# WSH Guidelines

# Safe Loading and Unloading on Vehicles

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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 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 employees 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 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 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 manufacturer specifications and ensure adherence to it.
- 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 repaired where needed.
- Ensure risk assessment is carried out for all operations.
- Conduct safety and health briefings before starting work/ every shift.
- Plan (delivery) routes in advance considering the different restrictions for driving 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 including measures to prevent vehicular movement during loading and unloading activities.
- 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 (and acts), near misses and incidents to immediate supervisor.

- Inspect the cargo dimension before and after loading to ensure that it is safe to be transported on the approved travel route.
- Wear appropriate 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 that 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 accidents that could result from poorly secured cargo.

An accident 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: Accidents due to poor cargo securement.

When the vehicle is moving, the cargo is subjected to forces that shift it in the four directions illustrated in Figures 2 and 3. Friction and weight of the cargo are insufficient to keep the cargo from moving about during transportation. Hence the cargo must be adequately contained or restrained to prevent it from shifting or falling off.

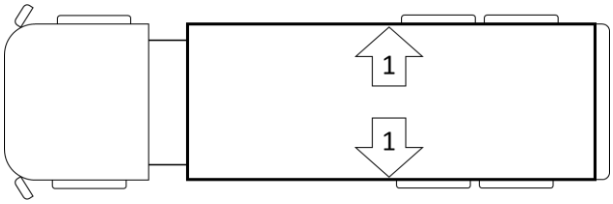


Figure 2: Top view of vehicle with lateral forces illustrated.

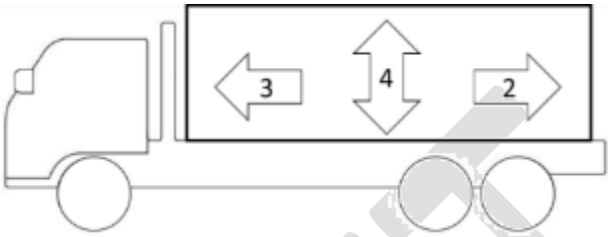


Figure 3: Side view of vehicle with forward, backward, and vertical forces illustrated.

How cargo may shift during transportation (taking reference from Figures 2 and 3):

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

**1.4 Transport packaging**

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

Primary packaging holds information about the product and bear 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.

Table 1: Examples of common 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 |

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

## 2 Loading and Unloading

An appropriate vehicle should be used for the loading and unloading operation to be carried out. At no time should the vehicle be overloaded or exceed the weight limit. 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 ground. 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 safe loading and unloading tips:

Loading
- Do not overload the vehicle
- Make sure that 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 the loads properly
- Ensure that the stacking arrangement is stable
- Do not stand in cargo holding or transport area when cargo is being loaded or adjusted

Unloading
- Make sure that the loads have not shifted during transportation before unloading
- Ensure that all equipment used for unloading are in good working condition

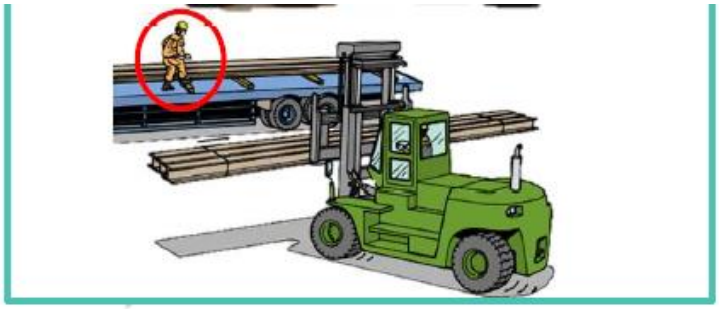

Figure 5: No standing on top of the cargo/ vehicle during loading and unloading operations.

### 2.1 Cargo arrangement

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

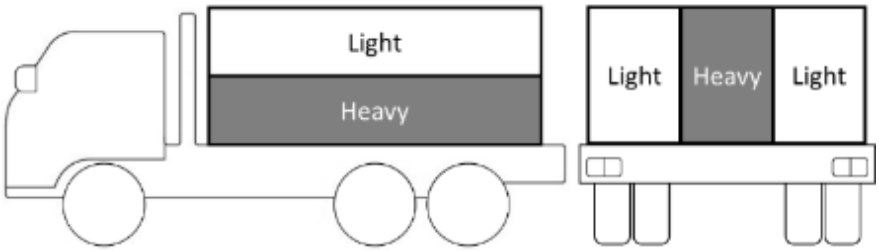


Figure 6: Cargo positioning for greater stability.

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 the stanchions where possible.
- Heavier cargo should generally be loaded below lighter cargo to lower the overall centre of gravity, and at the centre of the vehicle for better balance (see Figure 6).
- Cargo in 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 7: Examples of poor cargo arrangement. (From left to right: unstable stacking, unbalanced weight distribution, cargo stacked higher than headboard.)

**2.2 Common hazards**

Logistic operations are typically labour intensive, and employees frequently work around heavy machines and vehicles. Employees 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 employees 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**

Various aspects of work such as repetitive actions, handling heavy loads and over-exertion can lead to the development of Work-related Musculoskeletal Disorders (WRMSDs). Some common symptoms include persistent pains and aches in joints and muscles, discomfort, numbness, and tingling sensations.

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., trolley, 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 getting hit by moving or reversing vehicles. They may also get hit by heavy goods that fell 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 safe work procedures for work activities (e.g., stacking, rigging, lifting, securing) and ensure employees adhere to them.
- Implement a traffic management system at the workplace.
- Maintain equipment according to manufacturer's recommendations.
- Use appropriate personal protective equipment such as safety shoes and helmet.
- Place wheel chocks against vehicle's wheels to prevent accidental movement during loading and unloading operations.
- Steer 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 to steer clear of the opening door. Open one door at a time with caution and check for any possible falling cargo.

Other common hazards include pinch point hazards (see Figure 8) which can result in hand and finger injuries, and poorly maintained trailer bed platforms (see Figure 9) that can cause workers to lose their footing.

Figure 8: Example of a pinch point hazard.

