APPENDIX 7

Loads Transported by Roads

Introduction

Sakhalin Energy road safety activities rely heavily on road transportation of materials and loads. Loads transported by vehicles represent a threat being one of the root causes of considerable number of road traffic incidents related to load transportation.
This document describes Sakhalin Energy's minimum mandatory requirements to ensure the security and safety of loads transported by road.

Purpose

To manage Risks[1] related to loads transported by roads on Company Business.

Target audience

- *Project/Asset Managers*
- *Managers/Departmental Heads*
- *HSE Specialists*
- *Supply Chain engineers / buyers*
- *Drivers*
- *Staff, involved into cargo loading/unloading operations*
- *Fleet managers*
- *Road Safety Engineers and Specialists*
- *Contract Holders*
- *Contractors, Subcontractors*
- *Road Safety Monitoring Teams*

What situations are covered?

This document sets requirements for loads transported by Sakhalin Energy land transport and by (Sub) Contractors on behalf of the Company.

Terminology

TERM	MEANING
Shall	Indicates a mandatory course of action.
Should	Indicates a preferred course of action.
May	Indicates a permitted course of action.

[1] Italicized terms in this document are included in the in the Sakhalin Energy HSE Glossary

Definitions

TERM	MEANING
Cargo transport unit (CTU) or load	A freight container, swap body, vehicle, railway wagon or any other similar unit. Material object or non-commodity materials taken for transportation.
Shipper	The party named on the bill of lading or waybill as shipper or who concludes a contract of with a carrier.
Payload	The load capacity (load weight) transported by a vehicle.
Consignee	The party, which accepts the load after transportation.
Decanewton (daN)	Unit of force. 1 daN (kgf) = 10 N = 1 kg.
Divisible load	A load that, without loss of consumer properties or the risk of its spoilage, can be placed on 2 or more load spaces.
Incident	An Incident is an unplanned event or chain of events that has, or could have, resulted in injury, illness or damage to Assets, environment or reputation.
Company	Shall mean “Sakhalin Energy Investment Company, Ltd” and any other organizations (contractors and subcontractors, etc.) that operate on behalf of “Sakhalin Energy Investment Company, Ltd”.
Friction factor, μ	Friction coefficient between the load and the adjoining surface (Apendix 7.2).
Oversized load	The load, which, taking into accountconsidering the vehicle dimensions, exceeds the maximum permissible dimensions of vehicles according to RF regulations.
Packer	The party that loads, places or fills the load on the vehicle.
A person responsible for drawing up the schemes for stowage and lashing load on the vehicle	A person, who has the required knowledge in cargo stowage and securing on a vehicle, the ability to correctly select the type of lashing and to calculate the necessary number of lashing device that have been trained accordingly.
Tensioning device	Mechanical device inducing and maintaining a securing force in a load restraint assembly.
Standard tension force, S_{TF}	Residual force after physical release of the handle of the tensioning device, daN.
Standard hand force, S_{HF}	Hand operating force, daN.
Dangerous Load	Substances, products, industrial or other economic activity wastes, which by virtue of their features may endanger humans’ life and health, environment, or damage / destroy materials.
Sender	Company’s Department which prepares a consignment for transport load.
Carrier	The party, which based on a contract with Company, undertakes to transport or ensures safe transportation of cargo by road.

Gross Vehicle Mass	The maximum allowable weight of a vehicle when loaded, as stated by the vehicle manufacturer.
Blocking capacity, BC	Maximum force that a blocking device is designed to carry in a specified direction, daN.
Lashing capacity, LC	Maximum allowed force that a lashing device is designed to sustain in use, daN.
Breaking force, BF	Maximum force that the lashing device withstands when tested, i.e. complete with ratchet and end fittings, daN.
Vehicle Kerb Weight	The unladen weight of a vehicle.
Lashing device	Flexible device used in the securing of the load on a load carrier, with a label (a plate with information), conformance certificate and the passport.
Lashing Point	Securing device on a load carrier to which a lashing device may be directly attached.
Heavy load	Load, the mass of which with the vehicle mass exceeds the permissible gross vehicle mass according to the current legislation (Government Decision No. 272 of April 15, 2011).
Centre of Gravity	The point at which a load can be balanced with half of the mass on either side of a line crossing through the point.

1. Responsibilities

1.1. In general, transport operations using loads in particular, involve various parties each of whom have a responsibility to ensure that the load is transported through the supply chain without incident.

1.2. The shipper must provide a load which is safe and suitable for transport. The shipper remains responsible for any incorrect information on the load, deficiencies of the load or CTU that is a result of poor packing and securing.

1.3. If the **carrier** is not the **packer**, the shipper should fulfil its obligations to the **carrier** ensuring that the **load** is secured on the vehicle.

1.4. Within this chain of responsibilities, each party in the chain should comply with their individual responsibilities and in doing so increase safety and reduce the risk of any incident.

1.5. Functions within the chain of load transportation by vehicles:

1.5.1. The **sender** is responsible for:

- Provision of sufficient and true information about load to the shipper and(or) the carrier.

1.5.2. The shipper is responsible for:

- The loads are correctly described, including the total weight of the load and dimensions;
- All required documents are received from the sender;
- A person responsible for drawing up the schemes for stowage and lashing load on the vehicle and the carrier are notified of any unusual transport parameters of individual packages, for example, if the center of gravity is shifted;

- The carrier is provided with all the information required for proper laying and drawing up a scheme for load stowage and lashing load on the vehicle;
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- All loads are properly prepared for transportation. Packages are able to withstand the stresses that can be expected under normal transportation conditions;
- Dangerous load is correctly classified, packed and labeled. The loads were vented so that any poisonous or harmful gases could be removed prior to laying;
- The carrier is provided with the necessary documents and instructions for transportation on time.

