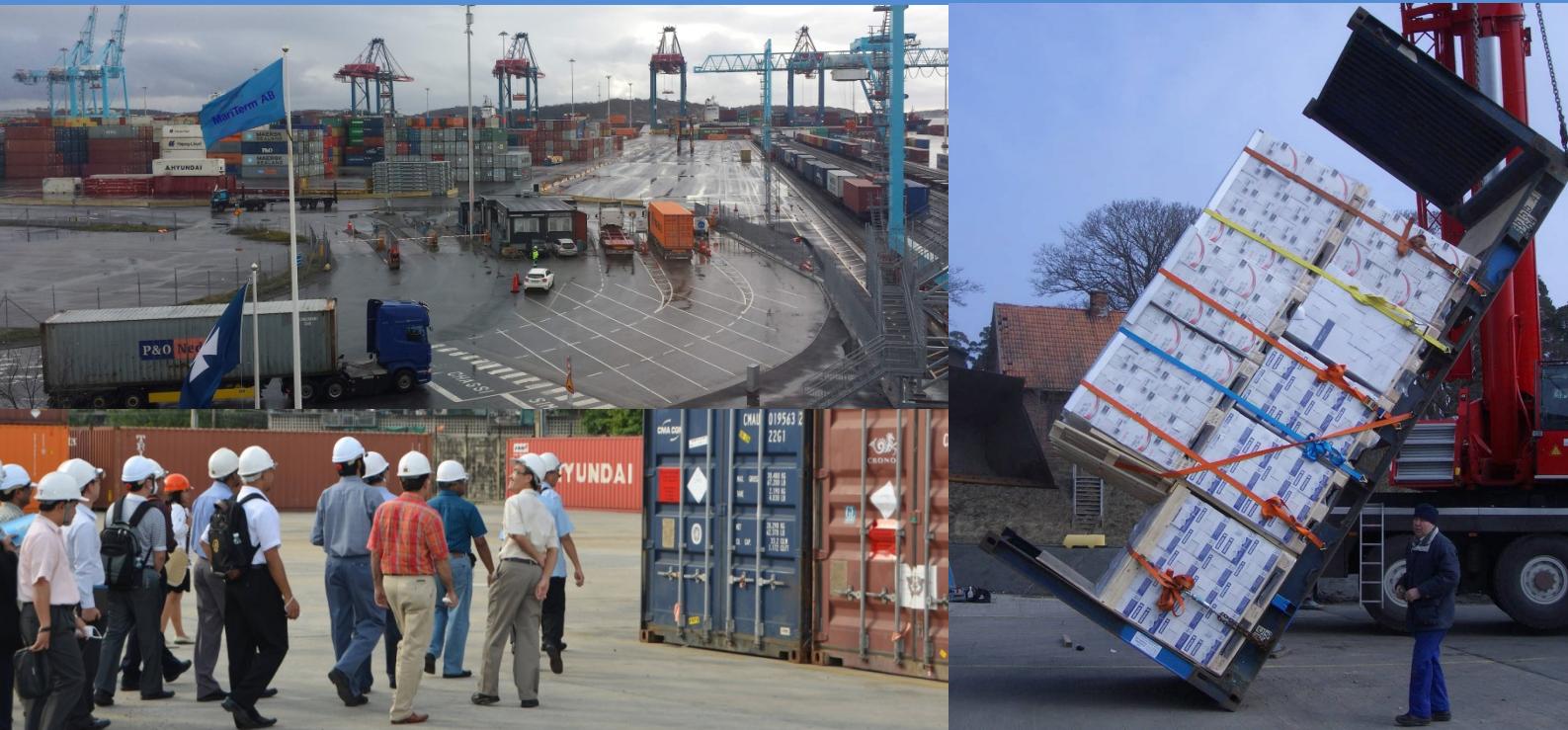


Research and Development

by MariTerm AB



2017

Introduction – The Company

MariTerm AB is a knowledge based consultancy company specialized in the field of safe and qualitative transports. The company was founded in 1978 and is owned by its senior consultants. To maintain a high level of efficiency of the transports, continuous research and development activities must be carried out. Thus, MariTerm AB conducts advanced research projects together with regulators, universities, branch organisations and industries. Based on the knowledge built up through participation in research and development projects and practical tests performed for industries and transport companies, MariTerm has built up a comprehensive training operation within the transport area. MariTerm AB offers technical calculations and practical tests to find optimal cargo securing solutions and provides instructions and certificates for these arrangements.