Figure 9: 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 LTA requirements (e.g., functioning taillights, 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 projecting 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 10]. Drivers should ensure that the red flag is clearly visible to other road users.

Figure 10: Red flag tied to overhang.

A permit from the Land Transport Authority (LTA) is needed if the vehicle width exceeds 3 metres (or 2.6m on controlled roads[1]), 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.

[1] Refer to LTA website at lta.gov.sg for the list of controlled roads.

Table 2: Vehicular limits for roadworthiness and associated requirements.

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

### 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 11: Cabin guards (left, middle) and front bulkhead (right).

A cabin guard, commonly referred to as 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 11). Cargo should not be stacked taller than the headboard ideally.

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

Vehicles with loading compartments within the vehicle chassis (e.g., van) will need a front bulkhead to separate the driver cabin from the cargo compartment. 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.

**Sideboard and tailboard**

Sideboards and tailboards frame the loading platform and form part of the load restraining system (see Figure 12). 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 restrain 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. Both hands should be on the board to lower it, where practicable.

Figure 12: 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 to withstand the expected loading (see Figure 13). 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 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.

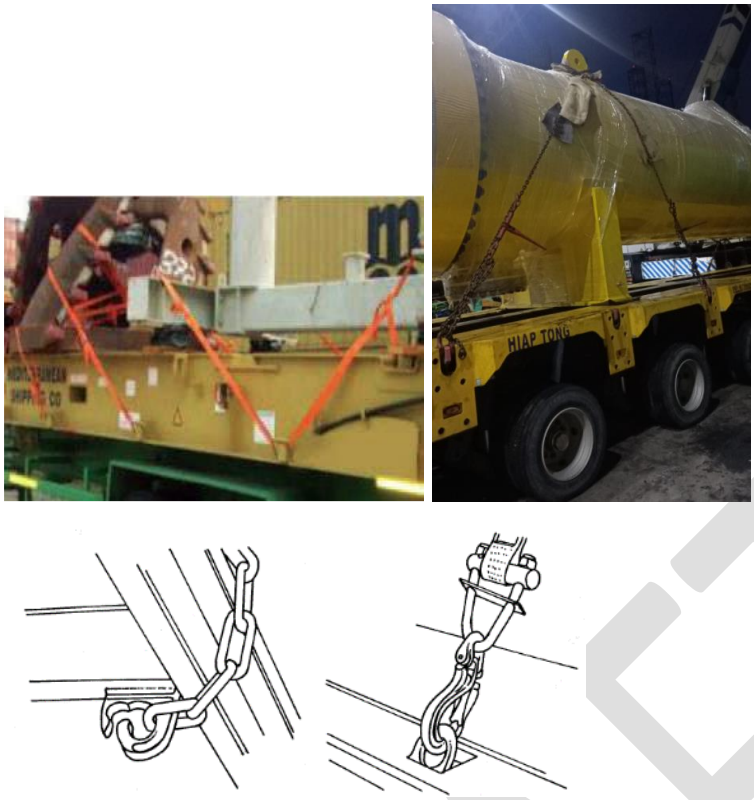


Figure 13: Photos of sample anchorage point and illustrated images.

Note: It is important not to mistake rope hooks for anchorage points (see Figure 14). Rope hooks vary in material and strength and can deform or give way easily when subjected to high stress. To avoid such mistakes, employees 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 14: Rope hooks on a lorry.

**Stanchion**


Figure 15: Stanchion bars on a trailer bed.

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 15). 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**


Figure 16: Vehicle fitted with curtain-sides.

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 16). 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.

### 3.3 Securing equipment

Securing equipment are the main means of keeping cargo anchored to the vehicle. 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.

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. 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.

Figure 17: Examples of protection on lashing devices.

**Load binder**

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 18). 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 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 18: Lever load binder (left) and ratchet load binder (right).

**Turnbuckle**

Figure 19: 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 19). Tension can be adjusted by rotating the frame, which extends or retracts both bolts simultaneously, without needing to twist individual bolts.

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

**Chains**

Chains can be used for lashing goods and secured with a load binder or turnbuckle (see Figure 20). Chains vary in thickness or grades which determine the SWL. The chain should be in good working condition and fit for use.


Figure 20: Steel chains with a grab hook attached on one end.

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

**Rope and Lashing belt**

Figure 21: Lashing belts and polyester rope.

Ropes can be 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 21).

Employees may attempt to tie two ropes together to create a longer rope (see Figure 22). This should not be allowed as the knot is a weak joint and can come apart easily in transit.

Figure 22: Bad practice of tying two lashing belts.

Lashing belt is typically made of plastic fibre (see Figure 21). Check and tighten the lashing, when necessary, before each trip for long-distance or multiple-stop trips because vibration generated from the engine and travel can loosen the lashings. Regular inspection should be carried out to spot wear and tear that will reduce load capacity. Edge protectors are recommended to protect webbing from abrasion.

**Net**

Nets can be made of webbing, rope or steel wires. It is 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 damaged section may give way during transportation.

**Sheet**

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 23).

Figure 23: Cargo covered with sheets for weather protection.

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.

**ISO freight container**


Figure 24: Trailer fitted with ISO container.

Trailers manufactured for carrying ISO freight containers are fitted with twistlocks for gripping and securing the containers at each corner (see Figure 24 and 29). Twistlocks are subject to frequent knocks and abrasion, hence should be frequently inspected for damages. All twistlocks should also be locked immediately after container has been loaded on trailer.

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.

Table 3: Cargo categories and examples.

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

## 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

Tying with lashing devices (e.g., rope, webbing, chains, cables, etc.) is the most common means of load restraint. 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: direct lashing and friction lashing.

- 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 25). Lashing devices need to withstand a greater force if the angle is larger than 60 degrees.

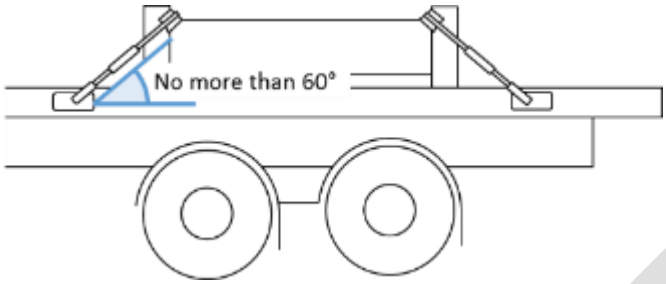


Figure 25: Direct lashing should be angled at no more than 60°.

