

RULES OF DISTRIBUTION WHEN TRANSPORTING GOODS BY ROAD TRANSPORT.

*Master degree İ. Jafarli
Baku Engineering University*

Before the vehicle is loaded and a loading plan is developed, the weight/dimensions and the horizontal location of the center of gravity for each piece of load carried must be determined. Trucks that are equipped with a trailer coupling device must be treated according to their usual operating conditions. Vertical coupling loads may be considered as load (in cases where a trailer is not usually drawn) or as part of the vehicle weight (if the truck is usually used with a trailer).

Necessary data for calculating the load distribution plan:

- maximum total weight;
- maximum payload;
- unladen weight;
- front axle load of unladen vehicle;
- rear axle load of unladen vehicle;
- maximum permitted front axle load;
- maximum permitted rear axle load;
- minimum front axle load;
- minimum rear axle load (% of total weight);
- wheelbase;
- distance front axle to foremost point of the headboard;
- load platform length.

Most of this data may be taken from plates fitted to the vehicle, registration documents, type approval documents or determined by measuring the vehicle. However, some of the information may only be available from the vehicle manufacturer (minimum front axle load for example).

Using the load distribution plan

Before the vehicle is loaded and a loading plan is developed, the weight/dimensions and the horizontal location of the centre of gravity for each piece of load carried must be determined.

A virtual loading plan may then be drawn. The horizontal location of the whole load has to be calculated, for example by calculating a torque balance around the foremost point of the load panel (or any other point of reference if more convenient).

As described hereafter, the load distribution plan will determine whether the vehicle has sufficient capacity to carry the total weight of the load at the calculated centre of gravity.

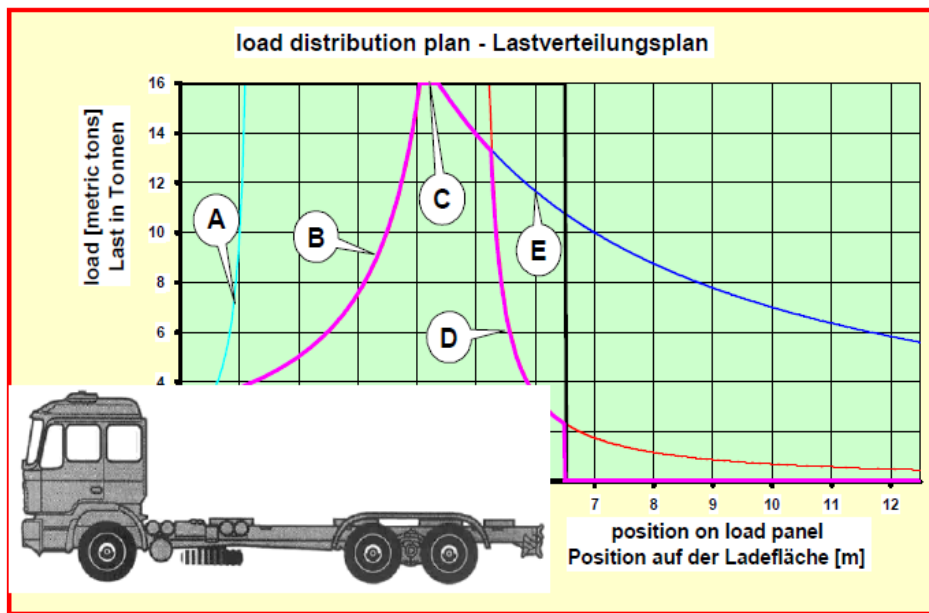
Developing a load distribution plan.

To determine the maximum of cargo mass which may be loaded onto the vehicle taking into account the position of the centre of gravity for the entire load, the following items must be considered:

- The rear axle load must exceed a certain minimum, if required by the vehicle characteristics;
- The maximum load may be found for each point of the load panel by setting up a torque balance around the front axle regarding load mass, unladen and minimum rear axle load, distance from front axle to foremost point of load and wheelbase.
- Some Member States require that the driven axle load must represent a minimum of 15% - 25% of the total vehicle or road train weight. It is recommended that the driven axle load is a minimum of 25% of the total laden vehicle weight. (curve "A");

- The maximum front axle load must not be exceeded. Calculation is done by torque balance around rear wheel. (curve "B");
- The maximum payload must not be exceeded. Taken from vehicle data. (curve "C");
- The maximum rear axle load must not be exceeded. Calculation is done by torque balance around front wheel. (curve "D");
- The front axle load shall be at a recommended minimum (20% of total weight or another value recommended by manufacturer). Calculation is done by torque balance around front wheel. (curve "E").