In this document, examples of research and development projects conducted by MariTerm AB during recent years are presented. Please visit www.mariterm.se for more information and to download the reports.

FRAMLAST – Development of Intermodal Cargo Transport Units

FRAMLAST is a study of performance of future CTUs to be used in intermodal transports within Europe, focusing on the cargo and the cargo care; both overall and in part of the level of details, taking into account different types of cargo, transport modes, ways of handling and administration etc. Also requirements from sea transport are included. Furthermore, actual CTUs as semi-trailers, swap bodies and freight containers are investigated for strong and weak points and if some changes in the design are desirable to better to facilitate intermodal transports.

The result of the project was used as a basis for the revision of the following standards:

- EN 283
- EN 12640
- EN 12642
- ISO 1496-1
- ISO 1496-5

FRAMLAST
Development of intermodal cargo transport units

MariTerm AB 2013-10-31 University of Zlina

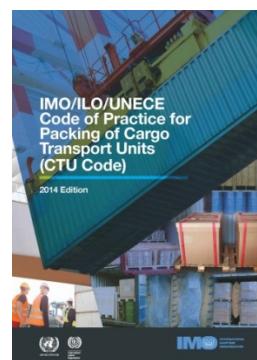
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2013-10-31

BEACON – Bedding Arrangements in Containers

As part of the revision of the IMO/ILO/UNECE Guidelines for Packing of Cargo Transport Units (CTU Code 2014), MariTerm performed a serie of tests to determine the strength of containers and to suggest suitable bedding arrangements for concentrated loads.



The project was part of MariTerm's efforts as members of the group of experts responsible for the new version of the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

Bedding arrangements in containers (BEACON)

MariTerm AB 2013-06-03 University of Zlina

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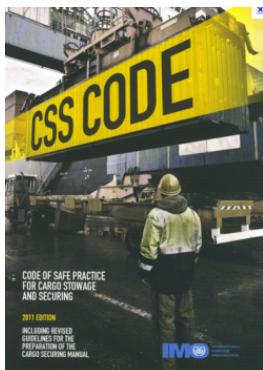
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2013-06-03

Tests performed in Avesta and Helsingborg in Sweden during April 2013

Lashing@Sea – Cargo Securing based on Environmental Conditions

The joint industry research project Lashing@Sea was launched in the summer of 2006, with the overall aim to improve the safety and efficiency of cargo securing. Lashing@Sea had participation of ship owners, lashing suppliers, governmental bodies as well as the following classification societies; American Bureau of Shipping, Bureau Veritas, Det Norske Veritas, Germanischer Lloyd, and Lloyd's Register of Shipping. All project partners co-operated in the project, where basics behind lashings were investigated in order to improve safety and economy for the whole industry. The project was co-ordinated by MARIN and the work was carried out for three types of marine transport: deep sea container shipping, heavy lift transport and Ro-Ro shipping.



The result was documentation for the revision of the IMO/ILO/UNECE Code of Safe Practice for Cargo Stowage and Securing (CSS Code).

