

CASE 6: DIRECT RESTRAINT USING CALCULATIONS

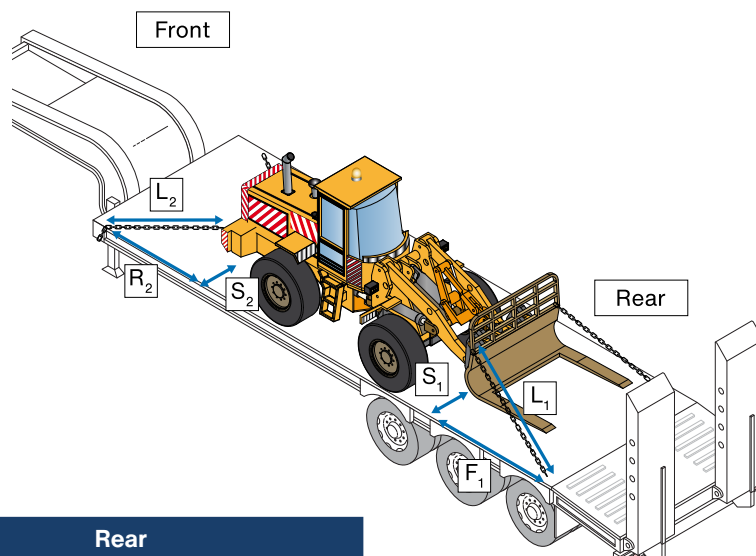
Load:

- 15 tonne front-end loader – *Figure 499*.

Figure 499 Front-end loader

Direct lashing angles:

- For this example, we will determine the direct lashing angle effect using a simple calculation. To do this we need to know the following information.



	Front	Rear
Lashing (chain) length	3,500 mm (L2 in diagram)	3,500 mm (L1 in diagram)
Distance between the tie points along the trailer	3,400 mm (R2 in diagram)	3,400 mm (F1 in diagram)
Distance between the tie points across the trailer	300 mm (S2 in diagram)	300 mm (S1 in diagram)

Step 1:

What is the mass of the load?

The total mass of the load is **15,000 kg**.

Step 2:

What is your direct lashing angle effect in the forward direction?

The **rear** chains provide the forward restraint.

To determine the **forward direct angle effect** divide the **distance between the tie points along the truck (F1)** by the **lashing length (L1)**:

$$3,400 (F1) \div 3,500 (L1) = 0.97 \text{ (forward direct angle effect)}$$

i For more information see [Lashing angles](#).

Step 3:

What is your direct lashing angle effect in the sideways direction?

Both the **front and rear** chains provide the sideways restraint. To determine the **sideways direct angle effect** divide the **distance between the tie points across the truck** by the **lashing length** for both chains:

Front chain $300 \text{ (S2)} \div 3,500 \text{ (L2)} = 0.086$ (sideways direct angle effect)

Rear chain $300 \text{ (S1)} \div 3,500 \text{ (L1)} = 0.086$ (sideways direct angle effect)



0.086 sideways direct angle effect is very low.

At this angle the direct lashing will have less than 9% effectiveness in the sideways direction.

To meet the sideways restraint requirement of 7,500 kg (50% of the load mass), each chain would need to restrain 3,750 kg. With only a 9% level of effectiveness, the chain's **lashing capacity would need to be 43,750 kg**. There are no chains available to provide this capacity.



Do not transport this load until you have properly restrained it.



The sideways direct angle effect can be improved by **increasing the distance between tie points across the truck**. This can be done by using a diagonal tie point. See worked example [Case 7](#).