1.5.3. The carrier is responsible for:

- It is confirmed that the gross mass, length, width and height of the vehicle comply with regulatory restrictions;
- For the proposed load transportation, a suitable vehicle is provided to minimize the risk of accidents and damage to the load;
- The vehicle complies with the requirements of Road Transport HSE Management Standard;
- All permits for transportation of oversized and heavy load were received according to current legislation and this Standard;
- Calculations were made and schemes of load stowage and lashing on the vehicle were drawn up;
- Scheme of load stowage and lashing on the vehicle and additional schemes, if necessary, are compiled for the whole route;
- A person responsible for drawing up the schemes for stowage and lashing load on a vehicle is competent and trained;
- The load is placed and secured according to the scheme for stowage and lashing load on a vehicle by trained personnel;
- Control over the loading and stowage of load on a vehicle;
- Prior to loading, if there is an objective possibility, the declared parameters of the load are verified against the actual ones. In case of discrepancy between the declared parameters and the actual ones, the loading is stopped until new conditions of transportation are agreed;
- Driver is properly trained and fully competent;
- The scheme for stowage and lashing load on a vehicle is transferred to the driver;
- Transportation is carried out according to the requirements of the Road Transport HSE Management Standard.

1.5.4. Packer is responsible for:

- Ensuring that the load is checked before loading and its condition is suitable to be transported;
- Condition of lashing devices have been visually checked before use and their characteristics comply with requirements of current legislation and this Standard;
- Load is properly secured, according to the scheme for stowage and lashing load on the vehicle;
- Timely inform Shipper and Carrier if there are any shortcomings in the scheme for stowage and lashing load on the vehicle.

1.5.5. Driver is responsible for:

- Visual inspection and condition control over of load spaces during loading;
- Ensure integrity and safety of all load spaces during transportation;
- Carry out checks, periodic and timely condition control over load spaces and lashing during the trip.
- Any identified load shifts should be reported, to prevent reoccurrence

1.5.6. Consignee is responsible for:

- Detecting any damage/shift of the load and to notify carrier and shipper;
- Returning the CTU completely empty and clean, unless otherwise agreed;
- Removing all marks, plates or signs related to the previous consignments.

1.6. Contract holders and / or heads of projects / facilities / departments of the Company or responsible persons Control of security and responsibility for the allocation of roles within the chain of movement of load in road transport rests.

2. General Requirements

2.1. Legal Requirements.

2.1.1. Specific legal requirements with respect to loads transportation are set forth in the following RF regulations:

- RF Government Decree No.1090 “On Traffic Rules” dated October 23, 1993;
- Federal Law № 259-FZ dated 08.11.07, "Charter for Road Transport and Urban Ground Electric Transport";
- Order of RF Ministry of Transport No. 7 of 15.01.2014 "On Approval of Rules to Ensure Safe Transportation of Passengers and Cargoes by Motor Vehicles and Urban Ground Electrical Transport, and List of Actions for Training of Personnel of Legal Entities and Private Entrepreneurs Engaged in Road Transportation and Urban Ground Electric Transportation, in Safe Operation and Keeping Vehicles in Safe Operating Condition";
- RF Government Decree No. 272 dated 15 April 2011 “On approval of Rules for Cargo Transportation by Road";
- GOST 26653-2015. Interstate standard. Preparation of general load for transportation. General requirements (made effective by the Order of Rosstandart from 17.05.2016 N 325-st);
- GOST 19433-88. Dangerous loads. Classification and marking (approved by Decree No. 2957 of the USSR State Committee for Standardization, dated 19.08.1988);
- Decree of the Sakhalin Region Administration No. 163-p, dated August 7, 2007 "On approval of requirements to develop and approve plans for prevention and elimination of natural and technogenic emergencies, and instructions on actions of an organization's personnel if natural and technogenic emergency occur in the Sakhalin Region".

2.1.2. Specific legal requirements with respect to the load transportation are provided for by the following International legislation:

- “European Agreement concerning the International Carriage of Dangerous Goods by Road” (ADR);
- IMO/ILO/UNECE Code of Practice for Packing of Load Transport Units (CTU Code)
- EN 12195-1 Load restraining on road vehicles – Safety – Part 1: Calculation of securing forces;
- EN 12195-2 Load restraining on road vehicles – Safety – Part 2: Web lashing made from man-made fibres;
- EN 12195-3 Load restraining on road vehicles – Safety – Part 3: Lashing chains;
- EN 12195-4 Load restraining on road vehicles – Safety – Part 4: Lashing steel wire ropes;
- EN 12640 – Lashing points;
- EN 12642 – Strength of vehicle body structure.

2.2. Requirements to ensure safe conditions for the carriage of load.

2.2.1. The load must be placed and lashed on the vehicle in a way to prevent injuries, vehicle instability during transportation, cargo displacement or removal from a vehicle or falling out of it.

2.2.2. Stowage and lashing of loads on a vehicle are done according to the scheme of stowage and lashing loads on the vehicle applicable to a specific type (model) of a vehicle considering

technical conditions of the load according to Appendix 7.1.

2.2.3. Scheme of stowage and lashing load on the vehicle is made for each transportation.

2.2.4. In case if additional cargo is loaded on a vehicle en-route, additional schemes for stowage and lashing loads on a vehicle for the entire route are executed.

2.2.5. Cargo must be loaded on a vehicle in accordance with the scheme of stowage and lashing loads on a vehicle observing the following requirements:

- Before loading, platform, supporting surfaces of the load must be cleaned of snow, ice and other impurities that reduce surface friction;
- use anti-slip mats that increase surface friction between the platform and the load and between the tiers of load;
- maximum load on the vehicle's axle (axis), which is caused by a change in the load weight distribution when it is partially unloaded (for groupage loads), must not be exceeded.

2.2.6. During transportation, drivers should regularly stop in safe places and inspect the load and its lashing. The weakened lashing identified during the inspection must be tightened by the driver so that the appropriate fixation of the load is maintained. The frequency of such inspections should be determined by the driver, considering road and weather conditions, but not less than every 2 hours.

2.2.7. When a new equipment is designed and manufactured specially for the Company needs, Customer (Sender) must ensure that technical specifications provide for lashing and placement of this equipment on the vehicle for future transportation.

