

Workplace Safety and Health Guidelines

Safe Loading and Unloading on Vehicles



WSHCOUNCIL

Tripartite Alliance for
Workplace Safety and Health

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Preface

Goods and cargo should always be safely loaded on and unloaded from vehicles. Unsafe loading and failure to secure loads properly can lead to accidents and endanger other road users during transportation. Drivers and others can be injured, and vehicles and goods being transported can be damaged. It is therefore important that loading and unloading operations are carried out safely and goods are secured properly for transportation.

To raise safety awareness and capabilities in the Logistics and Transport (L&T) industry in Singapore, the Workplace Safety and Health (WSH) Guidelines for Safe Loading and Unloading on Vehicles was developed in 2010 and subsequently updated in 2017. The guidelines provide guidance on safe work practices for loading and unloading activities, and cargo securing. It also provides practical information for transport operators, drivers and workers involved in the transport of cargo.

With the L&T industry transforming in current times to build long-term resilience, it is also imperative to re-examine the safety and health landscape and ensure that workplaces continue to remain safe for every worker. An industry working group was hence convened in 2021 to review the WSH Guidelines for Safe Loading and Unloading on Vehicles with the guidance of the WSH Council (Logistics and Transport) Committee to ensure its relevance.

1. Introduction

1.1 Scope

This set of revised guidelines shares good industry WSH practices that are current in the L&T industry. It covers the principles of cargo transportation, cargo arrangement, and methods for cargo securing on different vehicles. The guidelines also introduce and recommend the delivery plan to be implemented for safer cargo delivery.

1.2 Roles and responsibilities

The L&T industry comprises various stakeholders and each holds a different set of safety and health responsibilities. Some stakeholders may take on more than one role at any point in time. It is important that the different individuals understand their roles and associated responsibilities for their work in the workplace.

Employers should:

- Provide vehicles and equipment suitable for the type of cargo handled by the company.
- Establish a schedule for equipment and vehicle maintenance and repair according to the manufacturer's specifications and ensure its adherence.
- Ensure workers are trained and competent for their job.
- Implement a safety and health management system to manage WSH.
- Investigate and address reported safety lapses.

Managers and supervisors should:

- Ensure staff are adequately instructed for their tasks including the safe use and operation of equipment and vehicles.
- Ensure that vehicles and equipment are maintained regularly, and timely repairs are done where needed.
- Ensure risk assessments are carried out for all operations.
- Conduct safety and health briefings before starting work/every shift.
- Plan (delivery) routes in advance taking into consideration the different restrictions for commercial vehicles especially oversized vehicles.
- Implement measures to address reported safety lapses.

Drivers and loading crew should:

- Check vehicles and equipment before use.
- Adhere to safe work procedures (SWP) including measures to prevent vehicular movement during loading and unloading.
- Load and arrange cargo in a safe and stable manner before securing.
- Secure cargo to prevent movement in any direction during transporting.
- Report issues, unsafe conditions/acts, near-misses and incidents to immediate supervisor.
- Inspect the cargo's dimension before and after loading to ensure that it is safe to be transported on the approved travel route.

- Wear appropriate personal protective equipment (PPE), e.g. safety helmet, safety shoes, gloves, reflective vest, long working pants etc.

The responsibilities above are also applicable to manufacturers and suppliers who provide delivery services for their customers. Companies that outsource delivery services to contractors/transport operators are responsible for ensuring their contractors know how to handle the cargo safely.

Manufacturers and suppliers should:

- Package products for safe and easy loading, securing and unloading.
- Provide instructions on safe loading and unloading, and proper securement.

1.3 Basic principles of transporting

Any cargo being transported should remain safely on or within the vehicle. The cargo should not endanger the driver, passenger(s) on the vehicle or any other road users. See Figure 1 for examples of incidents that could result from poorly secured cargo.

An incident can result in:

- loss of life and/or bodily injury;
- loss of or damage to cargo;
- damage to vehicle; and
- damage to public property.



Figure 1: Incidents due to poor cargo securement.

During transportation, cargo is subjected to forces which causes it to shift. Friction and the weight of the cargo are insufficient to keep it from moving about during transportation (see Figures 2 and 3). Hence the cargo must be adequately contained or restrained to prevent it from shifting or falling off.

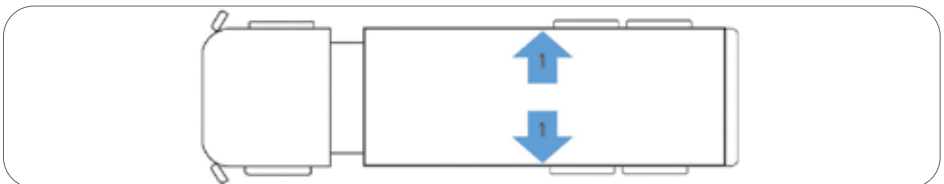


Figure 2: Top view of vehicle with lateral forces illustrated

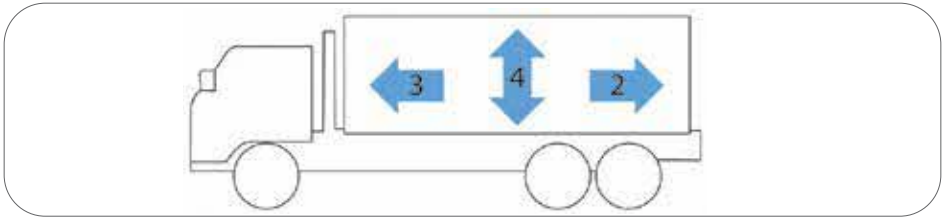


Figure 3: Side view of vehicle with forward, backward, and vertical forces illustrated.

These forces cause unsecured cargo to shift during transportation when:

1. the vehicle is turning, as the change in direction causes unsecured cargo to shift sideways.
2. the vehicle accelerates, as the increase in speed causes unsecured cargo to shift backward.
3. the vehicle decelerates or brakes, as the decrease in speed causes unsecured cargo to shift forward.
4. Driving on uneven ground as the bumpy drive causes unsecured cargo to bounce.

1.4 Transport packaging

Cargo packaging serves several functions; provides weather and damage protection, supports cargo during loading and unloading, and facilitates cargo securing. There are generally three types of packaging — primary, secondary and tertiary.

Primary packaging holds information about the product and bears the product brand, e.g. an aluminium can is the primary package that contains the beverage that is the product.

Secondary packaging allows consumers to conveniently handle multiple units of the product, e.g. a carton box that holds a dozen cans of beverage.

Tertiary packaging is also known as **transport packaging**. The objective is to bind cargo into larger, stable units to allow loading, unloading and securing to be more effective and efficient. It also serves to make handling and securing cargo safer and easier. See Table 1 and Figure 4 for examples of tertiary packaging.

Tertiary Packaging	Examples
Box	Wooden crate, plastic box, cardboard carton
Strap	Plastic strap, steel strap
Pallet	Wooden pallet, plastic pallet
Film	Stretch film, shrink film
Sheet	Anti-slip sheet, corrugated board, hardboard
Dunnage	Air bag, wooden blocks, folded cardboard, foam

Table 1: Examples of common tertiary packaging.



Figure 4: Boxed cargo wrapped in film and stacked on pallets.

2. Loading and Unloading

An appropriate vehicle should be used for loading and unloading. Vehicles should not be overloaded or have their weight limits exceeded. Always ensure that:

- The loading surface is clean and free from debris;
- All vehicular equipment are in good working condition;
- The engine of the vehicle is turned off prior to loading or unloading;
- The handbrake is fully applied during the operation; and
- The ground is flat and firm. If drivers need to park their vehicles on a slope, they should assess if it is safe to do so, and engage the appropriate gear where necessary.

Some tips for safe loading and unloading:

Loading:

- Do not overload the vehicle
- Make sure all equipment used are in good working condition
- Stack lighter loads on top of heavier loads
- Spread the loads out evenly for balanced weight distribution
- Secure and lash loads properly
- Ensure stacking arrangement is stable
- Do not stand in cargo holding or transport area when cargo is being loaded or adjusted
- Use cargo nets if required

Unloading:

- Make sure loads have not shifted during transportation before unloading
- Ensure all equipment used for unloading are in good working condition
- Keep secondary load restraints (such as stanchions) in position during unloading
- Keep loads under control at all times and do not allow them to roll off the vehicle
- Do not tie loads to an object to drag it off/down the vehicle by moving the vehicle

Safe Refuge

Where feasible, drivers and operators should stay at a safe location on ground away from the vehicle (instead of inside the cabin) while waiting for loading or unloading to complete.

2.1 Cargo arrangement

The way the cargo is arranged during loading will affect the stability of both the cargo and vehicle. When the cargo is unstable, it will be harder to secure and more likely to fall off the vehicle during transportation. See Figure 5 for examples of poor cargo arrangement. Bigger and heavier items loaded in an unstable manner can even cause the vehicle to overturn or topple. Figure 6 shows the general positioning of cargo on the vehicle that will confer greater stability.

Some good practices for cargo arrangement:

- When stacking, cargo should be able to remain stable without relying on lashing.
- Stacks should not be higher than the vehicle's headboard and stanchions where possible.
- Heavier cargo should generally be loaded under lighter cargo to lower the overall centre of gravity, and at the centre of the vehicle for better balance (see Figure 6).
- Cargo at the lower tier should be structurally strong enough to support the cargo stacked on top of it.
- Distribute cargo weight uniformly across the loading platform.
- Cargo should be loaded against the vehicle's headboard. Any space between the cargo and the headboard can cause the cargo to move or shift.
- Fill empty spaces with dunnage where necessary.

When making multiple stops during a delivery, cargo that has to be unloaded earlier should be easily accessible. Empty spaces on the loading platform meant for picking up additional cargo during the trip should not compromise cargo securement.



