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Spreading the load

Over the past six years Cranes&Access has taken an in-depth look at the temporary surfaces needed to support and spread high point loadings from lift equipment to prevent tipping and sinking. This includes outrigger mats for cranes and aerial lifts as well as crawler crane mats and tracking.

The first feature in 2006 was a result of reviewing the first full year of online accident reports on our web-based news service Vertikal.Net. The original aim of publishing this information was to quickly establish the facts and help quash the increasingly exaggerated rumours that used to circulate after every major crane or platform accident.

While this 'fact' reporting has achieved the original objective, the regular reporting of most crane and lift accidents on a worldwide basis has highlighted other issues, including the fact that there are far more accidents than most people realised and what causes cranes, aerial lift and telehandlers to tip over. It was not too long before the first repercussions occurred. A cluster of fatal aerial lift accidents in which users were thrown out of the platform because they were not wearing harnesses caused several rental company owners, managers and safety specialists to get together and devise the 'Clunk Click' harness campaign. Co-ordinated through the International Powered Access Federation (IPAF) it has largely transformed the use of harnesses and short lanyards on boom lifts.

either they are not set at all, or not extended to match the load chart required. Most often the load applied to the ground has not been spread widely enough for the ground conditions i.e. no mats or mats of the wrong size have been used.



Most incidents involving the ground giving way indicate that no outrigger mats were used at all

The situation has certainly improved since 2006 with far more users and operators now aware of the need to use mats, at least on soft or uncertain ground conditions. But the number of outrigger-related 'incidents' is still ridiculously high. IPAF has recently launched a campaign- 'Spread the Load' stressing the importance of checking out the ground conditions both for units with outriggers and equally important, for those that work free on wheels such as self-propelled booms and scissor

lifts. The campaign includes a first class short video entitled 'IPAF-Spread the Load' which clearly and simply demonstrates the importance of using mats under outriggers and stabilising jacks.

UK loader crane association ALLMI

has also introduced a programme highlighting the need to spread outrigger loadings. New loader crane regulations stipulate maximum ground loadings and put the onus on manufacturers and suppliers of cranes to keep ground bearing pressures to levels less likely to cause ground failures. These include the automatic monitoring of outrigger extensions and jack loadings, relating the results to an overload device/rated load capacity limiter.



A rare case of the ground giving way under a decent mat - clearly a void or softer ground than planned for was the cause



Being aware of ground conditions also applies to equipment working free on wheels

Similar but less stringent rules will also apply to mobile cranes in the USA as new rules come into force. The Department of Labor/OSHA recognised that poor outrigger set up along with lack of operator



Raising the awareness of accidents - led to the highly successful IPAF Clunk Click campaign.

A secondary and perhaps more widespread issue has been that of outrigger related accidents, often due to the lack of mats or proper cribbing under outriggers. Statistics indicate that the vast majority of crane and aerial lifts tip over because of outrigger problems -



ALLMI – supported by new standards – is aiming to reduce point loadings on loader cranes, where mats are often not used or even supplied

training are a major cause of crane accidents and it has included clauses in its legislation that it hopes will improve the situation.

While there is now a great deal of focus on the issue of outrigger mats and reducing point loadings, many crane and lift users are still oblivious to the issue. This is particularly true of smaller aerial lifts which has spurred IPAF to step up its campaign. At the recent APEX powered access exhibition in Maastricht at least one third of the truck mounted and spider lifts were set up without mats under the outriggers. The exhibitors argued that the machines were set up on solid paved areas or thick concrete floors and so they were not required. In all likelihood they were correct - the internal floors at the exhibition centre are built to withstand far higher point loadings than the machines on display could ever inflict and the interlocking blocks in the outside area it could be argued act like a mat.

However many internal floors are covered with carpet which hides numerous voids and cable ducts and channels which would clearly not have taken the weight. On top of that, manufacturers at an exhibition ought to be setting an example to users. If all operators got into the routine of always putting mats under their outriggers we could drastically cut the number of overturning incidents, save lives, reduce injuries and improve economic efficiency by eliminating the knock on effects of major accidents.



