[Slide General 1]

Cargo Securing at Road Transport

Cargo securing to prevent cargo damages on **road**, sea, rail and air

CARING is partially financed by the Leonardo da Vinci programme of the European Union. In Finland the Centre for International Mobility CIMO administers and is responsible for implementing the Leonardo da Vinci Programme. This publication has been funded by the European Commission. The Commission accepts no responsibility for the contents of the publication.

[Slide General 2]

General

Cargo securing has an important role in every transport mode whether it is question of conventional transport mode or intermodal transport. Today the role of cargo securing is even emphasized, because of increased international transport owing to increased international trade. As being international the cargo transport has to be considered as intermodal. The intermodalism has increased owing to developed transport system that is using more different kind of cargo transport units. The most well-known cargo transport unit that is used in intermodal transport is a container.

Recently, legislations that take into account cargo securing have changed and specifically the role of different parties has been specified accurately. As the driver has an important role in cargo securing, also shipper and loader have their own responsibilities. Also recently, the cargo securing European standard EN 12195-1:2010 has changed. This particular training tries to present cargo securing according to the new standard.

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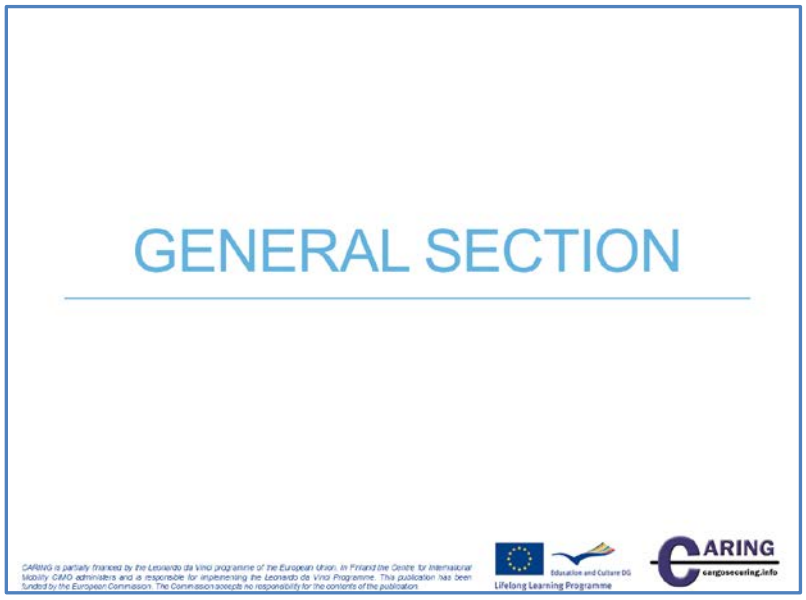
[Slide General 3]



The presentation material is divided into following parts:

- General section
- Road transport
- Sea transport
- Rail transport
- Air transport

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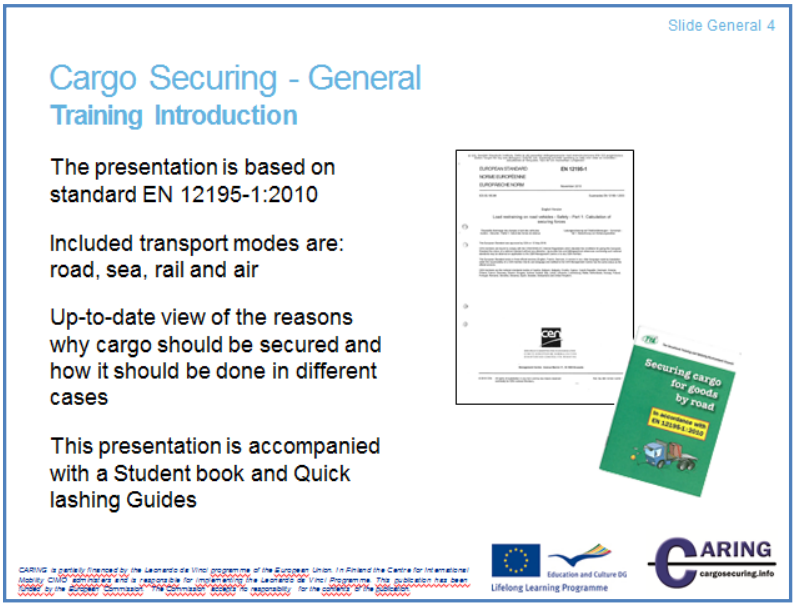
[Slide General 4]



Training introduction

The presentation material accompanying with teacher's manual, student book, quick guide and calculator is based on European standard EN 12195-1:2010. The presentation deals with the following transport modes' cargo securing:

- road -, sea -, rail – and air transport
- introduction, why the cargo securing is important and how cargo securing is made

The cargo securing in sea -, rail and air transport is dealt with from the aspect of combined transport. The presentation will be supported by the student book, which includes exercises for making cargo securing. Also the quick guide is important document for drivers or cargo loaders as this document can be carried in driver's pocket. The calculator will support to calculate, how many lashings will be needed in different situation.

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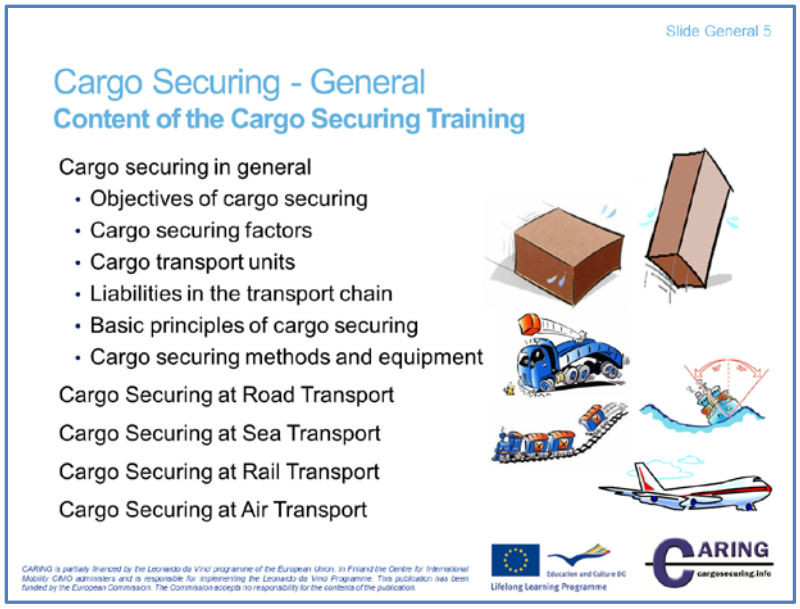

Content of the Cargo Securing Training

This training will cover all the relevant information from all major transport modes, which are road, sea, rail and air. All these transport modes have their specific characteristics, but some rules apply to all of them. Before learning about specific information of each transport mode general issues are gone over. These general issues give answers to the following questions:

- Why cargo securing is done?
- What kinds of forces acting on cargo during transport?
- What are the most common cargo transport units (CTUs) used to transport goods?
- Who is responsible for what in the transport chain?
- How cargo securing should be done and what kind of alternatives exist?

These general issues are gone over in more detailed way in transport mode specific sections.

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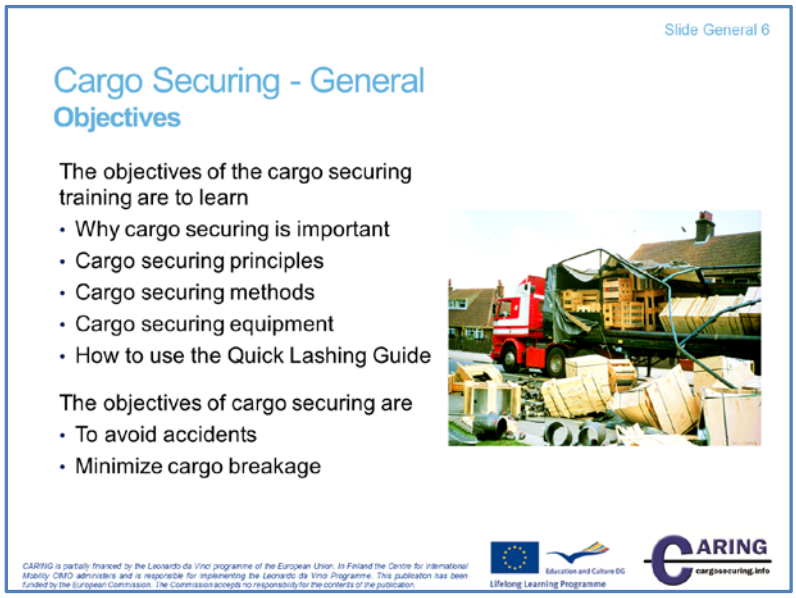
[Slide General 6]



Objectives

The objectives of this training are to learn why and how cargo securing should be done in different transport modes and with different cargoes. There are many different methods and equipment that can be used. All of them are valid and legal but some of them are meant for only specific cargoes. After this training you will know how and when different methods and equipment should be used.

Good cargo securing doesn't just keep the cargo on its place and prevent accidents from happening. It also makes sure the cargo doesn't break during transport. This is especially important and sometimes hard to achieve with fragile goods. For example, if the transported product is heavy but its surface is soft and uncovered, hard lashing chains can't be used for cargo securing. With chains the product would stay on its place but it would break in the process.

Notes

[Slide General 7]

Consequences of Insufficient Cargo Securing

The consequences of insufficient cargo securing can be divided into the following issues:

Direct consequences

- Loss of lives
- Damage to cargo and CTU
- Loss of CTU
- Damage to environment
- Economic consequences
- Bad will

The worst consequence of badly loaded and secured cargo is persons getting injured or killed. Accidents that involve a loss of live can happen at any stage of transport chain. Cargo has to be handled with care in every step of the way, from the loading to transport to unloading. This chain can be thousands of kilometres long and the acting forces can vary according to the used transport mode. If cargo securing is not done properly cargo can cause very dangerous situations by shifting its place or even breaking out of the CTU. It is not only the persons working in logistics that are in danger. For example other road users or persons on board a vessel can be in great danger.

Even though no one gets hurt in the event of cargo moving, it can cause significant damage to the CTU and of course to the cargo itself. In the worst case the CTU and cargo are severely damaged and basically lost. Damage can also be caused to environment not only to persons, CTUs and cargoes. Many CTUs transport dangerous goods that can be very harmful to environment. Even small quantities can cause severe consequences if they end up in drinking water.

Cargo damage during transportation costs annually industry large amounts. During only one autumn and winter season on the North Sea cargo may be damaged to the value of more than 20 million dollars.

Logistics chains are very tightly scheduled so if one part of the chain is late, it will affect all the partners in the chain. For example, if a truck misses a vessel, the whole transport could be a day or a few late. In the other end of the chain can be a shop waiting for new products for the start of a sale. If the products arrive late, the shop can't sell them when the sale starts.

Damages to cargo, CTUs and environment and products that arrive late create costs. These costs are useless and total waste of resources. Usually no one benefits from these costs. The only beneficiary could be insurance companies that transport companies pay great sums to cover the costs of mishandling cargo. In worst cases money can't cover what has been lost, for example if a human life is lost or environment destroyed.

In addition to economic consequences also bad will rise from bad cargo securing. Companies that notice frequent mishandlings of their cargo won't settle for money, they change the company. Once reputation is lost, it is very hard to build up again.

Notes

[Slide General 8]

Cargo Securing Factors

There are many factors that affect the cargo securing. First of all different transport modes have different regulations on how cargo has to be secured and what kind of cargo can be transported. In different transport modes also different CTUs are used.

Different CTUs have characteristics that determine a great deal how cargo securing has to be done. If the CTU has rigid walls as in a container, blocking against them is a very good option. Also availability of securing points and their strength dictates what kind of lashing equipment can be used.

Cargo has different characteristics that affect how it can be secured.

- Shape determines the orientation of the cargo.
- Durability determines what kind of lashing and blocking methods can be used. If the transported products are in soft packages, they can't be lashed with chains or webbings.
- Dimensions determine how cargo can be positioned in to the CTU while loading and also what kind of securing methods can be used. For example with flat cargo top-over lashing can't be used effectively.
- Weight is one of the most important things to know about the cargo. Without this knowledge safe cargo securing is not possible. For example the amount of lashing devices depends heavily on the weight of the cargo.
- Sharp edges may damage or break lashing devices or other cargo. Corner protection can be used to prevent damage to lashing devices and also cargo.
- In road transport cargo in one CTU can be distributed to many customers. The optimal way of loading the cargo for cargo securing might not be the order of distribution. This causes a

problem because items in the cargo should be in certain order to make the distribution efficient.

When loading the CTU, sufficient cargo securing equipment should be available. Sometimes it happens that the characteristics of the cargo are so difficult that for example enough blocking material (i.e. empty pallets) is not available. In this case lashing devices should be used for cargo securing. If sufficient cargo securing equipment is not available the cargo can't be transported. Sometimes the CTU's frame work can also be used as securing equipment.

Most mistakes in cargo securing are because of "human" factors. These factors are hurry, carelessness and lack of education. Cargo securing has to be made carefully to prevent unnecessary accidents in all conditions. Timetables or other personnel that belittle cargo securing shouldn't stand in the way of safe transport. After this course participants will have sufficient information to do the right choices in different situations!

Notes

[Slide General 9]

Cargo Securing Factors

If cargo securing isn't done properly cargo can start to slide, tilt or wander during transport. Sliding starts when cargo securing and friction can't hold cargo on its place. Sliding can be only a fraction of a centimetre or cargo unit can slide until it hits other cargo unit or the CTU. The horizontal force can trigger the sliding of a cargo unit. The force will be created by braking, cornering or accelerating the vehicle.

