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Best practice guidelines on Cargo Loading and Securing for Road Transportation

Every load being transported by road should be properly secured so as to protect the cargo, the vehicle, the general public, and the driver and other people involved in transporting the cargo. All those who work with road cargo - drivers, cargo handlers, supervisors and forwarders - need to understand the forces which act upon loads during transit and the appropriate methods of loading and transporting different types of loads.

This guide covers the key issues involved in the safe loading and securing of road cargo.

Road transportation – loading and securing cargo

Poor management of road cargo can put the cargo, vehicle, driver and other road users at significant risk. In addition to the financial and human costs of accidents and load losses, logistics personnel should consider other potential risks, including liability and negligence claims, criminal prosecution, the costs of legal action, higher insurance premiums and reputational damage.

Cargo loading – key issues

Acceleration forces on a load A cargo load is subject to acceleration forces when the vehicle on which it is travelling brakes, accelerates or changes direction. Friction alone will not prevent an unsecured cargo load from sliding forward, backwards or sideways during transport, especially if the trailer is affected by bumps or undulations in the road or vibrations due to road surface irregularities.

Expressed in simple terms, when a vehicle brakes, the force of *momentum* will cause its unrestrained load to continue moving in its original (forward) direction. The harder the vehicle brakes, the greater the momentum. If the cargo is not properly secured and moves forward independently of the vehicle, the resultant instability can pose significant risk of damage to the cargo and vehicle and personal injury to the driver or other road users.

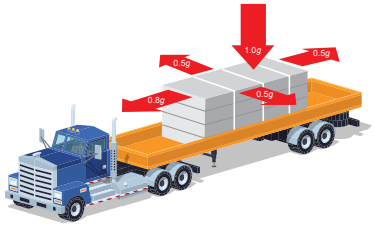
Adequate restraining devices are therefore necessary to ensure that the load is truly secure; for example, lashings over the top of the cargo can increase the frictional forces and improve cargo stability.

Forces at play in cargo under acceleration

Forward: 0.8*g* – (80% of cargo weight)

Backward: 0.5*g* – (50% of cargo weight)

Sideways: 0.5*g* – (50% of cargo weight)



The graphic above illustrates the forces that may be exerted on road cargo under certain accelerations. When securing cargo, it is good practice to consider the forces of acceleration shown here as the *minimum* potential force.

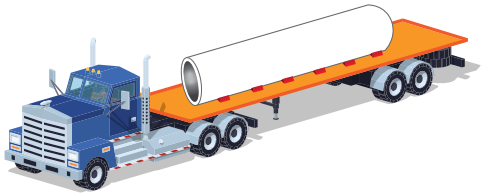
Cargo load-securing arrangements must be designed to resist these accelerations. It is vital that each lashing is applied separately and that no one lashing is used to calculate restraining forces in more than one direction.

Vehicle choice The design and construction of the vehicle and its bodywork must be appropriate for the load it is carrying. Before loading commences, the vehicle's platform trailer, body work and securing devices should be checked to ensure that they are fit for the purpose.

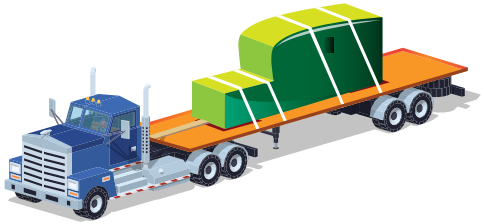
Centre of gravity The risk of the cargo tilting or tipping over depends on the dimensions of the cargo and the height of its centre of gravity. As a general rule, the lower the centre of gravity, the more stable the load; the higher the centre of gravity, the more likely it is to tip when subject to horizontal forces. The tilting or tipping risk is increased when a vertical line from the centre of gravity falls outside the base of the cargo, which means that the centre of gravity of the total cargo should be as close as possible to the longitudinal axis of the truck.

Cargo weight and load distribution The maximum gross weight of the cargo should never exceed the maximum axle loading capacity of the vehicle. Distributing the cargo to create lower axle loads will ensure that steering, braking and trailer stability are not adversely affected.