The maximum authorised load is the minimum of all these results.¹



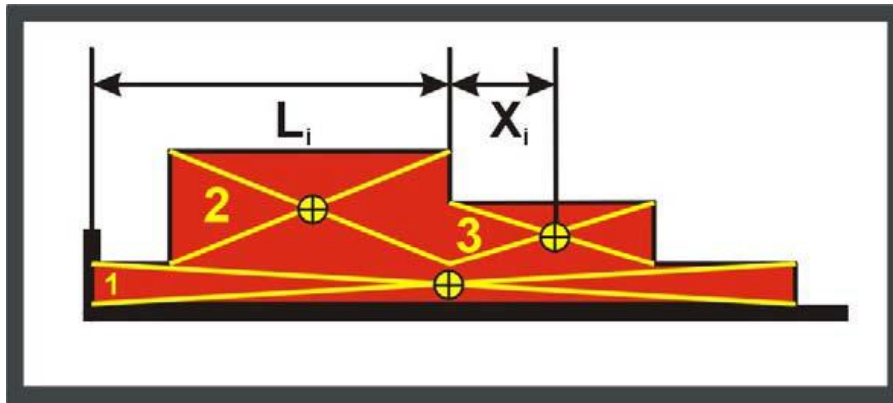
Please note that the truck in the graph is a schematic picture, the dimensions do not necessarily refer to the dimensions used in the calculation example here after. Although load panel length in the example is 6.5 m, the diagram is drawn up to a length of 12.5 m to show the curves as further information.

A detailed calculation guideline can be found in the German VDI guideline VDI2700 Part 4 ("Securing of loads on road vehicles, Cargo weight distribution").

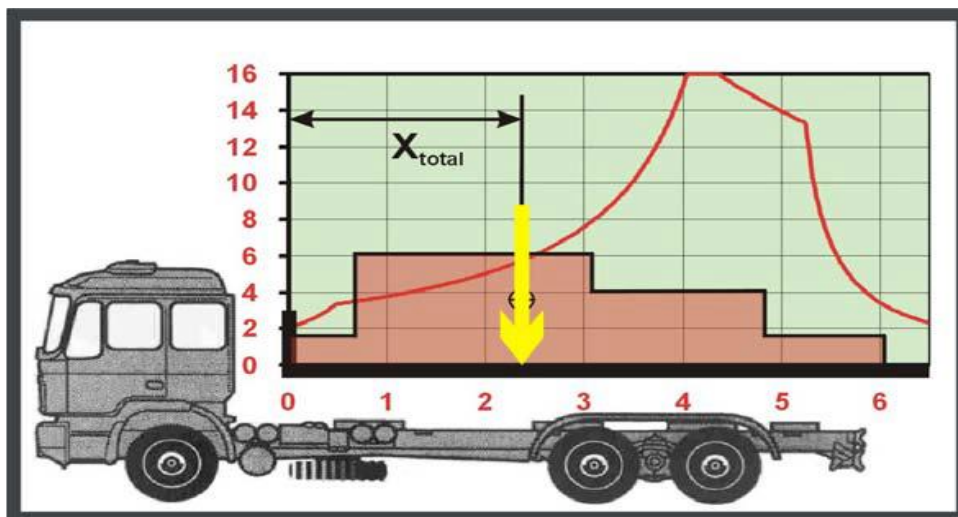
A heavy cargo with a total mass of 10 t needs to be loaded on a truck with a total capacity of 16 t. The centre of gravity of the cargo is so far unknown and has to be calculated first. The mass and position of the three parts of the cargo, intended to be loaded on the truck, are known as well as the centre of gravity of all three parts².

¹ Lifting & Lashing Points, RUD Group, Safety, RUD News. Importance of load securing in vehicles - Part 1 Posted 15/03/2023

² The Basics that Everyone Must Know About CARGO DAMAGE.Arviem., 24 Mar 2020



The distance from the headboard to the cargo's centre of gravity is shown as X_{total} and the yellow arrow represents the total mass of the cargo located at its centre of gravity. If the cargo is placed on the vehicle as shown, the graph of the load distribution plan shows that the vehicle is overloaded - although the mass of the load (10 t) is below the total capacity of the vehicle (16 t), the maximum front axle load is exceeded, since the yellow arrow crosses part B of the graph.³