If friction between the cargo unit and the carrier's platform is high, cargo unit do not perhaps start to slide but tilt or tip over due to sufficiently high longitudinal or transverse force. Tipping depends on how high is the centre of the gravity of the cargo unit. If the centre of gravity is above the geometrical centre of the cargo or near to one of the sides then it is more sensitive to tip over.

Wandering happens because the CTU vibrates while transport. Vibration is caused by CTU's engine and movement of the CTU on road, water, rail or air. If vibrations are strong enough cargo can even leave the surface of the platform for a short period of time. Wandering means that cargo slowly moves on the platform. This movement isn't usually visible to eye because of the slow speed of the movement. After hours of transport when the CTU is opened again it is possible to notice the movement.

Additional factors are compression and collapsing. Compression means that cargo loses its rigidity under lashing but doesn't break. Lashing devices are tightened very well before transport so soft packaging might give in during transport or even already at the tightening phase. Collapsing is the state after compression if tightening of lashings is continued. If cargo collapses during transport lashings are very loose and won't stop cargo from moving. If the cargo is not considered rigid enough to adequately apply lashings (sacks or big bags for example) the rigidity may be improved by the use

of filler material, boards, walking boards and supporting edge profiles. The amount of material needed to perform the blocking/supporting will depend upon the rigidity of the goods.

All the factors above can loosen the lashing during transport. Although it is not always possible to retighten lashing during transport it is advised. Cargo can "search its place" after a few kilometres of transport, which means that lashing devices can be a lot looser than in the beginning of the journey.

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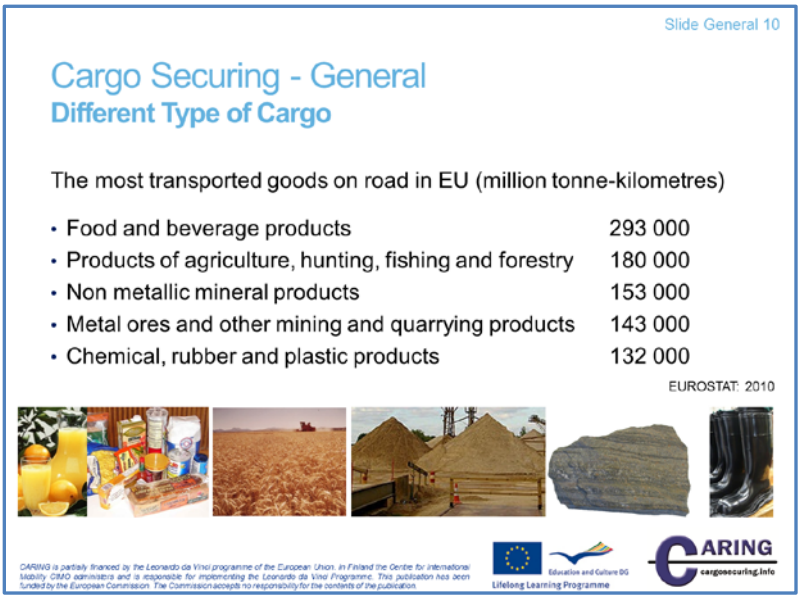
[Slide General 10]



Different Type of Cargo

On this list are the most transported goods on road in Europe in year 2010. One tonne-kilometre means that one ton of cargo is transported for one kilometre. In the same way if 40 tons of cargo is transported for 100 kilometres it equals 4000 tonne-kilometres. Source: Eurostat

It is important to remember that almost 90 % of the EU external freight trade is seaborne. Also short sea shipping represents 40 % of intra-EU exchanges in terms of ton-kilometres. In maritime transport about 70 % of the cargo is bulk as oil, iron ore, grain or coal. 30 % of the cargo is containers and other cargo.

Source: Rodrigue, J-P., Browne, M. 2007. International Maritime Freight Transport and Logistics.

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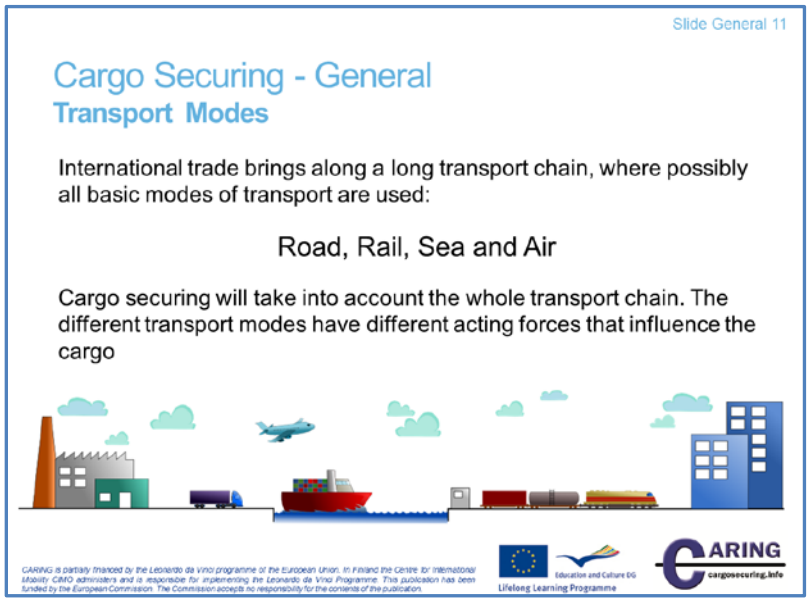
[Slide General 11]



Transport Modes

In modern world products are distributed all over the world only in a matter of days. Cargo might be loaded into a trailer in a European city, travel by road to a train station, continue its trip on a train car and end up onboard a ship to other side of the world. Long transport chains that include many different transport modes create a challenge to cargo securing. First of all the forces acting on the cargo are very different in the transport modes. Cargo securing has to be made thinking all used transport modes. Secondly the laws about cargo securing in different countries vary. These factors have to be taken into consideration when loading and cargo securing are done.

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[Slide General 12]

Different Cargo Transport Units and Cargoes

There are many different kinds of Cargo Transport Units (CTUs) available. In some of them a variety of cargoes can be transported, like in trailers or containers. Some CTUs are made for a specific purpose for example to transport very heavy objects (e.g. part of a ship) or glass windows. No matter what kind of CTU is used, the design and construction of the CTU and its bodywork should be suitable for the cargo that it is going to carry, particularly in terms of the characteristics and strengths of the materials used. Before the CTU is loaded, it should be checked to ensure that its load platform, bodywork and any load securing equipment are in sound and serviceable condition.

Vehicles and trailers, freight containers and flat racks are examples of different CTUs. On road transport vehicles and trailers transport almost all kinds of cargo from general cargo to steel products and liquid materials. In countries where inland waterways are not available, vehicles and trailers transport a significant amount of all the cargo. Nowadays containers are also used to transport all kinds of products. All the major material flows of solid cargo around the world are transported in containers. Containers are very versatile and that is why they are used in all different transport modes. Flat racks are like the name says flat platforms that have end walls that are fixed or removable. Flat racks are one type of a container and they can be stacked on top of each other. They are used to carry heavy objects that are not very sensitive to weather.

Notes

[Slide General 13]

Liabilities in the transport chain

The cargo securing is the necessary act in transport modes, because every transport is to be made safely protecting environment, human lives and stakeholders' any kind of properties. That's why countries have set legal acts, standards and norms for the cargo securing. It can be stated that cargo securing in every transport mode is effectively regulated by legislation, standards and norms. Liabilities for different parties involved in material handling, loading a vehicle and driving a vehicle as well as shipping operations are specified in legislation.

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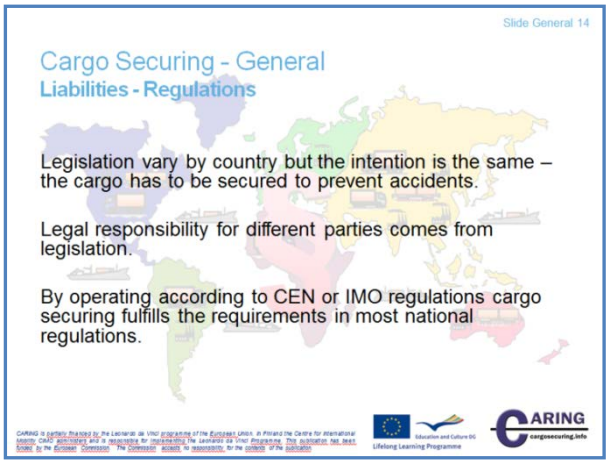
[Slide General 14 & 15]



Liabilities - Regulations

Proper cargo securing is an important element when loading of packed goods safely on a carrier. Cargo securing is regulated by legislation. Legislation varies by country, but the intention is the same – the cargo on every transport mode has to be secured properly to prevent accidents.

Legal responsibility for different parties comes from legislation. Responsibility means in the true sense of the word that a person or an organization is in charge of doing the securing properly. Liability is then extending the concept of responsibility. Liability comes into the picture when an accident has happened. Then somebody has charge of negligence.

European Committee for Standardization (CEN) is a major provider of European standards and technical specifications for products, operations and practices as well as technologies in all economic areas except electrotechnology and telecommunication. CEN is the only recognized European organization according to Directive 98/34/EC in standardization area.

International Maritime Organization (IMO) is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships. IMO has developed international regulations for cargo security at sea transport by promoting the adoption of about 50 conventions and protocols and adopted more than 1 000 codes and recommendations concerning maritime safety and security. These recommendations are then used in the work of legislation. Cargo that travels on a ship must be secured according to IMO rules.

Hence, by operating according to CEN standards and IMO rules cargo securing fulfills the requirements in the most national regulations.

The European norm EN 12195-1:2010 consists of load restraining principles and calculation of securing forces on road vehicles.

Rail transport has created own norms, but for intermodal transports the cargo securing that follows the principles of EN 12195-1:2010 standard is accepted by the most intermodal rail transport operator.

The International Air Transport Association (IATA) develops commercial standards for passenger traveling and cargo transport.

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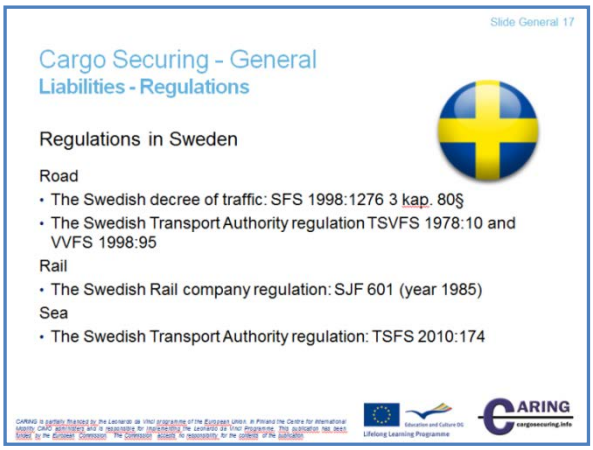
[Slide General 16 & 17]



Liabilities - Regulations

Regulations in Finland

Regulations that support companies' cargo securing for road transport are:

- The Finnish Road Transport Act 3.4.1981/267
- The Finnish Decree on the Use of Vehicles on the Road 4.12.1992/1257

In the rail transport the cargo securing is mostly regulated by the Government Decree on the Transport of Dangerous Goods by Rail 195/2002. The Railway Act does not particularly consider the cargo securing. The aim of the act is maintain and improve the safety use of the railway system.

For the sea transport the most important regulation is the Sea Act 674/1994 and Government Decree on the Transport of Dangerous Goods as General Cargo on Vessel 666/1998.

Regulations in Sweden

Regulations that support companies' cargo securing for road transport are:

- The Swedish decree of traffic: SFS 1998: 1276 3 kap. 80§.
- The Swedish Transport Authority regulation TSVFS 1978:10 and VVFS 1998:95

The regulation for rail transport's cargo securing is the Swedish Rail company regulation: SJF 601 (year 1985)

Instructions and liabilities for sea transport's cargo securing give the Swedish Transport Authority regulation TSFS 2010: 174.

Notes

[Slide General 18]

Regulations

Regulations in Germany

Security issue on road is regulated by road traffic act and directive VDI 2700a. The road traffic act governs responsibilities of the loader and of the driver. VDI directive 2700a is standard and considers the cargo security on road transport in detail.

The purpose and the use of German Railway Act is almost same as in Finland. The aim of the act is maintain and improve the safety use of the railway system. Railway operators have set norms for cargo security issue.

The Inland Waterway Vessel Act (BinSchG) essentially governs the legal relationships between ship owners (defined in § 1 BinSchG) and its creditors. It also determines the liability causes and its control.

