full. If the load space is not full from front to rear other means of load restraint is required.

The front wall is designed to restrain the load in the forward direction up to 0.8g.

The rear doors/ wall are designed to restrain the load in the rear direction up to 0.5g.

The curtains are a containment /blocking device so does not require any vertical restraint.

The side curtains are restrained by the structural vertical straps and the curtain tension front to rear.

The structural vertical straps and buckle systems must be maintained with no visible sign of damage. The curtain material must not have damage or a rip more than 100 mm in length.

All calculations and a typical vehicle have been checked by Greg Brown Technical Manager at MaxiTRANS, a qualified Mechanical Engineer with in excess of 10 years experience in the design and manufacture of road transport equipment and with full membership of the Institute of Engineers, No. 275995.

Greg Brown
Technical Manager

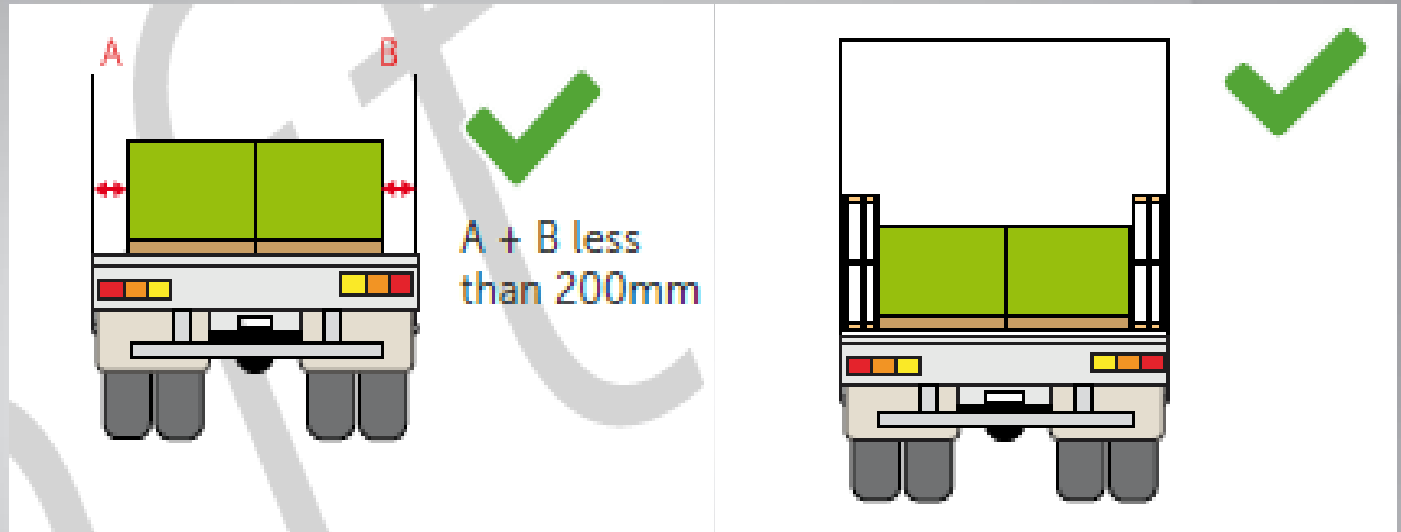


LOAD RATINGS AND HOW TO INTERPRET

- Maximum weight per pallet or 1200mm X 1200mm pallet space is 1850 kg with post centers up to 2800 mm centers.
- The load can be a “stable single load” or “stacked load” eg. cartons on pallets.
- The load height of adjacent pallets must be of similar height. The load per pallet space includes double stacked or second deck pallets.



GAPS IN THE LOAD



A maximum gap of 200 mm total A + B is allowed



Chris Loose and Mike Robertson

What and when the Law changes.

- 2nd Edition LRG - HVNL, NT and WA
- 3rd Edition LRG - HVNL, NT and WA
- OSOM and load restraint



THE LAW CHANGES, TO THE BEST OF OUR KNOWLEDGE

- 2nd Edition LRG, Performance Standard – page 186 is the only part in the LAW - HVNL WA reference the guide/NT in the road rules.
- 3rd Edition LRG is based on the exactly the same performance standard as the 2nd edition.
- 3rd Edition LRG is currently being review and should be published late 2017.
- Ministerial review November 2017, impacted by the Queensland election, and now expected it to be effective from mid to late 2018.
- WA will continue as is!

OSOM AND LOAD RESTRAINT



OSOM – Over Size Over Mass

- There are concerns some OSOM load don't comply to the performance standard today
- All loads must comply with the performance standard today
- In the future OSOM loads under permit/notice may be able to be managed by a risk management approach and be exempt from the performance standard



RESTRAINING THE LOAD

Q & A

Chair

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