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Dolly or not

It is not always a straightforward decision when considering whether a load or a route is suitable for a dolly type transport. MARCO VAN DAAL reports

Avoiding an accident with a dolly load requires attention to be paid to maintaining equal velocity of the dollies

A dolly transport is one where the physical dimensions of the load allow that two independent transporters (equipped with turntables) can be positioned in line underneath the load. There are a number of situations or instances where such a configuration is desirable or even a requirement to carry out the transport.

1.) Long loads, irrespective of weight, that need to be manoeuvred in such a way that the infrastructure of the surrounding demands the manoeuvrability of a dolly configuration as opposed to a single transporter: Such infrastructure demands include site restrictions, trees, light posts, buildings, roundabouts or traffic islands.

2.) Loads that are long but not heavy compared to their length and do not need to be supported over their full length: In such cases it would require more axle lines to carry out the transport without turntables than it would to carry out the transport with turntables.

Once it is determined that a load is transported in a dolly configuration, there are two types of configurations that can be used. At first glance these seem identical but further analysis shows a distinct difference between the two.

A.) The lead dolly is being pulled or propelled and the second one trails

B.) Both dollies are being pulled or propelled.

TYPE A (*Figures 1 and 2*) In both cases the lead dolly is being pulled by a truck or propelled by a power pack. There is no pushing or pulling force on the second dolly. It trails behinds the lead dolly. The velocity of the trailing dolly is determined by the velocity of the lead dolly.

It would seem that the velocity of the trailing dolly is the same as the velocity of the lead dolly. This is, however, only the case as long as both dollies are driving in the same direction.

As soon as the lead dolly starts turning (see figure 3), its velocity will start to differ from the trailing dolly.

Let's assume that the dolly transport has an initial velocity of 3 mph (about 5 km/h) and that both dollies are travelling in the same direction, the X-direction. The lead dolly now takes a turn (30 degrees) and maintains its speed of 3 mph. What happens at this point to the velocity of the trailing dolly?

As the lead dolly is now no longer travelling in the X-direction its velocity now has to be resolved in an X-velocity and a Y-velocity. The figure below shows that the velocity in X-direction is 2.7 mph (4.3 km/h) and the velocity in Y-direction is 1.7 mph (2.5 km/h).

The X-velocity is determined by:

V_{Lx} = cos 30 x V = 0.866 x 5 = 2.7 mph

V_{Ly} = sin 30 x V = 0.5 * 5 = 2.5 mph

The trailing dolly still travelling in >

FIGURE 1

ABOUT THE AUTHOR

Marco van Daal has been in the heavy lift and transport industry since 1993. He started at Mammoet Transport from the Netherlands and later with Fagioli PSC from Italy, both esteemed companies and leading authorities in the industry. His 20-year plus experience extends to five continents and more than 55 countries. It resulted in a book *The Art of Heavy Transport*, available at: www.khl.com/books/the-art-of-heavy-transport/

Van Daal has a real passion for sharing knowledge and experience – the primary reason for the seminars that he frequently holds around the world. He lives in Aruba, in the Dutch Caribbean.

FIGURE 2

FIGURE 3

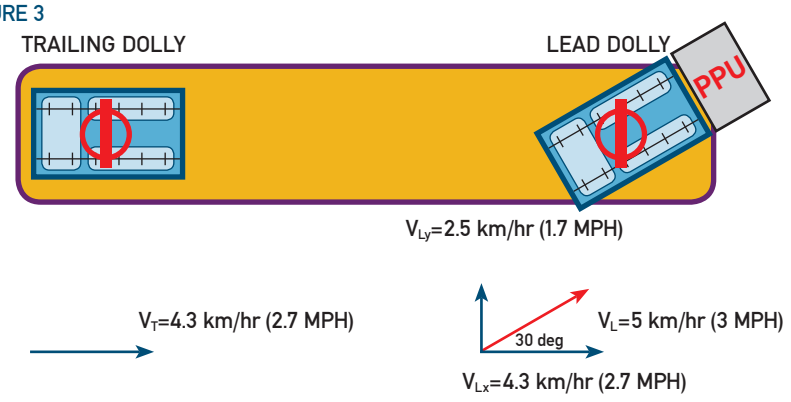


FIGURE 4

X-direction can only have a velocity that is equal to the X-velocity of the lead dolly, thus 2.7 mph.

Here is a situation where the velocity of the lead dolly is no longer equal to the velocity of the trailing dolly. The difference in velocity between the lead and trailing dolly becomes greater as the lead dolly takes a sharper turn. Note that in such cases the cargo should be secured well as the side forces can be substantial.