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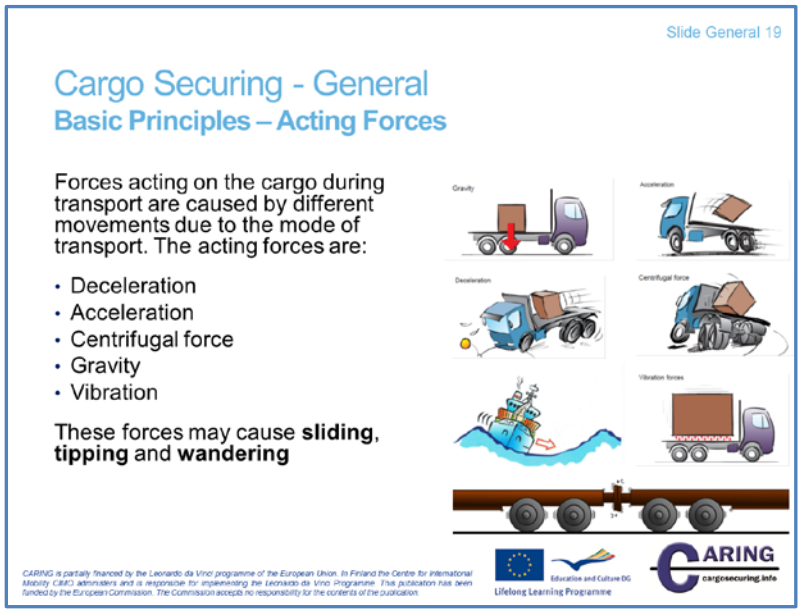

Basic Principles – Acting Forces

Forces acting on the cargo during transport are caused by different movements. The acting forces are:

- Acceleration
- Deceleration
- Centrifugal force
- Gravity (Weight)
- Vibration

Acceleration and deceleration are not actually forces, they are speeds that vary. When a mass in this case cargo is attached to acceleration or deceleration, then it is force. This force is mainly horizontal. Centrifugal force is caused when a vehicle is driving in curves. Gravity is the property that by which all masses attract each other. Weight is the force due to gravity. Vibration is a small movement up and down.

The above mentioned forces may cause sliding, tipping and wandering of a cargo on the platform of a vehicle. When the vehicle is moving the vibration from the road for instance can reduce the restraining force due to that so called friction force is decreased. When there is no restraining force then the cargo begins to slide on the platform. To tip means that a cargo overturns or falls.

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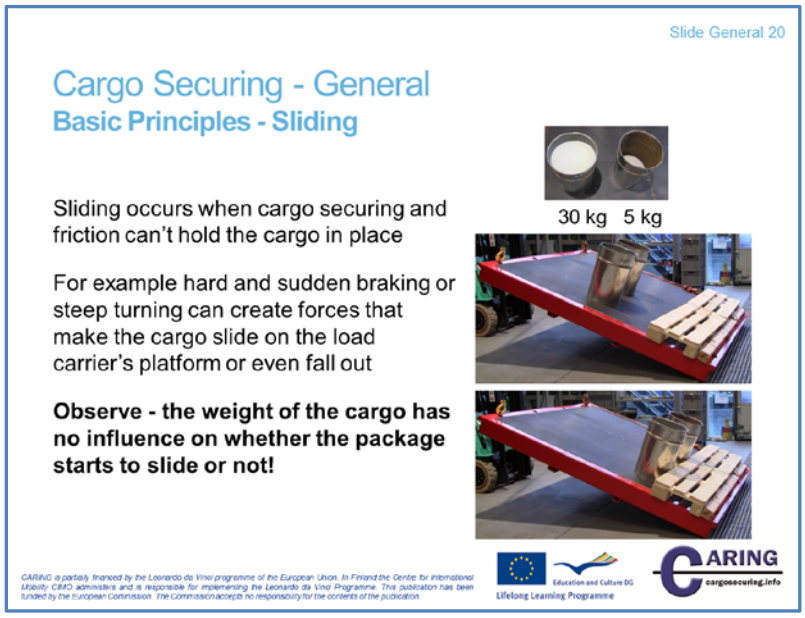
[Slide General 20]



Basic Principles - Sliding

Typically hard and sudden braking or steep turning can create forces that make the cargo slide on the load carrier's platform or even fall out.

The picture shows that the weight of the cargo has no influence if a package starts to slide or not.

Notes

[Slide General 21]

Basic Principles - Friction

Friction exists in the contact between two surfaces. The magnitude of the friction is expressed with the friction coefficient. Friction force is constituted with friction coefficient, mass and falling acceleration. Friction force resists the movement of the cargo on its surface. The higher the friction coefficient is the harder the cargo starts sliding. The friction force depends upon the mutual characteristics of the cargo and platform surface material in contact.

In the pictures both of the containers weight the same amount. Under the container further back in the picture is friction mat that increases the friction coefficient and prevents sliding. As seen in the video the container tips over before it starts to slide.

See video of an inclining test in: http://www.cargosecuring.info

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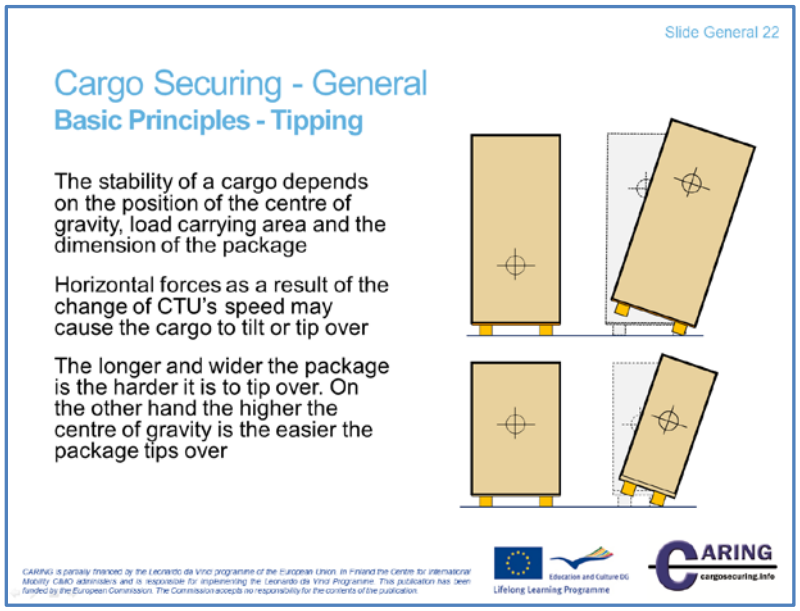
[Slide General 22]



Basic Principles - Tipping

The stability of a cargo depends on the position of the centre of gravity, load carrying area and the dimension of the package. The centre of gravity of an object is the average of the mass distribution within that object. Horizontal forces as a result of the change of cargo transport unit's speed may cause the cargo to tilt or tip over.

The longer and wider the package is the harder it is to tip over. On the other hand the higher the centre of gravity is the easier the package tips over.

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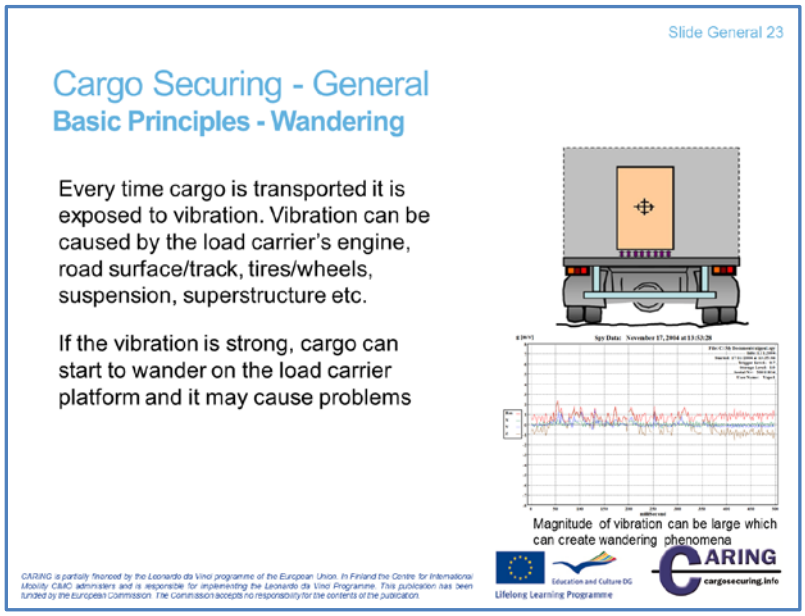
[Slide General 23]



Basic Principles - Wandering

Every time the cargo is transported it is exposed to vibration. Vibration can be caused by the load carrier's engine, road surface, tires or wheels, suspension or superstructure. If the vibration is strong, cargo can start to wander on the load carrier platform and it may cause an accident. Magnitude of vibration can be measured today with instruments that has a sensor to identify vibration.

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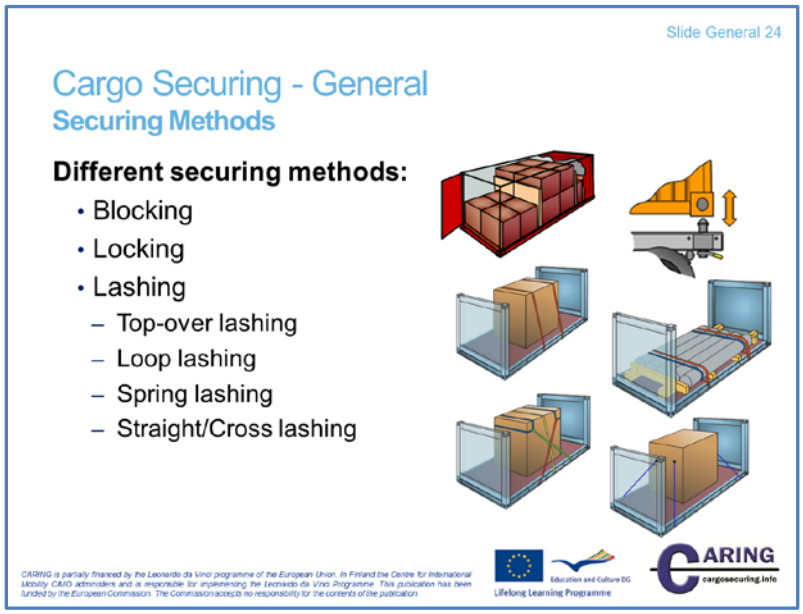
[Slide General 24]



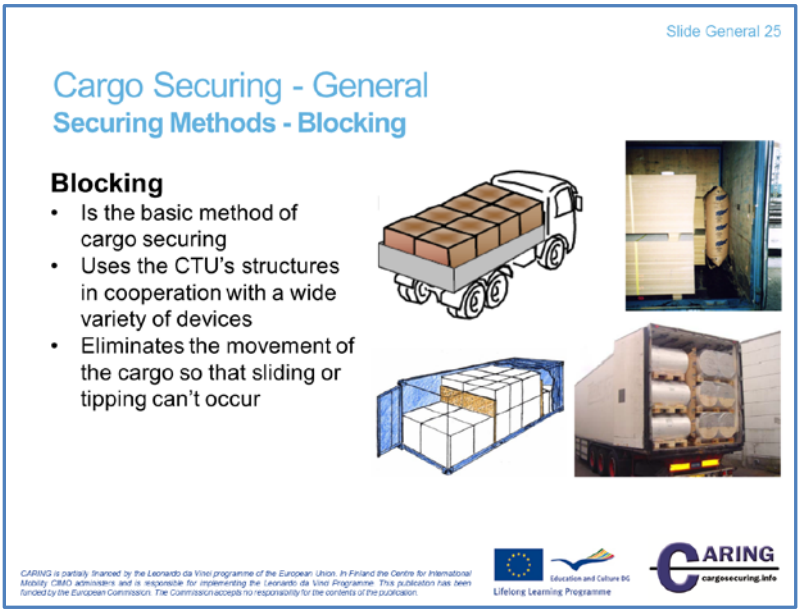
Securing methods

Securing methods can be divided into three different types: 1) blocking, 2) locking and 3) lashing. If a cargo is placed against the front wall of the load carrier, then the front wall works as a blocking fixture. Locking method is mostly seen in vehicle itself. Containers and swap bodies are locked on the chassis of vehicle with twist lock mechanism. In most cases twist lock is fitted to the vehicle during manufacture.

The new standard EN 12195-1:2010 categorize lashing methods to two: 1) frictional lashing and 2) direct lashing. Top-over lashing belongs to the first category and loop lashing, spring lashing, straight and cross lashing belong to second category. In loop and spring lashing the lashing device is connected directly only on the load carrier. In straight and cross lashing the lashing device is connected directly both on the load carrier and on the load.

Notes

[Slide General 25]



Securing Methods – Blocking

Blocking means that cargo is in close contact to the fixed structures or fixtures on the CTU. These may be in the form of headboards, sideboards, sidewalls, stanchion or other devices. Blocking should be the primary method of cargo securing because it eliminates sliding and tipping. Tipping is not eliminated if blocking is not done above the cargo unit's centre of gravity. Different CTUs have different characteristics concerning how much of the weight of the cargo can be blocked against head- and sideboards. See section "Cargo Transport Units – Superstructures" for more information.

The cargo can be stowed directly or indirectly by means of filling against the fixed blocking devices built into the load carrier, and these prevent any horizontal movement of the cargo. In practice it is difficult to achieve a tight fit against the blocking devices and a small clearance usually remains. Gaps must be kept to a minimum, especially those to the headboard. The cargo should be blocked against the head board either directly or by the use of filler material in between. The total accumulated gap in a section or a row of cargo shouldn't be more than the height of a European pallet. This means that if the gap is more than the height of a European pallet cargo should be altered so that the pallet fits in the section / row and the gap is eliminated.

Different blocking methods are introduced later in this training.