Several outside exhibitors at APEX did not use mats



While the indoor floors at APEX are solid, there are voids, many of which are hidden by carpet.

Doing it right

We were pleasantly surprised recently when a delivery driver of a transit flat bed truck and small Palfinger loader crane arrived at our offices with a bulk bag of gravel. The driver pulled into position and automatically got out his nylon mats and set up the outriggers before doing anything else. The jack to the rear of the lifting arc was on interlocking blocks and the operator - employed by Banbury-based Nichols - could easily have just put that one down without the mat. In fact there are those who would not have bothered to have put the jack down at all. It was quite obvious that given the load and the ground there was no need and yet he clearly had a well-practiced routine of always using them - saving the 20 to 30 seconds was not an option. When we asked he said: "It takes no time and it would not be worth my job to forget them." This is the attitude that manufacturers need to have at trade shows and in advertising literature so that they play their part in making the use of mats second nature.

Staying with loader cranes ALLMI has issued a document and simple spread sheet-based programme that not only explains the importance of using outrigger mats but also automatically works out the size required for various ground conditions based on a few simple inputs such as load, radius and outrigger spread.



Bone idle or ignorant?

So why don't all operators behave like the above mentioned delivery driver? As we covered in great detail last year there are several contributory factors. Ignorance or lack of training, call it what you will, is certainly one, although it is hard to say if this is the most common reason or laziness is? On numerous occasions we have received photographs of an accident scene where the outrigger jacks have punched through or sunk into the ground causing the crane to tip and yet there on the crane's deck - are a set of mats. The worst case we have covered involved an incident in which a crane operator sadly lost his life in a bizarre 'double whammy'. The crane - a 100 tonne plus telescopic - was set up on what looked like a firm hardcore surface in a refinery. The operator



The driver wonders why the camera?



The mat on the unloading side on the dry lawn. At the rear a mat was used on interlocking blocks - not necessary but still good practice.

had a set of medium sized steel plates on board to use as spreader mats, however at least two of the mats were stowed on the deck of the crane while he was carrying out his last routine lift - none had been used under the outrigger jacks. While placing the load, one of the outriggers punched through the ground surface into some kind of small void or area of softer material. The jack's small pad created a neat hole showing that at that point, the ground surface was little more than a crust over a void. The crane lurched over as it lost stability, the boom tip and load then hit the ground preventing a full overturn. As the crane started to move, the operator - not sure what was happening - jumped clear of the cab to the ground, just in time to be virtually decapitated by one of the steel outrigger mats sliding off the deck of the crane. While this operator was very unlucky he would have been alive today if he had bothered to use the mats provided which would have spread the load over a sufficiently wide area to have prevented the incident entirely.

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Secondly, with the mat being used on the ground it would not have sliced his head off. And finally, if he had remained in the cab he would have avoided the first two failings and even escaped injury as the load was obviously close enough to the ground that the crane was unlikely to do a flip.