- Friction lashing

Friction lashing is passed over cargo to bind it to 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 26) 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.

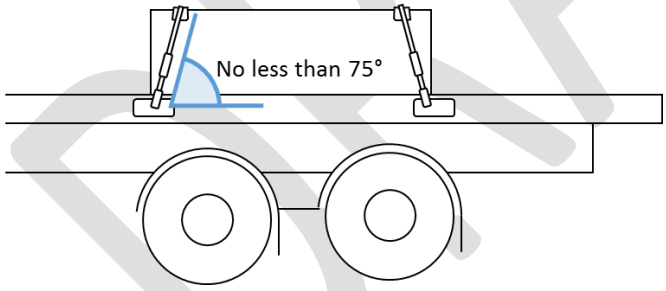


Figure 26: Friction lashing should be angled at no less than 75°.

Note:
- Always ensure that the cargo is stable before loosening the lashing.
- For asymmetric or bulky cargo like valve assemblies, please check with 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 27).

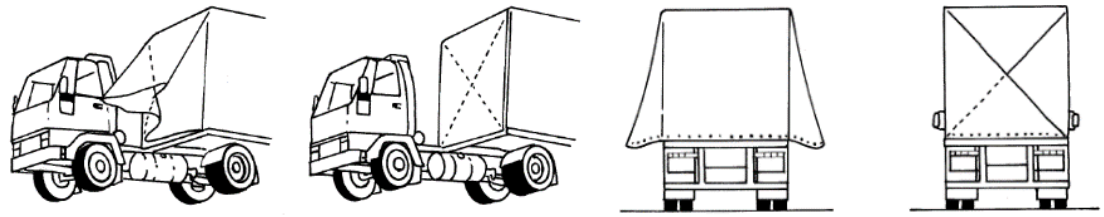

Figure 27: Securing sheet flaps at front and rear of vehicle.

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 28).

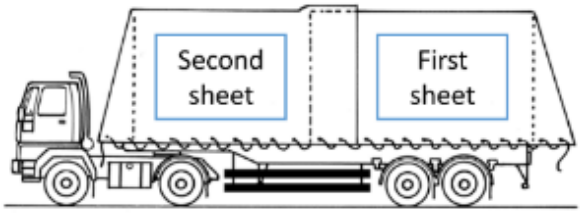


Figure 28: Using multiple sheets to cover cargo.

**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 29: 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 29). Every locking mechanism should be locked immediately after loading.

**Blocking method**

Cargo that are rigid enough can be blocked by fittings (e.g., stanchion, headboard; see Figure 30) 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.

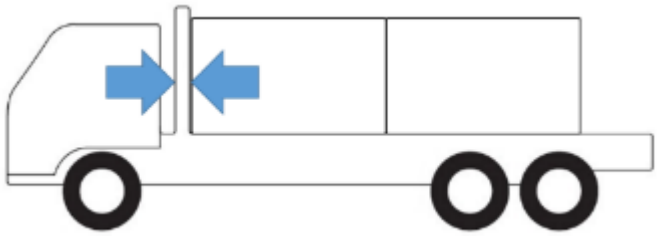

Figure 30: Blocking cargo with headboard.

Tiers of cargo can be blocked with a panel of plywood or chipboard (see part A of Figure 31) or by placing pallets to put a height difference in adjacent cargo units (see part B of Figure 31), which will block the upper layer against the lower layer.

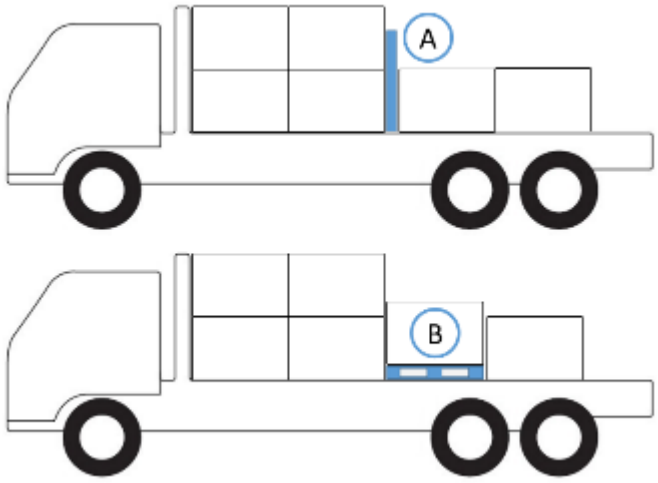


Figure 31: Blocking cargo with a board (A) or pallet (B).

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 32).

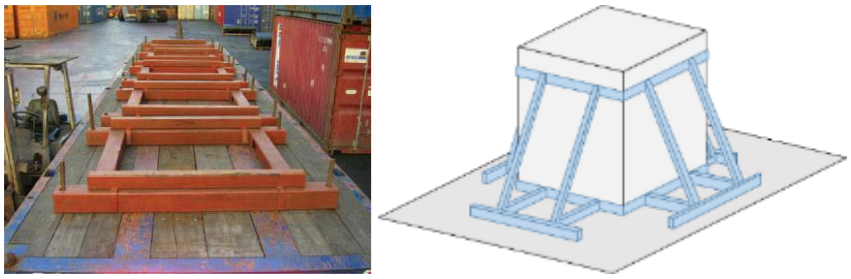

Figure 32: Examples of metal brackets for cargo support.

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

### 4.2 General freight

#### Bundles and bales

Bulk cargo (e.g., waste paper, 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 34).

Figure 34: Waste paper transported in bales.

Good practices to follow:

a) When loading one tier of bundles, an alternate arrangement creates a blocking effect (see Figure 35).
b) When loading two tiers, lash every row to vehicle. Bulk cargo requires additional securing as it usually bulges slightly so stacking will not be stable.
c) The content in a bundle may spill out of its packaging during the journey, so the entire load should be covered with a net or sheet after securing.