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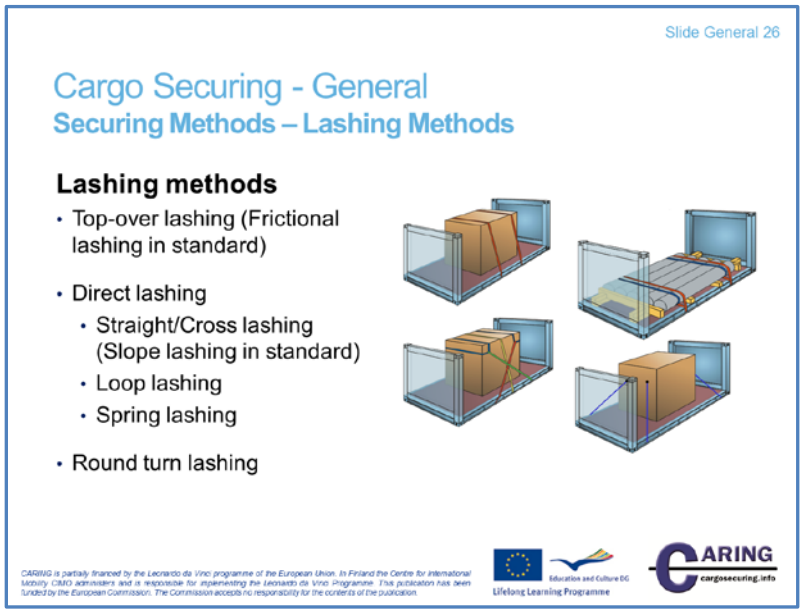
[Slide General 26]



Securing Methods – Lashing Methods

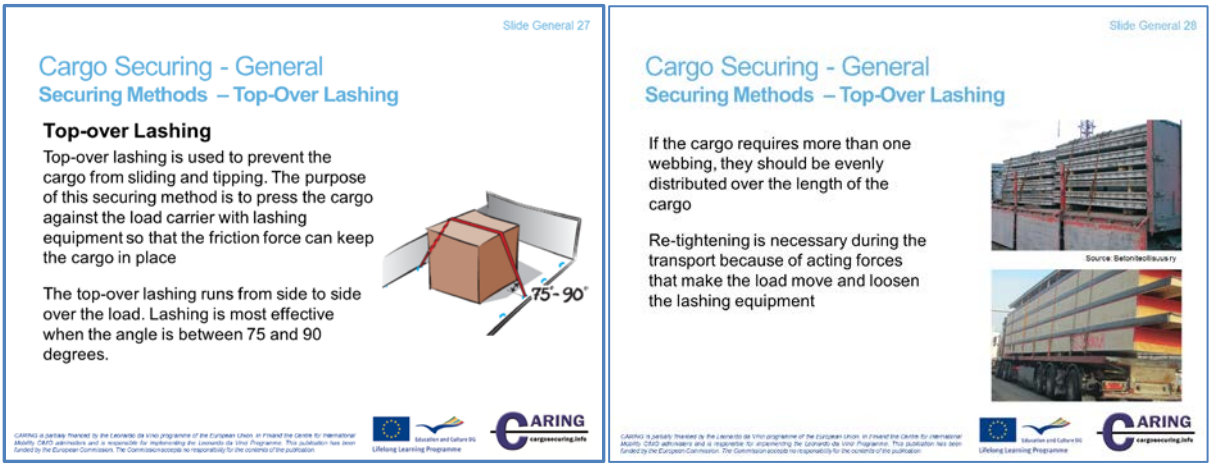
Lashing is done with webbings or chains. The purpose of lashings is to tie cargo together or to keep cargo in contact with the load platform or any blocking device. Lashings should be positioned so that they are in contact only with the cargo to be secured and/or the securing points. They should not be bent over flexible items, side gates etc. Only one lashing should be attached to one securing point.

Lashing methods that are gone over are:

- Top-over lashing (Frictional lashing in standard EN 12195-1:2010)
- Straight (Slope lashing in longitudinal and transverse direction in standard EN 12195-1:2010)
- Cross lashing (Diagonal lashing in standard EN 12195-1:2010)
- Loop lashing
- Spring lashing
- Round turn lashing (not mentioned in standard (EN 12195-1:2010)

Notes

[Slide General 27 & 28]



Securing Methods – Top-Over Lashing

Top-over lashing is a method of securing where lashings are positioned over the top of the goods in order to prevent the cargo section from tipping or sliding. Top-over lashing is used to press the cargo section towards the platform bed. This increases the friction force's ability to keep the cargo in place.

Top-over lashing is most effective when the angle between the loading platform and the upright part of the lashing is 90 degrees. Because of cargo's and CTU's characteristics this isn't always possible. Top-over lashing is still effective if the angle is more than 75 degrees. If the amount of lashings is calculated using the Quick Lashing Quide the number of lashings has to be doubled if the angle is under 75 degrees but above 30 degrees. Another lashing method should be used if the angle is less than 30 degrees. It is also important to place the lashings over the centre of the load. This prevents tipping forwards / backwards most effectively. If the cargo requires more than one lashing, they should be evenly distributed over the length of the cargo.

Top-over lashing is called frictional lashing in the standard EN 12195-1:2010 for a reason. To calculate the number of lashings the friction coefficient value is needed. The higher the friction the more goods weight in tonnes one top-over lashing can prevent from sliding. Remember that higher friction doesn't prevent the cargo from tipping! Even if friction prevents the cargo from sliding, vibrations and shocks during transportation can make the cargo wander. This makes top-over lashing necessary even if the friction is high.

An example of calculation of the number of lashings needed in top-over lashing is in section "Quick Lashing Guide – Example".

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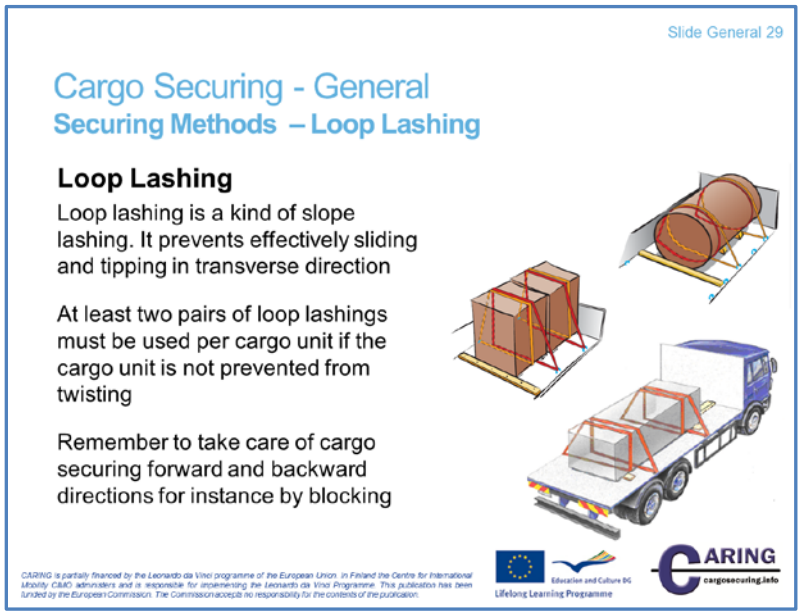
[Slide General 29]

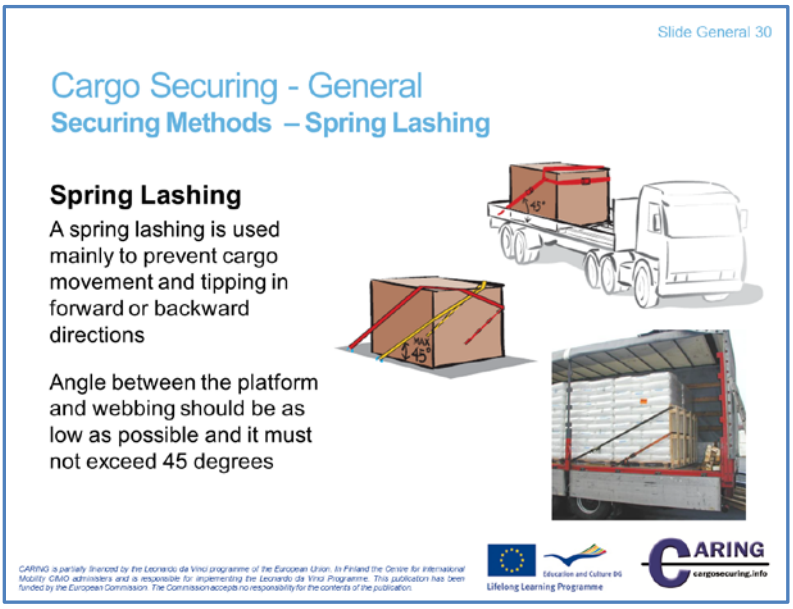


Securing Methods – Loop Lashing

In loop lashing cargo is lashed to one sides of the vehicle body by a loop around the cargo. Loop lashing thereby prevents the cargo from sliding towards the opposite side. To prevent sliding to both transverse directions, loop lashings must be used in pairs, which will also prevent the cargo from tipping over. Two pairs of loop lashings are required to prevent the cargo from twisting longitudinally. One pair is sufficient if the cargo is prevented from twisting by for example other cargo or blocking. To prevent the cargo from moving in a longitudinal direction, loop lashing must be combined with blocking.

Notes

[Slide General 30]



Securing Methods – Spring Lashing

Spring lashing is a kind of direct lashing without any attachment points in the cargo. As the load has no attachment points it is secured by a sling which is attached to the edges of the cargo. Spring lashing can be used to prevent tipping and/or sliding forwards or backwards and can be done in number of ways. It is also usable in transverse direction as well, but it is mainly used in longitudinal direction. Spring lashing in combination with base blocking forwards or backwards is a restraining method consisting of a sling across the corner of the cargo layer and two slope lashings, the purpose of which is to prevent a cargo layer from tipping or sliding. Spring lashing may also be in the form of a single web lashing, placed across the edge of the cargo layer and lashed by means of a slope lashing on each side. If web lashings are placed as in the middle picture, the values in Quick Lashing Guide can be doubled. The angle to the cargo surface is measured in the longitudinal direction, and it is recommended that the angle is not more than 45 degrees.

If the lashing is not done over the top corner, lowers it the lashing's ability to prevent tipping. The force preventing tipping diminishes in proportion to the height of the lashing. If lashing is done from ¾ of the height of the cargo, force preventing tipping is also ¾. If the cargo is in sections it is enough to calculate lashing against tipping for the last section. Remember that this only applies to lashing against tipping, not sliding!

Two opposite pairs of spring lashings may also be used as an alternative to round-turn lashing.

Notes

[Slide General 31]

Securing Methods – Straight/Cross Lashing

If the cargo is equipped with attachment points as strong as the used lashing device, it is possible to lash directly between the attachment points and the securing points on the vehicle. This type of lashing is used primarily on larger machinery or heavy loads that have proper attachment points. This lashing method prevents both sliding and tipping. The effect to prevent tipping or sliding depends on the angles of the lashing devices. The tables in Quick Lashing Guide are valid when the angle between lashing devices and the platform bed are between 30 - 60° in vertical and horizontal planes.

Straight lashing can be used to prevent movement only in forward and backward directions (upper picture). In this case other means are needed for sideways lashing. This is possible for example in vehicle transport if the trailer has wheel pockets that block sideways movement. If lashings are put crossways (cross lashing) it is very important that the cross occurs over the centre of gravity of the cargo - otherwise the lashing helps the cargo to tip over.

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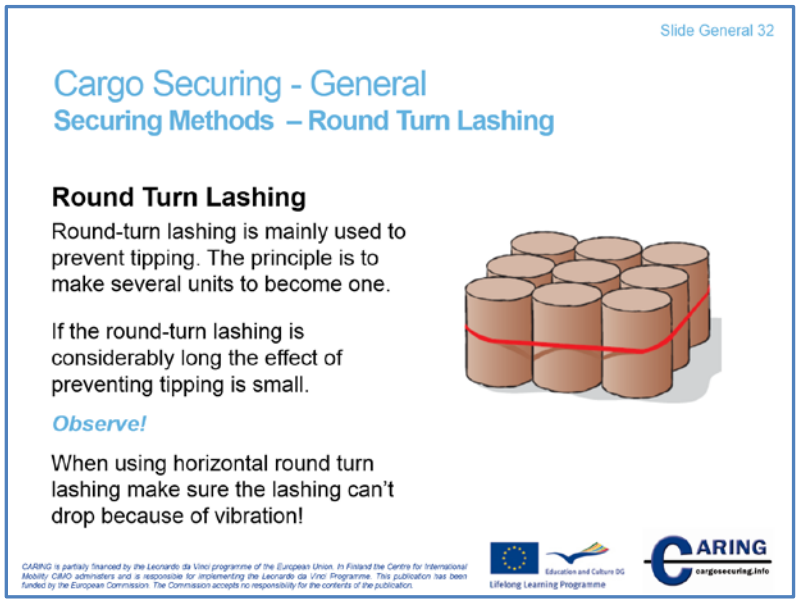
[Slide General 32]



Round Turn Lashing

Round turn lashing is a method to bind a number of packages together. This method is used against tipping so other means have to be used to prevent sliding. Round turn lashing is most commonly used with products that are prone to tip over, e.g. paper rolls. By making the products as a solid unit, it creates a very long and wide surface against the platform and therefore prevents tipping. If the length of the lashing device is long this method loses its ability to prevent tipping. Web lashings elongate under tension which enables the packages to move individually. It crates space between packages and thus doesn't prevent tipping of the cargo anymore. Round turn lashing can be also used in vertical direction, but it isn't used as commonly as in horizontal direction. When using horizontal round turn lashing vibration and slight movement of the cargo can loosen the lashing and make it drop. Because of this possibility the lashing has to be attached in such a manner that it can't drop.

Notes

[Slide General 33 & 34]

Securing/Lashing Equipment – Webbing

Webbing is the most commonly used cargo securing equipment. Webbing is easy to use and versatile. Many kinds of cargoes can be secured by webbing. Webbing's material is fiber, so it does not stand sharp edges of the package. Also it prolongs under strain, so it needs to be retightened during the transport.

Webbing has to be made according to standard except webbings that are used only once (one-way webbings). Standard EN 12195-2 determines characteristics of webbing. For instance the following properties are determined:

- Breaking load
- Lashing capacity
- Standard hand force
- Standard tension force

The producer of the webbing will mark these properties into label that is attached to webbing.