**LASHING
SEA**

Cargo securing based on Environmental Conditions

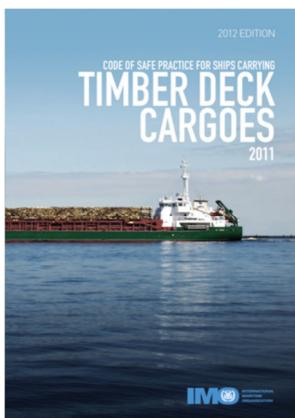
Proposal on unified interpretation
of the IMO Rules and Guidelines on
Cargo Securing
to increase efficiency with maintained safety

www.cargosecure.com

2009-10-27
Lashing@Sea

TIMRA – Timber Deck Cargoes

The national project TIMRA started in Sweden with the purpose of preparing a draft code to be presented for the International Correspondence Group on the Revision of the Timber Deck Code. As part of this project, practical tests were performed with typical timber deck cargoes in order to investigate their behavior and characteristics. Tests were performed with both round wood and square sawn timber packages at SCA Transforest's facilities in Sundsvall, Sweden.



The result was used as a basis for the new version of the IMO Code of Safe Practice for Ships Carrying Timber Deck Cargoes.

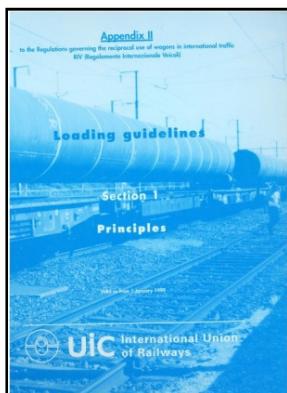
**Practical Tests with
Timber Deck Cargoes**

Tests performed in Sundsvall, Sweden,
between February 5th and 7th 2008
as part of the TIMRA-project

2008-05-06
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CombiSec – Proposal of Unified Cargo Securing Principles for Road and Combined Transport Trains

The principles for cargo securing in combined transport units (trailers and swapbodies) are different for road and railway transports according to current regulations. This situation is not ideal for the intermodal transport chain and a review of the regulations is required to obtain unified principles for cargo securing. Through basic research, including tests, measurements, and calculation comparisons, it was investigated if current regulations for road transports could be used for transports by rail as well.



The result has been used as a basis for revising the UIC Loading Guidelines.

CombiSec 2011-02-24 MariTerm AB

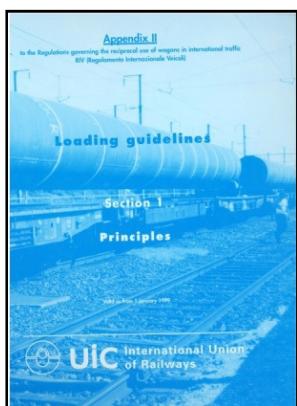
CombiSec

Proposal of unified cargo securing principles for road and combined transport trains

2011-02-24
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DESTINY – Investigations to Establish Design Accelerations for Static Design of Cargo Securing Arrangements for Intermodal Rail Transports

The basic design accelerations for road and intermodal rail transports are currently not the same, which is an unfavorable situation for intermodal traffic. The question has therefore been raised whether cargo securing arrangements designed according to the road principles also can withstand the accelerations that may occur during an intermodal rail transport.



To establish whether the current accelerations are sufficient also for the design of securing arrangements for combined rail transports, it was decided by UIC, UIRR and MariTerm AB on a meeting at UIC in Paris 2014, that dynamic test transports between selected terminals in Europe should be carried out jointly as part of the European project Destiny.

DESTINY Dynamic Tests

Investigations to establish design accelerations for static design of cargo securing arrangements for intermodal rail transports

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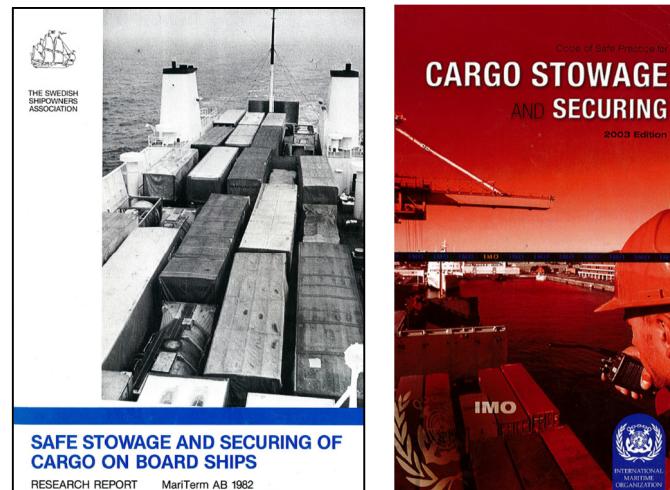
Report from Pulling Tests with Used Lashing Equipment