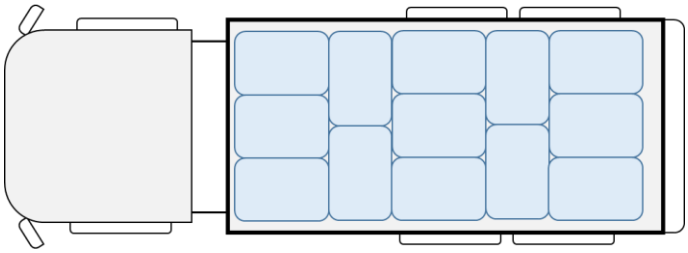

Figure 35: Alternating arrangement of cargo.

**Sacks and bags**

Granular cargo such as agricultural produce (e.g., rice, flour), gravel, and polymer beads are usually transported in sacks (see Figure 36). Sacks are bags made of pliable material (e.g., cloth, plastic) which makes securing a challenge because they do not hold their shape (see Figure 37).

Figure 36: Sacks loaded in alternating directions.

Figure 37: Bags on trailer.

Good practices to follow:

a) Keep height of layers uniform.
b) Use tensioning devices to secure every sack 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) Stacking on pallets and wrapping each stack with stretch film makes securing more effective.

**Long sections**

This category includes wooden planks, metal beams, bars etc. They may be transported as loose cargo or bundled up with rope (see Figure 38).

Figure 38: Various long cargo bundled and lashed.

Good practices to follow:

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

**Mixed cargo**

Good practices to follow:

a) Where 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 39). Avoid having cargo sticking out the sides of vehicle.
c) Fill up empty spaces with dunnage.

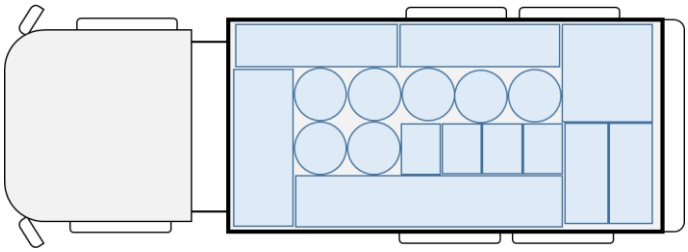

Figure 39: Enclosing smaller cargo units with the bigger cargo units.

**Palletised cargo**

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

Good practices to follow:

a) Before loading, check pallets for damages. Do not accept damaged pallets for loading.
b) Multiple small units should be stacked in a stable manner on pallet and secured to it with straps or shrink wrap. Individual units should not come loose and fall off (see Figure 40).
c) Do not exceed maximum laden weight of individual pallets and vehicle.
d) Distribute weight evenly across 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 vehicle to prevent movement and tipping. Lashing pallet alone is not recommended.
f) When stacking pallets, do not exceed height of headboard and lash every row. Ensure that the lower stack can withstand the weight. It may be necessary to support top stack by reinforcing lower stack with plywood to avoid crushing it.
g) Secure empty pallets to vehicle because they are light enough to be blown off from the vehicle.

Figure 40: Palletised cargo stacked.

**Boxes**

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

Good practices to follow:

a) Block upper layers by using bigger boxes, wood panels or pallets (see Figure 41 and section 4.1 Securing methods).
b) Lash every row of boxes (see Figure 42).
c) Do not stack boxes beyond height of headboard. Boxes at the lower tier should be strong enough or reinforced to support boxes on top.

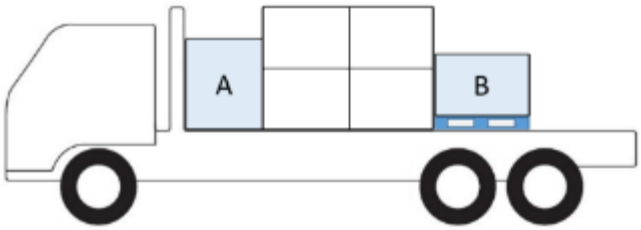


Figure 41: Blocking by using taller boxes (A) or raising boxes on pallets (B).

Figure 42: Lashing on boxes.

**Wheeled cages**

Commonly used to transport food items or gas cylinders. The wheels made handling bulk cargo easier however the wheels also made 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 cage from toppling over.
d) Load heavier items at the bottom of the cage.

**Skip containers**

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 43)
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 as necessary.

Figure 43: 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 44). 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 44: 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 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 shall 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.

Figure 45: 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.

Figure 46: Sheet metal rolls chocked with dunnage (left) loaded within metal brackets (right).

Loading on face of coil: It is preferable to use platforms with supporting brackets pre-fitted on to transport coils under such arrangement. However, each of the coils may still have the tendency to move in between the brackets during transportation. Therefore, adequate lashings to each coil will be

necessary. If such brackets are not available, every coil should be lashed with adequate tension and chocked with beams of dunnage wood (see Figure 46).

Figure 47: Coiled sheet metal loaded on pallets and lashed.

Loading on side of coil: Securing is more difficult. Each coil will need several lashings. Loop lashing around the coil prevents forward, backward and sideward shifting (see section 4.1 – direct lashing). Friction lashing over the coil further secures it (see Figure 47).

**Tyres**

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

Good practices to follow:

a) When stacking tyres, the column should not be taller than the headboard.
b) All tyres stacked in one column should be bound together to prevent individual tyres from coming loose from the column (see Figure 48).
c) Each column should be lashed with adequate tension so that the lashing does not loosen.