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[Slide General 35 & 36]

Securing/Lashing Equipment

Chain

Chains are typically used when transporting heavy cargo like electric transformers or earth movers. The main difference between a web and a chain lashing is that under a normal load the chain lashing does not stretch so much as the webbing. Also the chain does not get damage when securing cargoes with sharp edges.

Blocking

Effective blocking can be made by stowing packages against the load carrier's walls or putting fixtures between the individual packages or building different kind of structures of fixtures against the package. Structures can be build using beams or bars. Dunnage bag is a device that is put between the individual packages. Wedges are plastic or wooden devices that block rolls and other such kind of cylindrical form cargoes. When there are large gaps between the cargo and blocking fixtures, it is often appropriate to use blocking braces fitted with sufficiently strong wooden spacers.

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[Slide General 37]

Securing/Lashing Equipment - Others

Friction coefficient can be increased with friction mat. Friction mats can be used also between packages not only between the package and platform. Tag washer is a metal sheet that has sharp peaks. The sharp peaks stick tightly in wooden platform. Tag washer and its properties have not been presented in the standard EN 12195-1:2010.

Different kinds of protection devices have also been produced. Soft packages can be protected with a corner protection device, which is used in top-over lashing method. With supporting edge profile several packages can be combined together so as to lessen the amount of webbings. Companies have also developed a lashing cover. Lashing cover includes several webbings. Also a net has been developed. You can secure all packages with one net.

Notes

[Slide General 38]

Inspection of Web and Chain lashings

Webbings will wear out within a certain period. The period can be short if webbings used daily to secure heavy loads. Before reusing a web, check its condition. Do not use a web if you notice edge damage, cuts, tear damage or knots. Some warnings are also related to chain usage. Do not use a chain if you notice cracks in the surface, any visual deformation and wear more than 10 % of the diameter.

Notes

[Slide Road 39]

[Slide Road 40]

Typical Factors for a road transport

Factors that typically affect cargo securing are:

- Loading and unloading
- Large forces in forward direction due to brakes
- Variability of cargo units
- Weather conditions
- Vibrations

In loading phase the cargo is stowed and secured. When securing the cargo, instructions shall be followed strictly.

When driving, the speed should be adapted to the circumstances so as to avoid brisk change of direction and heavy braking. Also take into account weather conditions.

Variability of cargo units forms challenges to secure the cargo properly. Before loading the vehicle, clear plan should be created. Making the plan and then loading according to plan needs exercise.

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[Slide Road 41]

Typical cargoes

In this cargo securing presentation material only typical cargoes are presented. Different kinds of packages are classified as general cargo. Pallets, cages, sacks, boxes, barrels are examples of cargo units. These units have differences in weight and shape as well as package strength. When making the cargo securing for these units the following considerations should be taken into account:

- Centre of gravity
- Load distribution
- Blocking
- Filler material
- Palletizing

Bulk

Loose bulk is a load that has not any form of packaging. Examples of loose bulk loads are sand, ballast, grain, woodchips etc. The superstructures themselves are manufactured so that the safe transport of loose material is guaranteed.

Timber

Timber loads are divided to bulk and sawn. Sawn timber is usually transported in standard packages complying with ISO4472 and related standards. Sawn timber packages are wired at each end. Before loading the package the wires should be checked for safety. Round timber is transported on a vehicle that is equipped with stanchions. Stanchions are upright supports in both sides of the superstructure.

Round timber is loaded longitudinally against stanchions. In securing the load chain lashings are used. The load and lashing should be checked before passing from a forest road to a public highway.

Paper

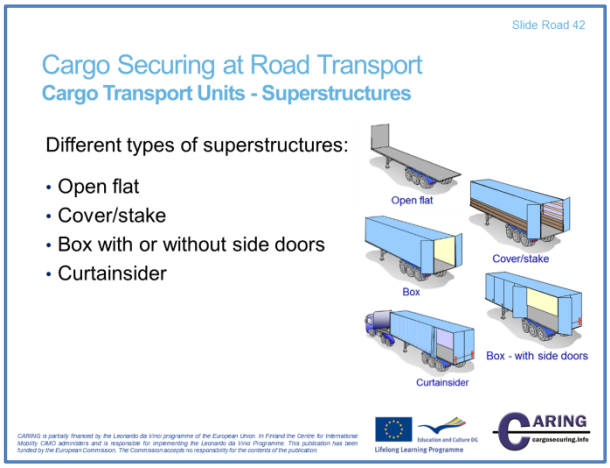
Paper material is in cylindrical form and can be stowed either to vertical or horizontal position. The height of the roll is typically high, so it is stowed mostly to vertical position. In securing paper rolls round turn lashing is widely used. If it possible to put another layer on the carrier then top-over lashing method is used with sideboards that support rolls and protect their edges.

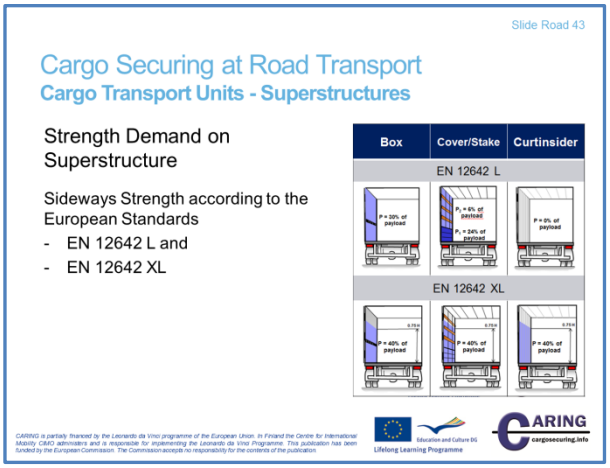
Metal

Metal materials take many transport unit forms, sheets, pipes, bars etc.

Notes

[Slide Road 42 & 43]





Superstructures

Transport services need many kinds of vehicle body structures that are called also as superstructures. Basic types of superstructures are: open flat, box, cover/stake and curtainsider.

Open flat

Open flat structure has no walls, usually only headboard. The headboard can be used for blocking (however, see manufacturer's specification). The cargo securing arrangements has to be complemented by blocking by e.g. wooden battens, bars, and braces or with lashings.

Box

The box type superstructure can be loaded at rear end or by side, if it has side doors. The strength requirements for the walls are fulfilled according to standard EN 12642 or (EN 283 for swap bodies).

Cover/stake

In the cover/stake structure the walls have rigid part and lightly built part. Typically the lightly build part is made using laths. See the standard EN 12642, how the walls are designed to withstand the load and then calculate how much other securing methods have to be used.

Curtainsider

Curtainsiders are common types of superstructures, because they are light and so more cargoes can be loaded than in box type superstructures. Curtainsiders are also easy to load and unload. See the strength requirements below.

Strength requirements

The strength of the body structure on a vehicle is based on standard EN 12642:2006 "Securing of cargo on road vehicles – Body structure of commercial vehicles – Minimum requirements". The related requirement for swap bodies is contained in standard EN283. The standard allows for two types of trailer structure: L, which is standard vehicle body and XL, which is reinforced vehicle body. According to L type, the safety requirement for the box type body structure is that the sidewall must withstand a uniformly distributed force equivalent to 30 % of the maximum cargo weight. For the cover/stake structure the requirement is that the rigid part of the sidewall should withstand 24 % of the maximum cargo weight and 6 % for the lath work. For the curtainsider structure the curtains must not be considered as part of any load restraint system.

According to XL type the safety requirement for the box type body structure is that the sidewall must withstand a uniformly distributed force equivalent to 40 % of the maximum cargo weight. The height of the surface shall be 75 % from the total height or at least 1,6 m. The safety requirement for the cover/stake body structure and for curtainsider body structure is same as for box type body structure.

Note that the laws in different countries might have restrictions on how much of the cargo weight can be blocked by the body structure even though the vehicle is built according to EN 12642:2006 standard!

Notes

[Slide Road 44]

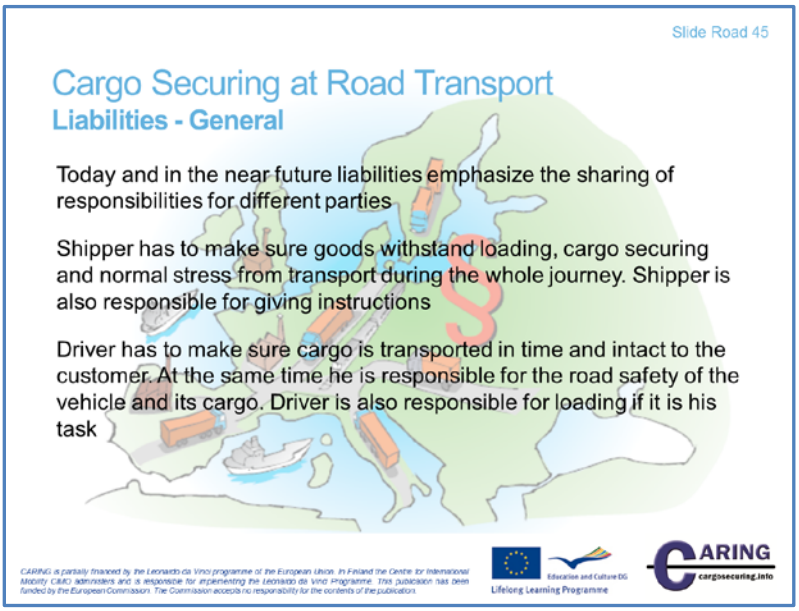
Lashing points

Lashing points are fixture parts in superstructure. Lashing points are installed in pairs, opposite each other along the long sides with a spacing of 0,7 m – 1,2 m longitudinally and maximum of 0,25 m from the outer edge.

The standard EN-12640 determines the strength of a lashing point. For instance, floor lashing points in vehicles that weigh over 12 tons should withstand 2000 kg of tensile force. Lashing points in the front wall withstand 1000 kg.

Notes

[Slide Road 45]



Liabilities – general

Today and in the future liabilities in cargo securing emphasize the sharing of responsibilities for different parties. So, not only the driver is responsible for cargo securing but also shipper and loader. Responsibility extends to tasks that have to be done. Liability has broader view: it considers also responsibilities after something bad has happened. Task responsibilities are usually clarified in regulation that considers freight transport, for instance road traffic act.

Shipper has to make sure goods withstand loading, cargo securing and normal stress from transport during the whole journey. Shipper is also responsible for giving instructions.

Driver has to make sure cargo is transported in time and intact to the customer. At the same time he is responsible for the road safety of the vehicle and its cargo. Driver is also responsible for loading if it is his task.

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[Slide Road 46]

Liabilities – Road regulations and standards

National regulation

National regulation for cargo securing is usually comprised of several acts and decrees because of the nature of the transport system that is based on the public road network, vehicles and goods terminals and entities that are using or managing the system. See examples of Finland's and Sweden's regulations below.

European Standard EN 12195-1:2010

This European Standard was approved by CEN on May 2010 and replaces the previous standard that was dated from the year of 2004. Many countries have already confirmed the updated standard as the national standard. It has to be noted that only the part 1 has been updated. The parts 2, 3 and 4 date yet from the year 2004. The part 1 presents calculation of securing forces for different securing methods. The part 1 presents clearly also the methods with pictures.

IMO/ILO/UNECE Guidelines

IMO/ILO/UNECE guidelines for packing of Cargo Transport Units are for the packing of cargo other than bulk cargo into or onto cargo transport units (CTUs). Guidelines are applicable to transport operations by all surface and water modes of transport. These guidelines give information, best practices and requirements for the safe stowage and packing of cargo in freight containers and vehicles. Guidelines present first general conditions that a container might encounter in its journey. After condition discussion several instructions are presented. Instructions include characterization of different tasks that have to be made so as to secure cargo properly.

European Best Practice Guidelines on Cargo Securing for Road Transport

The European Best Practice Guidelines on Cargo Securing for Road Transport is a comprehensive instruction book for cargo securing. The purpose of the guidelines is to provide basic practical advice and instructions to all persons involved in loading/unloading and securing a cargo on vehicles. This is also valuable material for carriers and shippers. The book is intended to European countries. The book can be downloaded free of charge from the following European Commission website:

http://ec.europa.eu/transport/roadsafety/vehicles/best_practice_guidelines_en.htm

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[Slide Road 47]

Liabilities – Regulations Dangerous Goods

When transporting dangerous goods on road cargo securing is done properly when it is done according to the EN 12195-1:2010 standard. Although this complies with only transport of dangerous goods on road it is a good implication that the standard might have an even stronger role in EU legislation in the future. This is one significant reason why it is important to teach cargo securing according to the standard.

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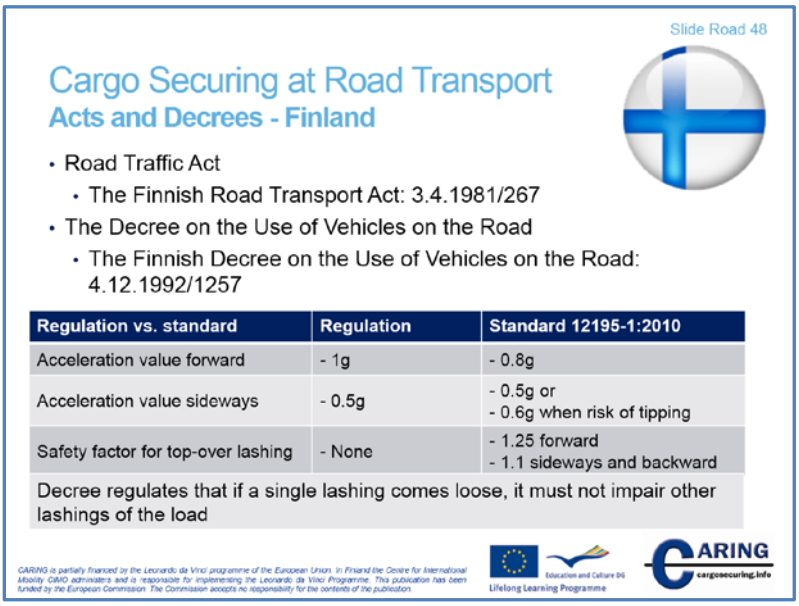
[Slide Road 48]



Acts and decrees in Finland

The road traffic act's section 87 regulates the loading and placing a load. The vehicle shall be loaded so that the transport is safe for human beings and does not damage property.