2.3. Maximum permissible dimensions and weight of vehicles.

2.3.1. The dimensions of loaded vehicles shall not exceed the following limits:

- 4,0 m in height;
- 2,55 m in width;
- 20,0 m in length.

2.3.2. Journey Management Plan (JMP) must be executed for any load transported by road, which cannot meet the above limits, regardless of the trip category. JMP and the scheme for stowage and lashing load on a vehicle must be provided no later than five working days prior to carriage for approval by the Company's Road Safety Department. Taking into account the complexity and specifics of transportation, escort vehicles might be additionally required.

2.3.3. Gross Vehicle Weight and the axle load shall not exceed the limit values specified in the vehicle's passport and the permissible axle load according to the current legislation, permanent and temporary regional restrictions established on public roads.

2.3.4. Ensuring safety in the transportation of oversize and (or) heavy load must comply to the requirements of existing regulations on the Russian Federation territory.

2.4. Vehicle technical condition requirements.

2.4.1. Before loading the vehicle, Shipper must check technical condition of the body parts: the front side, side and rear flaps, the side platform. The body as a part of the load securing system must restrain lateral and longitudinal load displacements.

2.4.2. The sides, the flooring of the side platform should not have mechanical damages, cracks, rupture of the skin sheets, significant corrosion damage. The awning of the side platform and the body-van should not have any damage, ruptures and must be securely fixed. Elements of the frame for the awning should not be damaged and must be securely fixed in the lashing devices.

2.4.3. Outside, the side platforms must be equipped with devices for linking the tent and securing the load (with rims, hooks, staples, other devices).

2.4.4. The lashing points shall be marked with the designation of the permissible holding force. In the absence of this marking, the permissible anchoring force to this lashing point shall be 2000 daN.

2.4.5. It is not allowed to have a malfunction of the body door locks, the side boards of the side platform, which have significant external damage to the body parts.

2.4.6. Usage of a container carrier with defective rotary locks is allowed.

2.5. Requirements to stow the load and select a vehicle for transportation.

2.5.1. The vehicle selected to carry a specific load must be appropriate for the duty, the design

and construction of the vehicle must be compatible with the load to be carried. Usage of vehicle for a specific task must not contradict manufacturer's requirements.

2.5.2. Vehicles shall not carry load or tow a trailer in excess of the recommended payload specified by the vehicle manufacturer.

2.5.3. Bulk liquids must be transported in vehicle tanks designed to completely contain the load and minimise the of load movement effecting vehicle stability (i.e. fitted with baffles). Loading must meet the requirements of tank manufacturers for filling them.

2.5.4. Heavy load, heavy mobile plant, vehicles and equipment (mobile cranes, engineering plant, bulldozers, graders, etc.) shall only be transported by low-bed trailer. Hydraulic booms shall not be used a means of load restraint.

2.5.5. When using semi-trailers equipped with swivel locks (container carriers), all four locks per container must be used to transport load containers 20 and 40 feet in size with the help of rotary locks.

2.5.6. When transporting goods in bulk (soil, clay, gravel, sand and gravel mixture, etc.), the shipper, when loading, should evenly distribute the material in the vehicle body so that the load does not protrude beyond the upper edges of the open body. To prevent load from falling out of the body when the car is in motion, loose materials (eg sand or soil) should be covered to prevent blowing or dropping off during transportation. It is allowed to deviate from requirements under this item if transportation is carried out within the asset.

2.5.7. Divisible load is stowed on the vehicle in such a way that total weight of the vehicle with such load does not exceed the vehicle gross weight and permissible axle loads of the vehicles.

2.5.8. When locating the cargo, the following requirements are considered:

- Larger and heavier loads are placed at the bottom and closer to the longitudinal axis of symmetry of the platform or body of the vehicle or container taking into accountconsidering the center gravity as low as possible over the deck of the platform and in the middle of the length of the platform;
- homogeneous piece loads in a vehicle body or in a container it is necessary to stack with the same number of layers and ensure a reliable fastening of the upper tier of the stack;
- loads with a smaller bulk density are placed on loads with a large bulk density;
- free space, gaps between load stacks and body walls are filled with gaskets, inflatable containers and other devices.

2.5.9. When placing the load, it is necessary to ensure that vehicle controllability and braking efficiency under any conditions is retained.

2.6. Requirements for lashing devices.

2.6.1. Means of securing load are divided into:

- Frictions lashing (straps, chains, ropes);
- Direct lashing (straps, chains, ropes);
- Blocking (wooden devices, bars, supports);
- Frictional (anti-slip mats).

2.6.2. The following shall not be used for load securing:

- together different lashing devices (strap with a rope, strap with a chain and others);
- mechanical aids (rods, levers, mounts and other means not designed for lashing load);
- knotted lashing straps, chains, ropes.

2.6.3. Before loading by the shipper, lashing device condition is visually checked for compliance with requirements of current legislation and this Standard. If any damage is found, the lashing devices must not be used.

2.6.4. The lashing devices must visually inspected on a regular basis, at least once every six months for compliance with requirements of current legislation and this Standard with documentary confirmation and record in the relevant log.

2.6.5. Lashing straps, chains, ropes must be protected from the exposed surfaces of the load to avoid mechanical damage by means of protective devices – corners, linings and other devices.

2.6.6. Tags of lashing straps with marking, ropes and chains must not be damaged, they must be clearly marked.

2.6.7. It is prohibited to use lashing straps in the following cases:

- In the formation of ruptures, transverse cracks or incisions, delaminations, significant foci of corrosion of metal parts, damage to clamping or connecting elements;
- In case of damage to the bearing seams;
- if there is no marking of the lashing straps.

2.6.8. Lashing ropes are prohibited to be used in the following cases:

- when the rope wears out, when its nominal diameter is reduced by more than 10%;
- with flattening, when the rope is squeezed by more than 15% or it has a sharp edge.