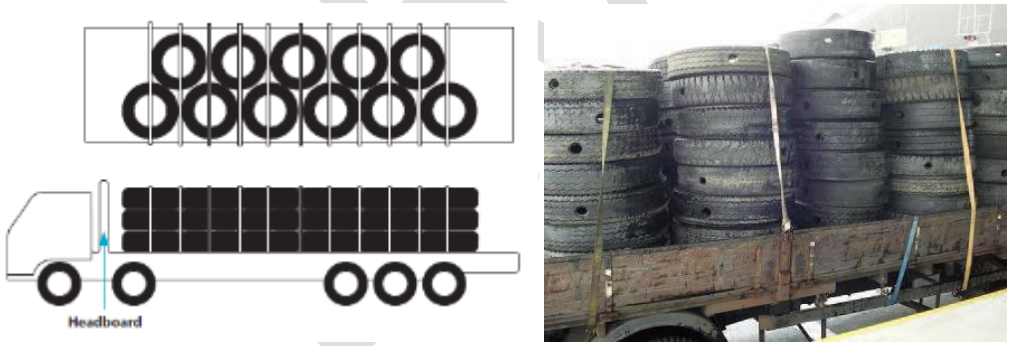


Figure 48: Stacks of tyres lashed to loading platform.

**Drums**

When drums are lying down (core horizontal), vehicles with fittings in the front and back (e.g., 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 such manner that movement will be restricted. Lash drums and chock 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 laterally to prevent drums from tipping over. Load drums up against headboard. Friction lashing should be applied for first and last row of drums (see Figure 49).

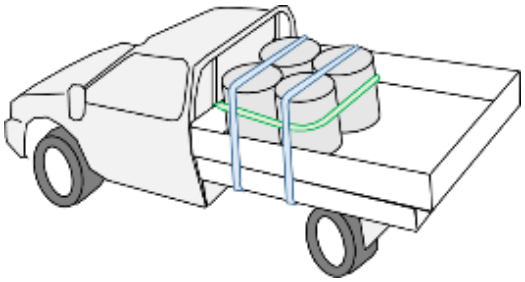

Figure 49: Lateral lashing (green) and friction lashing (blue).

**Pipes and poles**

Good practices to follow:

a) Long cylindrical cargo should be placed up against headboard and secured like long sections (see Figure 50; see also 4.2 General freight).
b) Stanchions or side boards are needed for blocking cargo.
c) Additional friction lashing is recommended to restrain cargo and prevent long pieces from whipping.
d) Tie a red cloth to over-hang extending beyond rear of loading platform.

Figure 50: Steel pipes loaded against stanchion and lashed to loading platform.

**Gas cylinders**

Preferably transported in customised racks fitted on 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 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 sticks out

of the sides of vehicle, load them lengthwise along 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 transporting.

### 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 51). The vehicles must be restrained carefully on the transporter as the suspension systems and tyres of the vehicles will make the vehicles bounce during transportation.

Figure 51: Vehicle transporters.

Good practices to follow:

a) Chock both front wheels of the vehicle (see Figure 52).
b) Ensure that parking brakes of every vehicle are applied.
c) Lash vehicles directly to trailer.

Figure 52: Anchorage point under a car (left) and wheel chock (right).

#### Heavy machines

These include excavators, crawler cranes and manufacturing equipment. 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 centre of gravity for more stability (see Figure 53).
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 brake applied.
e) If lashing points are available on the machine, lash it to the trailer directly. Lashing should have a minimum of four anchorage points per machine and sufficiently secured. Bigger and heavier machine may require more lashing points.
f) Movable assemblies (e.g., boom arm of crane, arm and bucket of excavator) should be positioned according to manufacturer 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 53: 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 facilitate securing and transporting.

Good practices to follow:

a) 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 is used to bind branches that are overhanging to prevent whipping.
c) After securing, cover tree with a sheet to prevent leaves, branches and soil in the root ball from being blown off by the wind during transportation (see Figure 54).

Figure 54: 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 and 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 trailer bed (see Figure 55).
b) Check that the delivery route has adequate height and weight clearance.
c) 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 55: Trailers mounted with steel frames for transporting precast concrete.

**4.5 Other cargo types**

**ISO containers and ISO 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 onto the trailer.
b) Cargo loaded into containers should be arranged and restrained in a manner that is stable and does not move 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 after loading is complete.
d) ISO liquid tanks are usually partially full. Changes in vehicle's speed and movement can lead to instability due to liquid flowing around in the tank. Low-bed trailers with mounted twistlocks are recommended to lower the centre of gravity (see Figure 56).
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 any loading can proceed.
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.
h) Driver must wear hand gloves to lock/unlock the container twistlocks and must do so with minimum 2 slots away from the mounting slot.
**i)** Driver must also ensure there is no worker in the container before pulling the container away

Figure 56: ISO container and ISO tank.

**Glass panels**

The use of glass as a building material is increasingly popular because it is a versatile material with various uses (e.g., insulation, internal partition, structural component). However, glass may be easily damaged due to impact forces, 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 57).
d) Additional lashing is also necessary for the entire unit of frame and glass.
e) The vehicle should have weather protection. If the vehicle lacks weather protection, a sheet can be used as weather protection because glass becomes slippery when wet. The sheet can also contain glass shards if a glass panel shatters or breaks during transportation.

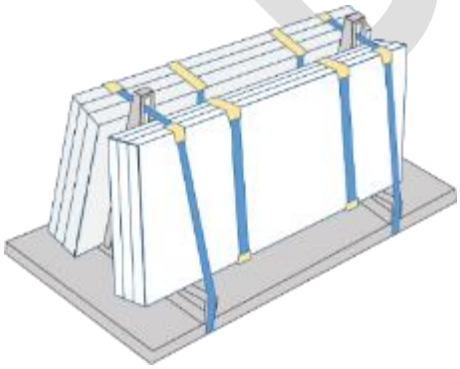

Figure 57: Large glass panels loaded and lashed on A-frame.

**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 SCDF).

Dangerous cargo are categorised into different classes. In Singapore, the different classes of dangerous goods are governed by different authorities (see Table 4).

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

| 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 |

- 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 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 type of package (i.e., drum, sack, and box).
d) Only transportation routes approved by NEA can be used, between 9.00 am and 5.00 pm on 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:
    - Pack in separate compartments on the same vehicle
    - Pack individual containers with strong material for extra protection and containment against leakage
    - Load 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 explosives should be secured to prevent them from knocking into the explosive cargo container. To minimise risk of fire, avoid use of 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 should be briefed on the emergency response plan (ERP) prior to the transportation.
i) 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.

