



Project cargo

Stability of hydraulic modular trailers & SPMT's

Hydraulic modular trailers and self propelled modular transporters (SPMT) are used worldwide for land transport as well as for RoRo handling of outsized and heavy cargo. With the modular system payloads from 70 mt to as much as 15,000 mt may be transported.

The hydraulic suspension together with the pendulum axle technique allows for homogenous axle loads whilst driving over uneven ground.

There have been a number of accidents with trailers tipping and/or cargo sliding off in the past, partly with loss of lives.

There are no rules or even guidelines concerning modular trailer stability. From the position of the

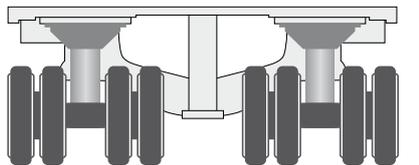


shipper or industrial plant builder who needs to contract RoRo handling or onshore transportation of critical plant items the following should be considered.

Some companies are reported to have established their own in-house guidelines as a company standard. More axle lines provide more transverse stability when combined side by side. This is why we encourage shippers also to compare the technical statements of potential contractors not only the price.

1 Trailer width and module configuration

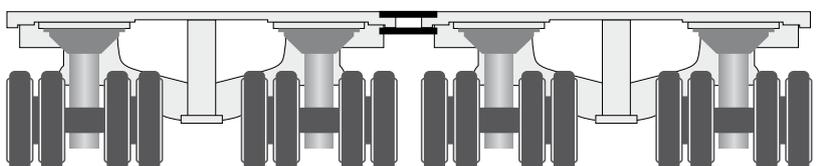
The transverse stability depends largely on the width of the configuration.



"2-File" (or "single") configuration

Hence SPMT have always less transverse stability against tipping in single / 2 file configuration.

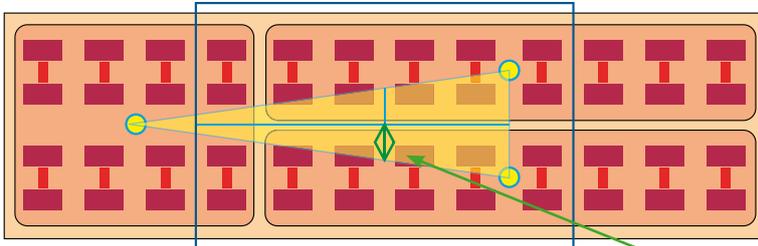
The module configuration also makes up for the transverse stability.



Obviously the wider the configuration is the more stable the transport will be in transverse direction.

2 Stability

Transverse and longitudinal stability is achieved by dividing hydraulic circuits. Usually 3 point or 4 point suspension is used. However all trailer and SPMT modules may be configured differently when they are part of a bigger configuration.

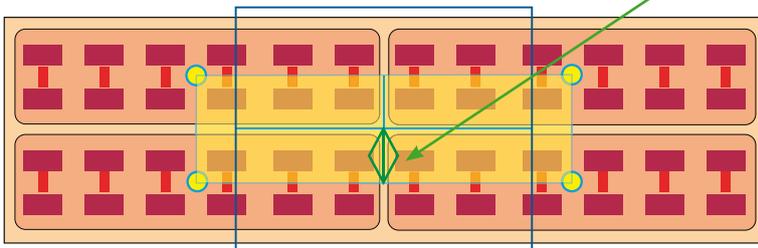


Obviously the center of gravity of the combined trailer & cargo mass needs to be inside of the triangle, otherwise the trailer will tip over immediately.

3 point suspension

Compared to 4 point suspension the 3 point configuration is much easier to be controlled on uneven terrain.

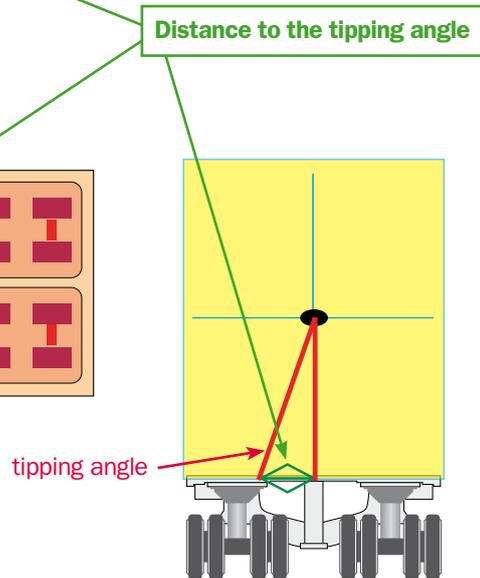
4 point suspension provides enhanced transverse stability compared to 3 point suspension.