2.6.9. Lashing chains are prohibited to be used in the following cases:

- when the thickness of the links is reduced in any place by more than 10% of the nominal thickness;
- with the elongation of the link by any deformation of more than 5%;
- with cuts.

3. Calculation of lashing devices.

3.1. Loades, transported by road, are lashed on the vehicle regardless of the transportation distance. The choice of lashing devices and the method of lashing depends on type and composition of the load, considering road safety measures, safety of the transported loads and vehicle.

3.2. Each load must be lashed in such a way so that during transportation it does not displace, relative to the vehicle.

3.2.1. The following forces, acting on the load the vehicle is in motion, are taken into accountconsidered:

- longitudinal horizontal inertial forces arising during vehicle braking and acceleration;
- transverse horizontal forces that arise when the vehicle is moving on corners and rounded roads;
- vertical forces arising when the vehicle is swinging;
- friction force (the force acting by means of friction between the load and the adjacent surfaces during the movement of the load);
- Gravity (load weight).

3.2.2. The forces acting on the load must compensate (figure 7.1):

- force equal to 0.8 of the load weight, in the forward direction (longitudinal horizontal in the same direction as the vehicle moves);
- force equal to 0.5 weight of the load, in the reverse direction and sideward (left, right) the same direction as the vehicle moves.

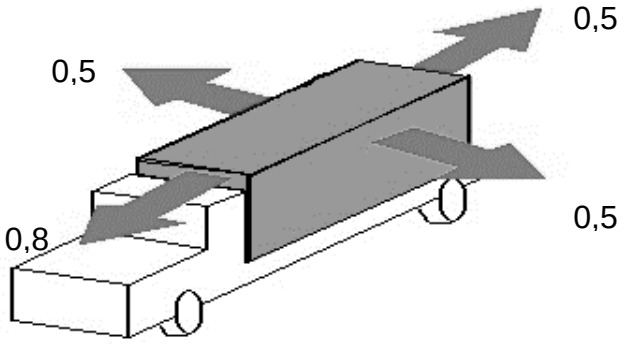


Figure 7.1 – Forces acting on load

3.2.3. Generally, load securing consists of balancing the forces of a load by locking, blocking and/or lashing. Locking, a completely positive connection, is mainly used in the transport of containers and is not usually combined with lashing devices. Blocking results in a positive connection in the blocked direction only and therefore is often combined with lashing devices. The general requirements for a safe transport are:

- the sum of forces in any direction equals zero;
- the sum of moments in any plane equals zero.

3.2.4. For loads not subject to sliding or overturning, appropriate measures should be taken to avoid their significant displacement due to vibration.

3.3. Stability of load against overturning should be determined in both longitudinal and transverse directions. If the condition of Equations is met:

$\mathbf{l > 0,8h}$ - in the longitudinal direction;

$\mathbf{b > 0,5h}$ - in the transverse direction;

$\mathbf{L - l > 0,5h}$ - in the opposite direction,

where L – length of the load, m;

l – distance from the load front edge to the center gravity in the longitudinal direction, m;

b – distance from the load lateral edge to the center gravity in the transverse direction, m;

h – height of the center of gravity of the load, m.

3.4. There are two methods of load lashing: friction lashing and positive locking.

3.4.1. Friction lashing is based on increasing the friction force between the load and the platform. To do this, with the help of lashing devices, pressure on the load increases, so that it presses more strongly against the floor and maintains its original position by an increased friction force (figure 7.2).

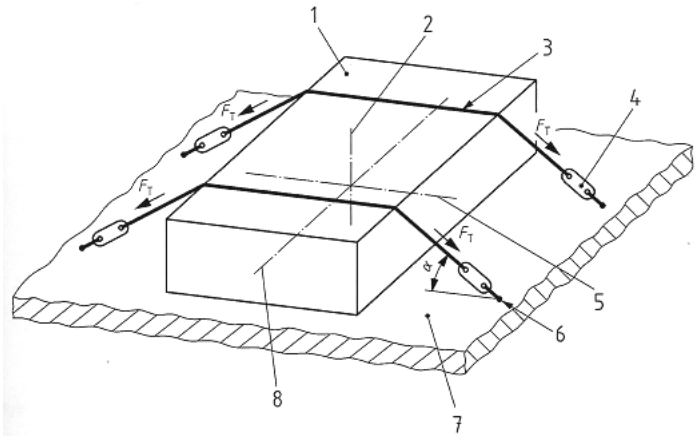


Figure 7.2 – Friction lashing of a load

1 – load; 2 – vertical axis; 3 – lashing device; 4 – tensioning device; 5 – transverse axis; 6 – lashing point; 7 – horizontal plane; 8 – longitudinal axis

3.4.2. The number of lashing devices to prevent slipping of the load is determined according to Appendix 7.3 and 7.4, or by the following equation:

$$\boldsymbol{n = \frac{(c_{x,y} - \mu) \cdot 0,63m}{\mu \cdot sin\alpha \cdot S_{TF}}}$$

where $c_{x,y}$ – acceleration coefficients in the longitudinal and lateral (reverse) direction (c_x = 0,8; c_y = 0,5);

α – angle between the fastening equipment and the platform;

m – weight of cargo, кг.

3.4.3. The number of lashing devices to prevent overturning of the load is determined according to Appendix 7.5 or by the following equation:

$$\boldsymbol{n = \frac{1,25m(c_{x,y} \cdot h - l,b)}{L,B \cdot sin\alpha \cdot S_{TF}}}$$

where B – width of the load, m.

3.4.4. If there is no marking on the lashing strap's tag standard tension force, use the standard tension force equal to 0.1 LC, which occurs at a maximum force of 50 daN applied to the tensioning device.

3.4.5. If there is no marking of the lashing chain's tag standard tension force, use the standard tension force equal to 0.25 LC for the chains of the caliber of 6-10 and 0.15 LC for the chains of caliber 13-16, which occurs at a maximum force of 50 daN applied to the tensioning device.

3.4.6. Positive locking is based on reducing of space around the load. Thus, one side of each cargo unit adjoins another surface, whether it is another load or front, rear, side wall, or space is limited by lashing devices.

