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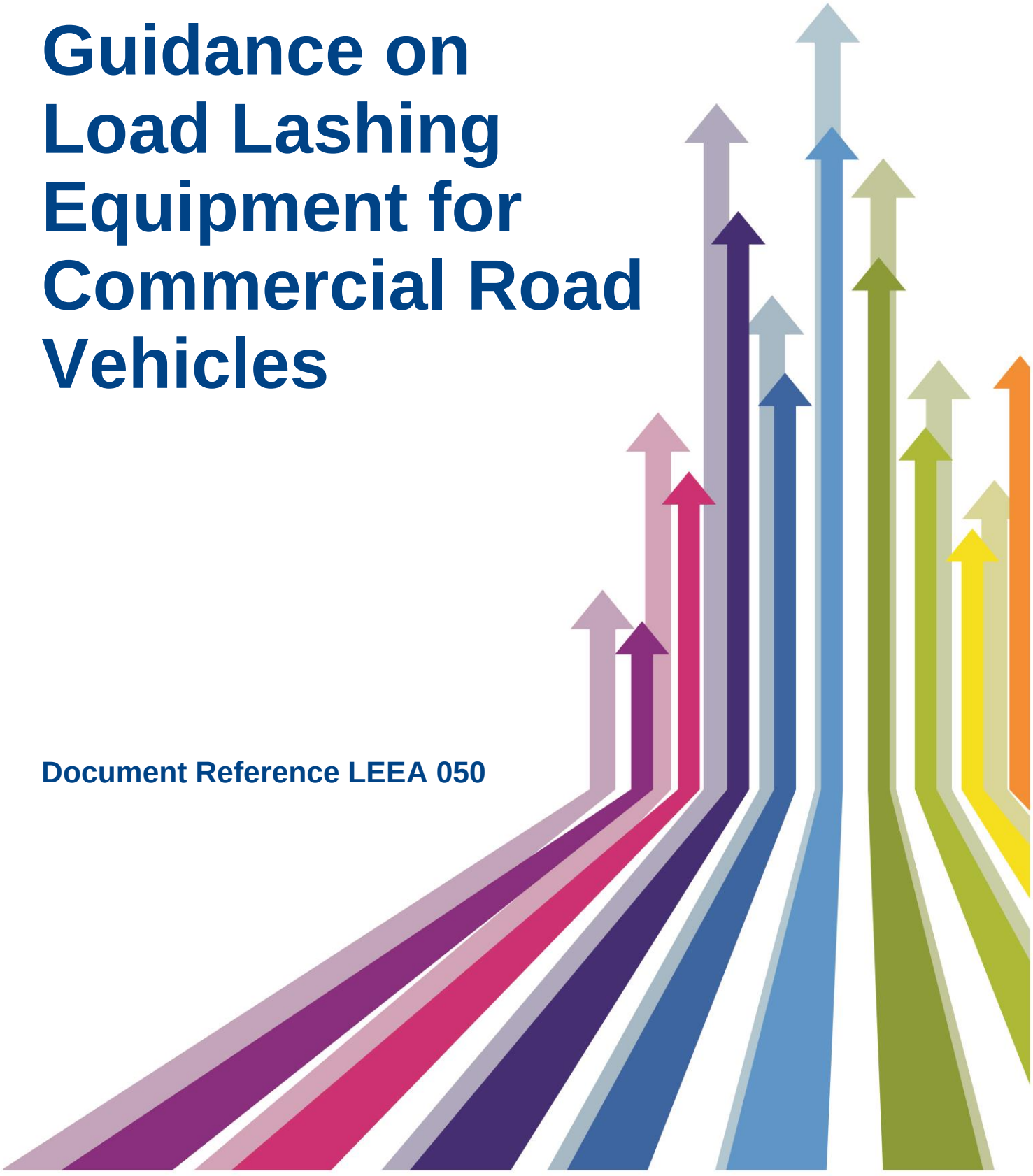
LEEA

Guidance on Load Lashing Equipment for Commercial Road Vehicles



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LIFTING EQUIPMENT ENGINEERS ASSOCIATION
3 Osprey Court, Kingfisher Way
Hinchingbrooke Business Park
Huntingdon PE29 6FN
United Kingdom
Tel: + 44 (0) 1480 432801 Fax: + 44 (0) 1480 436314
E-mail: mail@leea.co.uk Website: www.leeaint.com

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1.0 Introduction

Thousands of loads are moved on our roads every day. Without adequate restraint these loads can be a lethal hazard. Inadequate restraint can damage the load or the vehicle and subject other road users to unacceptable risks. Knowledge the forces involved, the various methods of load restraint and the correct application of the lashing equipment is an essential part of training the user to provide adequate load restraint.