Section 87a regulates that the driver has to make sure that the load does not move during the transport. The section regulates responsibilities for different actors. A worker (a driver or a loader) who has loaded the cargo is in charge of the proper loading. Also a worker, who has given instructions for loading is responsible for the action as well.

The driver, loader, or the worker who has given instructions are not responsible, if they have not sufficient information about the vehicle (is the vehicle suitable for transporting the particular goods). Also the shipper is responsible for that the loader has correct and sufficient information about the goods.

The decree on the use of vehicles on the road gives instructions for placing of a load. Regarding the cargo securing the most important is the second section, which says, that the load shall be supported against the front face of the goods compartment.

The section 47 is important, because it regulates the securing. The load must not move essentially in relation to the loading platform when a forward force is corresponding to the acceleration of 1 g and a sideways or rearward 0,5 g. In addition the section says that the load shall be supported, bound, locked or covered in order to secure the load. When defining the securing strength of the load, the retention capacity provided by friction may be taken into account. So, in regards to the information above, we can conclude that when making the cargo securing according to standard, fulfill to a great extent or in the majority of cases the requirements of the decree.

The section 48 regulates the lashing of the load. The section does not explain any method, but determines how a lashing device shall be bounded. Regarding to tension the section states that the lashing devices shall be sufficiently tighten and shall be checked during the transport. If a single lashing comes loose, it must not impair other lashings of the load.

In addition the section 48 regards one particular material group (timber or similar long materials) and gives instructions how to bind or block by side pillards. Also this section takes into account a container. If a kind of container cannot be locked to chassis, then it has to be lashed with at least four lashing devices to the bottom corner castings.

Finally the section 48 regulates the minimum nominal strength to lashing devices in regards to movement of a load to forward, rearward, and sideways.

The Decision of Ministry of Transport and Communication about compartments of vehicles, loading and attachment of a load states the nominal strengths of attachments points. It also determines requirements of lashing devices and states that the condition of a lashing device has to be checked sufficiently often.

It has to be noted that the Decree of the Ministry of Transport and Communications on the Transport of Dangerous Goods by Roads gives instructions for transporting and loading dangerous goods.

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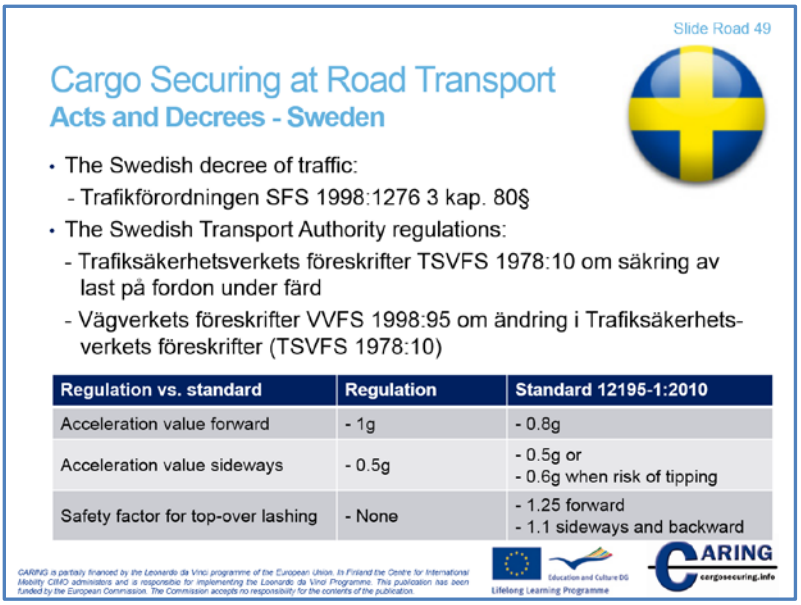
[Slide Road 49]



Acts and decrees - Sweden

The Swedish decree of traffic is "Trafikförordingen SFS 1998: 1276 3 kap. 80§". This decree is almost the same as in Finland's road traffic act. The decree says that the cargo should not be loaded and placed into or onto vehicle so that it will hurt a person, make damages to property, fall from the vehicle or disturb the driving.

The Swedish Transport Authority regulations include the following decree: Trafiksäkerhetsverkets föreskrifter TSVFS 1978:10 om säkring av last på fordon under färd. This decree regulates in detail manner cargo securing at road transport. The decree includes also securing of cargo transport units.

Notes

[Slide Road 50]

Acts and decrees – Germany

Legal principles of cargo securing are set in German road traffic regulations (StVO) and German Road Traffic Licensing Regulation (StVZO). The sections 22 and 23 govern the responsibilities of the loader and of the driver. Clause 1 in the section 22 determines that the cargo must be secured roadworthy manner and particularly against falling off. Both driver and loader are responsible for securing the cargo. In addition, the section 23 gives responsibility for driver that he must take care of that the road safety of the vehicle is not affected by the load.

In Road Traffic Licensing Regulation the sections 30 and 31 govern the responsibilities of the vehicle owner. The vehicle must be loaded and equipped so that their normal operation does not harm anybody nor endanger, impair or molest him more than is unavoidable. In addition, the occupants are protected as far as possible against injuries, particularly in case of accidents, and that the degree and the consequences of injuries are kept as small as possible. The owner must not order or allow the operation if he knows or must know that the load does not comply with the regulations, or that the road safety of the vehicle is affected by the load or by the occupancy.

Standards and guidelines have also important role in cargo securing in Germany. The German Engineers' Association (VDI) has established guidelines for cargo securing. Guidelines contain a number of general and special instructions for securing loads on road vehicles. Guidelines also complement German Road Traffic Regulation's sections 22 and 23. DIN EN 12195-1 standard has not yet been officially approved and therefore VDI instructions are followed. If a DIN EN 12195-1 standard comes into force the corresponding German DIN standard and the respective VDI guidelines are withdrawn.

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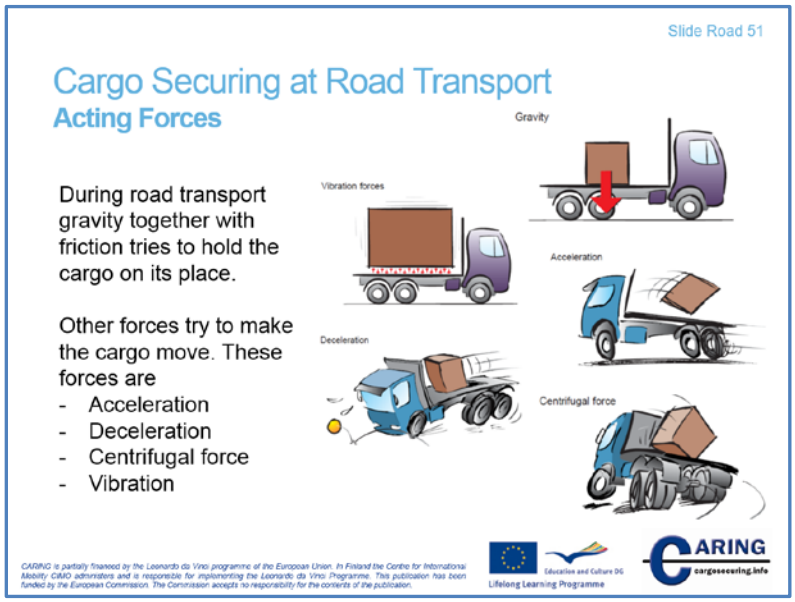
[Slide Road 51]

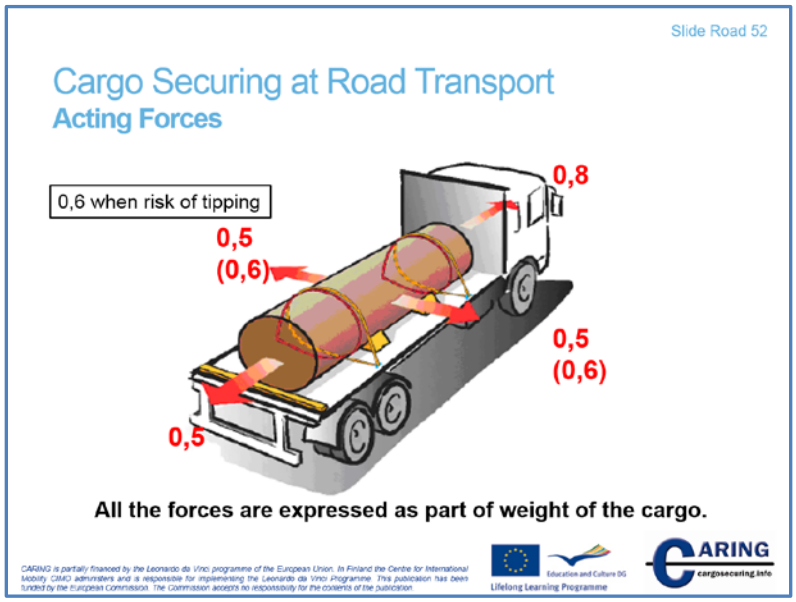


Acting Forces

In road transport forces act on the cargo due to breaking, driving in curves and accelerating. Vibration is caused by the CTU's engine, tires and suspension. Also road surface contributes to the amplitude of vibration and may cause fast and strong shocks. These forces try to move cargo from its place on the cargo deck. Friction together with properly performed lashing counters the forces acting on cargo and guarantee safe transport.

Notes

[Slide Road 52]



Acting Forces

During transport the acting forces to different directions are different in magnitude. Cargo has to be secured so that lashing bears 0,8 times the weight of the cargo forwards, and half the weight sideways and backwards. If cargo has a risk of tipping, then the lashing has to bear 0,6 times the weight in sideways. As an example, if a cargo unit weights 2000 kg, lashing has to bear forward 0,8 * 2000 kg =1600 kg and sideways and backwards 0,5 * 2000 kg = 1000 kg.

These rules are logical. If you think of yourself sitting in a truck, you encounter the hardest forces while braking efficiently. During hard braking you usually lean a bit against the seat belts. You could say that seat belts are lashing devices for the driver and passengers. Second hardest forces are in sideways i.e. in cornering. You very easily lean towards the door or the centre of the cabin if the driver is handling the vehicle recklessly in a corner.

But you shouldn't forget forces acting backwards on the cargo. Although trucks don't usually accelerate very rapidly a steep uphill with acceleration can create a force that moves cargo backwards on the platform. Also after a very hard braking the truck tends to "jump" backwards. Usually during this "jump" persons in the cabin are pulled back on their seats because of seat belts. If there is no similar "seat" for the cargo it would move backwards.

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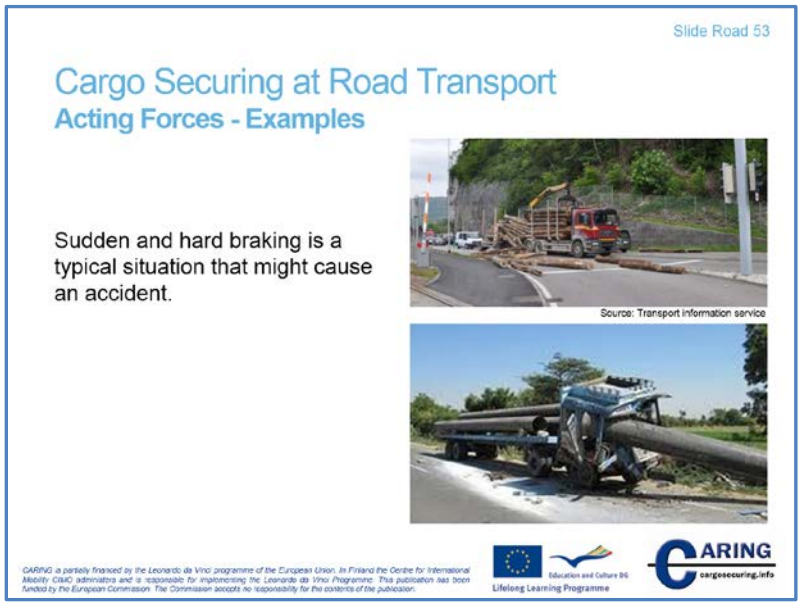
[Slide Road 53]



Acting Forces - Examples

Here are a few good examples of how big the acting forces can be in forward direction. Sometimes during transport drivers encounter surprising situations. Car in front may stop suddenly or someone can drive in front of the truck in an intersection.

In the first picture you can see a lumber truck at an intersection. There's no damage to the truck itself so it didn't hit anything. The truck made an emergency braking that stopped the truck but the cargo (logs) continued their movement. A few of the logs flew quite far away so the driver was lucky no one was in front of him.

The second picture illustrates an incident in which the truck was in an accident. The whole cabin is in very bad condition and it is clear that the long metal pipe caused a lot of the damage. It is evident that one of the metal pipes weren't appropriately secured. Again the truck stopped to move but the metal pipe continued its movement through the cabin. The driver was lucky the loose pipe wasn't on the left side of the platform.