Figure 5: Examples of poor cargo arrangement. From left to right: unstable stacking, unbalanced weight distribution, cargo stacked higher than headboard.

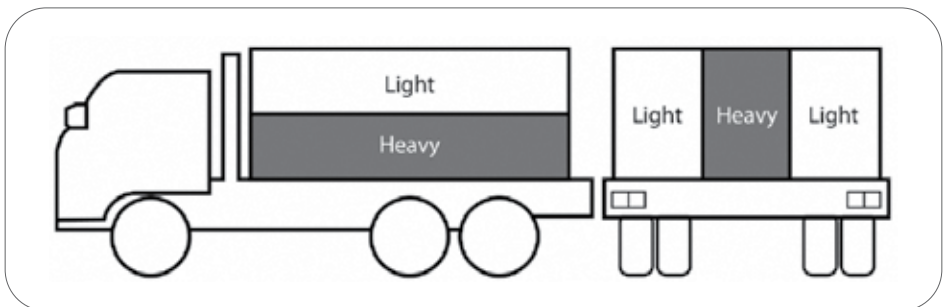


Figure 6: Cargo positioning for greater stability.

2.2 Common hazards

Logistic operations are typically labour intensive, and workers frequently work around heavy machines and vehicles. Workers are therefore exposed to a variety of hazards daily that can result in bodily harm and injuries. The following sections list some of these common hazards.

Slips, trips and falls

Slips, trips and falls can happen to any worker in the workplace. They can cause minor injuries like sprains to more serious ones like head injuries and even deaths in more serious cases.

Some hazards associated with slips, trips and falls include:

- Slippery floor, e.g. wet or oily floors due to spills
- Inadequate footwear such as worn-out shoes
- Open sides, e.g. falling off loading platform while working near the edge
- Poor workplace housekeeping, e.g. tripping over a pile of lashing belts lying haphazardly on the floor

Examples of risk control measures:

- Implement a housekeeping system to keep the work environment clean and tidy
- Apply anti-slip coats on floors to improve traction, especially at areas with high foot-traffic
- Track and document near-miss incidents and work-related injuries to identify unsafe work areas and conditions
- Ensure workers put on appropriate (safety) footwear
- Secure and lock all sideboards and tailboard when there is no work (such as loading and unloading activities) in progress
- Implement a fall prevention plan for all loading and unloading operations

Ergonomic risk factors

Work involving repetitive actions, handling heavy loads, and over-exertion can lead to the development of work-related musculoskeletal disorders (WRMSD). Some common symptoms include persistent pains, aches, discomfort, numbness, and tingling sensations in joints and muscles.

Possible WRMSDs and their causes include:

- Lower back sprains from over-exertion, e.g. sudden overloads
- Back pain from using the wrong lifting technique
- Neck and shoulder pain from driving long hours without taking a break to stretch

Examples of risk control measures:

- Raise awareness on ergonomic risk factors at work and measures to overcome them
- Schedule adequate rest breaks during work shifts
- Use mechanical aids, e.g. trolleys, to move heavy loads
- Do simple stretching exercises when tired

Impact hazards

Bodily injuries sustained from impacts can range from minor bruises to more serious fractures. Workers may get struck by moving objects such as moving or reversing vehicles. They may also get hit by heavy goods that fall onto their hands, feet or head when unloading cargo.

Some possible incidents where workers are at risk from impact hazards:

- Struck by swinging cargo during lifting due to improper rigging methods
- Struck by falling cargo due to unstable stacking or inadequate securement
- Struck by falling cargo when opening the doors of container
- Struck by moving machine due to equipment failure
- Knocked by vehicle or machine because driver or operator was distracted

Examples of risk control measures:

- Establish SWP for work activities, e.g. stacking, rigging, lifting, securing, and ensure workers adhere to them. For instance, the SWP for handling heavy cargo with toppling risks should consider the safe unpacking method, safe work positions and mechanical equipment to be used where appropriate.
- Implement a traffic management system at the workplace.
- Maintain equipment according to manufacturer's recommendations.
- Use appropriate PPE such as safety shoes and helmet.
- Place wheel chocks against vehicle's wheels to prevent accidental movement during loading and unloading operations.
- Stay clear of vehicle's blind spots when the vehicle is moving during loading and unloading operations.
- Open the door of the container and move in the direction of the door opening. All other people are to stay clear of the opening door. Open one door at a time with caution and check for any possible falling cargo.

Driveaway hazards

Vehicles may move prematurely during the loading or unloading operation. Such driveaway situations can lead to serious accidents resulting in injuries and even fatalities.

A safe system of work should be put in place so that drivers would not move their vehicles (accidentally or deliberately) until the load is secure and safe to drive off. Safe systems of work can include proprietary vehicle restraint systems, interlock systems and supervisory controls.

Hazards associated with dock levellers

Dock levellers are devices used to bridge the gap between the loading dock and the lorry or trailer bed to facilitate loading and unloading of goods (see Figure 7).

Some possible hazards associated with dock levellers:

- Trapping of lower limbs or feet between the descending platform and loading dock
- Trips or falls from the platform or loading dock
- Caught under the dock leveller



Figure 7: Dock leveller (integrated to loading dock).

Examples of risk control measures:

- Return a dock leveller integrated to the loading dock to its horizontal position when it is not in use, or as soon as the loading or unloading operation is completed.
- Place toe guards or fencing at the sides of the leveller to prevent feet from being caught under the platform as it descends.
- Provide a mechanism that prevents the platform from falling in the event of a vehicle driveaway.
- Enable the dock leveller to be mechanically locked in a raised position when maintenance or repair work is necessary.

Hazards associated with tail gates

Tail gates are lifting platforms fitted to a vehicle (see Figure 8). Some common hazards when using tail gates are:

- Falling from the platform, e.g. while moving loads from the vehicle onto the tail gate;

- Struck by loads falling from the platform, e.g. wheeled delivery cages;
- Feet or toes trapped between the moving platform and the ground or stationary parts of the vehicle;
- Fingers or parts of the body trapped in moving mechanisms; and
- Workers trapped under the platform.



Figure 8: A vehicle's tail gate.

Examples of risk control measures:

- The safe working load of the tail gate should never be exceeded
- Ensure the tail gate is properly inspected and maintained by a competent person according to manufacturer's recommendations
- Check that the tail gate is stowed securely before driving off the vehicle
- The vehicle should never be driven off with a loaded tail gate platform

Other common hazards include pinch point hazards (see Figure 9) which can result in hand and finger injuries, and poorly maintained trailer bed platforms (see Figure 10) which can cause workers to lose their footing.



Figure 9: Example of a pinch point hazard.

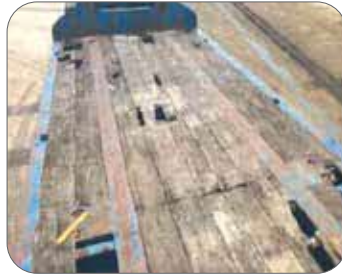


Figure 10: A poorly maintained trailer bed platform.

3. Equipment

3.1 Vehicle

General requirement

The vehicle chassis must be sturdy to support the weight of the cargo and withstand the directional forces (sideward, forward and backward) exerted by the cargo during transportation. The chassis must also be durable enough to withstand the frequency and intensity of use. Transport operators should therefore anticipate the maximum expected load and choose the most suitable vehicle for the job.

The loading platform should be kept clean and free from grease and debris. Dirt could reduce friction between the cargo and the loading platform, while debris could fall off the vehicle and strike other vehicles and road users.

Trailers used must be fit for transportation on public roads and fulfil the relevant the Land Transport Authority's (LTA) requirements, e.g. functioning tail lights, tyres and mud guards.

Vehicle dimension

The loading platform should be long and wide enough to fully contain the cargo. Any length of cargo sticking out of vehicle, i.e. overhang, should be minimised. Overhang that is more than 300mm protruding from rear of vehicle should have a clean red flag of 300mm square tied to it as a visual warning for other road users (see Figure 11). Drivers should ensure that the red flag is clearly visible to other road users.



Figure 11: Red flag tied to overhang.

A permit from LTA is needed if the vehicle width exceeds 3 metres (or 2.6m on controlled roads¹), or if the overhang is greater than or equal to 40% of the vehicle length or 1.8m, whichever is lesser. Police escorts will be required if the width exceeds 3.4m, or if the height exceeds 4.5m.

Maximum laden weight

The maximum expected weight of cargo needs to be known before loading. The combined weight of the vehicle and cargo, i.e. total laden weight, should not exceed limits of roads or structures where the vehicle will be driving on or parking at. Police escorts will be required if the total laden weight is 80,000kg or more. See Table 2 for the vehicular limits for roadworthiness and associated requirements.

¹Refer to LTA's website at www.lta.gov.sg for the list of controlled roads.

Requirement	Limits
LTA permit	• Vehicle width > 3 m (or 2.6 m on controlled roads) • Overhang $\geq$ 40% vehicle length or 1.8 m (whichever is lesser)
Police escort	• Vehicle width > 3.4 m • Vehicle height > 4.5 m • Total laden weight $\geq$ 80,000 kg

Table 2: Vehicular limits for roadworthiness and associated requirements.

3.2 Fittings

Vehicles may come with pre-installed fittings (or retrofits) on the chassis to aid the securing of cargo. The design, strength and integrity of these fittings should withstand the routine operations of loading, unloading and transportation. See common fittings and their functions below.

Headboard/cabin guard/front bulkhead



Figure 12: Cabin guards.

A cabin guard, commonly referred to as a headboard, is installed behind the driver's cabin to serve as a physical barrier between cabin and cargo. It should be at least as wide as and taller than the driver's cabin (see Figure 12). Ideally, cargo should not be stacked taller than the headboard.