MariTerm AB has on behalf of the Swedish Transport Agency – Maritime Department performed a study by pulling used lashing equipment to break in order to find out at which level of wear and damage lashing equipment has to be scrapped. The tests were carried out with a large quantity of used lashing equipment at the site of Forankra in Vårgårda and at the site of Ro-Ro International AB in Gothenburg.

Safe Stowage and Securing of Cargo on Board Ships

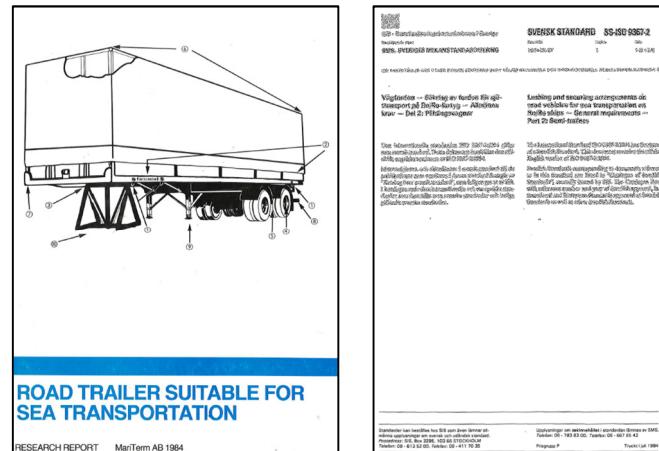
Shifting of cargo on board a ship can cause damage to the cargo and risk the safety of the ship. Due to some severe accidents in 1980 a study was undertaken, the purpose of which was to propose common rules for calculation of forces acting on the cargo, and also to propose how to establish a ship's manual for securing of the cargo. Swedish authorities have supplied IMO with the report as part of the Swedish work contribution to this field.

The result was documentation for the IMO Code of Safe Practice for Cargo Stowage and Securing.



Road Trailer Suitable for Sea Transportation

When the winter storms begin in the North Sea, cargo and trailers on board trailer ships will suffer damage. The reason for this is insufficient securing of trailers to the ship and of the cargo on the trailer. This report analyzes the problems and offers proposals for measures to be taken for the safe securing of trailers. It also proposes how to minimize the cost of handling damage on trailers. The report contains a thorough investigation of international and national rules and regulations, affecting the design and the use of road trailers, and can, in this context, be used as reference literature. An important part of the result is a proposal for standardization of lashing points in trailers and on ships.



The result was documentation for the standard ISO 9357-2.

Optimum Safety Factors for Securing of Cargo on Board Ships

This report presents an analysis of requirements and standards for securing equipment on board ships and the level of the safety factor.

Comparable rules and regulations are presented. These are:

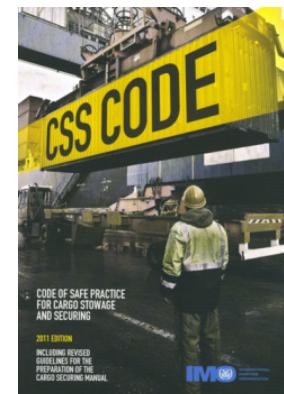
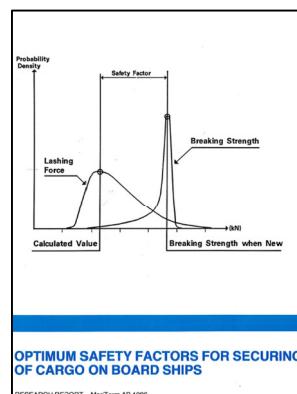
- Securing of containers according to classification societies
- Standards for lifting equipment