3.4.7. Dynamic durability of the front side should withstand is the force of 30% of the vehicle's capacity, but not more than 3500 daN, the rear and side boards - 10%.

3.4.8. There are the following types of positive locking:

- Blocking (Figure 7.3);
- Diagonal lashing (Figure 7.4);
- Loop lashing (Figure 7.5);
- Sprinkling (Figure 7.6).

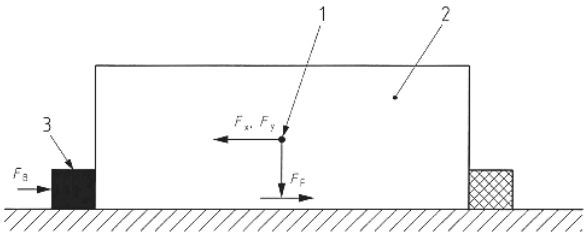


Figure 7.3 – Blocking

1 – centre of gravity; 2 – load; 3 – blocking device

3.4.9. The number of lashing devices to prevent the load from slipping is determined according to 7.6 or by the following equation:

$$LC \geq \frac{m(c_{x,y} - 0,75\mu)}{2(cos\alpha \cdot cos\beta_{x,y} + 0,75\mu \cdot sin\alpha)}$$

where $\beta_{x,y}$ – the angle between the projection of the lashing device on the platform and the longitudinal or transverse axis of the vehicle, respectively, deg.

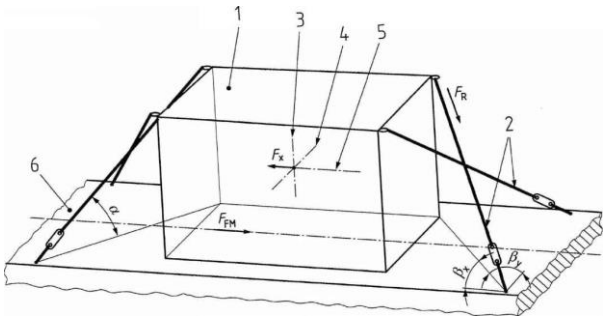


Рисунок 7.4 – Diagonal lashing of a load

1 – load; 2 – lashing device; 3 – vertical axis; 4 – transverse axis; 5 – longitudinal axis; 6 – loading plane

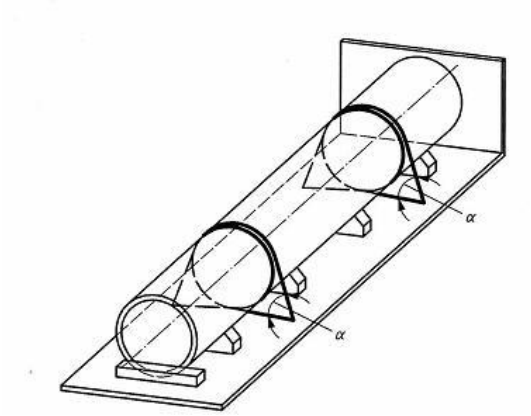


Рисунок 7.5 – Loop lashing

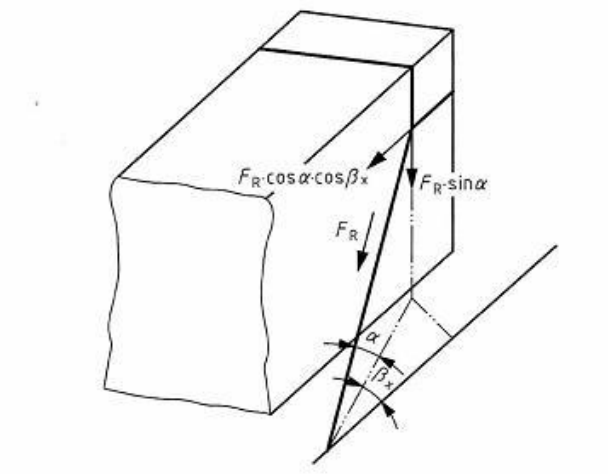


Рисунок 7.6 – Spring lashing

3.5. It is allowed to use a combined method of load lashing.

3.6. As a specific and detailed guide to the safe stowage and lashing of Sakhalin Energy cargo, the following sources should be used:

- European Best Practice Guidelines on Cargo Securing for Road Transport;
- International Guidelines on Safe Load Securing for Road Transport.

4. Transportation of dangerous loads

4.1. Transportation of dangerous loads poses additional risks to human and environmental safety and must be carried out in full compliance with the regulatory documents of the Russian Federation with regards to special requirements, information on the hazard and actions in emergency situations.

4.2. Transportation of dangerous loads by road on the territory of the Russian Federation shall fully comply with the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). Changes to this agreement are made every two years. The ADR also defines additional requirements for the lashing of such loads.

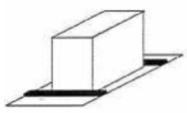
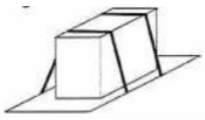
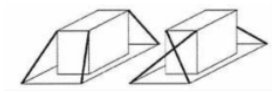
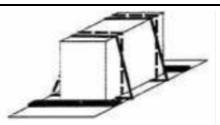
4.3. The packing of dangerous loads must be carried out in compliance with the revised European standard for securing cargo on vehicles (EN 12195-1: 2010)[2]. Other guidelines can also be obtained from

[2] This Standard does not apply for vehicles with a total weight equal to or lower than 3 500 kg. Lighter vehicles can have driving characteristics, which give higher values of acceleration on the road.

competent authorities and industry departments.

4.4. Mixed loading of dangerous goods of Class 5.1 (Oxygen) with dangerous goods of Class 2.1 (Flammable Gases) in the same vehicle is not permitted.