Headboards with gaps cannot adequately restrain narrow or small items, e.g. pipes, as individual pieces can fit through the gaps. A wire mesh can be used to cover the gaps without hindering the driver's view in the rear-view mirror.

Vehicles with loading compartments within the vehicle chassis, e.g. vans, will need a front bulkhead to separate the driver cabin from the cargo compartment (see Figure 13). Front bulkheads are internal partitions that serve the same function as headboards. It is a physical barrier that protects the driver by preventing cargo from shifting forward.



Figure 13: Front bulkhead.

Sideboard and tailboard

Sideboards and tailboards frame the loading platform and form part of the load restraining system (see Figure 14). All tailboards and some sideboards come with a locking mechanism. When unlocked, they swivel open to facilitate loading and unloading.

When locked in place, the boards provide some restraint for light cargo. It is not advisable to rely on them solely for larger or heavier goods, as the locks are not designed to withstand high stress and can fail easily. Other restraining methods should be used to hold the loaded cargo in place.

Recommendations:

1. Drivers must always ensure that the locking pin is secured before they move off even when it is for a short distance trip.
2. Drivers must wear proper PPE such as gloves.
3. Drivers must ensure sideboards and tailboards are properly maintained at all times.
4. Supervisors are advised to do periodic checks on the boards and locking mechanisms.
5. Sideboards and tailboards should not be allowed to free fall after being unlocked. Where practicable, both hands should be on the board to lower it.
6. Driver should ensure that the securing pins and fixtures are in good working condition and adopt two-man operations in the opening and closing of larger and heavier sideboards and tailboards, if required.



Figure 14: Sideboard and tailboard of trucks.

Anchorage point

Lashing devices are secured to anchorage points to restrain cargo. Anchorage points should be integrated into the main chassis to ensure adequate strength in withstanding the expected loading (see Figure 15). Operators should consult manufacturers if they wish to retrofit additional anchorage points, as drilling holes or welding attachments will weaken the integrity of the vehicle frame and reduce the load capacity of existing anchorage points.

Vehicles need more designated anchorage points to avoid attaching multiple lashing devices to a single anchorage point as this would put that anchorage point under greater stress. When this happens, the anchorage point is more likely to fail, and the attached lashing devices can come loose.

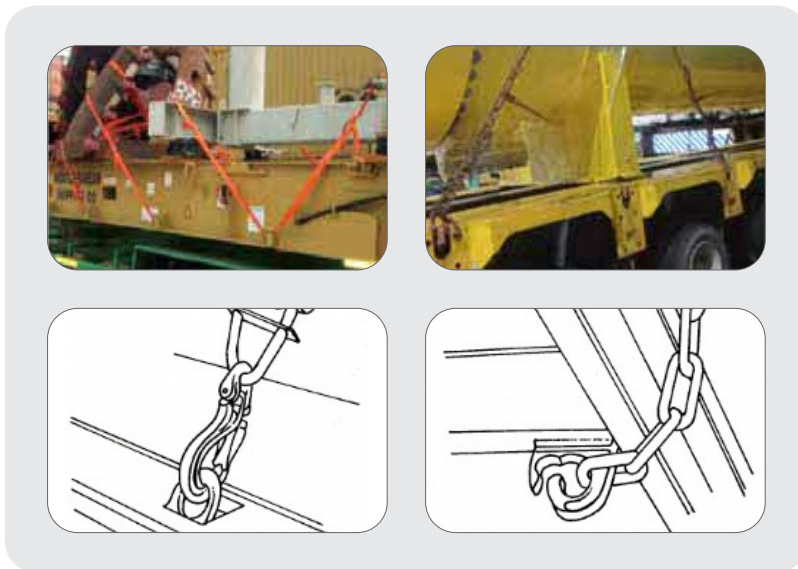


Figure 15: Photos of sample anchorage point and illustrated images.

Note: It is important not to mistake rope hooks for anchorage points (see Figure 16). Rope hooks vary in material and strength and can deform or give way easily when subjected to high stress. To avoid such mistakes, workers should be trained to use correct lashing points. Visual cues, e.g. labels or bright paint, can help make anchorage points easier to identify.



Figure 16: Rope hooks on a lorry.

Stanchion

Stanchions are upright metal beams welded or mounted on both sides of the vehicle or trailer chassis to provide lateral blocking, usually for cargo that will roll (see Figure 17). It should be strong enough to block the cargo should lashing devices fail.

There should be at least two stanchions on each side if the cargo is lengthy, e.g. 12m long pipes. Additional stanchions should be added when required. Longer trailers should have more stanchions. When stacking goods, the total stacked height should not exceed the height of stanchions.

Curtain-side

Curtain-side vehicles are installed with two PVC tarpaulin sheets, i.e. curtains, that cover the entire length of loading platform on the left and right (see Figure 18). The curtains provide weather protection and can also be strapped down to contain the cargo. The curtains are not designed for restraining, hence goods would still need proper restraint as though they are loaded on an open platform.

During transportation, the curtains may swell if the cargo shifts sideward. Workers should not untie the curtains when there is obvious swelling as the cargo may have toppled onto them. They should access from the back or opposite side if safe to do so.



Figure 17: Stanchion bars on a trailer bed.

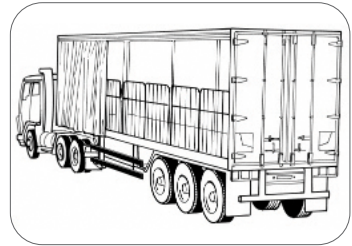


Figure 18: Vehicle fitted with curtain-sides.

3.3 Securing equipment

Cargo must be secured tightly to the deck of vehicles to prevent or minimise shifting during transit. Operators should equip themselves with the correct securing equipment for the type and composition of cargo transported. Additionally, the safe working load (SWL) of all securing equipment should always be clearly indicated.

Regular inspection should be carried out according to the equipment manufacturer's suggested frequency. Rope and webbing should be checked for frays and cuts, and metal devices and components checked for rust or deformation. Any damaged or defective equipment should not be used and be replaced immediately.



Figure 19: Examples of protection on lashing devices.

To protect cargo and lashing devices, e.g. rope, webbing, chains, from damage, it is recommended to place padding between lashing and sharp corners of cargo (see Figure 19). Any appropriate material, e.g. cardboard, rubber, plastic, can be used. Workers should also secure excess lengths of lashing, as these will dangle off the vehicle and pose a danger to other road users.

Load binders

A load binder is a tensioning device used with metal chains. The two known types are lever load binders and ratchet load binders (see Figure 20). Ratchet binders have two hooks threaded into a handle. The hooks can be gradually extended or retracted with a ratchet mechanism to adjust the reach of hooks and create tension. Lever binders have two hooks attached to two points along a lever. Tension is created by manually pulling the lever into a locked position.

Lever load binders are easier to install but the reach of hooks is not adjustable. As tension is stored in the lever handle, caution must be exercised when tightening and releasing the handle. The handle will recoil readily due to stored tension and may cause injury.

Ratchet binders are a safer option as less tension is stored in the handle. The ratchet mechanism provides better control in releasing tension slowly.



Figure 20: **Lever load binder (left) and ratchet load binder (right).**

Turnbuckles

A turnbuckle is a tensioning device. It is made up of two eye bolts or hook bolts threaded in opposite directions into each end of a metal frame (see Figure 21). The tension can be adjusted by rotating the frame, which extends or retracts both bolts simultaneously, without needing to twist individual bolts.

Turnbuckles come in various grades and load capacities as they are commonly used in various applications, aside from securing loads. Hence, it is important for operators to use turnbuckles that are rated for the cargo they are securing.



Figure 21: **Turnbuckles.**

Chains

Chains can be used for lashing goods and are secured with a load binder or turnbuckle (see Figure 22). They vary in thickness or grades which determine the SWL. Chains should be in good working condition and fit for use.



Figure 22: Steel chains with a grab hook attached on one end.

Edge protectors should be used to avoid deforming the chains and damaging cargo. Replace chains that are deformed or have broken links. Avoid trying to repair damaged links or connecting two short chains to make a longer chain, as the integrity and strength cannot be determined.

Lashing belts and ropes

A lashing belt is typically made of plastic fibre (see Figure 23). Check and tighten the lashing, when necessary, before each trip for long-distance or multiple-stop trips because the vibration generated from the engine and transportation can loosen the lashings. Regular inspections should be carried out to spot wear and tear that will reduce load capacity. Edge protectors are recommended to protect webbing from abrasion.

Ropes are made of either natural fibre, plastic fibre, or metal wires with treated ends, e.g. plastic coat, melting, splicing etc., to prevent fraying or unravelling. It is important to select the appropriate material and thickness for the type of cargo to be lashed (see Figure 23).

Do not allow workers to tie two ropes together to create a longer rope (see Figure 24) as the knot is a weak joint and can come apart easily in transit.



Figure 23: Lashing belts and polyester rope.



Figure 24: Bad practice of tying two lashing belts.

Nets

Nets can be made of webbing, rope or steel wires (see Figure 25). They are used to divide a space into compartments or cover open vehicles if cargo does not need weather protection. They are also fitted with tensioning devices and clamps along corners and edges.

Common signs of wear and tear include fraying and cuts on webbing, and stitches that are unravelling. Damaged webbing should not be used, as the damaged section may give way during transportation.



Figure 25: Tying down cargo on truck bed with load securing net.

Sheets

There are two types of sheets: tarpaulin and purpose-made. Tarpaulin sheets only provide weather protection and should not be considered as part of the restraint system. The sheet should be adequately tied down to prevent flapping during transportation (see Figure 26).

Purpose-made sheets come fitted with lashing straps along the sides to allow them to be tied to the vehicle chassis. These sheets have been designed and tested with a rated load capacity, thus making it suitable for restraining. The entire sheet should be adequately tensioned to avoid loose flaps, which can cause danger to other road users.



Figure 26: Cargo covered with sheets for weather protection.

