Can your lorry loader stand its ground?

The latest safety systems have without doubt reduced the number of accidents with loader cranes. However there are still many instances of lorry loaders overturning whilst carrying out lifts due to poor ground conditions.

When a crane picks up a load it generates a load moment that has to be resisted by an equal and opposite force if there is to be a state of equilibrium. This 'reaction' moment has to come from the ground resisting the force the stabilisers place upon it. Whilst overload devices can help prevent all sorts of overloading, there is no electronic way of guaranteeing that the ground is capable of withstanding the stabiliser force that will be imposed upon it.

So in order to have a safe lift, sound mathematics and common sense have to be applied. The Association of Lorry Loader Manufacturers and Importers (ALLMI) is in the process of producing Guidance Notes on the calculation of stabiliser forces and ground pressure. If there is any doubt about the ability of the surface under the stabiliser feet to withstand the applied pressure, the Guidance Notes will provide a valuable source of information. A summary of that advice is provided below.

The first step is to ascertain the force that the stabilisers will apply to the ground during the lift. The Manufacturer's manual for the loader crane should give the maximum stabiliser loadings in kilo Newtons (kN), if not then they should be obtainable from the crane manufacturer or importer. It should be noted however that the actual loadings can be affected by many factors such as:

- Loaded condition of the vehicle
- Condition/inflation of each vehicle tyre
- Type of vehicle suspension system
- Torsional resistance of the vehicle chassis
- Force with which the stabilisers are deployed - has the vehicle been jacked clear of the ground?
- Sloping ground
- Swinging of the load when lifted

Always use outrigger mats and if in doubt select larger ones to lower ground bearing pressure.

If stabiliser loadings are not available from the manufacturer and need to be calculated then the moment generated by the lift must be found. The manufacturer should at least be able to provide the 'gross lifting moment', but if not then a formula in the Guidance Notes will help in calculating this.

The reactive moment generated by the stabilisers will be equal to the lifting moment but it will be shared between the number of deployed stabilisers. The calculation to provide the loading on each stabiliser must take into account its location relative to the column of the loader crane. Typically one will be located close to the column of the crane and this will carry a higher proportion of the reaction loading.

Once the loading of each stabiliser has been found it is vital to establish if the ground will support this loading. To do this the loading must be converted to a pressure - the loading divided by the surface area of the stabiliser pad or mat. Obviously the larger the pad the lower the ground pressure.

At this point it is best to work backwards from the ground pressure that the ground in question can withstand. The following table is taken from the DIN standard 1054 and contains invaluable information regarding the load bearing capacity of different ground conditions in kiloNewtons per square metre.

Permissible pressure on the ground (load-bearing capacity of the ground) to DIN 1054	
Filled ground, not compacted	0 - 100 kN/m^2
Asphalt	200 kN/m^2
Established, evidently undisturbed ground	
1 **Mud, peat, marshy ground**	0 kN/m^2
2 **Non-cohesive, adequately firmly established ground:**	
Fine to medium sand	150 kN/m^2
Coarse sand to gravel	200 kN/m^2
Crushed stone compacted	250 kN/m^2
3 **Cohesive ground**	
Mushy	0 kN/m^2
Soft	40 kN/m^2
Firm	100 kN/m^2
Half-solid	200 kN/m^2
Hard (solid)	300 kN/m^2
4 **Rock**	
Weathered	100 kN/m^2

So having decided on the appropriate figure, the minimum required area in square metres of footpad can be calculated:

$$\text{Required foot pad area (m}^2\text{)} = \frac{\text{Stabiliser Loading (kN)}}{\text{Load Bearing Capacity of Ground (kN/ m}^2\text{)}}$$

Extreme caution must be used in the use of these calculations as the load bearing capacity of the ground can be dramatically reduced by underground hazards such as:

- Electricity cables
- Gas/Water/Drainage pipes
- Culverts
- Uncompacted material
- Covered shafts and manholes

Additionally great care must be taken when deploying stabilisers close to buildings as ground conditions may be weakened by:

- Recently backfilled excavations and trenches
- Voids under concrete foundations
- Cellars and basements

The information on the diagram below advises on the minimum distance from building features or slopes that should be observed.

For work adjacent to structures or temporary works,
B ≥ 4A and B ≥ 1.5H

For work adjacent to cut slopes,
C ≥ 4A and C + D ≥ 2H

There is a great deal to take into account to ensure that the lorry loader can 'stand its ground' but it is essential if an accident is to be prevented. Should any doubt exist about the adequacy of the ground then further advice should be sought from a geo-technical engineer.