To determine the proper level of the safety factor for securing equipment, a method has been developed. According to this, the following are evaluated:

- Acceleration affecting the cargo
- Lashing force
- The capacity of the lashings

The acceleration has a probability level corresponding to the maximum value in 20 years of what will affect the cargo. The lashing force is determined by means of a calculation model using statistical input values. The capacity of the lashings has been determined by testing, also taking into account the time factor for the equipment in use. The result is presented with suitable test methods and safety factors for different types of lashing equipment.

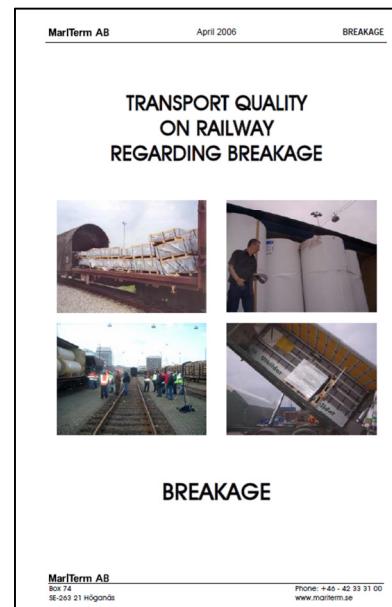
The result was documentation for the IMO/ILO/UNECE Code of Safe Practice for Cargo Stowage and Securing (CSS Code) Annex 13.



Breakage – Transport Quality on Railway Regarding Breakage

The railway has during the last decades lost market shares compared to other transport modes, which may be caused by the challenging transport environment, causing breakage damages. The reasons for breakage is presume to be the forces acting during transport as well as the forces acting on cargo when railway wagons are shunted together. In the project the amount of breakage and the underlying reasons are analyzed and actions that could be taken to limit the risk of breakage were identified.

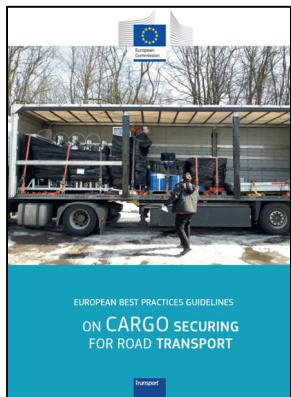
The result was documentation for regulations for securing of cargo in rail wagons.



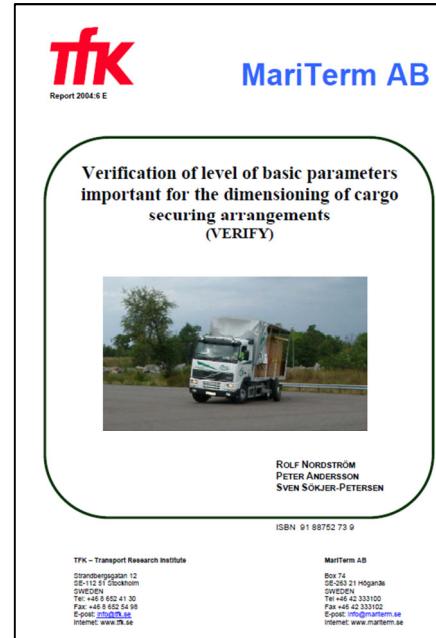
VERIFY – Verification of Level of Basic Parameters Important for the Dimensioning of Cargo Securing Arrangements

The VERIFY project was carried out during autumn 2004 with the purpose of verifying the basic principles that should be used in the common guidelines for cargo securing within EU.

Differences between principles mentioned in the internationally accepted guidelines, by IMO were compared with principles mentioned in the European standard EN 12195-1 as well as in the German VDI 2700 standard.



The result was documentation for the standard EN 12195-1:2010 and EU BPG.



For more information about MariTerm AB, please visit www.mariterm.se