ISO freight containers

Trailers manufactured for carrying ISO freight containers are fitted with twistlocks for gripping and securing the containers at each corner (see Figures 27 and 32). As twistlocks are susceptible to frequent knocks and abrasion, they should be frequently inspected for damages. All twistlocks should also be locked immediately after the container has been loaded on the trailer. They should be fully unlocked before allowing the lifting and offloading of the container from the trailer.



Figure 27: Trailer fitted with ISO container.

Cargo loaded inside containers should be arranged in a stable manner and restrained (with lashing, blocking, nets, etc.) so that movement within the container is restricted. Dunnage is often used to fill up empty spaces to minimise shifting during transportation.

4. Securing Cargo

Cargo comes in different types and sizes. Table 3 shows some of the categories and examples of the different types of cargo that are discussed in this guideline.

Category	Examples	
General freight Standard cargo type commonly encountered in logistics.	• Bundles and bales • Sacks • Long sections • Mixed cargo • Palletised cargo	• Boxes • Wheeled cages • Skip containers • Plastic containers • Intermediate bulk container (IBC) tanks
Cylindrical Cargo with a round cross-section that tend to roll.	• Wire coils • Sheet metal coils • Cable drums • Tyres	• Drums • Gas cylinders • Pipes and poles
Large or out-of-gauge Cargo with dimensions that exceed those of the vehicle.	• Automobile • Heavy machine • Whole trees	• Structural steel • Precast concrete
Others	• ISO containers • ISO tanks	• Dangerous cargo • Glass panels

Table 3: Cargo categories and examples

4.1 Securing methods

General requirement

All cargo must be secured via a combination of lashing, blocking, and/or friction to prevent movement during all expected conditions of transportation. The load restraint equipment and vehicle chassis must be suitable and strong for the type of cargo transported. Proper access up and down the vehicle must also be provided for workers to secure and loosen the cargo safely.

Lashing method

The most common way of restraining load is by tying them with lashing devices, e.g. rope, webbing, chains, cables, etc. Lashing must be checked and retightened regularly, especially after a sudden brake or sharp turn and on multiple-delivery stops. Check and ensure that the cargo is stable before lashing or loosening the straps.

There are two ways to lash cargo:

- Direct lashing

Direct lashing restraints the cargo by opposing movement of the cargo in a specific direction. Lashing devices can be attached to lashing points on cargo or looped around or over it. The angle of lashing should be less than 60 degrees (see Figure 28). Lashing devices need to withstand a greater force if the angle is larger than 60 degrees.

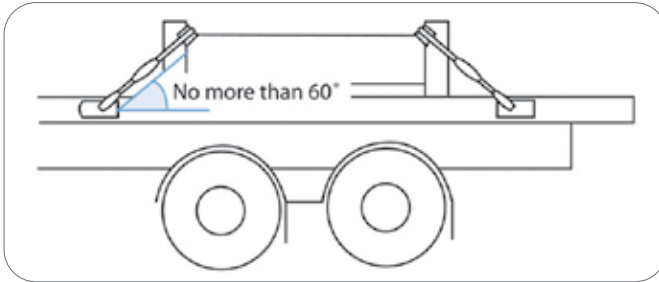


Figure 28: Direct lashing should be angled at no more than 60°.

- Friction lashing

Friction lashing is passed over cargo to bind it to the loading platform. Tension in the lashing increases friction between cargo and loading platform to prevent tipping or sliding. The angle of lashing should be more than 75 degrees (see Figure 29) for it to be effective. Placing frictional mats can increase the effectiveness. Generally, there should be at least one lashing device every 1.5m along the length of the cargo unit.

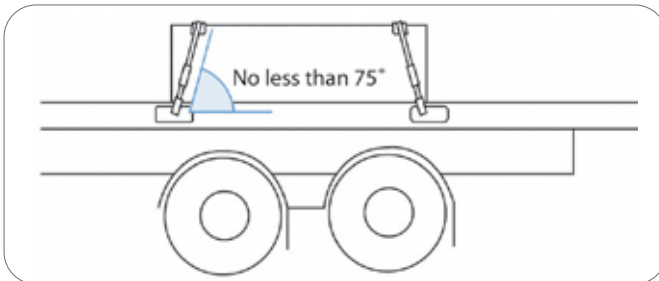


Figure 29: Friction lashing should be angled at no less than 75°.

Note:

- Always ensure that the cargo is stable before loosening the lashing.
- For asymmetric or bulky cargo like valve assemblies, please check with their supplier on the centre of gravity and lashing configurations.

Sheeting method

Sheets are usually used to contain loose cargo, e.g. construction debris, that can fall off during transit. Lashing is needed to fasten the sheet directly to the vehicle. Any excess lashing and loose flaps of sheet should be tied and secured, to avoid causing danger to other road users. Tail lights, reflectors and licence plates should not be obstructed by the sheets. Any tears or holes found in the sheets should be mended.

Operators should note that sheets can get caught by wind if not adequately tensioned and secured. Loosened sheets caught by the wind will balloon and expose cargo. Loose flaps should be tied backwards so that wind will keep the flaps closed (see Figure 30).

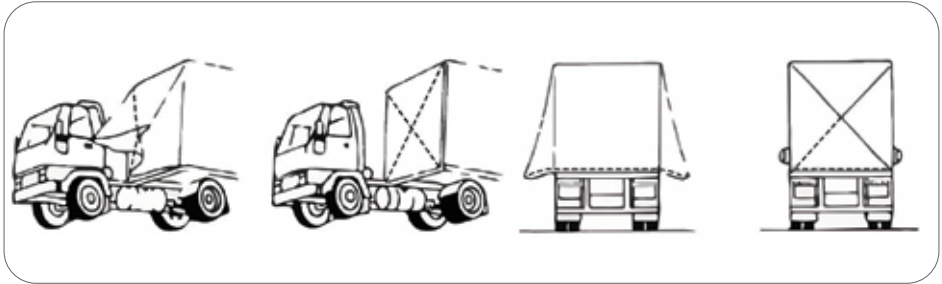


Figure 30: Securing sheet flaps at front and rear of vehicle.

If more than one sheet is needed, lay sheets starting from the rear. This ensures that the gap in the overlapping sheets is facing the rear, thus preventing rain or wind ingress (see Figure 31).

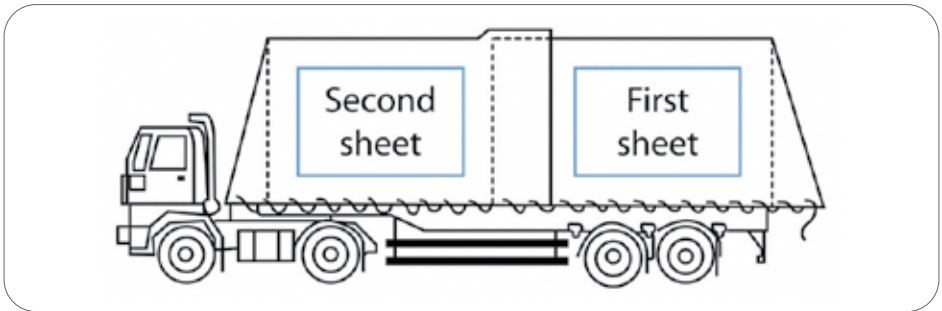


Figure 31: Using multiple sheets to cover cargo.

Netting method

Nets can be used in place of sheets if cargo does not require weather protection, e.g. scrap metal. The mesh size must be small enough to prevent the smallest piece of cargo from falling through. It can be tensioned with lashing devices or roped to vehicle chassis. Excess netting and lashing should be securely tucked away to prevent it from endangering other road users when it hangs and flaps.

Locking method



Figure 32: Twistlocks in locked and unlocked positions.

Locking is the most secure method, but it requires specific fittings and equipment. Examples of locking mechanisms are twistlocks for ISO containers and steel crates that hold gas cylinders (see Figure 32). Every locking mechanism should be locked immediately after loading.

Blocking method

Cargo that is rigid enough can be blocked by fittings, e.g. stanchion, headboard (see Figure 33), or other cargo units by loading cargo against the fitting or adjacent cargo. If that is not possible, the space should be filled with dunnage. Dunnage should fit snugly and securely, so that it will not come loose and fall off during trips.

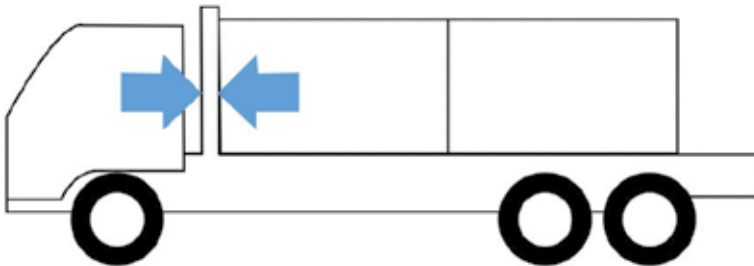


Figure 33: Blocking cargo with headboard.

Tiers of cargo can be blocked with a panel of plywood or chipboard (see part A of Figure 34) or by placing pallets to put a height difference in adjacent cargo units (see part B of Figure 34), which will block the upper layer against the lower layer.

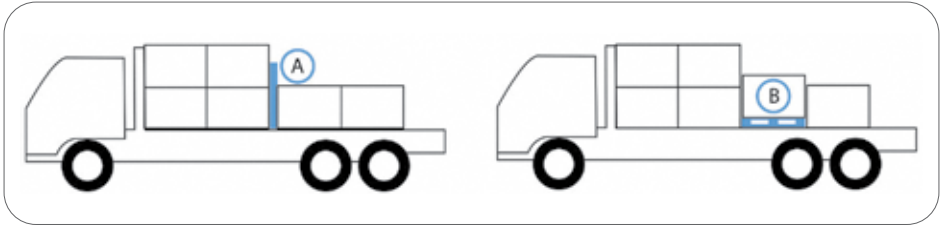


Figure 34: Blocking cargo with a board (A) or pallet (B).