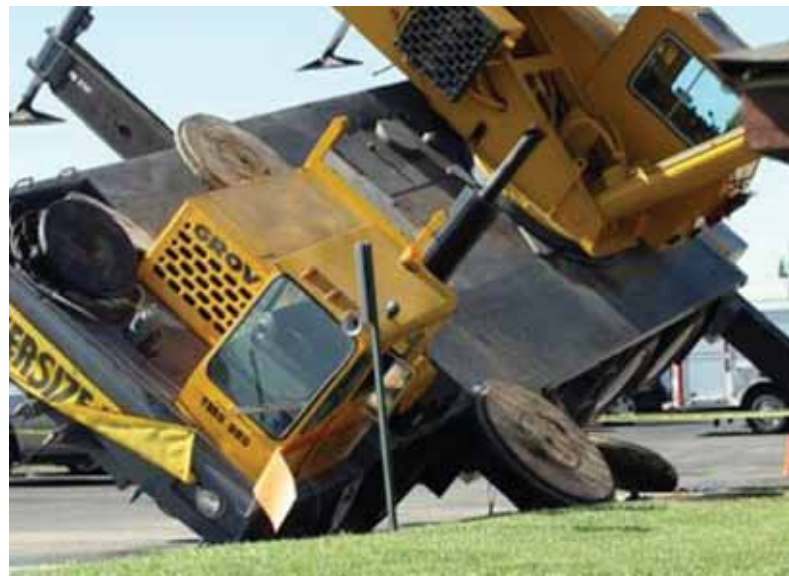
Ease of use

Modern mats are clean and easy to use, so there really is no excuse not to employ them every time the outriggers are set. On larger platforms or on cranes where larger mats tend to be the norm, it helps if the mats are stowed in an easy to reach location. Not only does this encourage their use, but manual handling rules and risk assessments demand it. Many crane rental companies install rear mounted storage chests allowing circular mats to be rolled out rather than lifted. When even larger steel mats are required some form of mechanical handling is essential. Most of the larger truck mounted aerial lift manufacturers offer a boom mounted device to lift and place such mats although Dutch access company Debru has developed a unique steel mat handling trailer for its 70 metre Wumag - see Handling big mats.

Last minute change of plans

We have mentioned lack of training/ignorance and laziness as two of the most common causes of outrigger related accidents, but there is also a third common cause - lack of planning or last minute changes to a pre-agreed plan of work. An absolute classic scenario that causes overturning is a change of route while moving a fully rigged

crane with its outriggers raised. Many wheeled or narrow track crawler cranes can be moved in this way while rigged, but doing so requires meticulous planning with a thorough risk assessment and ideally an aviation-type check list. A typical accident scenario involves a crane moving along a well-planned route but encounters a blockage or restriction along the way. In a properly planned move this has to be a temporary obstruction, as the route would have been walked, checked and any obstacles factored in. 'Obstacles' can be as simple as a parked vehicle with no driver in sight and in such a case the crane should park up, lower its jacks and wait... However on a busy site with strict time pressures and a handful of observers walking along side including a site manager.... there is rarely any shortage of advice for the driver. With the advice to drive his crane around the obstacle being almost deafening. After all "it's the same level ground so you are not really changing the plan!" Many a crane operator will crumple in the face of a so much high powered advice, especially as the clock keeps on ticking. So he takes the detour and on more than one occasion in the past two years the ground is nowhere near as level as the planned route and over goes the crane and the client's manager/supervisor is more than likely to develop a case of amnesia relating to his earlier insistence to get on and drive around the obstacle! A good operator should stick to his guns - after all if anything goes wrong it is not the overbearing site supervisor whose life or job is most at risk. Another cause which often relates



Leaving the mats on the deck does not help with flotation.

to deviating from the plan also involves the human frailty of forgetfulness and with the average age of crane drivers on the rise this may well become more prevalent? Examples include the setting up of a crane in a restricted width space, or

outriggers were not extended on that side! Once again the favour is quickly forgotten in the chaos that ensues.

Some of the latest cranes and truck mounted aerial lifts automatically monitor this and will not allow the



When moving a fully or partially rigged crane plan the route carefully and do not deviate unless there is good cause and the new route is thoroughly checked out first

more typically to leave a lane in the road behind open for passing traffic. The crane has been set up to carry out one or more lifts over a 180 degree range on one side of the crane, so no problem at all - as long as proper mats have been used under the jacks of course. During the work or at the end of it someone on site asks the operator to place, pick or reach something on the other side of the machine - as a sort of last minute favour. The operator, always ready to oblige and be helpful readily agrees, slews the crane around and over goes the crane just as he recalls that the

crane to slew over that area if the outriggers are not extended. However the majority of equipment has no such system in place. Simple pre-settable zone warning devices or limiters have though been around for decades, but are often not used. None of us likes to plan for a 'senior moment'.