Over recent years VOSA and HSE have conducted a number of campaigns where vehicles have undergone roadside checks and it was reported that over 80% of loads were found to be inadequately secured. Training in the load security is typically not included in any HGV courses.

There are numerous standards, codes of practice and other documents on this subject published by various authoritative sources. These are listed below.

This guidance is aimed at those LEEA members who manufacture, supply or inspect load lashing equipment and also those persons who have some responsibility for specifying, purchasing or using load restraint on road transport. It is intended as a starting point, to explain the problems and identify the information available. It does not deal in any detail with other load restraint equipment such as that used for blocking or locking.

Separate from this guidance are three safety information sheets, each dealing with a particular type of lashing equipment. They provide LEEA members with an information sheet which they can include with each supply of lashing equipment to guide the user. See SI No. 22.0 (Chain) SI No. 23.0 (Webbing) SI No. 24.0 (Wire rope).

2.0 The problems

Loads on road vehicles are subjected to the forces generated due to the vehicle accelerating, braking and cornering. The magnitude of these forces will vary according to the type of vehicle, the road surface and the quality of driving as well as the nature, weight and shape of the load. The effect of the forces on an unrestrained load will be for the load to slide or topple. Therefore all loads need to be adequately secured in transit, and the underlying principles are the same for them all.

Vehicles with a gross weight of 3,500kg or less generally can accelerate, brake and corner more sharply than those classed as an HGV. Trailers may have different characteristics to those of the towing vehicle. Curtain sided vehicles should be treated as flat bed vehicles and the load restrained accordingly. Hills and adverse cambers tilt the vehicle or trailer and load. Uneven surfaces rock and vibrate the load and reduce the friction between the load and the vehicle allowing an unrestrained load to slide. Harsh braking and swerving increase the forces. Load types include pallets, steel girders, concrete pipes and wheeled equipment some of which can easily move if not restrained. Tall loads or those with a high or offset centre of gravity are more likely to topple. The load may comprise several items which need to be secured collectively or secured individually.

The nature of the journey also needs to be considered. If the vehicle or trailer is to be transported by rail or sea at any stage, the forces arising from those methods are generally higher, so need to be addressed. If the journey involves delivering or collecting part loads, the load restraint system should take account of the changing load.

The quality of some of the lashing equipment currently on the market is poor. Unfortunately it is a market where price often comes before quality. Also some drivers and vehicle operators are reluctant to provide a sufficient quantity of lashings to adequately cover their normal requirements.

3.0 The sources of information

The EN 12195 series of standards are an important source. These are published in the UK by BSI as BS EN standards as follows:

- BS EN 12195-1: 2010 Load restraining on road vehicles – Safety - Part 1: Calculation of securing forces
- BS EN 12195-2: 2001 Load restraining on road vehicles – Safety - Part 2: Web lashing made from man-made fibres
- BS EN 12195-3: 2001 Load restraining on road vehicles – Safety - Part 3: Lashing chains
- BS EN 12195-4: 2003 Load restraining on road vehicles – Safety - Part 4: Lashing steel wire ropes

There are two documents published by the European Commission, Directorate-General for Energy and Transport and are free to download from the following link:

http://ec.europa.eu/transport/road_safety/vehicles/guidelines_cargo_securing_en.htm

They are:

- European Best Practice Guidelines on Cargo Securing for Road Transport
- European Best Practice Guidelines for Abnormal Road Transports

These documents refer to the EN 12195 series of standards.

The UK Department for Transport publishes a code of practice – Safety of Loads on Vehicles. (ISBN 0-11-552547-5) This is available from the Stationary Office Bookshops by e-mail from the following address:

book.orders@tso.co.uk

Information sheets on vehicle safety can be downloaded free of charge from the following link:

http://www.dft.gov.uk/publications/vehicle-safety-standards/

The Department for Transport publications refer to the European Best Practice Guidelines. It can therefore be seen that the standards are the foundation on which the guidelines, codes and information sheets are based.

4.0 The responsibilities

In the UK, under the provisions of the Road Traffic Act 1991, a person is guilty of the offence of dangerous driving if the vehicle is in a dangerous state and dangerous state includes the manner in which any load is attached or carried.