# 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.

RA shall be carried out and risk control measures implemented before the start of any work activity. A sample RA form can be found at **Annex A**.

The employer or principal shall conduct a RA on WSH risks, including mental well-being, associated with any activity or exposure in the workplace. Considerations for 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, namely, Hazard Identification, Risk Evaluation and Risk Control. These steps are elaborated in Figure 58 below.

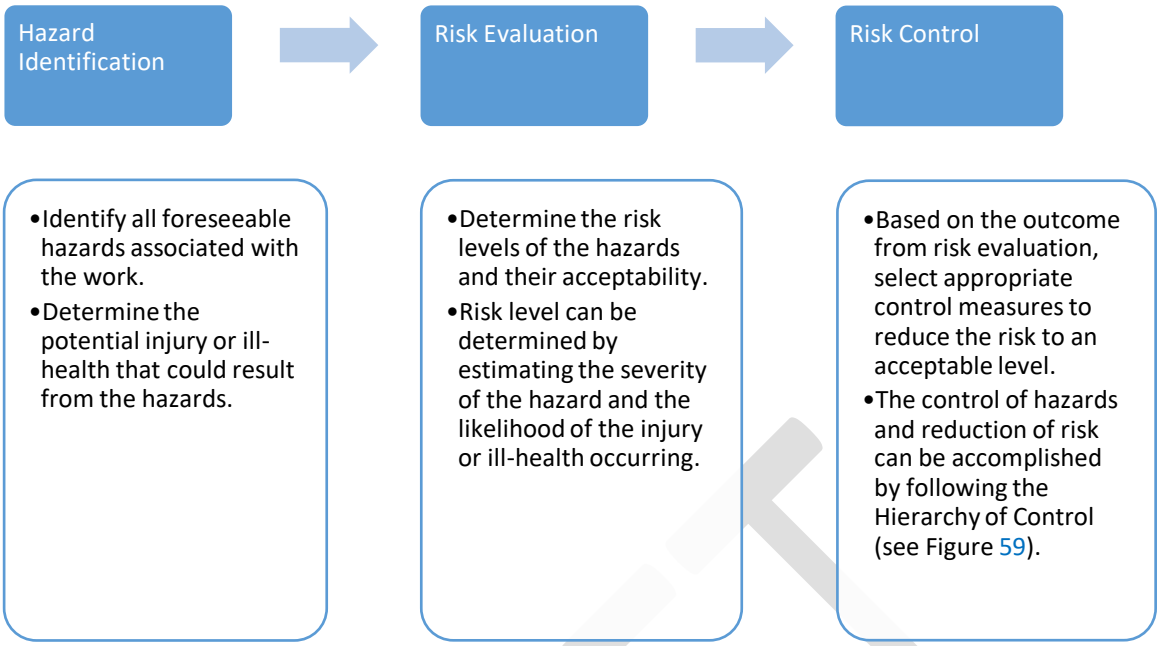


Figure 58: RA methodology.

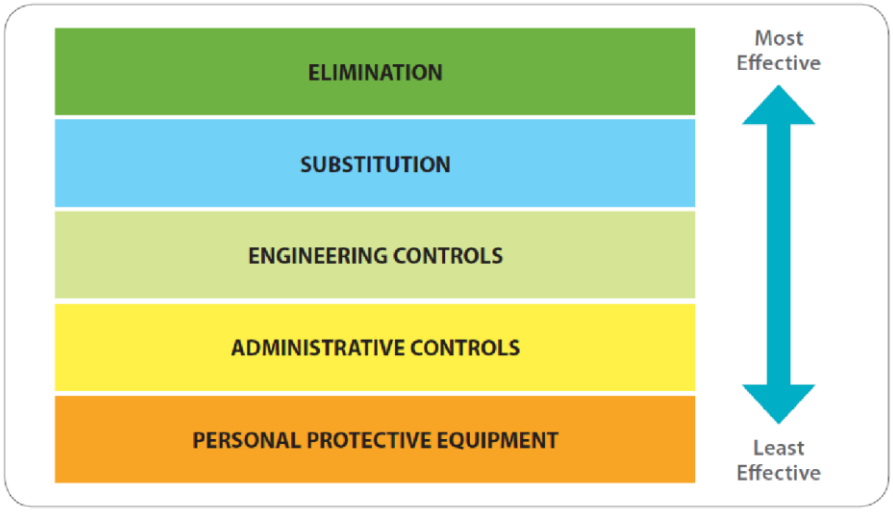


Figure 59: The Hierarchy of Control.

### 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 any measure or Safe Work Procedure (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; or
- Upon the occurrence of any bodily injury to any person because of exposure to a hazard in the workplace; or
- When there is any significant change in work practices or procedures; or
- Where there is any significant change in the employee'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 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 amongst 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 the delivery.

Delivery planning should begin with a proper assessment of the possible delivery hazards and associated risks by the customer. When a customer places an order with a supplier, a supply agreement is entered into between them. The agreement should provide clarity to both parties on their areas of safety and health responsibilities 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, who will ensure that all the hazards identified by the customer are communicated and made known to the driver. A sample delivery plan template is provided in **Annex B**.

The delivery plan is recommended for heavy goods (e.g., deliveries where vehicles used are categorised as Heavy Goods Vehicle (> 3,501 kg to 16,000 kg)) and out-of-gauge cargo deliveries.

## 6.4 Elements of delivery plan

The delivery plan should include but not limited to the following considerations:

- Personnel involved and their roles, responsibilities and competencies
- Compliance to statutory requirements and vehicle manufacturer’s operation manual for securing of loads for transportation
- Nature, weight (including net and gross weights) and dimensions of load
- Vehicle selected for loading and transporting the goods
- Type and location of securing points on the vehicle

- Selection and capacity of appropriate lifting/handling plant (including attachments to be used), securing equipment and tools
- Application of the correct loading/unloading methods
- Position of plant, personnel and of 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 accounts 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 (PTW) should be implemented accordingly.

RA, lifting plan and PTW are integral parts of the delivery plan to ensure that the necessary risk controls are put in place for safe delivery operations.

