

**NATIONAL TRANSPORT COMMISSION
&
ROADS & TRAFFIC AUTHORITY NSW**

LOAD RESTRAINT GUIDE

**Guidelines and Performance Standards
for the Safe Carriage of Loads on
Road Vehicles**

**SECOND EDITION
2004**

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“Imagine being in my driver’s seat”

That’s me in the driver’s seat. My mother and father were in the back seats. The steel beam slid off the truck and went through the rear window and windscreen of my car.

I didn’t leave home expecting to have an accident. I doubt that the driver of the truck had planned to have an accident that day.

My experience shows that without warning, an accident can happen at a time when you least expect it. My parents and I are lucky to be alive.

I commend this guide to everyone as it explains why loads move and gives advice on how to restrain loads properly. It provides some technical information and explains items that make good sense. It’s not smart to drive with an unsecured load.

The security of your load, your life and the life of others relies on proper load restraint practices.

If you have any doubts about spending the time to read this guide and to restrain loads properly, imagine being in my driver’s seat.

A handwritten signature in black ink that reads "Brad Shields".

Brad Shields

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Acknowledgment is also made of:

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- the contributions of the many organisations and individuals who attended the load restraint meetings in Sydney, Melbourne, Adelaide and Perth and those who provided written information during the public comment period;
- the permission given by the Association of German Engineers for use of material contained in Directives VDI 2700, VDI 2701 and VDI 2702;
- the permission given by the Ministry of Transport, New Zealand, for use of material contained in the 'Truck Loading Code - Code of Practice for the safety of loads on heavy vehicles'.
- the document is based on the Load Restraint Guide 1994 and was developed by: Peter Goudie of the Roads & Traffic Authority and Richard Larsen of Loadsafes Australia Pty Ltd as a consultant for the project.



INTRODUCTION

The safe loading of vehicles is vitally important in preventing injury to people and damage to property. There are economic benefits to all if the load arrives at its destination intact and without damage.

This guide provides drivers, owners, operators, freight consignors, vehicle manufacturers, equipment manufacturers and suppliers with the basic safety principles that should be followed to ensure the safe carriage of loads.

The information is based on proven principles and the ability of load restraint equipment to apply the necessary restraint forces. It takes into account the performance of vehicles and towed trailers.

The guide is in two parts. Part 1 is for Drivers and Operators and Part 2 is intended for Engineers and Designers although it may be of interest to other readers. It contains greater technical detail and information on how to test and certify a load restraint system. The pages of Part 1 have a blue border and Part 2 a red border. An Appendix and a Glossary of Terms and other information is at the back. The borders on these pages are coloured yellow.

This guide and other information can be found on the Internet Web Site of the National Transport Commission, www.ntc.gov.au

Suggested improvements or additions are welcomed and should be sent to:

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The Performance Standards in Section F1 are referred to in the national Road Transport Reform (Mass and Loading) Regulations 1995. These regulations have been approved by the Australian Transport Council for adoption by the States and Territories since 1995. Comparable requirements apply in all States and Territories and readers are advised to check the relevant legislation.

In addition, it must be remembered that the common law imposes liability for negligent acts that cause injury or damage to others and there are other legal requirements that impose a duty of care in the workplace.

SCOPE

- 1** Loads must be restrained to meet the Performance Standards of Section F1. The remaining contents of this guide are intended to be treated as recommended practice only, except where 'must' is used indicating that the design meets an Australian Standard or similar recognised standard, a manufacturer's standard or the load restraint system described meets the Performance Standards.
- 2** The principles described in this guide apply to loads of all sizes and types.
- 3** Performance Standards apply to all vehicles. However in situations where extremely large loads have been permitted to move only when the road is closed to other road users, relaxation of one or more of the Performance Standards may be accepted provided the operators of the vehicles moving the load and the escorting personnel are not put at risk.
- 4** Alternative load restraint methods to those referred to in this guide may be used provided they have been shown to meet the Performance Standards outlined in Section F1.
- 5** Requirements for the safe transport of dangerous goods as packages, unit loads or bulk loads are covered by this guide, but without reference to their 'dangerous goods' characteristics. References to the specialised requirements of the 'Australian Code for the Transport of Dangerous Goods by Road and Rail' (see Section J.3) are included where applicable.

**The security of your load,
your life and the life of others
relies on proper
load restraint**

EXPLANATION OF TERMS

This guide contains some technical terms and details. A Glossary is contained in Section J and the following is a brief explanation of a few of the major terms:

Mass: Mass is a measure of the amount of matter in an object.
(In this guide, mass is referred to in kilograms (kg) or tonnes (t).)

Force: Force is applied to a mass to move it.
(Force is normally measured in Newtons (N) or kilo Newtons (kN). However, in this guide, force is referred to in kilograms force (kgf) or tonnes force.)