Appendix 7.1 – Scheme for stowage and lashing load on the vehicle

Responsible persons			
Sender / Company		*Shipper / Company*	
Carrier / Company		*Consignee / Company*	
Load			
Name	*Quantity*	*Mass*	*Dimensions*
		□ Heavy load	□ Oversize load
Driving route			
Date and time of departure		*Data and time of arrival*	*Distance*
Point of departure		*Point of arrival*	□ JMP
Vehicle			
□ Dump truck	□ Tanker	□ Truck	
□ Trailer	□ Container	□ Platform	
□ Other:			
Friction factor			
Anti-slip mats: □ Yes □ No	*Friction factor*	*Description* □ Load might be overturning	
Blocking device			
□ Front board	□ Rear board	□ Wedges	
□ Side board	□ Side racks	□ Blocking crossbar	
□ Other			
Lashing method			
□ Blocking □ Front □ Right □ Left □ Rear		□ Friction lashing □ Strap □ Chain S_{TF} = _____daN Quantity_____	
□ Diagonal lashing □ Strap □ Chain LC = _____daN Quantity_____		□ Loop lashing □ Strap □ Chain LC = _____daN Quantity_____	
□ Another			

The schemes for stowage and lashing load on the vehicle is presented on the back of this form.
I confirm that the load is secured in accordance with the schemes for stowage and lashing load on the vehicle:

Packer _____

Shipper _____

Driver _____

Appendix 7.2 – Friction factor

MATERIAL COMBINATION IN THE CONTACT AREA [3]	Friction factor μ
Sawn wood	
Sawn wood – fabric base laminate/plywood	0,45
Sawn wood – grooved aluminium	0,4
Sawn wood – shrink film	0,3
Sawn wood – stainless steel sheet	0,3
Plane wood	
Plane wood – fabric base laminate/plywood	0,3
Plane wood – grooved aluminium	0,25
Plane wood – stainless steel sheet	0,2
Plastic pallet	
Plastic pallet – fabric base laminate/plywood	0,2
Plastic pallet – grooved aluminium	0,15
Plastic pallet – stainless steel sheet	0,15
Steel and metal	
Steel crate – fabric base laminate/plywood	0,45
Steel crate – grooved aluminium	0,3
Steel crate – stainless steel sheet	0,2
Concrete	
Concrete rough – sawn wood battens	0,7
Concrete smooth – sawn wood battens	0,55
OTHER	
Anti-slip mat	0,6
Other materials	According with certificate

It is necessary that the friction factor used correspond to the actual conditions of carriage. If the contact surface is not cleaned from dirt, frost, ice and snow, the friction factor above μ = 0,2 cannot be used. Special precautions must be taken for surfaces with grease.

[3] Surface dry or wet but clean without oil, ice and grease

Appendix 7.3 – Calculation of quantity lashing straps per 1000 kg load for securing it in longitudinal direction by friction lashing

Angle α	S_{TF} (daN)	Friction factor, μ					
		0,1	0,2	0,3	0,4	0,5	0,6
83 – 90°	250	~~17,63~~[4]	~~7,56~~	~~4,20~~	2,52	1,51	0,84
	300	~~14,69~~	~~6,30~~	3,50	2,10	1,26	0,70
	350	~~12,59~~	~~5,40~~	3,00	1,80	1,08	0,60
	500	~~8,82~~	3,78	2,10	1,26	0,76	0,42
	750	~~5,88~~	2,52	1,40	0,84	0,50	0,28
	1000	~~4,41~~	1,89	1,05	0,63	0,38	0,21
80 – 82°	250	~~17,77~~	~~7,62~~	~~4,23~~	2,54	1,52	0,85
	300	~~14,81~~	~~6,35~~	3,53	2,12	1,27	0,71
	350	~~12,69~~	~~5,44~~	3,02	1,81	1,09	0,60
	500	~~8,88~~	3,81	2,12	1,27	0,76	0,42
	750	~~5,92~~	2,54	1,41	0,85	0,51	0,28
	1000	~~4,44~~	1,90	1,06	0,63	0,38	0,21
70 – 79°	250	~~18,62~~	~~7,98~~	~~4,43~~	2,66	1,60	0,89
	300	~~15,52~~	~~6,65~~	3,70	2,22	1,33	0,74
	350	~~13,30~~	~~5,70~~	3,17	1,90	1,14	0,63
	500	~~9,31~~	3,99	2,22	1,33	0,80	0,44
	750	~~6,21~~	2,66	1,48	0,89	0,53	0,30
	1000	~~4,66~~	2,00	1,11	0,67	0,40	0,22
60 – 69°	250	~~20,21~~	~~8,66~~	~~4,81~~	2,89	1,73	0,96
	300	~~16,84~~	~~7,22~~	~~4,01~~	2,41	1,44	0,80
	350	~~14,43~~	~~6,19~~	3,44	2,06	1,24	0,69
	500	~~10,10~~	~~4,33~~	2,41	1,44	0,87	0,48
	750	~~6,74~~	2,89	1,60	0,96	0,58	0,32
	1000	~~5,05~~	2,17	1,20	0,72	0,43	0,24
50 – 59°	250	~~22,84~~	~~9,79~~	~~5,44~~	3,26	1,96	1,09
	300	~~19,04~~	~~8,16~~	~~4,53~~	2,72	1,63	0,91
	350	~~16,32~~	~~6,99~~	3,89	2,33	1,40	0,78
	500	~~11,42~~	~~4,90~~	2,72	1,63	0,98	0,54
	750	~~7,61~~	3,26	1,81	1,09	0,65	0,36
	1000	~~5,71~~	2,45	1,36	0,82	0,49	0,27
40 – 49°	250	~~27,23~~	~~11,67~~	~~6,48~~	3,89	2,33	1,30
	300	~~22,69~~	~~9,72~~	~~5,40~~	3,24	1,94	1,08
	350	~~19,45~~	~~8,33~~	~~4,63~~	2,78	1,67	0,93
	500	~~13,61~~	~~5,83~~	3,24	1,94	1,17	0,65
	750	~~9,08~~	3,89	2,16	1,30	0,78	0,43
	1000	~~6,81~~	2,92	1,62	0,97	0,58	0,32
30 – 39°	250	~~35,00~~	~~15,00~~	~~8,33~~	~~5,00~~	3,00	1,67
	300	~~29,17~~	~~12,50~~	~~6,94~~	~~4,17~~	2,50	1,39
	350	~~25,00~~	~~10,71~~	~~5,95~~	3,57	2,14	1,19
	500	~~17,50~~	~~7,50~~	~~4,17~~	2,50	1,50	0,83
	750	~~11,67~~	~~5,00~~	2,78	1,67	1,00	0,56
	1000	~~8,75~~	3,75	2,08	1,25	0,75	0,42