Metal brackets or bracing can be used to block cargo and hold them in place. These brackets are usually customised for supporting specific types of cargo (see Figure 35).

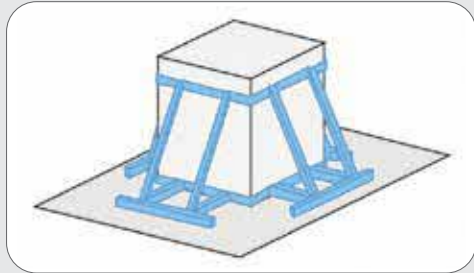


Figure 35: Examples of metal brackets for cargo support.

Wedges affixed to a loading platform prevent cylindrical cargo from rolling (see Figure 36). The inclined edge should be in contact with the cargo. The weight of cargo can lock wedges in place if the vehicle is not moving.



Figure 36: Cylindrical cargo being wedged.

4.2 General freight

Bundles and bales

Bulk cargo, e.g. wastepaper, cloth, can be packed into a rough cube or cuboid using anneal steel wire. Each package is referred to as a bundle or bale (see Figure 37).



Figure 37: **Wastepaper transported in bales.**

Good practices to follow:

- a) When loading one tier of bundles, an alternate arrangement creates a blocking effect (see Figure 38).
- b) When loading two tiers of bundles, lash every row to the vehicle. Bulk cargo requires additional securing as it usually bulges slightly so stacking will not be stable.
- c) As the contents in a bundle may spill out of its packaging during the journey, the entire load should be covered with a net or sheet after securing it.

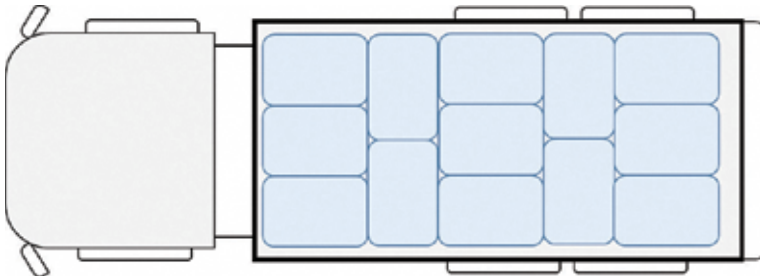


Figure 38: **Alternating arrangement of cargo.**

Sacks and bags

Granular cargo such as agricultural produce, e.g. rice and flour, gravel and polymer beads are usually transported in sacks (see Figure 39). Sacks are bags made of pliable material, e.g. cloth and plastic, which makes securing a challenge because they do not hold their shape (see Figure 40).



Figure 39: Sacks loaded in alternating directions.



Figure 40: Bags on trailer.

Good practices to follow:

- a) Keep height of layers uniform.
- b) Use tensioning devices to secure every sack's length, because material in the sacks and bags, e.g. rice, polymer beads, can settle around lashing and cause it to loosen.
- c) Use sheets to prevent loose material from falling off open sacks and bags.
- d) Stack pallets and wrap each stack with stretch film to make securing more effective.

Long sections

Long sections refers to wooden planks, metal beams, bars etc. They may be transported as loose cargo or bundled up with rope (see Figure 41).



Figure 41: Various long cargo bundled and lashed.

Good practices to follow:

- a) Load cargo up against the headboard. If individual pieces can fit through the headboard, add a layer of wire mesh between the headboard and cargo.
- b) Avoid stacking cargo higher than the stanchion.
- c) Sections with different lengths should be loaded against the headboard. Uneven ends are to be pointed towards the rear. Secure longer pieces to minimise whipping.
- d) The number of lashing devices needed depends on the length of the cargo. (see friction lashing in section 4.1)
- e) If cargo is strapped into bulk packages, ensure that the straps are not damaged. Otherwise, reinforce them with a lashing device to ensure that individual pieces will not come loose.
- f) Reduce the travelling speed when heavy goods are being transported.

Mixed cargo

Vehicles may be loaded with different goods in a single consignment.

Good practices to follow:

- a) Where the cargo is a mix of heavy and light items, load heavier items at the base and rear. Light items can be loaded on top and in front (see section 2.1 Cargo arrangement).
- b) Where cargo is a mix of different sizes, load big items surrounding small items to “enclose” them (see Figure 42). Avoid having cargo sticking out the sides of the vehicle.
- c) Fill up empty spaces with dunnage.

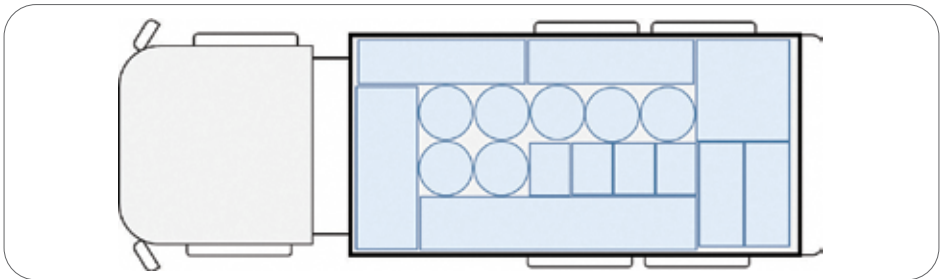


Figure 42: Enclosing smaller cargo units with the bigger cargo units.

Palletised cargo

There are two considerations when securing palletised cargo. Firstly, check whether the cargo is secured to the pallet. Secondly, check whether the entire unit of pallets and cargo is secured to the vehicle.

Good practices to follow:

- a) Before loading, check pallets for damage. Do not use damaged pallets for loading.
- b) Multiple small units should be stacked in a stable manner on the pallet and secure it with straps or shrink wrap (see Figure 43). Individual units should not come loose and fall off.
- c) Do not exceed the maximum laden weight of individual pallets and vehicle.



Figure 43: Palletised cargo stacked.

- d) Distribute weight evenly across the loading platform; this may require spreading pallets apart. When spread out, lash every row of pallet and fill empty spaces with dunnage to block movement.
- e) Always lash the entire unit, i.e. pallet and cargo, to the vehicle to prevent movement and tipping. Lashing a pallet alone is not recommended.
- f) When stacking pallets, lash every row and do not exceed the height of the headboard. Ensure that the lower stack can withstand the weight above it. To avoid crushing the lower stack, it may be necessary to add further support to the top stack by reinforcing the lower stack with plywood.
- g) Secure empty pallets to the vehicle because they are light enough to be blown off the vehicle.

Boxes

Boxes are one of the most common forms of cargo packaging. It can be made of cardboard, metal, wood or plastic.

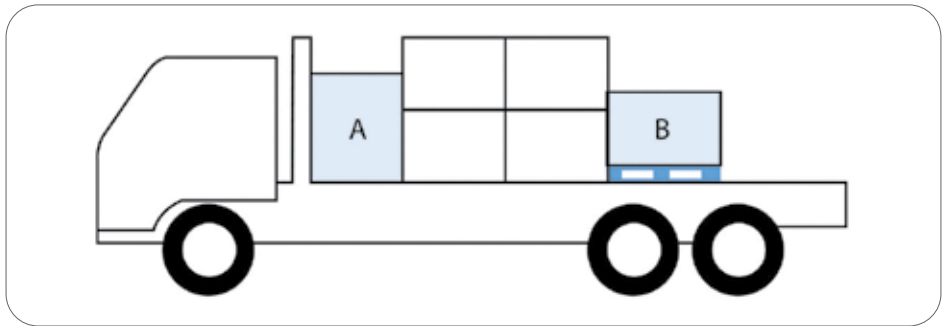


Figure 44: Blocking by using taller boxes (A) or raising boxes on pallets (B).

Good practices to follow:

- a) Block upper layers by using bigger boxes, wood panels or pallets (see Figure 44 and section 4.1 Securing methods).
- b) Lash every row of boxes (see Figure 45).
- c) Do not stack boxes beyond the height of headboard. Boxes at the lower tier should be strong enough or reinforced to support boxes on top.



Figure 45: Lashing on boxes.

Wheeled cages

These are commonly used to transport food items or gas cylinders. The wheels make handling bulk cargo easier but they also make securing the cages on a vehicle challenging.

Good practices to follow:

- a) Lock individual caster wheels after loading.
- b) Use wedges to chock wheels that lack a locking mechanism.
- c) Restrain the entire cage by blocking or lashing to prevent it from toppling over.
- d) Load heavier items at the bottom of the cage.

Skip containers

Skip containers are used for transporting loose bulk cargo that are not packaged, e.g. scrap metal, gravel. The container may have an open top, removable lid, or drop sides that open for loading and unloading.

Good practices to follow:

- a) Perform regular maintenance to prevent loss of material through gaps in the body of the container, especially if the lids or drop sides are damaged or distorted.
- b) Keep chassis attachment points and fittings, e.g. hinge pins, brackets, and locks) in good condition. Maintain the hook lift regularly.
- c) Do not overfill open top containers as material can easily fall over or get blown off.
- d) Cover the skip container with a net or canvas sheet to minimise loss of material (see Figure 46).
- e) When making sharp turns or traveling on slopes, cargo may slide to one side of the container and destabilise the vehicle. Redistribute the cargo where necessary.



Figure 46: Skip container transporting construction debris.

Intermediate bulk container

When using intermediate bulk containers (IBC), the entire IBC unit including the pallet should be lashed and secured (see Figure 47). Check that the discharge valve is not leaking and screw caps are tightly sealed. Adjacent IBC units may need to be spaced apart with dunnage to avoid damaging the valve.



Figure 47: Intermediate bulk containers secured with lashing.