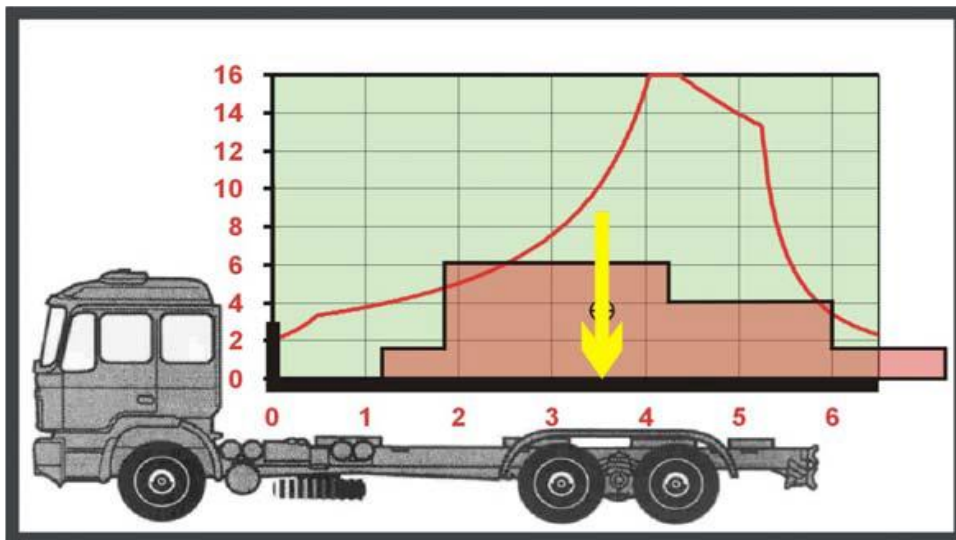


The cargo could be shifted to the rear of the vehicle, but two other problems will occur:

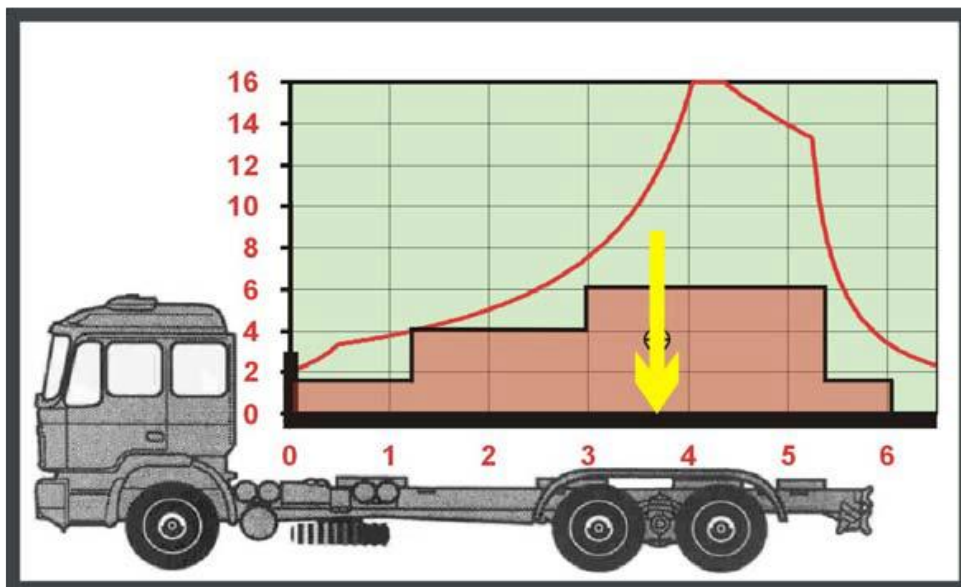
- The cargo overhangs the rear of the vehicle.
- The cargo can't be correctly secured because of the gap between the headboard and the load.⁴

³ <https://arviem.com/the-basics-that-everyone-must-know-about-cargo-damage/>

⁴ <https://wiki.unece.org/plugins/viewsource/viewpagesrc.action?pageId=23102046>



If the cargo is turned around 180° these problems disappear and the load distribution is correct.



List of references:

1. Lifting & Lashing Points, RUD Group, Safety, RUD News. Importance of load securing in vehicles - Part 1 Posted 15/03/2023
2. The Basics that Everyone Must Know About CARGO DAMAGE. Arviem, . 24 Mar 2020
3. <https://arviem.com/the-basics-that-everyone-must-know-about-cargo-damage/>
4. <https://wiki.unece.org/plugins/viewsource/viewpagesrc.action?pageId=23102046>