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[Slide Road 54]

Acting Forces - Examples

The sideways forces can be surprisingly high as can be seen in these pictures. If the cargo isn't secured properly sideways forces can cause many dangers to the driver, vehicle and also other road users.

Strong sideways forces can move cargo inside the CTU and break or loosen the lashing devices. Cargo changing its place during transport makes the truck unbalanced. Unbalanced truck is harder to operate, behaves inconsistently and causes unnecessary strain to the body and suspension.

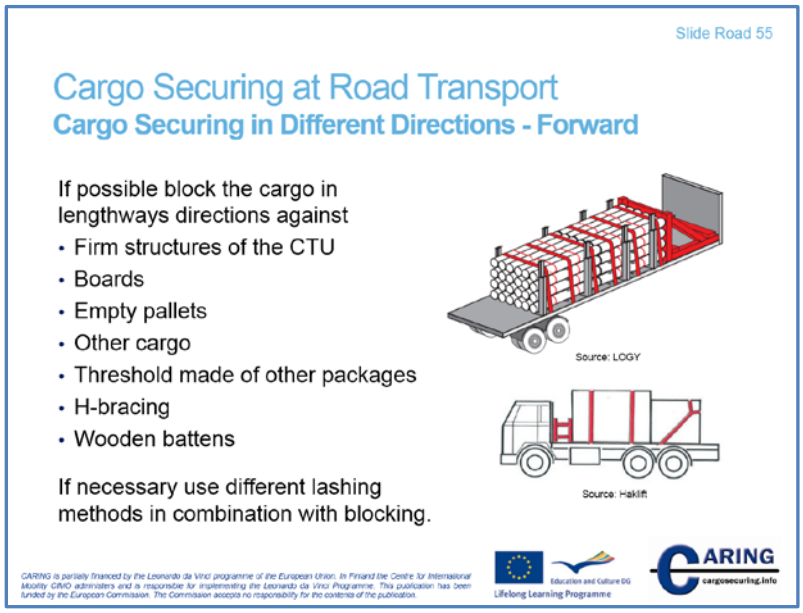
If the cargo has enough mass and speed it can break the side wall of the CTU. This causes a dangerous situation for all the road users. How the situation has to dealt with depends on the cargo. The situation is especially dangerous if cargo contains dangerous goods. In any case cargo exiting the CTU causes a serious situation.

Last option how loose cargo can affect the truck can be seen in the lower picture. If the SIDE WALL of the CTU can withstand the force caused by the moving cargo the force is directed to the truck body. At this point the centre of mass is not anymore in the centre of the platform, which makes the truck unstable and easier to tip over. The cargo can weight more that the truck itself, so it can create sideways force large enough to tip the truck over.

Truck can also tip over even if the cargo securing is done properly. If the centre of mass of a heavy cargo is high it can cause the truck to tip over if special attention is not made to the driving behavior in cornering.

Notes

[Slide Road 55]



Cargo Securing in Different Directions – Forward

Blocking is the primary and most efficient method of cargo securing in road transport. If blocking against 0,8 times the weight of the cargo isn't possible because of cargo or CTU characteristics or due to lack of available blocking devices, lashing has to be used. Different lashing methods have already been described earlier in this presentation.

Blocking can be arranged in forward direction in many different ways:

- Firm structures of the CTU: As described earlier, different superstructures have different blocking capabilities. How much of the weight of the cargo can be secured by blocking against the headboard or side / rear walls depends on the strength and type of the CTU and characteristics of the cargo. It is essential that cargo is in close contact to the blocking devices. All gaps should be eliminated. Boards, pallets and other cargo can be used to fill gaps.
- Boards: Boards can be utilized in many different ways. They can be e.g. used as corner protection, blocking device and thresholds and be placed between cargo units to fill gaps. Blocking can be achieved by nailing boards to the platform to block cargo forwards or sideways. Some CTUs have a possibility to use blocking bars that are connected between the sideboards. These blocking bars are usually used to block the cargo from moving backwards.
- Empty pallets: Goods pallets are very commonly used in logistics and they can be utilized in blocking. They can be used both in horizontal and vertical plane. A very common size of the pallet is 80 cm x 120 cm x 15 cm (width, length, height).
- Other Cargo: Other cargo is used very often as a blocking device. This is especially important in parcel transport. Parcel cargo can contain many different types of products and packages

that can't be lashed easily. When using other cargo as a blocking device special attention has to be paid in how the cargo is loaded in to the CTU.

- Threshold made of other packages: If cargo is in many layers threshold can be made with e.g. other cargo or h-bracing. Cargo should have sufficient strength if it is used as a threshold. If the threshold isn't high enough to prevent tipping other cargo securing methods should be added.
- H-bracing: H-bracing is usually created from timber. The strength of the timber depends on the weight of the cargo how the h-brace is going to be used. H-brace can be used at least as filler between cargo units and blocking device in longitudinal direction or threshold. H-brace doesn't need to be nailed to the platform if the brace is long enough to lie against CTU's structures.
- Wooden battens: Wooden battens are used more often in containers but they can be used in CTUs made for road transport. Wooden battens block cargo from moving in longitudinal direction. Blocking can be made to prevent sliding or sliding and tipping. Blocking against tipping is achieved when battens reach above the centre of gravity. If only battens are used to prevent sliding other means have to be used to prevent tipping like round turn lashing.

Notes

[Slide Road 56]

Cargo Securing in Different Directions - Forward

Examples of cargo securing forwards:

- Upper left: Threshold created with a panel
- Lower left: Threshold created with other cargo
- Upper right: Threshold created with H-bracing
- Lower right: Blocking with bars attached to sideboards

Notes

[Slide Road 57]

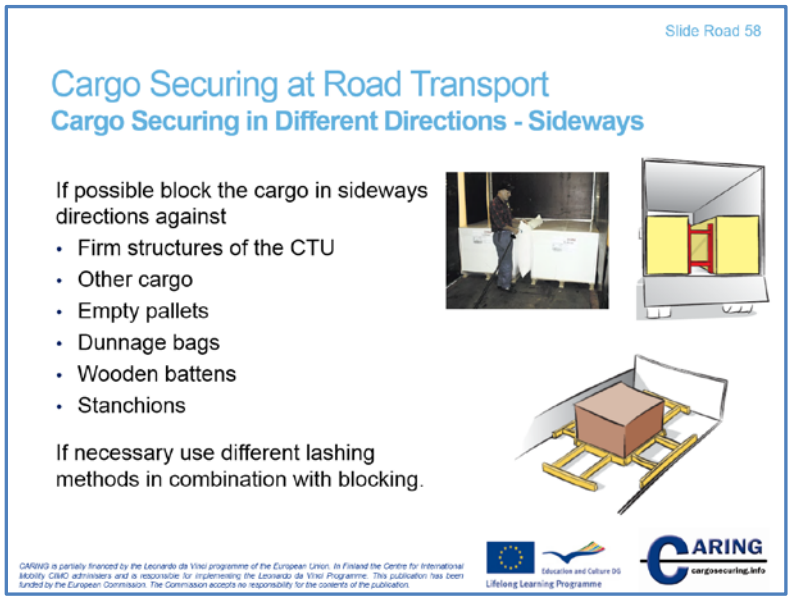
Cargo Securing in Different Directions - Forward

Examples of cargo securing forwards:

- Upper and lower left: Blocking with bars/stanchions
- Upper middle: Blocking against other products and CTU
- Upper right: Blocking against empty pallets and top-over lashing
- Lower middle/right: Direct lashing and blocking against CTU

Notes

[Slide Road 58]



Cargo Securing in Different Directions – Sideways

Same rules apply to cargo securing in sideways than forwards. Differences are in how sideboards/walls can be used as blocking devices and cargo has to be secured for half the weight of the cargo (0,6 times when risk of tipping).

- Dunnage bags: Dunnage bags are commonly used in containers but they can be used in other CTUs that have rigid side walls as well. Dunnage bags are air filled cushions that can be fitted between cargo units or cargo and CTU's structures. They are very efficient, but if they are inflated too much, they can damage the cargo or even CTU's sideboards/walls.
- Stanchions: Stanchions are metal poles attached to the CTU. For example on flat beds stanchions can be used to block cargo sideways. Stanchions can also be used in other superstructures to add versatility to sideways and also to forwards blocking methods.

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[Slide Road 59]

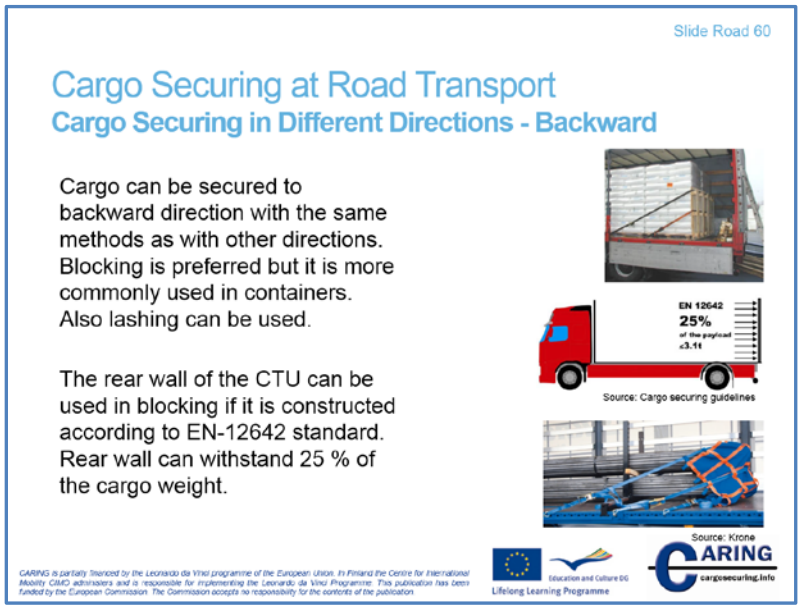
Cargo Securing in Different Directions – Sideways

Examples of cargo securing in sideways:

- Lower left: Blocking against other cargo and CTU
- Top left: Blocking against other cargo and CTU
- Top right: Blocking with empty pallets
- Lower middle: Blocking against other products and top-over lashing
- Lower right: Blocking against beams/stanchions

Notes

[Slide Road 60]



Cargo Securing in Different Directions – Backward

Same cargo securing methods can be used to secure cargo backwards as to other directions. Usually the rear wall of the CTU isn't as strong as the headboard or sideboards. Rear wall can secure 0,25 (L-code) or 0,3 (XL-code) times the weight of the cargo if the CTU is constructed according to EN-12642 standard.

Example pictures:

- Upper picture: Spring lashing using web lashings and goods pallets
- Middle picture: Strength of the rear wall in a L-code CTU
- Lower picture: Spring lashing using a lashing cover

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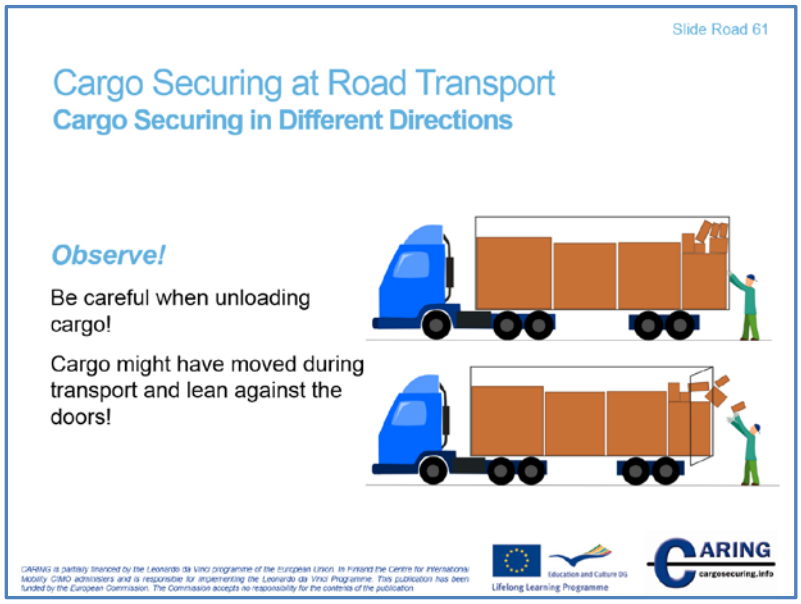
[Slide Road 61]

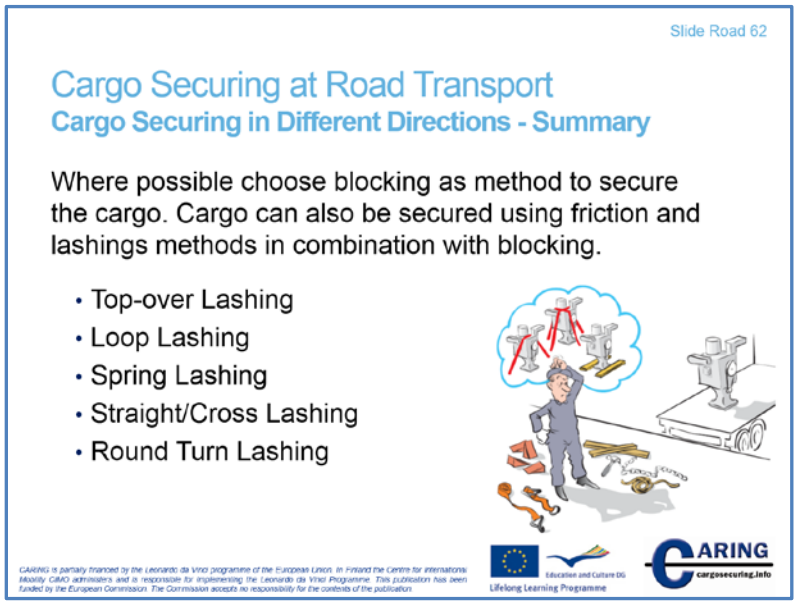


Cargo Securing in Different Directions – Observe

Be careful when opening the doors of a CTU. Cargo might have moved during transport and lean against the doors. Even a lightweight package can cause injuries when it falls from height of nearly 5 meters.