4 point suspension

Constant control and adjustment is required in order to ensure proper support during transport.

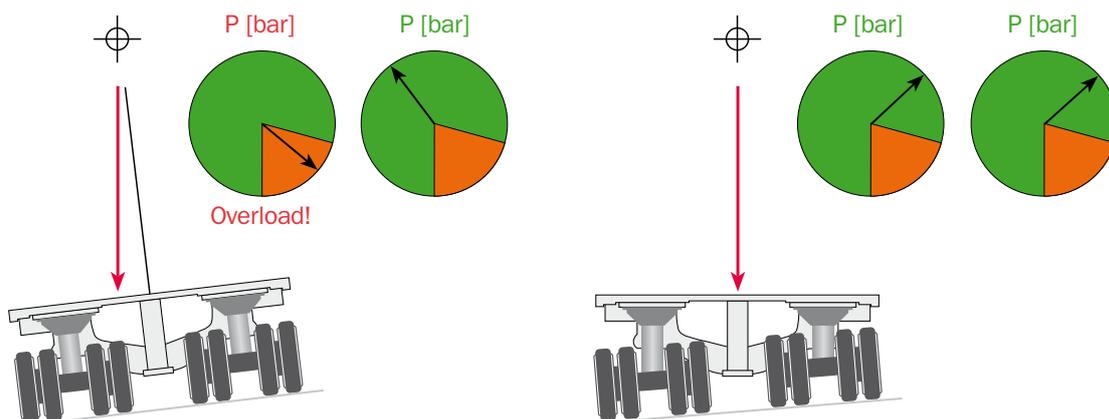
On uneven ground, hydraulic circuits may be overloaded and the torsion stress on the trailer may be critical.



3 Hydraulic overload limit

The pressure on the stabilizing hydraulic circuits is changing when the trailer platform is inclined. This may lead to overload on the respective "lower" circuit.

Depending on the actual axle line load the overload limit may be reached **before** the tilting limit is reached!



4 Other hazards

1. Slope & kink limits

Trailer operators must know the limits of their configuration when it comes to RoRo ramps, flyover bridges, bypasses and other difficult terrain.



2. Old trailers

Corresponding to old transport and handling equipment in general (i.e. ships, cranes, etc.) the use of these units will raise the risk of damage considerably. Very often these units have been poorly maintained and not properly repaired. The old hydraulics provide less safety in case of an overload.

3. Training

There is no national or international training standard at all.

Shippers should ask for proof of training and operational experience of the personnel prior to start of operations.



4. Road & ground bearing capacity

Ground support must obviously always be ensured prior to passage. If part of the axle lines fail to be supported this may not cause the trailer to tip over initially.

However the possible hydraulic overload on the remaining axles may cause tipping as a secondary reaction.

5. Dynamic influences

Whenever critical

- terrain or sharp turns must be negotiated
- the speed should be reduced to a minimum
- sudden stops in sloped curves avoided
- the influence of traction power during sharp turns considered.

6. Pre-planning

Proper pre-planning prevents poor performance.

Shippers should ask for a detailed pre-planning and have same reviewed by in-house or external experts for approval. Often the quality of the pre-planning says a lot concerning the capabilities and limits of possible contractors when it comes to difficult operations.

7. Centre of gravity

Shippers must provide an accurate position of the unit's centre of gravity. This should be indicated in the transport drawing as well as on the unit itself.

Operators & surveyors must check the pressure gauges of the hydraulic trailer / SPMT for homogenous pressure of the stabilizing hydraulic circuits after placing of the cargo on the trailer.

8. Securing

Proper securing of the cargo on the trailer is essential.

Basic guidelines

1. Choose a reputable contractor with trained & experienced personnel using 1st class equipment
2. Have a detailed route survey conducted not only focussing on the sole feasibility of the transport but also on enhanced safety. If all critical parts of the route are known in detail less improvisation will be required during transport
3. Have the operations manual / technical pre-planning be reviewed and approved by in-house or 3rd party experts
4. When the route permits always favour the wider trailer / SPMT configuration
5. Use 3 point suspension as a universal supporting system which is easily controlled
6. Use 4 point suspension with experienced crew, high cargo units and on easy/ moderate terrain only
7. Know the overload and tilting limits. Think of creating in-house limits to which contractors must comply
8. Have difficult operations (e.g. barge load out, bypass passage) be inspected by a dedicated heavy lift expert