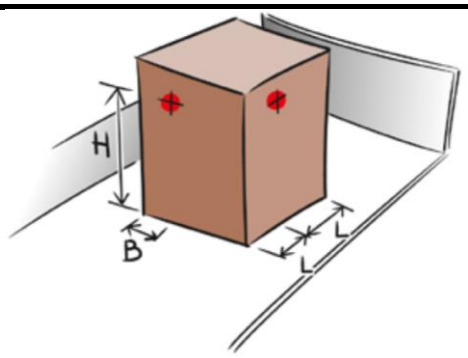
[4] (highlighted and crossed out) It is not rational to use friction lashing method.

Appendix 7.4 – Calculation of quantity lashing straps per 1000 kg load for securing it in transverse direction by friction lashing

Angle α	S_{TF} (daN)	Friction factor, μ					
		0,1	0,2	0,3	0,4	0,5	0,6
83 – 90°	250	~~8,87~~	3,32	1,48	0,55	To fix from possible moving up	To fix from possible moving up
	300	~~7,39~~	2,77	1,23	0,46		
	350	~~6,33~~	2,37	1,06	0,40		
	500	~~4,43~~	1,66	0,74	0,28		
	750	2,96	1,11	0,49	0,18		
	1000	2,22	0,83	0,37	0,14		
80 – 82°	250	~~8,94~~	3,35	1,49	0,56		
	300	~~7,45~~	2,79	1,24	0,47		
	350	~~6,38~~	2,39	1,06	0,40		
	500	~~4,47~~	1,68	0,74	0,28		
	750	2,98	1,12	0,50	0,19		
	1000	2,23	0,84	0,37	0,14		
70 – 79°	250	~~9,36~~	3,51	1,56	0,59		
	300	~~7,80~~	2,93	1,30	0,49		
	350	~~6,69~~	2,51	1,11	0,42		
	500	~~4,68~~	1,76	0,78	0,29		
	750	3,12	1,17	0,52	0,20		
	1000	2,34	0,88	0,39	0,15		
60 – 69°	250	~~10,16~~	3,81	1,69	0,64		
	300	~~8,47~~	3,18	1,41	0,53		
	350	~~7,26~~	2,72	1,21	0,45		
	500	~~5,08~~	1,91	0,85	0,32		
	750	3,39	1,27	0,56	0,21		
	1000	2,54	0,95	0,42	0,16		
50 – 59°	250	~~11,49~~	~~4,31~~	1,91	0,72		
	300	~~9,57~~	3,59	1,60	0,60		
	350	~~8,21~~	3,08	1,37	0,51		
	500	~~5,74~~	2,15	0,96	0,36		
	750	3,83	1,44	0,64	0,24		
	1000	2,87	1,08	0,48	0,18		
40 – 49°	250	~~13,69~~	~~5,13~~	2,28	0,86		
	300	~~11,41~~	~~4,28~~	1,90	0,71		
	350	~~9,78~~	3,67	1,63	0,61		
	500	~~6,85~~	2,57	1,14	0,43		
	750	~~4,56~~	1,71	0,76	0,29		
	1000	3,42	1,28	0,57	0,21		
30 – 39°	250	~~17,60~~	~~6,60~~	2,93	1,10		
	300	~~14,67~~	~~5,50~~	2,44	0,92		
	350	~~12,57~~	~~4,71~~	2,10	0,79		
	500	~~8,80~~	3,30	1,47	0,55		
	750	~~5,87~~	2,20	0,98	0,37		
	1000	~~4,40~~	1,65	0,73	0,28		

Appendix 7.5 – Cargo weight in ton prevented from tipping (angle α ~ 75 - 90°)

Cargo weight in ton prevented from tipping



$\frac{H}{B}$	S_{TF} (daN)	Sideways					$\frac{H}{L}$	Forward	Back-ward
		1 row	2 rows	3 rows	4 rows	5 rows			
0,6	**250**	X	X	X	4,2	1,9	**0,6**	X	X
	400				6,8	3,1			
	1000				16,8	7,6			
0,8	**250**	X	X	3,6	1,3	0,9	**0,8**	X	X
	400			5,9	2,2	1,5			
	1000			14,4	5,2	3,6			
1,0	**250**	X	X	1,4	0,8	0,6	**1,0**	X	X
	400			2,3	1,3	1,0			
	1000			6,4	3,2	2,4			
1,2	**250**	X	3,0	0,8	0,5	0,4	**1,2**	2,5	X
	400		4,9	1,4	0,9	0,7		4,0	
	1000		12,0	3,2	2,0	1,6		10,0	
1,4	**250**	X	1,5	0,6	0,4	0,3	**1,4**	1,2	X
	400		2,4	1,0	0,7	0,6		2,0	
	1000		6,0	3,6	2,4	1,2		4,8	
1,6	**250**	X	1,0	0,5	0,3	0,3	**1,6**	0,8	X
	400		1,6	0,8	0,6	0,5		1,3	
	1000		4,0	2,0	1,2	1,2		3,6	
1,8	**250**	X	0,7	0,3	0,3	0,2	**1,8**	0,6	12,5
	400		1,2	0,6	0,5	0,4		1,0	20
	1000		2,8	1,2	1,2	0,8		2,4	50
2,0	**250**	X	0,5	0,3	0,2	0,1	**2,0**	0,5	5
	400		0,9	0,5	0,4	0,3		0,8	8,0
	1000		2,0	1,2	0,8	0,4		2	20
2,2	**250**	4,9	0,5	0,3	0,2	0,1	**2,2**	0,3	3,1
	400	7,9	0,8	0,5	0,4	0,3		0,6	5,0
	1000	19,6	2,0	1,2	0,8	0,4		1,2	12,4
2,4	**250**	2,5	0,4	0,2	0,1	0,1	**2,4**	0,3	2,2
	400	4,0	0,7	0,4	0,3	0,3		0,5	3,6
	1000	10,0	1,6	0,8	0,4	0,4		1,2	8,8
2,6	**250**	1,6	0,3	0,2	0,1	0,1	**2,6**	0,3	1,6
	400	2,6	0,6	0,4	0,3	0,2		0,5	2,6
	1000	6,4	1,2	0,8	0,4	0,4		1,2	6,4
2,8	**250**	1,2	0,3	0,1	0,1	0,1	**2,8**	0,2	1,2
	400	2,0	0,5	0,3	0,2	0,2		0,4	2,0
	1000	4,8	1,2	0,4	0,4	0,4		0,8	4,8
3,0	**250**	1,0	0,2	0,1	0,1	0,1	**3,0**	0,2	1,0
	400	1,6	0,4	0,3	0,2	0,2		0,4	1,6
	1000	4,0	0,8	0,4	0,4	0,4		0,8	4,0