In a recent case where a large lattice crane was being moved, the plan had the crane's outriggers fully extended and skimming the ground in order to act as stabilisers in the case of anything caused the crane to waver. However according to a number of people, claiming to be



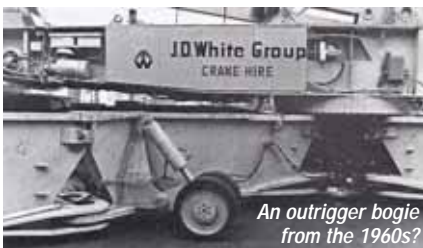
Here is a nice storage set up for both mats and cribbing timbers



Leave the outriggers on one side retracted and you had better be sure not to forget - especially if there is a last minute change of plan

eye witnesses, the route encountered an unforeseen width restriction. The team pulled the outriggers in to pass through the restriction but then "forgot" or omitted to put the out again and the inevitable happened. A camber, minor deviation or even a strong gust of wind caused the crane to 'wobble' and over she went.

Years ago rolling outriggers were commonly used for such moves, allowing full pressure to be retained under the outrigger jacks - as long as the ground is level of course. Some large Demag lattice units even had wheels built in to the outrigger beams. Such devices seem to have gone out of use, possibly as many were homemade and may well have inflicted structural side loadings onto outrigger beams for which they were not designed? However with an apparent growing need to move rigged cranes, perhaps they ought to be looked at again?



An outrigger bogie from the 1960s?



Demag built small wheels into the outriggers of some of its models, including this TC4000

residential sites before any above ground work commences. Because of the substantial home market it is no surprise that the timber mat industry is dominated by Dutch-based companies, increasingly sourcing their timbers from sustainable plantations in South or Central America. While large timbers - which also make excellent outrigger mats - may look like a basic commodity-type product, nothing could be further from the truth. The specialists in this market actually add a considerable amount of value in timber selection, machining and combining different woods into mats to provide specific performance criteria and improve durability. For further information, check out previous features in the soon to be established library



This should not happen to a good quality engineered mat, although in this case it does look like extreme abuse - moving a big crawler over too big a step up



Timber mat suppliers usually keep large inventories ready for immediate delivery

Crawlers don't float

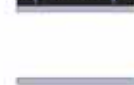
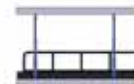
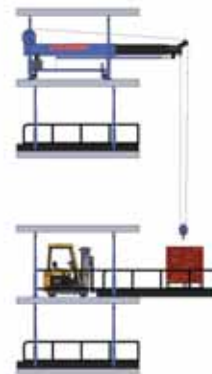
Too many people think that a wide tracked crawler crane can cope with almost any ground conditions. Such assumptions tend to be found among operators of small to medium-sized cranes which require far less planning and preparation compared to large crawlers. In countries where soft ground conditions are the 'norm' such as the Netherlands, timber mats are almost automatically used under every crane, even relatively small crawlers. This is particularly true with foundation work - a major consideration for most commercial and some

section of our web site www.Vertikal.net. Why timber and not alloy roll-type mats or heavy duty temporary roadways? Price and availability is probably a factor along with load bearing capacity. Purpose designed heavy-duty timber mats also provide an excellent surface for all types of crawler tracks and are very 'forgiving' taking the abuse from heavily laden crawler crane undercarriages. The main suppliers hold huge inventories of mats and individual timbers, ready for immediate supply with many offering a rental service for use on specific jobs.

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This crane went over when the road collapsed while travelling fully rigged.

One sector where large cranes have been involved in a number of accidents and near misses over the past couple of years is wind energy. Most wind farms include multiple turbines in close proximity to each other, so there is a natural desire to travel large cranes without having to strip and re-rig them. The productivity gains are naturally huge and given that the majority of accidents occur while rigging and stripping out, limiting the re-rigging frequency can bring safety as well as productivity gains.

However by their very nature, wind farm sites tend to be in remote areas with uncertain and often soft ground. Tracks laid between turbines tend to be narrow and not always capable of handling the loadings big cranes can inflict. In a perfect world the route between turbines would be adequately constructed or if not, paved with timber mats, just as a crane company might do when using a big fully rigged crawler on the public highway. Unfortunately the distances are usually great and time is precious, so this rarely, if ever, happens. The major crane manufacturers offer narrow track models with outriggers for extra stability and do all they can to ensure safe travel with the full boom, counterweight and jibs required for the job.