Plastic containers

Plastic is a popular material in manufacturing containers, e.g., pallet, box. Extra caution should be taken when securing plastic containers because plastic surfaces become slippery when wet, either from rain or condensation when transporting cold cargo. A combination of different securing methods, e.g., lashing with blocking, is recommended to compensate for the reduced friction.

4.3 Cylindrical cargo

Wire coils

Wire coils are generally arranged in rows along transporting platforms. Stanchions should be provided at the front and rear of the platform to prevent forward and backward movement. The front coils should be secured to the front stanchion to prevent them from falling over. Subsequent rows should be maintained in a straight line and in close contact with one another to prevent movement. Lashing should be carried out such that any forward and backward rocking of the wire coils, as well as any sideward movement due to braking or acceleration, is minimised (see Figure 48).



Figure 48: Wire coils lashed and blocked with a metal bracket at the rear.

Rolls and drums

Rolls (sheet metal, paper) and drums (cables) can be loaded either on the face of the coil (rounded outer surface) or on the side of the coil (flat surface). However, the sensitivity and stability of the cargo, e.g. paper, will need to be taken into consideration.

For loading on the face of the coil, it is preferable to use platforms with pre-fitted supporting brackets to transport coils under such arrangement. However, adequate lashings to each coil are necessary as each of the coils may still have the tendency to move in between the brackets during transportation. If such brackets are not available, every coil should be lashed with adequate tension and chocked with beams of dunnage wood (see Figure 49).



Figure 49: Sheet metal rolls chocked with dunnage (left) loaded within metal brackets (right).

For loading on the side of the coil, each coil will need several lashings. Loop lashings around the coil to prevent it from shifting forward, backward and sideward (see section 4.1 – direct lashing). Use friction lashing over the coil to further secure it (see Figure 50).



Figure 50: Coiled sheet metal loaded on pallets and lashed.

Tyres

Tyres are usually stacked in columns (core vertical) for ease of loading and unloading.

Good practices to follow:

- When stacking tyres, the column should not be taller than the headboard.
- All tyres stacked in one column should be bound together to prevent individual tyres from coming loose from the column (see Figure 51).
- Each column should be lashed with adequate tension so that the lashing does not loosen.

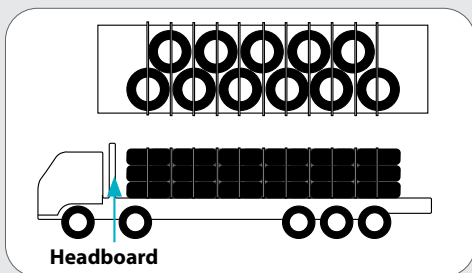


Figure 51: Stacks of tyres lashed to the loading platform.

Drums

When drums are lying down (core horizontal), vehicles with fittings in the front and back, i.e. headboard and stanchions respectively, are necessary to contain the drums. Drums should not be stacked taller than the fittings unless sufficiently secured. Arrange and secure the drums in a manner that movement will be restricted. Lash drums and chock them with dunnage for additional restraint. Ensure adequate restraint so that the drums can be unloaded safely.

If drums are standing (core vertical), bundle groups of drums together or lash them laterally to prevent them from tipping over. Load drums up against the headboard. Friction lashing should be applied on the first and last row of drums (see Figure 52).

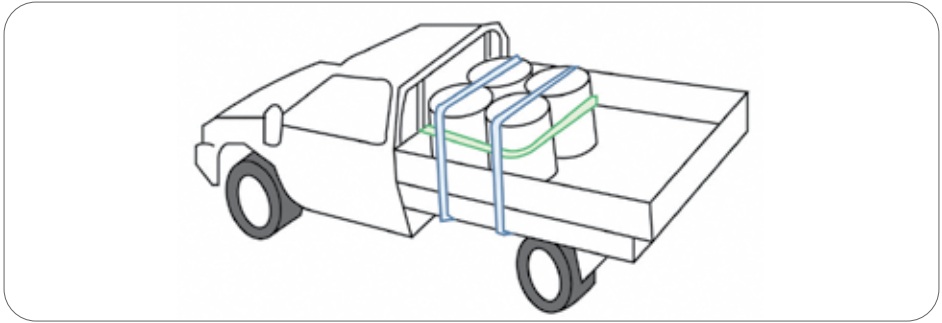


Figure 52: Lateral lashing (green) and friction lashing (blue).

Pipes and poles

The stability of cylindrical cargo like pipes and poles on vehicles is an important factor to note during loading and unloading operations.

Good practices to follow:

- a) Long cylindrical cargo should be placed up against the headboard and secured like long sections (see Figure 53; see also section 4.2 General freight).
- b) Stanchions or side boards are needed for blocking cargo.
- c) Additional friction lashing is recommended to restrain the cargo and prevent long pieces from whipping.
- d) Tie a red cloth to parts of the cargo that extend beyond the rear of the loading platform.



Figure 53: Steel pipes loaded against stanchion and lashed to loading platform.

Gas cylinders

Gas cylinders are preferably transported via customised racks fitted on the vehicle or in cages to avoid damaging valves and regulators. Open-air vehicles are preferred so that any leaks can be dispersed without harm. Adequate ventilation must be provided if they are carried in closed vehicles.

Good practices to follow:

- a) Gas cylinders that can stand (core vertical) should be secured in a manner like drums. Note that liquefied petroleum gas containers should always be transported upright. This prevents the pressure relief device from coming into contact with the petroleum and causing a malfunction.
- b) Gas cylinders with rounded bottoms should be laid lengthwise across loading platform (core horizontal) so that it would only roll forward or backward. If a cylinder is too long and protrudes out of the sides of vehicle, load them lengthwise along the loading platform. Secure them in the same way as pipes and poles.
- c) When transporting cylinders in cages, the entire cage should be lashed to the vehicle. This is because the weight of the cage and cylinders will not be enough to prevent movement during transportation.

4.4 Large units

Vehicles

There are specially designed trailers for transporting vehicles such as cars, vans and small trucks, i.e. vehicle transporter. (see Figure 54). The vehicles must be restrained carefully on the transporter as the vehicles may bounce during transportation due to their suspension systems and tyres.



Figure 54: Vehicle transporters.

Good practices to follow:

- a) Chock both front wheels of the vehicle (see Figure 55).
- b) Ensure that the parking brakes of every vehicle are applied.
- c) Lash vehicles directly to the trailer.



Figure 55: Anchorage point under a car (left) and wheel chock (right).

Heavy machines

These include excavators, crawler cranes, forklifts, mobile elevating work platforms and other heavy machinery. The machines should be dismantled to smaller components as much as possible before loading to keep every component contained within the trailer bed dimensions. Always check the height and weight clearance of the route before transporting them (see section 3.1 Vehicle).

Good practices to follow:

- a) Use low bed trailers to reduce total height and lower the centre of gravity for more stability (see Figure 56).
- b) Metal lashing devices are preferred for their higher load capacity.
- c) Machines with hydraulic systems should have pressure in the hydraulics released before loading.
- d) Machines with wheels and tracks should have their parking brakes applied.
- e) If lashing points are available on the machine, lash it to the trailer directly. Lashing should cover a minimum of four anchorage points per machine for it to be sufficiently secured. Bigger and heavier machines may require more lashing points.
- f) Movable assemblies, e.g. boom arm of crane, arm and bucket of excavator, should be positioned according to the manufacturer's recommendations so they do not stick out of the trailer bed. It should be securely lashed to prevent independent movement in any direction during transit.
- g) Remove any loose dirt or gravel on the machines as they can fall off while on the road and endanger other road users.
- h) The trailer bed and ramp should be free from grease.



Figure 56: Transporting heavy machines on low bed trailers.

Trees

When transporting whole trees, the foliage (leaves and branches) and root ball (root system and soil) should be pared down to reduce the dimensions and weight, to better facilitate securing and transporting.

Good practices to follow:

- a) The trailer bed should have at least two pairs of stanchions on opposite sides for blocking.
- b) Depending on the height of the tree, a minimum of three lashing devices should be used, one of which should be used to bind branches that are overhanging to prevent whipping.
- c) After securing, cover the tree/s with a sheet to prevent leaves, branches and soil in the root ball from being blown off by the wind during transportation (see Figure 57).



Figure 57: Sawn tree branches covered with a sheet.

Structural steel and precast concrete

Structural steel and precast concrete usually come in big dimensions, which poses a challenge to stability when securing them to trailers. Always use trailers that are custom-built to transport these out-of-gauge cargo where possible.

Good practices to follow:

- a) Use purpose-built trailers that are strong enough to withstand the weight and forces exerted. Even weight distribution should be prioritised when positioning structural steel and precast concrete on the trailer bed (see Figure 58).
- b) Check that the delivery route has adequate height and weight clearance.
- c) The trailer should have fixed frames to provide the main restraint, where appropriate and practical.
- d) Lashings should be done to prevent cargo movement and toppling, especially if the units are tall. Metal lashings are preferred.



Figure 58: Trailers mounted with steel frames for transporting precast concrete.

4.5 Other cargo types

ISO containers and tanks

ISO containers and tanks are transported on trailers with specific locking mechanisms that pairs with corner castings on the containers and steel frames.

