Informal meeting on Code of Practice for Packing of Cargo Transport Units

at the request of the United Nations Economic Commission for Europe Working Party on Intermodal Transport and Logistics

Geneva and virtual, 17-18 March 2022

Bedding arrangements

Submitted by IUMI and Mariterm AB

This document proposes guidance on bedding arrangements to be included in clause 3.1.2 of Annex 7. The text proposed below should replace the existing text under that clause.

Background:

The weight of compact heavy cargo items should be spread over a greater area of the container floor by suitable bedding arrangements. Favourably, longitudinal beams should be used to transfer the load onto a greater number of structural cross-members of the container floor. This proposal contains a method for determining the proper length and dimensions of such beams.

Proposed text:

3.1.2. The necessary length (LR) of these beams depends on the cargo weight and their mutual distance (B). It is important to make the distance B of the longitudinal beams as large as possible in order to minimise the stress onto the cross-members of the container floor.
The beams must have sufficient strength for effectively spreading the load. Their necessary dimensions should be determined by the cargo weight and the intended spreading effect, expressed by their "free length".
This simple arrangement complies with the principles of structural engineering. There is no benefit of flooring the area under the cargo item with beams of lesser strength.

The following steps should be followed:

3.1.2.1 Step 1 – Determination of minimum length

The bedding beams must be long enough to cover the distance of the container's floor so that load from the cargo will not overstress the floor.

The minimum length depends on the following factors:

- The cargo mass (in ton)
- The distance between the beams, B (in meters)

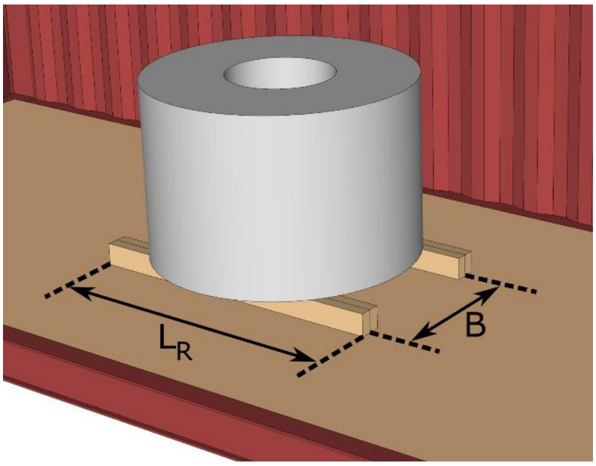


Table X.1 gives the minimum required length, L_R, of longitudinal bedding beams based on these two factors.

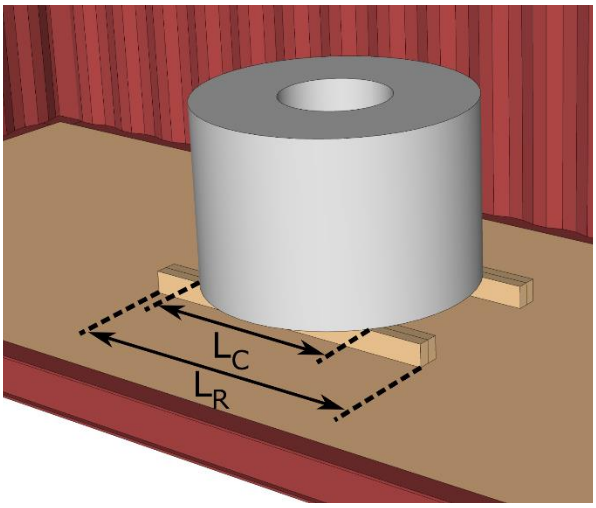
Minimum required length of longitudinal bedding beams, L_R, [m]							
Spacing between beams, B [m] \ **Cargo mass [ton]**	**4**	**8**	**12**	**16**	**20**	**24**	**28**
0.50	1.2	2.4	3.6	4.8	6.0	-	-
0.75	1.0	2.1	3.1	4.1	5.1	6.2	-
1.00	0.9	1.7	2.6	3.4	4.3	5.2	6.0
1.25	0.7	1.4	2.1	2.8	3.5	4.2	4.9
1.50	-	1.1	1.6	2.1	2.6	3.2	3.7
1.75	-	0.7	1.1	1.5	1.8	2.2	3.0
2.00	-	-	0.6	0.8	1.3	2.1	3.0

Table X.1

3.1.2.2 Step 2 – Determination of minimum dimensions

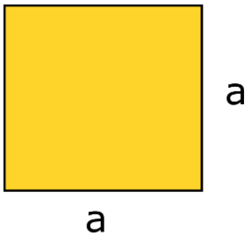
The proper size of the bedding beams depends on the bending resistance (section modulus) that is required of the beams for them to successfully transfer the load from the cargo over the required floor length. The required section modulus depends on the following factors:

- The cargo mass (in ton)
- The minimum length of the beams, LR (in meters), as given by Table X.1
- The length of the footprint of the cargo on the beams, LC (in meters)
- The strength of the material of the bending beams



The difference between the length of the beams, L_R, and the length of the cargo footprint, L_C, is denominated as the free length.

When wooden beams are used, the section modulus is given by their cross section dimensions. Table X.2 shows the minimum height and width, a x a, of square wooden beams to use in mm based on the cargo mass and the free length of the beams.

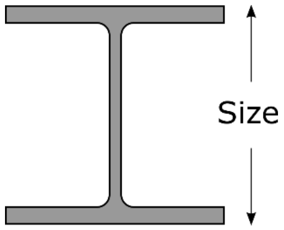


Definition of height and width, a × a, for wooden beams with a square cross section

Minimum height and width, a × a, of a pair of square wooden beams with σ_p = 1.5 kN/cm^2 [mm]							
Cargo mass [ton] / Free length L_R - L_C [m]	**4**	**8**	**12**	**16**	**20**	**24**	**28**
0.5	79	99	114	125	135	143	151
1.0	99	125	143	158	170	181	190
1.5	114	143	164	181	194	207	218
2.0	125	158	181	199	214	227	239
2.5	135	170	194	214	231	245	258
3.0	143	181	207	227	245	260	274
3.5	151	190	218	239	258	274	289
4.0	158	199	227	250	270	287	302

Table X.2

When steel beams are used, the section modulus depends on the type of profile used. Table X.3 shows the minimum size (in mm) to use for standard HEB profiles based on the cargo mass and the free length of the beams.



Definition of size for HEB steel profiles

Minimum size of a pair of HEB steel beams with σ_p = 15 kN/cm^2 [mm]							
Cargo mass [ton] / Free length L_R - L_C [m]	**4**	**8**	**12**	**16**	**20**	**24**	**28**
0.5	100	100	100	100	100	100	100
1.0	100	100	100	100	100	120	120
1.5	100	100	100	120	120	140	140
2.0	100	100	120	120	140	140	160
2.5	100	100	120	140	140	160	160
3.0	100	120	140	140	160	160	180
3.5	100	120	140	160	160	180	180
4.0	100	120	140	160	180	180	200

Table X.3

If multiple pairs of beams or beams with a different cross section are used, they shall have the same combined section modulus as the beams represented in the tables above. Furthermore, the required section modulus is proportional to the bending strengths, σ_p, given in each of the tables X.2 and X.3 above.