Appendix 7.6 – Calculation of minimum LC on lashing device

$$LC = \frac{m}{k}.$$

Angle α	Angle β	Friction factor, μ					
		0,1	0,2	0,3	0,4	0,5	0,6
1 – 14°	1 – 10°	0,10	0,13	0,18	0,26	0,44	1,16
	11 – 20°	0,90	1,10	1,41	1,96	3,16	5,42
	21 – 30°	1,70	2,07	2,65	3,50	4,13	5,02
	31 – 40°	2,11	2,38	2,69	3,10	3,66	4,45
	41 – 50°	1,76	1,98	2,24	2,58	3,05	3,71
	51 – 60°	1,38	1,55	1,75	2,02	2,39	2,91
	61 – 70°	0,94	1,06	1,20	1,38	1,64	1,99
	71 – 80°	0,47	0,53	0,61	0,70	0,84	1,02
	81 – 89°	0,06	0,07	0,09	0,10	0,13	0,17
15 – 29°	1 – 10°	0,18	0,33	0,57	0,97	1,87	5,46
	11 – 20°	0,95	1,28	1,77	2,62	4,51	5,88
	21 – 30°	1,64	2,20	2,97	3,60	4,41	5,49
	31 – 40°	1,95	2,28	2,71	3,26	3,97	4,94
	41 – 50°	1,64	1,93	2,31	2,80	3,38	4,22
	51 – 60°	1,30	1,56	1,89	2,25	2,74	3,44
	61 – 70°	0,92	1,13	1,35	1,63	2,01	2,55
	71 – 80°	0,51	0,63	0,78	0,97	1,23	1,61
	81 – 89°	0,11	0,18	0,27	0,39	0,55	0,78
30 – 44°	1 – 10°	0,26	0,53	0,94	1,67	3,28	5,81
	11 – 20°	0,89	1,37	2,02	3,15	4,40	5,64
	21 – 30°	1,46	2,07	2,72	3,33	4,17	5,35
	31 – 40°	1,67	2,02	2,47	3,05	3,83	4,94
	41 – 50°	1,41	1,74	2,14	2,67	3,39	4,41
	51 – 60°	1,14	1,43	1,79	2,27	2,91	3,77
	61 – 70°	0,82	1,07	1,39	1,78	2,27	2,98
	71 – 80°	0,48	0,69	0,91	1,19	1,58	2,13
	81 – 89°	0,15	0,28	0,45	0,67	0,96	1,39
45 – 59°	1 – 10°	0,32	0,69	1,27	2,27	3,92	5,12
	11 – 20°	0,77	1,30	2,13	2,99	3,82	5,00
	21 – 30°	1,18	1,79	2,25	2,84	3,65	4,80
	31 – 40°	1,28	1,63	2,07	2,63	3,40	4,50
	41 – 50°	1,10	1,42	1,83	2,36	3,08	4,11
	51 – 60°	0,90	1,20	1,58	2,07	2,74	3,70
	61 – 70°	0,67	0,94	1,29	1,74	2,35	3,21
	71 – 80°	0,42	0,67	0,98	1,33	1,82	2,52
	81 – 89°	0,19	0,37	0,61	0,91	1,32	1,91
60 – 74°	1 – 10°	0,35	0,80	1,50	2,25	2,99	4,04
	11 – 20°	0,59	1,13	1,67	2,20	2,93	3,97
	21 – 30°	0,81	1,19	1,60	2,13	2,84	3,86
	31 – 40°	0,79	1,11	1,50	2,01	2,71	3,70
	41 – 50°	0,69	0,99	1,37	1,87	2,54	3,49
	51 – 60°	0,58	0,87	1,24	1,71	2,35	3,27
	61 – 70°	0,46	0,74	1,08	1,53	2,14	3,01
	71 – 80°	0,33	0,59	0,92	1,34	1,92	2,72
	81 – 89°	0,21	0,43	0,72	1,08	1,58	2,29
75 – 89°	1 – 10°	0,26	0,52	0,85	1,28	1,86	2,68
	11 – 20°	0,26	0,52	0,85	1,28	1,85	2,68
	21 – 30°	0,25	0,52	0,84	1,27	1,85	2,67
	31 – 40°	0,25	0,51	0,84	1,26	1,84	2,66
	41 – 50°	0,24	0,50	0,83	1,25	1,82	2,64
	51 – 60°	0,23	0,49	0,82	1,24	1,81	2,63
	61 – 70°	0,23	0,48	0,81	1,23	1,80	2,61
	71 – 80°	0,22	0,47	0,79	1,21	1,78	2,59
	81 – 89°	0,21	0,46	0,78	1,18	1,74	2,52
		- in the side					
		- in the front					