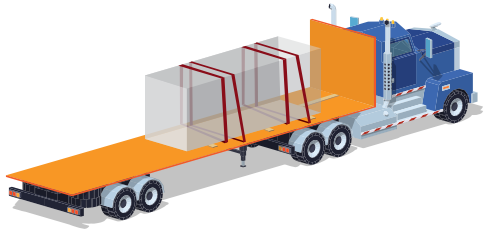
Cargo rigidity The most appropriate method of securing the cargo depends on the cargo's rigidity. If the cargo is not rigid, the use of filler materials and supporting edges will enhance rigidity and ensure that the cargo is properly secured.



Blocking

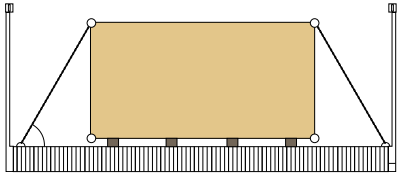


Simple top over lashing



Loop lashing

Spring lashing



Direct lashing

Cargo restraint techniques

Road transit of cargo should not be attempted under any circumstances or for any distance without the application of basic lashings. Sufficient cargo restraint measures should be used to reduce sliding and tipping forces, and the driver must be able to tighten the lashings during transit.

Steel-on-steel contact between the load and the platform trailer bed should be avoided; instead, wooden packing or rubber matting should be used to increase friction. Wooden packing or hessian sacks can also be used to protect the cargo from damage caused by lashings and other securing equipment.

Cargo stability can be enhanced by using the following techniques (alone or in combination):

Blocking Blocking involves stowing cargo such that it lies flush against fixed carrier structures or fixtures such as headboards, sideboards, sidewalls or stanchions. If the cargo does not completely fill the space between the load carrier structures, filler material such as inflatable air cushions, timber blocking braces or cross battens can be used to fill the gaps.

Top over lashing Lashings over the top of the cargo can help prevent cargo sliding or tipping while on the trailer platform bed. These lashings generally do not have any horizontal lashing angle and are almost always applied in the transverse direction of the vehicle. Unlike blocking, top over lashing tightens the cargo to the platform bed, thereby increasing friction forces.

Typical top over lashing includes loop lashing (lashings looped around the cargo and secured to the trailer bed), round turn lashing (lashings passed around the cargo to bind a number of smaller packages together) and spring lashing (lashings designed to prevent forward or backward movement).

Direct lashing If the cargo unit is fitted with suitably sized lashing points, it is possible to lash the cargo directly to securing points on the vehicle.

Cargo lashing equipment

All equipment used in securing road cargo should be inspected regularly for damage and wear and tear.

Best practice dictates that only lashings where the safe working load (SWL) or working load limit (WLL) are known and marked should be used. If the SWL or WLL are not known, for example when using wire ropes, a recent load test certificate should be consulted in order to estimate maximum securing loads.

Polyester webbing straps or lashings are often used for top over lashings; however, for heavier cargo such as machinery or steel structures, suitably sized chains should be used with chain tensioners or ‘binders’ to adjust tightness. Wire ropes tensioned with turnbuckles can also be used for heavier cargo units. It is important to note that kinked, crushed or bent wire ropes lose some of their securing strength.

The use of chain blocks as lashings is not recommended, as this approach is not a fail-safe design. Similarly, jury rigs, such as wire ropes that are twisted tighter and held in place by pipes or metal bars (known as a ‘Spanish windlass’), should never be used.

Key issues

Cargo loading

- Acceleration forces on a load
- Centre of gravity
- Cargo rigidity
- Vehicle choice
- Cargo weight and load distribution

Cargo restraint techniques

- Blocking, top over lashing or direct lashing

Cargo lashing equipment

- SWL/WLL, polyester or chain/wire lashing

Want more information?

European Best Practice Guidelines on Cargo Securing for Road Transport, European Commission, 2014 edition.

European Best Practice Guidelines for Abnormal Road Transport, European Commission Directorate, General for Energy and Transport, 2010.

International Guidelines on Safe Load Securing for Road Transport (IRU) - 2014

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