In the past two years two large cranes of this type have gone over, thankfully without serious injuries. One appears to have been due to soft ground, the other due to going too close to the edge of the wind farm track.

Manufacturers have gone to great lengths to improve handling on soft ground and to distribute the total crane weight equally over the tracks. Liebherr for example recently introduced an extension to its LR600 superstructure in order to allow a reduced counterweight when rigged with boom and jib configuration for 100 metre high, 3MW turbine installations. For heavier work Manitowoc introduced a unique variable counterweight system on its 31000 that constantly adjusts itself to distribute weight over the crane's four individual track units. Expect to see this appear on smaller models in the years ahead. Where fully rigged crawler cranes tend to come 'unstuck' is the turns. Even if a track surface can cope with the ground bearing pressures applied by a fully rigged crane, the 'spragging' or churning effect can cause the front of the tracks to dig in and start a chain reaction that ultimately can cause it to overturn. Terex installs four motor drive systems on some of its larger cranes to help keep turns smooth, while Liebherr takes it a step further and fits twin slew rings to its narrow crawlers, allowing the tracks to be lifted clear of the ground and rotated to face the direction of travel.

The key when travelling with such cranes is to keep the outriggers out and close to the ground with mats at the ready, then if the tracks do start to sink into the ground the operator can use them to gain additional stability and prevent an overturn. Other wind farm lifting contractors are now preferring to



Moving fully rigged cranes is attractive in terms of productivity, but precautions need to be taken. These outriggers and strapped on mats saved the day when one track began to sink

use large telescopic wheeled cranes that can be relatively easily stripped and then gain the lost time in their faster travel speeds between turbine sites. The Grove GTK 1100 is one specialised example of this. Another is of course the Liebherr LTM1200-9.1, a highly popular unit for wind farm work.

While timber mats lend themselves for platforms for big crawlers and as larger outrigger mats for big

mobiles, there has been a recent trend towards larger engineered steel mats. While more expensive and less readily available than their timber equivalents, they are particularly suited to certain applications such as the narrow track crawlers when keeping their outriggers lowered and close to the ground. In this instance it is possible to strap or rather tie steel mats to the crane's outrigger pads.

Handling big mats

Large steel and timber mats are heavy and need to be loaded, transported, unloaded and placed mechanically. Because of the weight there is absolutely no chance of any kind of manual handling or depending on a site forklift. A crane can of course do this itself as long as the ground is not too soft. A large truck mounted lift on the other hand is less suited to such handling. While most suppliers such as Palfinger and Bronto will and do provide lifting hooks or hoists on their machines for handling mats, they are not always the most convenient to use and if the application involves frequent moves such devices are not always the most efficient. Dutch access rental company Debru has devised a solution which it claims has greatly improved its productivity on such work. It has

designed a trailer which can be towed behind its 70 metre Wumag/Palfinger truck mounted lift and carry the large steel mats that it had made for the soft ground typically found on Dutch wind farms. The trailer has its own built-in loader crane for lifting and positioning the 2.4 metre long mats. It is also self-propelled with its own small power unit to both operate the crane and propel the trailer under its own steam. Debru says that the trailer has enough spare capacity to carry a small car or 4x4 allowing the operator to leave the truck mounted lift on site and drive home at the end of the day. There is some debate as to whether the trailer is allowable in all European countries due to the various road regulations however Debru says it would be happy to co-operate with anyone interested in the concept.

This trailer from Debru is fully self-contained and self-propelled.



The unit can be towed behind its 70 metre truck mounted lift

Some good examples



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A good example of a steel mat with sand to provide a good base.

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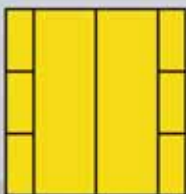
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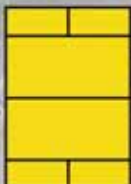


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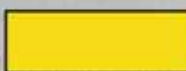
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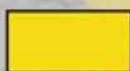


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