Employers have a general duty under sections 2 and 3 of the Health and Safety Work Act 1974 for the safety of their employees and other persons. This therefore covers loading and unloading operations as well as loads in transit. Legislation to a similar effect applies in most countries.

Employers also have a duty under Regulation 4 of the Provision and Use of Work Equipment Regulations to ensure that work equipment is suitable. Lashing equipment is work equipment.

Manufacturers, importers and suppliers of lashing equipment have a general duty under section 6 of the Health and Safety at Work etc Act 1974 to ensure that the product is safe to use. To that end they must carry out or arrange to have carried out such tests and examinations as are necessary and provide adequate information about the use of the item.

5.0 Methods of load lashing

As stated above, the forces acting on an unrestrained load will cause it to slide or topple. There are methods such as blocking and locking which can prevent a load sliding or toppling. These are addressed in the documents listed above but are outside the scope of this guidance which focuses on load lashing. In general there are two main methods of load lashing:

- Friction lashings also known as top-over lashing. See figure 1.
- Direct lashing where the load is directly connected to the bed of the vehicle or trailer. See figure 2.

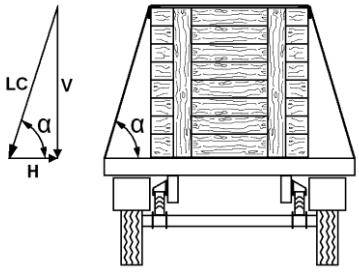

Figure 1
Example of friction lashing

Figure 1 illustrates a wooden crate secured by a friction lashing. This forces the crate onto the bed of the vehicle thereby increasing the friction between the crate and the bed so as to prevent the load from sliding in any direction. This counters to some extent the effects of vibration and shocks which tend to reduce the friction arising solely from the weight of the load. The maximum permitted tension in the lashing is the lashing capacity (LC). It is the vertical component (V) of the tension in the lashing which forces the crate onto the bed of the vehicle. The greater the value of V, the greater the friction. Therefore the maximum friction is obtained when V = LC which is when α = 90º. When α reduces, V reduces. (For example, when α is 30º, V is reduced to 0.5 LC.) The amount of friction generated will also depend upon the friction factors of the materials the load and the bed are made from. It can be enhanced by using a friction mat between the load and the bed. (See Annex B of BS EN 12195-1 for a table of friction factors.)

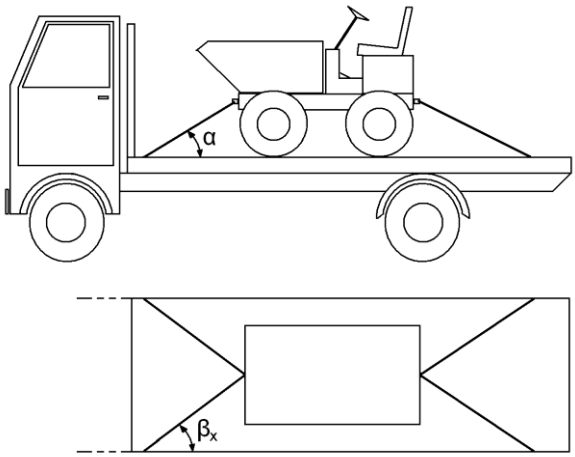

Figure 2
Example of direct lashing

Figure 2 illustrates a dumper truck secured by direct lashing. With direct lashing it is the horizontal component of the tension in the lashing which provides the majority of the longitudinal and transverse restraint. Whilst the vertical component does increase the friction, the contribution of the friction to the overall restraint is relatively small. In plan view, the longitudinal lashing angle β_x controls the balance between the longitudinal and transverse restraint. For a given lashing capacity and vertical lashing angle α, as β_x increases, the longitudinal restraint decreases and the transverse restraint increases.

Direct lashing can only be used when both the load and the bed are equipped with lashing points compatible with the required strength of the lashing.

Other methods of lashing are loop lashing, spring lashing and round turn lashing. These are often used in conjunction with blocking. The European Best Practice Guidelines illustrated all these methods and explains them in more detail.

6.0 The advantages of working to EN 12195
Complying with the EN 12195 series is not a legal requirement. However it does carry a great deal of authority. Therefore calculating the securing forces, specifying lashing equipment according to that standard and applying it in accordance with the European best practice guidelines should not only ensure that the legal obligations are met but also that an effective and economically efficient load restraint system is used.

Lashing equipment has a factor of safety of only half that used for lifting. Consequently it is important that the quality and quantity of lashings used is adequate.