TYPE B (*Figures 4 and 5*) Both the lead dolly as well as the trailing dolly are propelled or pushed. The trailing dolly is no longer trailing as it now has a propulsion force applied to it but for simplicity we still call it here the trailing dolly. Both trucks or operators maintain the same velocity and both transporters are travelling in the same direction.

Now, as before, the lead dolly takes a turn of 30 degrees (see figure 6)and maintains its speed of 3 mph. As demonstrated before, the velocity of the lead dolly in X-direction is now 2.7 mph. How does the operator or driver of the truck know what the velocity of the lead dolly is in X-direction? The answer to this question is simple; he does not know.

A difference in velocity in X-direction is obviously not possible as both dollies are connected and this results in forces between the leading and trailing dolly. These forces are acting on the load as the load is what keeps both dollies connected.

In case the driver or operator of the trailing dolly does not notice that he needs to slow down, or he is not experienced enough to correctly interpret the signs, these forces 'have to go somewhere' as this situation of unequal velocities cannot be sustained.

As the lead dolly takes a sharper turn (more than 30 degrees) its velocity in X-direction further decreases and if the trailing dolly tries to maintain its velocity the forces on the load, on the turntables and on the lashing, keep increasing.

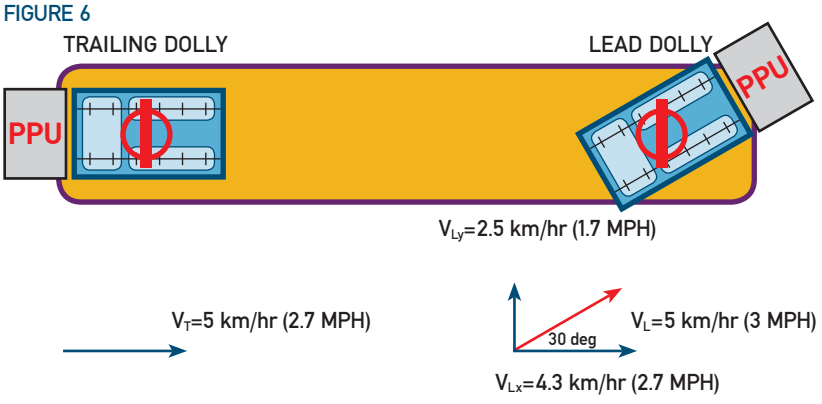
Getting an idea

There are a few methods, however, that give feedback to the driver or operator of the trailing dolly if his velocity is either too high or too low.

For self propelled: the oil pressure in the drive line is an indication if the velocity is getting too high, this pressure

FIGURE 5

FIGURE 6



will increase as the trailing dolly is now pushing the leading dolly to go faster. The operator of the trailing dolly is required to slightly reduce his RPM. Likewise, if the trailing dolly falls behind in velocity, the oil pressure is an indication for the operator to slightly increase his RPM.

If this is recognised and the velocity of the trailing dolly is adjusted accordingly, the transport proceeds as planned. Needless to say that both operators should be in constant contact with each other.

Propulsion forces

Under the influence of these forces, a range of things can happen. In cases of relatively light dolly loads, the tyres may start spinning under the influence of the propulsion force, this can happen with both self propelled as well as with a truck. Spinning is a sign that the operator or driver needs to reduce his speed.

In the worst case it can lead to some very real unwanted situations as one of the dollies can be pushed out from underneath the load and the load can end up in the ditch (see the picture on previous page).

Note that on public roads many turns and curves show a road camber, this causes the load to lean and if not recognised and corrected it adds to the risk of overturning the load in addition to the forces caused by the velocity differential. There is a much smaller force required to push a dolly out from underneath the load if the load is already leaning in the right direction.

A similar problem occured on another project, where large storage tanks were transported inside a frame placed on two self propelled dollies. This frame was used to allow access under some pipe racks just outside the refinery.

During the transport of these tanks, the tanks themselves formed part of the strength of the frame. When the tank was delivered, however, and lifted out of its frame using a site crane, the frame had to travel back empty. It turned out that it was a very flimsy frame.

As with every project, there were time constraints as the transport route partially blocked a railroad track. The operators of each dolly did not take into account or they did not realise, their different velocities in the X-direction and the Y-direction and the associated forces on the empty frame. While leaving the plant, in the last turn the frame buckled, with the result that the forces caused the frame to reach its plasticity limits and, permanently deformed, it was unsuitable for further use.

Note: when the frame buckled and was useless, one more tank had to be brought to its final destination. With the frame no longer available the last tank was skidded under the pipe racks and into the refinery, a distance of many hundreds of feet. ■

NOTE: Every effort is made to ensure the accuracy of the contents of these articles. If you find any mistakes, a brief notification and explanation would be appreciated.