Notes

[Slide Road 62]

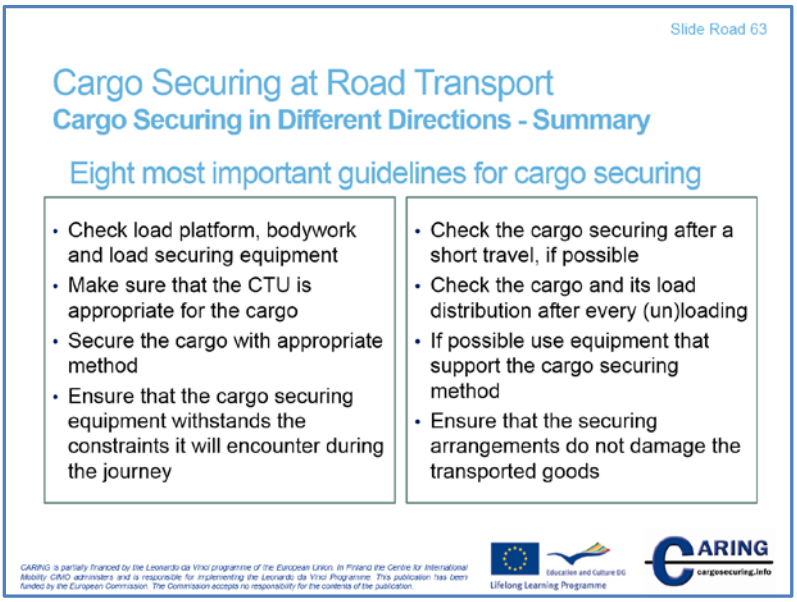


Cargo Securing in Different Directions – Summary

Always start with different blocking methods. If blocking can't be done to fulfill the law's demands use different lashing methods in combination with blocking.

Notes

[Slide Road 63]



Cargo Securing in Different Directions – Summary

By following these eight guidelines you can make sure that your cargo arrives safe and sound.

Notes

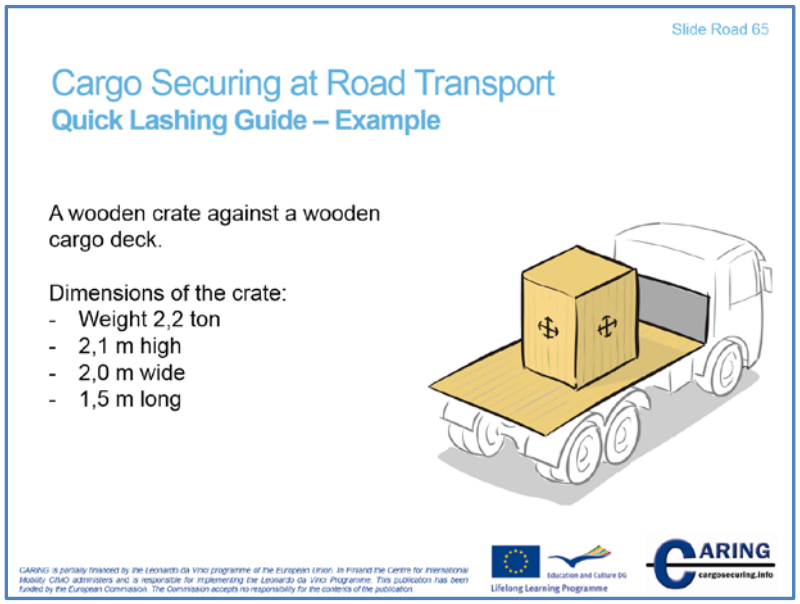
[Slide Road 64]

Quick Lashing Guide – User Instructions

The Quick Lashing Guide is a very easy guide to use. It is used to calculate how many lashing devices are needed to prevent cargo from sliding and tipping in three simple steps. First step is to calculate how many lashings prevent cargo from sliding, second step is to calculate how many lashings prevent cargo from tipping and third step is to apply lashings according to the highest number. In every transport (other than bulk) these three steps have to be made. In QLG all the tables are valid for lashings devices that have lashing capacity of 1600 daN and tension force of 400 daN.

Notes

[Slide Road 65]



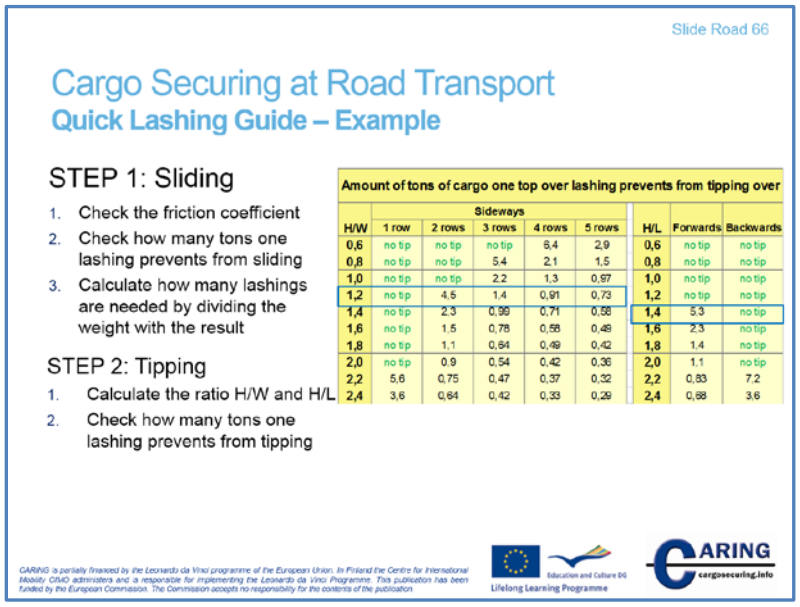
Quick Lashings Guide – Example

This is a simple example of how QLG can be used in cargo securing. In this example a wooden crate is transported on wooden cargo deck and top-over lashing is used. The dimensions of the crate are:

- Weight: 2,2 tons
- 2,1 m high
- 2,0 m wide
- 1,5 m long

Notes

[Slide Road 66]



Quick Lashing Guide - Example

This slide is an animation showing how QLG is used in practice.

Notes

[Slide Road 66]

Securing Bulk Cargo

In transporting bulk cargo it is very important to choose correct CTU and also cargo securing equipment before arriving to the pickup site.

Loose bulk loads, e.g. sand, gravel, wood chips, etc are usually carried in open bodied vehicles. Because of the characteristics of the transported material small quantities of material can fall through gaps in the bodywork or be lifted by air turbulences from the top of the load compartment. The load compartment should be kept in good condition to minimize the risk of leakage. Special attention should be given to drop sides and tailboards where damage or deformation can easily lead to loss of part of the load through small gaps. In general the CTU should be in very good condition to prevent any leakage.

The body sides should be of sufficient height not only to contain the cargo when it is loaded but also to reduce the risk of parts of the load from falling or being blown over the edge. The load compartment should be covered if there is a risk of part of the load falling or being blown from the top of the vehicle. The type of cover used will depend on the characteristics of the load being carried. Materials such as dry sand or ash are particularly susceptible to being blown off and should always be covered by a suitable sheet. Covering with a net can sometimes adequately retain loads that consist of large items, such as scrap metal and building waste. If a net is used the mesh size should be smaller than the smallest items being carried and the net should be strong enough to prevent any carried article from escaping.

Liquid loads or loads which behave in the same way as liquids (grain or flour for example which are also frequently carried within tanks) should be transported in full tanks. If tanks or similar transportation units are partly filled, the load will start moving if the vehicle accelerates, decelerates

or turns through a corner. This will change the Centre of Gravity (CoG) of the load and the whole vehicle launch a swinging process of the load. The movement of the load affects the drivability of the vehicle and in worst cases may lead to an incident such as vehicle rollover. Where possible, tanks shall be nearly completely filled with liquid or empty to avoid the effects mentioned above. The use of tanks equipped with baffles can be used to avoid load movements encountered with partly filled tanks.

Notes

[Slide Road 68]

Securing Vehicles

Heavy vehicles

Vehicles should only be carried on vehicles or trailers suitable for that purpose. This will include having appropriate lashing points in terms of number, position and strength. The following points should also be addressed:

- The vehicle or trailer should be carried with the parking brake engaged;
- Steering wheel lock must be active and preferably with the wheels chocked;
- Where applicable the transmission should be engaged in lowest possible gear;
- If possible the chocks should be securely attached to the carrying vehicle's deck.

The vehicle being carried should be positioned so that its weight is fully supported by the carrying vehicle. The restraint provided by the friction between the tyres and the deck with the parking brake on will not be sufficient to prevent movement. The vehicle being carried should be lashed to the carrying vehicle using appropriate lashing equipment. A tensioning device should be used in each lashing and they should be tested for adequate tension after the vehicle has travelled a few miles and again at intervals during the journey and be re-tensioned if necessary.

Lashing should be attached onto parts of the vehicle's axles or chassis that are adequate for the purpose. Care should be taken to avoid straining or damaging components such as brake pipes, hoses, electrical cables etc., through lashing over or near them.

The carriage of loaded vehicles is not recommended but if this is necessary then extra attention should be paid to the resultant higher centre of gravity of the carried vehicle and the possible resulting loss of stability when cornering or braking. It may also be necessary to put extra lashings

onto the chassis of the vehicle or trailer being carried to pull it down on its springs and hence help to avoid an unstable load.

Passenger cars and vans

These vehicles should preferably be secured by using a combination of both lashing and blocking. How many lashings and blocking devices have to be used depends on the incline of the platform and vehicle weight. If the incline of the platform is more than 10 degrees to the front, blocking must be used in front of foremost wheels and behind rear wheels. All the wheels have to be lashed.

If the incline is less than 10 degrees, blocking has to be used in front of foremost wheels and behind any two wheels. Lashing has to be used on foremost wheels except if rear wheels are blocked then all wheels have to be lashed. If the weight of the vehicle is more than 3500 daN all wheels have to be lashed and blocked from both sides.

If the incline is more than 10 degrees rearwards blocking must be used in front and behind the foremost wheels. Lashing is added to the blocked wheels.

Blocking against movement across the transporting vehicle must be done through well fixed flanges, blocks, bars or similar devices resting firmly against the wheel sides of the transported vehicle up to a height of at least 5 cm. If the transporting vehicle is specially built for transport of cars, trailers, and if the cargo platform is fitted with grooves, limited by flanges being at least 5 cm high and permitting maximum 30 cm free movement across the transport vehicle, the requirements in respect of blocking of the movement across the transporting vehicle are regarded as having been met.

Blocks or wedges used for preventing longitudinal movement should preferably be positioned against the transported vehicle's tyre. The block wedges should preferably have a height corresponding to one third of the radius of the wheel being blocked and should be rigidly fixed to prevent movement along the bed of the transporting vehicle.

Wherever possible the lashing should be positioned in such a way that the vehicle is pulled directly towards the platform floor (the lashing will be as close as possible to forming a right angle with the carrying vehicle floor). The total lashing for one pair of wheels should be strong enough to resist a force of 2 x mass of the vehicle directed upwards. As an alternative to applying the lashing to the wheel, the lashings may be attached to axle beam(s). If the lashing can be positioned so that it cannot slide along the axle beam and has sufficient strength, it is acceptable to use one lashing per axle.

Notes

[Slide Road 69]

Securing Sawn Timber

Sawn timber is usually transported in standard packages. Be aware that any plastic covering the timber will lower the coefficient of friction and more lashings may be required. These packages are generally strapped or wired at each end and before loading the straps should be checked for safety. If the straps are damaged or loose extra care must be taken to ensure that the complete load is adequately secured to the vehicle. Standardized packages of this kind should preferably be stowed on flat platforms equipped with either centre stanchions or sideboards and secured by blocking or top-over web lashings.

Sawn timber is also transported in various other package sizes. When cargo units are not homogenous special care has to be taken in blocking and lashing all the cargo units. In box type CTUs preparations for the lashing has to be made before loading because cargo units block the way to the securing points.

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[Slide Road 70]

Securing Concrete Elements

Securing methods of concrete blocks depend on the used CTU and the concrete block characteristics. Concrete block are very often transported on trailers that don't have any head board, which makes blocking in longitudinal direction very difficult. In some cases also blocking is possible as the lower picture illustrates.

Chains are most commonly used in securing concrete elements because of their strength compared to the weight of the cargo. In forward direction blocking should be the primary securing method if the CTU has a front wall. If blocking isn't possible spring lashing is very often used. The amount of lashings depends on the lashing capacity of the chain and the weight of the cargo. Sideways and backwards movement can be eliminated with a top-over lashing in the rear end of the cargo. In addition to top-over lashing blocking can be used to prevent sideways movement. Direct lashing is also used if lifting anchors or other suitable attachment points are available in the concrete blocks.

Special CTUs are manufactured for transport of certain concrete elements, e.g. wall elements. In these CTUs special blocking devices are used to block the movement of cargo and also to keep it in certain position. Some wall elements are so wide that they have to be transported in an upward direction and the trailer has to have a very low platform height.

If web lashings are used in lashing of lighter concrete elements, corner protection has to be used to prevent damage to the lashings. Concretes hard surface can easily damage and cut a web lashing. Also with chains corner protection has to be used if the concrete element's surface is fragile.

Notes