EN 12195-1 specifies how the lashing forces should be calculated based on the possible acceleration of the load. The acceleration is expressed as a coefficient which, in effect, is the proportion of the weight of the load which the lashing must restrain in a particular direction. Figure 3 illustrates the forces which can arise from the acceleration, braking and cornering of an HGV under normal driving conditions. For example, under braking the load can push forward with a force equivalent to 0.8 of the weight of the load.

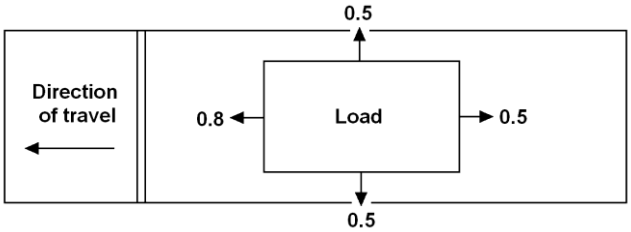

Figure 3
Forces acting on the load

These are the forces which try to make the load slide. Additional restraint may be required to prevent the load from toppling. Higher forces may act on the load if the gross vehicle weight is less than 3,500kg or if the vehicle is transported by rail or sea.

This part of the standard includes a useful informative Annex C which is a load securing protocol without copyright. It can therefore be freely reproduced and used or adapted. It provides the person responsible for determining the load security with a checklist and means of specifying the load restraint equipment and method.

The equipment must be of acceptable quality. Parts 2-4 inclusive specify the lashing equipment using materials which are similar or identical to those used for lifting. They include requirements such as safety latches for hooks to prevent accidental displacement and a specification for the instructions for use and maintenance. Specifying the appropriate part will ensure acceptable quality.

The specifications include the marking requirements which provide a summary of the information required for safe use and identify the manufacturer together with traceability to his production records.

Lashings are marked with their lashing capacity (LC). This is expressed in daN (da = deca meaning a factor of 10) although some are marked in kN (k = kilo meaning a factor of 1,000). The Newton (N) is a unit of force and equals a mass of 1 kg accelerated at 1 m/s^2. The acceleration due to gravity is 9.81 m/s^2 so a mass of 1 kilogram exerts a force of 9.81N under gravity. Therefore rounding this up makes 1 daN a force equivalent to a load of 1 kg and 1 kN a force equivalent to a load of 100 kg.

The marking should include a warning that the lashing is not to be used for lifting the load.

7.0 Inspection of lashing equipment

As for lifting equipment, lashing equipment can only be relied upon if it is in serviceable condition. The nature of the application, particularly the possibility of the load moving in transit, means that lashing equipment can be accidentally damaged each time it is used. It should therefore be inspected before each use. This need not be a formal inspection and no record is required but trained users should be able to 'cast their eye' over it and check for any obvious damage.

The LEEA also recommend that lashing equipment should periodically be formally inspected by a competent person and a record made of the result. Some categories of goods vehicles undergo safety checks at intervals of 3 months and the LEEA recommends that the load restraint equipment should be included in those checks. In cases where that does not apply, it should be inspected at intervals not exceeding 6 months. The record should, as a minimum, include:

- ID of the lashing equipment
- Brief description
- Date of inspection
- Result of inspection clearly stating whether the equipment is safe to use
- Name of person making the inspection
- Signature of person making the inspection

8.0 Other considerations

The standards and the guidance assume that the bed of the vehicle or trailer is equipped with suitable lashing points. Unfortunately this is not always the case. Users must therefore be aware of any limitations in the capacity, number or position of lashing points. In some cases the capacity of each lashing point will be the limiting factor. In those cases it may be possible to achieve adequate load restraint by using a greater number of lashings thus sharing the load across more lashing points. However it is important to ensure that it will be shared equally taking account of possible movement in transit which may allow some lashings to relax whilst increasing the tension in others.

Lashing equipment is often used over the edges or corners of the load. This can result in the load damaging the lashing equipment or the lashing equipment damaging the load. In particular, web lashings can easily be cut or abraded by sharp edges of metal or concrete products. Therefore, as for lifting equipment, consideration should be given to the use of suitable packing between the lashing equipment and the load. Purpose made protective sleeves and edge protectors are available.

Fixing and releasing load lashings often involves working at height or alongside the vehicle at the roadside, both of which can be hazardous. Users should consider the risks involved and address them when planning the method of load restraint.

When releasing load lashings, the user must consider whether any part of the load will topple or fall. The possibility of load movement in transit and the levelness of the surface on which the vehicle or trailer is parked should be taken into account.