Weight: Weight is the force exerted by gravity on a mass.
(1 kilogram force is the weight of a mass of 1 kilogram.)

'g': The acceleration due to gravity is called 'g'. It is equal to 9.81 metres/sec/sec.

Performance Standards: A way of specifying the minimum amount of load restraint required, measured in terms of 'g' or the weight of the load.

Tie-down: Tie-down is a form of load restraint where the load is restrained by friction. It is sometimes called indirect restraint.

Direct Restraint: Direct restraint is a form of load restraint where the load is restrained by containing, blocking or attaching.

Friction: Friction is the resistance of one surface sliding across another.

Coefficient of friction (μ): The coefficient of friction is a measure of the friction between two surfaces in contact. It is equal to the amount of force required to make one surface slide relative to the other, divided by the force that presses them together.

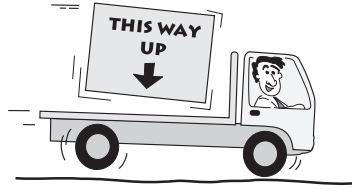
Lashing: A lashing is a restraint device such as a rope, chain or strap and can include other components such as tensioners, hooks, etc.

Pre-tension: Pre-tension is the force in a lashing resulting from initial tightening by the operator.

Dunnage: Dunnage is packing used to separate loads (typically, a length of timber).

Unitised load: A unitised load is a number of separate items bound together to form a single item of load.

DID YOU KNOW ?



- A load that is restrained so it doesn't shift is required to withstand forces of at least:
 - 80% of its weight in the forward direction;
 - 50% of its weight sideways and rearwards, and
 - an additional 20% of its weight vertically.
- Some industry practices have been tested and the forward restraint found to be only half that required.
- There is often a greater chance of losing a load when braking at low speed than at high speed as it is easier for the brakes to grab at low speed.
- Ropes are extremely ineffective for restraining loads.
- Even though a rope might feel tight, the amount of tension in it is very low.
- The tension in a webbing strap is generally about 5 to 10 times more than a rope.
- Short chains are difficult to tighten properly with a 'dog', because they won't stretch as much as a long chain, to allow the handle to be pulled down. Turnbuckles are better.
- If a load is properly restrained, on a stationary tipping truck or trailer, it will not dislodge, even when the deck is fully tilted.
- Just because a load has been carried in a particular way for many years does not mean it is properly restrained.
- A 'curtain-side' cannot restrain a load properly unless it is part of a certified load restraint system.
- The weight of the load alone cannot provide enough friction to restrain it during normal driving. Additional restraint must be used.
- A heavy load is just as likely to fall off as a light load. The same 'g' forces are acting on both.
- If a load falls off a vehicle travelling at 100 km/h and is hit by a vehicle travelling in the opposite direction at 100 km/h, it has the same impact as the load travelling at 200 km/h and hitting the vehicle when it is stationary.
- Most headboards and loading racks are not strong enough to fully restrain heavy loads.

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- Any load that is properly restrained will not come off a vehicle in normal driving including the most severe braking, swerving and cornering.
 - Most load restraint accidents occur at low speed in city areas and often only after a short distance. The same amount of restraint must be used for every journey.
 - When the load settles, the lashings loosen and cause a huge reduction in tension. The tension in the lashings should be checked soon after moving off and then regularly during the journey.
 - Checkerplate steel decks are just as slippery as smooth flat steel decks.
 - Loading directly onto slippery steel decks, roof racks or A-frames should be avoided. Use wood or rubber to improve the grip.
 - The most cost-effective method to tie down many loads is to put a tough rubber load mat underneath the load. Rubber load mat can more than halve the number of lashings needed.
 - Conveyor belting may have only half the grip of rubber load mat. Its surface is designed to resist wear and is therefore more slippery especially when wet. Rubber load mat or timber dunnage is better.
 - Low friction is 'high risk'.
 - In some cases, if the load and deck are both slippery, it could be necessary to use four 50 mm webbing straps (each 2 tonne lashing capacity) to tie down a half tonne load.
 - If you have enough tie down lashings and the load does not shift when cornering or braking, the tension in the lashings always stays the same. It does not increase even under heavy braking because the load has not moved.
 - The driver could lose control if a trailer or caravan begins to sway sideways because it is poorly loaded. Make sure the drawbar always pushes down on the towbar.
 - The headlights on some vehicles should be adjusted when they are loaded.

LOAD SAFETY IS ROAD SAFETY

If you want to find out more about how to restrain loads safely, read on ...



These photos show three important points :

- 1 No load is too small to be restrained;
- 2 The toy truck is raised off its wheels on timber to provide friction;
- 3 The angle of the webbing strap is so low that the 50 mm heavy duty ratchet can just apply enough downward force to prevent movement of the toy truck.

LOAD RESTRAINT GUIDE

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