Good practices to follow:

- a) Ensure the container twistlocks are in good working condition and all locks should be secured immediately after loading the containers and steel frames onto the trailer.
- b) Cargo loaded into containers should be arranged and restrained in a manner that is stable and prevents movement within the container. The payload should not be exceeded, and the weight should be evenly distributed (see section 2.1 Cargo arrangement where applicable).
- c) Ensure the container door locks are in good working condition and securely locked, even for empty containers, during transportation.
- d) ISO liquid tanks are usually partially full. Changes in vehicle speed and movement can lead to instability due to liquid flowing around inside the tank. Low-bed trailers with mounted twistlocks are recommended to lower the centre of gravity (see Figure 59).
- e) Tanks carrying gases or liquids will have hatches, valves and pressure relief devices. Check that all of these are in good working condition and not leaking.
- f) Driver should ensure wheels are properly chocked before proceeding with loading.
- g) Driver must not leave the vehicle at the container yard during a Lift-On/Lift-Off (LOLO) operation of the container onto the chassis. During the queuing for the LOLO operations in the container yard, a safety distance must be maintained from the vehicle in front.
- h) Driver should wear hand gloves to lock/unlock the container twistlocks and must do so at a minimum of two slots away from the mounting slot.
- i) Driver must ensure that there is no worker in the container before pulling the container away.
- j) Driver should be familiar with and follow all SWP, (e.g. container handling procedures) at clients' premises/ports/terminals.



Figure 59: ISO container and ISO tank.

Glass panels

The use of glass as a building material is increasingly popular because it is a versatile material for use, e.g. insulation, internal partition, structural component etc. However, glass can be easily damaged from impact, which makes handling and transporting a challenge.

Good practices to follow:

- a) Small glass panels packed into crates or pallets can be secured according to the practices outlined in section 4.2 General freight.
- b) Large glass panels should be transported on vehicles mounted with A-frames. Parts of the frame that come into contact with glass should be covered with rubber to absorb vibration or shock.
- c) Panels on each side of the A-frame should be lashed together (see Figure 60).
- d) Additional lashing is also necessary for the entire unit of frames and glass.
- e) The vehicle should have weather protection, otherwise a sheet can be used as weather protection, as glass becomes slippery when wet. The sheet can also contain glass shards if a glass panel shatters or breaks during transportation.

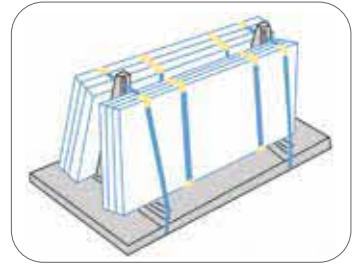


Figure 60: Large glass panels loaded and lashed on A-frame.

Dangerous cargo

Transporting cargo that are toxic, corrosive, explosive or flammable is riskier than transporting regular cargo. They are normally packed in containers specially designed to contain the contents safely under normal transport conditions. Operators that handle dangerous cargo should have their workers properly trained, e.g., HazMat Driver course by the Singapore Civil Defence Force. Dangerous goods/cargo are categorised into different classes and governed by different authorities (see Table 4).

Class	Description of class	Authority
1	Explosives substances and articles	SPF
2.1	Flammable gases	SCDF
2.2	Non-flammable, non-toxic gases	NEA
2.3	Toxic gases	NEA
3	Flammable liquids	SCDF
4.1	Flammable solids	SCDF
4.2	Substances liable to spontaneous combustion	SCDF
4.3	Substances that emit flammable gases when in water	SCDF
5.1	Oxidising substances	SPF, NEA
5.2	Organic peroxides	NEA
6.1	Toxic substances	NEA
6.2	Infectious substances	NEA
7	Radioactive materials	NEA
8	Corrosive substances	NEA
9	Miscellaneous dangerous substances and articles	NEA

Table 4: Classes of dangerous goods and their governing authorities.

- Maritime Port Authority of Singapore (MPA): Regulates movement of dangerous goods through port terminals.
- National Environment Agency (NEA): Regulates import, storage, and transportation of scheduled hazardous substances in Singapore.
- Singapore Civil Defence Force (SCDF): Regulates import, storage, and transportation of petroleum and flammable materials in Singapore.
- Health Sciences Authority (HSA): Regulates transportation of radioactive materials.
- Singapore Police Force (SPF): Regulates transportation and storage of explosives and pyrotechnics within Singapore.

Good practices to follow:

- a) Caged, closed, curtain-side vehicles are ideal to prevent cargo from falling off. If unavailable, use additional sheets, nets and/or straps for additional containment.
- b) Arrange cargo such that the United Nations placards on the container or packaging are easily visible to the crew during loading and unloading. Transporting dangerous cargo in bulk will require a Transport Emergency Information Panel (TEIP) prominently displayed on the left, right and back of the vehicle. See SS 586 Part 1: 2021 Transport and storage of dangerous goods for more information.
- c) Secure cargo according to the type of package, i.e. drum, sack, and box.
- d) Only transportation routes approved by NEA can be used. They can only be used between 9.00 am and 5.00 pm from Monday to Saturday, excluding Sundays and public holidays.
- e) When handling mixed cargo that are incompatible, e.g. oxidisers and flammables, it is best to transport them in separate vehicles. Otherwise, separate and secure the cargo such that they will not mix even under accident conditions, such as by:
 - Packing them in separate compartments on the same vehicle;
 - Packing individual containers with strong material for extra protection and containment against leakage; or
 - Loading incompatible containers as far apart as possible with inert cargo acting as a barrier in between.
- f) Explosives are sensitive to temperature and friction (in some cases). Cargo should be secured to prevent scraping and rubbing, and avoid impact between containers. Anything carried along with the explosives should be secured to prevent them from knocking into the cargo container where the explosives are in. To minimise the risk of fire, avoid using cardboard or wood as dunnage. Fire-retardant packaging foam would be a better option. Refer to the Arms and Explosives Act for more information.
- g) Driver should have a copy of the Safety Data Sheet (SDS) of all transported chemicals for reference in case of emergency during transportation.
- h) Driver assigned to transport dangerous goods should be competent to read and understand the information in SDS and take the necessary measures to protect themselves.

Vehicles transporting dangerous goods should have an appropriate emergency response plan (ERP) and drivers should be briefed on the ERP.

5. Risk Management

Risk Management (RM) is a systematic way to identify, assess, control, and monitor WSH risks associated with any work activity or trade. The main components of the RM process are:

- Preparation
- Risk Assessment (RA)
- Risk Control Implementation
- Record-keeping
- Review

Communication is a constant aspect throughout the RM process.

5.1 Risk assessment

Conducting RA and implementing risk control measures are requirements under the WSH (Risk Management) Regulations.

An RA should be carried out and risk control measures implemented before the start of any work activity. A sample RA form can be found in Annex A.

The employer or principal should conduct an RA on WSH risks, including mental well-being, associated with any activity or exposure in the workplace. Considerations on preparedness for terrorism threats and disease outbreaks at the workplace should also be included.

RA should be conducted in consultation with relevant stakeholders, e.g. contractors, suppliers as much as possible.

RA can be conducted in three simple steps: Hazard Identification, Risk Evaluation and Risk Control. These steps are elaborated in Figure 61 below.

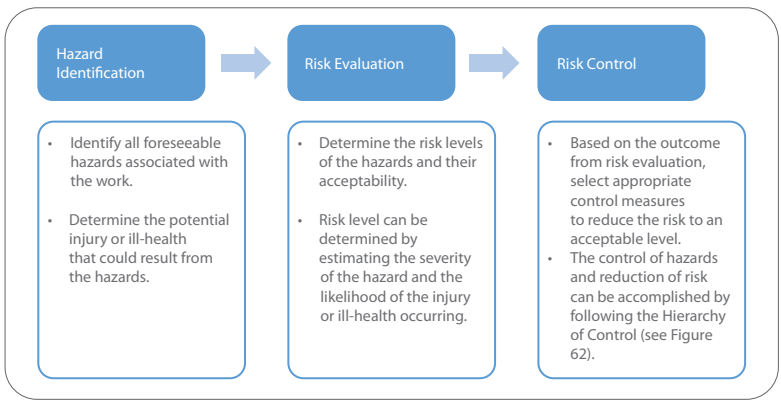


Figure 61: RA methodology.

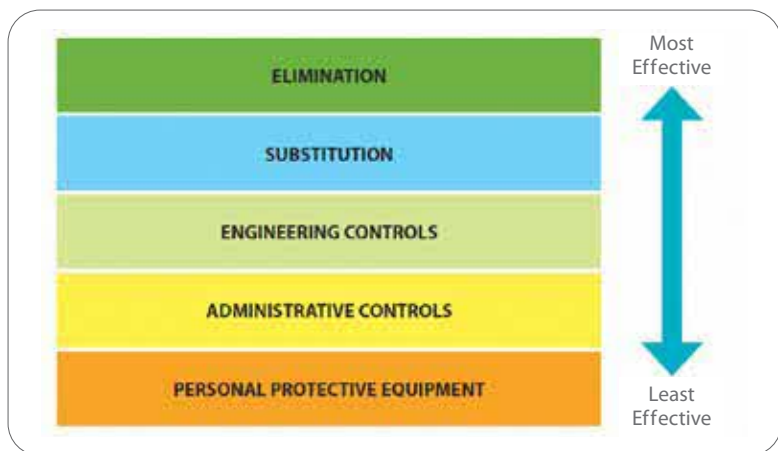


Figure 62: The Hierarchy of Control.

5.2 Risk control implementation

The employer or manager should implement the risk control measures as soon as possible. To facilitate this, an action plan can be prepared, which includes the implementation timeline and persons responsible for implementing the measures.

All persons exposed to the risks must be informed of the nature of the risks involved and the measures or SWP implemented.

Regular inspections or audits should be conducted to make sure that risk control measures have been implemented and practised effectively.

5.3 Record-keeping

RA records, including but not limited to RA forms and control measures records, should be kept for at least three years from the RA approval date.

5.4 Review

Review and, if necessary, revise the RA:

- At least once every three years from the RA approval date;
- Upon the occurrence of any bodily injury to any person because of exposure to a hazard in the workplace;
- When there is any significant change in work practices or procedures;
- Where there is any significant change in the worker's personal health (including mental well-being) in relation to safety critical work process or activity; or
- When new information on WSH emerging risk, threat of terrorism, disease outbreak, or mental well-being is made known.