## 7 Acknowledgements


| Organisation | Contributor(s) |
|---|---|
| Workplace Safety and Health Council (Logistics and Transport) Committee | Mr Eric Law |
| Container Depot and Logistics Association (Singapore) (CDAS) | Ms Iris Tan |
| SAAA@Singapore (SAAA) | Mr Gabriel Lam |
| Singapore Logistics Association (SLA) | Mr Chan Hsien Hung |
| Singapore Transport Association (STA) | Mr Fabian Ong |
| Singapore Institution of Safety Officers (SISO) | Mr Manickam Thirumurugan |
| Jurong Port Pte Ltd | Mr Charles Tan |
| PSA Corporation Limited | Mr Roger Lim |
| Supply Chain Employees' Union (SCEU) | Mr Mohamad Bin Jonid |
| Land Transport Authority (LTA) | Ms Ding Woon Keong |
| Ministry of Manpower (MOM) | Mr Khairil Anuar Malek |
| Workplace Safety and Health Council | Mr Edd Hong Shuqi |
| | Ms Lin Peifen |

## Annex A - Sample Risk Assessment Form

| | | | | | | |
|---|---|---|---|---|---|---|
| Department: | Warehousing | RA Leader: | Roy Lim | Approval | | Reference number: |
| Work activity: | Loading and unloading cargo | RA Member 1: | Hong Qi Shun | Signature: | | 20220206RA0007 |
| Event / Location: | Container trucks and warehouse | RA Member 2: | Han King Siu | | | |
| Assessment Date: | 6 Feb 2022 | RA Member 3: | Eddie Lo | Date: | 10 Feb 2022 | |
| Last review date: | 7 Feb 2021 | RA Member 4: | Prakash Muthu | Name: | Wong Shi Huat | |
| Next review date: | 5 Feb 2023 | RA Member 5: | - | Designation: | Manager | |

| Ref | Hazard Identification | | | Risk Evaluation | | | | Risk Control | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Work activity | Hazard | Possible injury or ill-health | Existing risk controls | S | L | RPN | Additional controls | S | L | RPN | Implementer | Due Date | Remarks |
| 1 | Loading and unloading with a forklift | Forklift movement during loading. | Heavy concussion and possible fractures. | Segregating vehicular and human traffic at worksite to reduce chances of collision. | 4 | 4 | 16 | Installing a reversing alarm on forklift. | 4 | 2 | 8 | Eddie Lo | 10 Feb 2022 | |
| | | Cargo falls off forklift due to unstable stacking on pallet. | Bruising and contusions. | Enforce proper stacking and shrink wrap individual stacks to pallet. | 2 | 3 | 6 | - | - | - | - | Hong Qi Shun | 10 Feb 2022 | |
| 2 | Loading and unloading manually | Handling heavy loads manually. | Muscular strains and sprains. | Instruct employees to always handle cargo mechanically where possible. | 3 | 4 | 12 | Pair up with a co-worker to carry loads together. | 3 | 2 | 6 | Han King Siew | 10 Feb 2022 | |
| | | Fingers crushed between cargo items while unloading manually. | Fractured finger, bruising. | Instruct employees to always handle cargo mechanically where possible. | 3 | 4 | 12 | - | | | | Eddie Lo | 10 Feb 2022 | |
| | | Excessive workload or work pace. | Job burnout, stress, and anxiety. | Survey employee mental wellbeing e.g., iWorkHealth | 3 | 4 | 12 | Implement protected time e.g., company-wide time out | 3 | 2 | 6 | Hong Qi Shun | 10 Feb 2022 | |
| 3 | Securing cargo with lashing belt | Cargo falls off vehicle due to stacking palletised cargo. | Bruising and contusions. | Restrict height of stacking. | 3 | 2 | 6 | - | - | - | - | Han King Siew | 10 Feb 2022 | |
| | | Struck by over-tensioned lashing device that snapped. | Bruising and contusions. | Check lashing devices for tears and frays before use. | 4 | 1 | 4 | - | - | - | - | Eddie Lo | 10 Feb 2022 | |
| 4 | Transporting cargo on public road | Cargo falls off during transportation due to lack of lashing. | Cargo strikes other vehicles on road, possible road traffic accident. | Use lashing devices on top of vehicles with fittings that block the cargo. | 5 | 2 | 10 | Cover cargo with tarpaulin sheet or netting after securing. | 5 | 1 | 5 | Roy Lim | 10 Feb 2022 | |
| | | Cargo falls off during transport due to inadequate tension in lashing. | Cargo strikes other vehicles on road, possible road traffic accident. | Check lashing devices for tension before leaving loading bay. | 5 | 2 | 10 | Cover cargo with tarpaulin sheet or netting after securing. | 5 | 1 | 5 | Han King Siew | 10 Feb 2022 | |
| | | 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 | - | - | - | - | Prakash Muthu | 10 Feb 2022 | |
| 5 | Driving to meet delivery orders | Driving continuously over-time after an eight-hour shift. | Developing muscle strains from staying in same posture for long hours. | Educate and encourage drivers to stretch during their breaks. | 3 | 5 | 15 | Schedule routine job rotations amongst employees to vary work activities. | 3 | 3 | 9 | Eddie Lo | 10 Feb 2022 | |
| | | | Developing loss of concentration due to fatigue. | Provide adequate breaks during shift work. | 5 | 3 | 15 | Install fatigue management systems on vehicles. | 5 | 1 | 5 | Roy Lim | 10 Feb 2022 | |
| | | Runaway driving with unconscious driver. | Serious injury or fatality. | Medical examination for drivers | 5 | 3 | 15 | Regular health screening with close follow-up for drivers with chronic health conditions (e.g., high blood pressure). Targeted wellness programmes for drivers with chronic health conditions. | 5 | 2 | 10 | Prakash Muthu | 10 Feb 2022 | |
| 6 | Releasing lashing belt for unloading of cargo | Over-tensioned belt snaps. | Bruising and contusions. | Check lashing devices for tears and frays before use. | 5 | 1 | 5 | - | - | - | - | Hong Qi Shun | 10 Feb 2022 | |
| | | Cargo falls over after releasing tension in lashing belt. | Bruising and contusions. | Restrict height of stacking. | 3 | 2 | 6 | - | - | - | - | Prakash Muthu | 10 Feb 2022 | |