To learn more about RM, refer to the WSH Council's Code of Practice on Workplace Safety and Health Risk Management.

6. Delivery Plan

6.1 General

The delivery plan describes and details the delivery process. It also articulates the joint responsibilities of the supplier, contract haulier (where the supplier is not the haulier) and the customer for the delivery.

All deliveries must be properly planned, with the supplier and customer agreeing in advance on the management arrangements, plant, equipment and systems of work to ensure safe and efficient delivery.

6.2 Importance of delivery plan

The delivery plan aims to facilitate consensus among involved stakeholders for a safe delivery, where proper risk controls are put in place to manage identified health and safety risks that could arise from the delivery process.

6.3 Ownership and execution of delivery plan

Many accidents that occur during cargo deliveries, such as at customer premises, could be avoided if the unloading operation was carefully planned for prior to the delivery.

Delivery planning should begin with a proper assessment of the possible delivery hazards and associated risks. When a customer places an order with a supplier, they enter into a supply agreement. The agreement should provide clarity to both parties on their responsibilities for safety and health as much as possible. The full co-operation between all parties involved in the process is necessary.

The supplier should ensure that a competent person is assigned to prepare the delivery plan, whose role is to ensure that all the hazards identified are communicated and made known to the driver and all relevant parties and personnel. A sample delivery plan template is provided in Annex B. The items listed in this template should be captured minimally and users are advised to include other items or information that are necessary to ensure a safe delivery operation.

The delivery plan is recommended for heavy goods, e.g. deliveries where vehicles used are categorised as Heavy Goods Vehicle (from 3,501kg to 16,000kg) and out-of-gauge cargo deliveries. Drivers and operators are advised to keep a copy of the delivery plan for the relevant delivery operation in their vehicles.

6.4 Elements of delivery plan

The delivery plan could include the following considerations:

- Personnel involved and their roles, responsibilities and competencies.

- Compliance to statutory requirements and the vehicle manufacturer's operation manual for securing of loads for transportation.
- Nature, weight (including net and gross weights) and dimensions of the load.
- Vehicle selected for transporting the goods.
- Type and location of securing points on the vehicle.
- Selection and capacity of appropriate lifting equipment (including attachments to be used), securing equipment and tools.
- Application of the correct loading/unloading methods.
- Position of plant, personnel and the load, before and after the loading/unloading operation.
- Presence of and proximity to other plant and work activities at the delivery location.
- Means of communication during loading/unloading operation.
- Other relevant safety and health provisions for all personnel during loading/unloading operations.

6.5 Harmonisation of delivery plan vis-à-vis risk assessment

The RA for loading and unloading activities should specify control measures that account for the appointment of competent personnel, usage of appropriately maintained handling plant, and the physical work environment.

Where lifting is part of the loading/unloading process, the lifting plan and relevant permit-to-work should be implemented accordingly.

All necessary risk controls should be put in place as part of the delivery process.

7. Acknowledgements

	Organisation	Contributors
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	Jurong Port Pte Ltd	Mr Charles Tan
	PSA Corporation Limited	Mr Roger Lim
	Land Transport Authority	Ms Ding Woon Keong
	Ministry of Manpower	Mr Khairil Anuar Malek
	Workplace Safety and Health Council	Mr Edd Hong Shuqi
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Annex A – Sample Risk Assessment Form

Department: Warehouseing

RA Leader: Roy Lim

Approval

Work activity: Loading and unloading cargo

RA Member 1: Hong Qi Shun

Signature:

Event / Location: Container trucks and warehouse

RA Member 2: Han King Shun

Date: 10 Feb 2023

Assessment Date: 6 Feb 2023

RA Member 3: Eddie Lo

Name: Wong Shi Huat

Last review date: 7 Feb 2022

RA Member 4: Prakash Muthu

Designation: Manager

Next review date: 5 Feb 2024

RA Member 5: -

Reference number: 20230208RA0007

Ref	Hazard Identification		Risk Evaluation			Risk Control					Remarks
	Work activity	Hazard	Possible injury or ill-health	Existing risks controls	L	RPN	Additional controls	S	L	RPN	
1	Loading and unloading with a forklift	Forklift movement during loading, Forklift off forklift due to unstable stacking on pallet.	Heavy concussion and possible fractures.	Segregating vehicular and human traffic at work site to reduce chances of collision.	4	4	16	4	2	8	10 Feb 2023
			Bruising and contusions.	Enforce proper stacking and shrink wrap individual sacks to pallet.	2	3	6	-	-	-	10 Feb 2023
			Muscular strains and sprains.	Instruct workers to always handle cargo mechanically where possible.	3	4	12	3	2	6	10 Feb 2023
2	Loading and unloading manually	Handling heavy loads manually. Fingers crushed between cargo items while unloading manually. Excessive workload or work pace.	Fractured finger, bruising.	Instruct workers to always handle cargo mechanically where possible.	3	4	12	-	-	-	10 Feb 2023
			Job burnout, stress, and anxiety.	Well-being, e.g. WorkHealth	3	4	12	3	2	6	10 Feb 2023
3	Securing cargo with lashing belt	Cargo falls off vehicle due to stacking palletised cargo. Struck by over-tensioned lashing device that snapped.	Bruising and contusions.	Restrict height of stacking. Check lashing device for tears and frays before use.	3	2	6	-	-	-	10 Feb 2023
			Bruising and contusions.	Check lashing device on top of vehicles with fringing that block the cargo.	4	1	4	-	-	-	10 Feb 2023
			Cargo strikes other vehicles on road, possible road traffic accident.	Check lashing device for tension before leaving loading bay.	5	2	10	5	1	5	10 Feb 2023
4	Transporting cargo on public road	Cargo falls off during transport due to inadequate tension in lashing. Unsecured excess tarpaulin sheet flapping during transportation.	Visibility of other road users obscured possible road traffic accident.	Check tarpaulin sheet are properly folded or tied down before leaving loading bay.	5	2	10	-	-	-	10 Feb 2023
			Developing muscle strains from staying in same posture for long hours.	Educate and encourage drivers to stretch during their breaks.	3	5	15	3	3	9	10 Feb 2023
			Developing loss of concentration due to fatigue.	Provide adequate breaks during shift work.	5	3	15	5	1	5	10 Feb 2023
5	Driving to meet delivery orders	Runaway driving with unconscious driver.	Serious injury or fatality.	Medical examination for drivers.	5	3	15	-	-	-	10 Feb 2022
								5	2	10	10 Feb 2022
6	Releasing lashing belt while unloading cargo	Over-tensioned belt snaps. Cargo falls over after releasing tension in lashing belt.	Bruising and contusions.	Check lashing device for tears and frays before use.	5	1	5	-	-	-	10 Feb 2022
			Bruising and contusions.	Restrict height of stacking.	3	2	6	-	-	-	10 Feb 2022

5x5 Risk Matrix with Risk Prioritisation Number (RPN)

Assessment of Likelihood		Assessment of Severity		Likelihood		Severity		5x5 Risk Matrix with Risk Prioritisation Number (RPN)	
Level	Likelihood	Level	Ranking	Rate (1)	Remote (2)	Occasional (3)	Frequent (4)	Almost certain (5)	Page X of Y pages
5	Almost certain	5	Catastrophic	5	10	15	20	25	
4	Frequent	4	Major	4	8	12	16	20	
3	Occasional	3	Moderate	3	6	9	12	15	
2	Remote	2	Minor	2	4	6	8	10	
1	Rare	1	Negligible	1	2	3	4	5	

Annex B – Sample Delivery Plan Template

Description of load/s		
Weight of load/s		
Dimension of load/s		
Load restraining system	☐ Bulkhead	☐ Cabin Guards
	☐ Sideboard & Tailboard	☐ Stanchion bars
	☐ Anchorage	☐ Curtain-side
	☐ Others:	
Methods of securing the loads	☐ Direct Lashing	☐ Friction Lashing
	☐ Sheeting Method	☐ Netting Method
	☐ Locking Method	☐ Blocking Method
	☐ Others:	

Sequence /Special Precautions	Sketch of Securing the Load/s
	<i>(It is recommended that you include the method of securing the load and its anchoring points.</i>

Note: This is only a sample Delivery Plan, the content is by no means comprehensive. Users would have to include any document and information they deem necessary to ensure safe loading/unloading.

8. References

- Workplace Safety and Health (WSH) Act
 - WSH (General Provisions) Regulations
 - WSH (Risk Management) Regulations
 - WSH (Incident Reporting) Regulations
 - WSH (First-Aid) Regulations
- Arms and Explosives Act 1913
- Road Traffic Act
 - Road Traffic Rules
 - Road Traffic (Motor Vehicles, Construction and Use) Rules
- Code of Practice on Workplace Safety and Health Risk Management
- Code of Practice on Safe Lifting Operations in the Workplaces
- Singapore Standard SS 663: 2020 Code of Practice for Safe Loading on Vehicles
- Singapore Standard SS 586: Part 1: 2021 Transport and storage of dangerous goods
- Code of Practice on Safety of Loads on Vehicles (3rd Edition), UK
- European Best Practice Guidelines on Cargo Securing for Road Transport
- Driver's Handbook on Cargo Securement, USA
- Driver's Manual for the Safe Securement of Metal Coils and Other Cargo, USA
- National Safety Code for Motor Carriers, Standard 10, Cargo Securement. Canada
- IPAF Best Practice Guidance – Load and Unload

9. Useful Resources

- WSH Guidelines on Workplace Traffic Safety Management
- WSH Guidelines on Safe Operation of Forklift Trucks
- WSH Guidelines on Improving Ergonomics in the Workplace
- WSH Guidelines on Landscape and Horticulture Management
- Activity Based Checklists:
 - Safe loading of materials
 - Safe storage in warehouse
 - Safe use of forklift trucks
 - Safe handling of loads

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