**Assessment of Likelihood**

| Level | Likelihood | Description |
|---|---|---|
| 5 | Almost certain | Continual or repeating experience. |
| 4 | Frequent | Common occurrence. |
| 3 | Occasional | Possible or known to occur. |
| 2 | Remote | Not likely to occur under normal circumstances. |
| 1 | Rare | Not expected to occur but still possible. |

**Assessment of Severity**

| Level | Ranking | Description |
|---|---|---|
| 5 | Catastrophic | Fatality, fatal diseases or multiple major injuries. |
| 4 | Major | Serious injuries or life-threatening occupational disease (including amputations, major fractures, multiple injuries, occupational cancer, and acute poisoning). |
| 3 | Moderate | Injury requiring medical treatment or ill-health leading to disability (includes lacerations, burns, sprains, minor fractures, dermatitis, deafness, and work-related upper limb disorders). |
| 2 | Minor | Injury or ill-health requiring first-aid only (includes minor cuts and bruises, irritation, and ill-health with temporary discomfort). |
| 1 | Negligible | Not likely to cause injury or ill-health. |

**5x5 Risk Matrix with Risk Prioritisation Number (RPN)**

| Severity \ Likelihood | Rare (1) | Remote (2) | Occasional (3) | Frequent (4) | Almost certain (5) |
|---|---|---|---|---|---|
| Catastrophic (5) | 5 | 10 | 15 | 20 | 25 |
| Major (4) | 4 | 8 | 12 | 16 | 20 |
| Moderate (3) | 3 | 6 | 9 | 12 | 15 |
| Minor (2) | 2 | 4 | 6 | 8 | 10 |
| Negligible (1) | 1 | 2 | 3 | 4 | 5 |

## Annex B – Sample Delivery Plan Template

| **1. General** | |
|---|---|
| Location of loading/unloading operation | |
| Contractor carrying out loading/unloading operation | |
| Date/time of loading/unloading operation | |

| **2. Details of the Load/s** | | | |
|---|---|---|---|
| Description of load/s | | | |
| Overall dimensions | | | |
| Weight of load | Kg/tonne | ☐ Known weight | ☐ Estimated weight |
| Position of loads on the vehicle | ☐ Estimated | ☐ Determined by drawing | |

| **3. Details of Vehicle** | | |
|---|---|---|
| Type of vehicle to be used | | |
| Size of the vehicle | | |
| Load restraining system | ☐ Bulkhead | ☐ Cabin Guards |
| | ☐ Sideboard & Tailboard | ☐ Stanchion bars |
| | ☐ Anchorage | ☐ Curtain-side |

| **4. Details of Securing the Loads / Cargos** | | |
|---|---|---|
| Methods of securing the loads | ☐ Direct Lashing | ☐ Friction Lashing |
| | ☐ Sheeting Method | ☐ Netting Method |
| | ☐ Locking Method | ☐ Blocking Method |
| | ☐ **Others:** | |
| Type of securing Equipment | ☐ Load Binder | ☐ Turn Buckle |
| | ☐ Chains | ☐ Webbing |
| | ☐ Rope | ☐ Sheet / Net |
| | ☐ **Others:** | |

| **5. Details of the Material Handling Equipment/Handling Plant** | |
|---|---|
| Type of material handling equipment | |

| | |
|---|---|
| Maximum SWL as certified by equipment manufacturer | |
| Any attachments to be used | |
| Has the attachment been certified fit for use with the equipment manufacturer | |

| **6. Personnel Involved in Loading/Unloading Operation** | | |
|---|---|---|
| Name | **Role** | **Qualification/Experience** |
| | | |
| | | |

| **7. Means of Communications** | | |
|---|---|---|
| Mode of Communication between the team | ☐ Walkie Talkie | ☐ Others, please specify: |

| **8. Physical and Environmental Consideration (please include any details in the space provided)** | | |
|---|---|---|
| Ground conditions | Is the ground made safe (e.g., placing steel plate)? | ☐Yes ☐No |
| Obstacles | Are there any blind spots along the route of the material handling equipment/handling plant? | ☐Yes ☐No |
| | Are there nearby structure, equipment or stacked materials that may obstruct loading/unloading operation from being carried out safely? | ☐Yes ☐No |
| Demarcation | Has the zone of operation been barricaded (with warning signs and barriers) to prevent unauthorized access? | ☐Yes ☐No |
| Environment | Do not proceed with loading/unloading operation under the following circumstances:<br>☐ Thunderstorm and lightning strikes in the area. The ground conditions must be checked after a thunderstorm.<br>☐ Other circumstances (please specify) | |

| **9. Sequence / Special Precautions** | **10. Sketch of the Zone of Operation:** |
|---|---|
| | *(It is recommended that you include the initial location of the load, the final location and path of the load. It is also important to indicate any obstructions or equipment that may obstruct the loading/unloading operation).* |

| | | |
|---|---|---|
| **Applied by:**<br><br>**Name:** | **Signature:** | **Date:**<br><br>**Time** |
| **Prepared by:**<br><br>**Name:** | **Signature:** | **Date:**<br><br>**Time** |
| **Reviewed by:**<br><br>**Name:** | **Signature:** | **Date:**<br><br>**Time** |
| **Approved by:**<br><br>**Name:** | **Signature:** | **Date:**<br><br>**Time** |

Note: This is only a sample Delivery Plan, the content is by no means comprehensive. Users would have to include key critical document and information such as cargo details, placement of cargo, selection of securing equipment, securing method, etc to ensure safe loading/unloading.

## References


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


## Useful Resources

1. WSH Guidelines on Workplace Traffic Safety Management
2. WSH Guidelines on Safe Operation of Forklift Trucks
3. WSH Guidelines on Improving Ergonomics in the Workplace
4. WSH Guidelines on Landscape and Horticulture Management
5. Activity Based Checklists:
   - Safe loading of materials
   - Safe storage in warehouse
   - Safe use of forklift trucks