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Halving accidents overnight

It is a plain and simple fact that the majority of crane and aerial lift accidents are caused by a few common errors. The two greatest causes are contact with overhead power lines and incorrect outrigger set-up/ground failure.

When it comes to general crane and lift work rather than overhead utility work, poor outrigger set-up is by far and away the biggest killer.

If only all crane and aerial lift users would ensure that they fully understood the need to a) extend outriggers properly and b) to spread the outrigger load over as wide an area as possible, we would cut accidents in half overnight.

The puzzling fact is that in spite of the clear evidence that some simple set up rules will prevent most outrigger related accidents, their frequency shows no sign of letting up. To get the average person on the street to understand a couple of basic rules would take about 10 minutes and would stop at least 75 percent of all outrigger accidents. These are:

- Always put the mats supplied under the outrigger pads
- Always extend the machine's outriggers to their full width and ensure all of them are loaded (the mats will not move if they are loaded!)

While that is not the end of the story, this highly simplistic approach alone would prevent the majority of accidents. Over the past four years we have been sent hundreds of accident photographs, a large number of them clearly caused by ground failure and outrigger set up. In the vast majority of cases either no outrigger mats of any size were used, or the outriggers were not fully extended or not even deployed.

Moving on from the basic rules

It is said that you can't make any machine 'idiot proof' and that is an irrefutable fact of life. However it ought to be possible to teach an idiot the two rules above in no time at all.

The next simple message that would pick up a further few percent or so of accidents is: "Avoid setting up near to a bank, just as you would not park your car on the very edge of a cliff." Putting a load onto something that regularly crumbles into the sea or a river makes no sense at all.

Finally for the more complex set-ups such as where limited space requires a machine to use partial outrigger set up, if the operator is not totally familiar with the machine's load charts and rated load indicator programmes, he should not be in the cab in the first place. But for the sake of our simplistic exercise – you could forbid such an operator from partial outrigger set-ups and send a more skilled individual to such jobs.

The point of the above exercise is not to provide a real life set of operators' instructions, but simply to illustrate how it should be possible to slash the risk of overturning accidents caused by poor outrigger set-up.

So why do we still have so many outrigger/ground related tip overs?

So if it is simple to train operators in the very basics of proper outrigger set-up, why do we still have so many accidents?

Automatic safety

While it should be relatively straightforward to set the machines outriggers correctly and to



If operators would only use the mats provided, regardless of ground conditions tipping accidents would be significantly reduced



Accidents relating to poor outrigger set up show no sign of slowing up



In this accident a two shift scenario caught the operator unaware that his rear outriggers had been left in the retracted position

Two main reasons:

- Laziness/bone idleness - call it what you will, all too often the operator figures that the ground is firm enough so thinks 'I can't be bothered to lug those mats down from the deck or from their storage brackets.' When his crane has overturned causing hundreds of thousands of pounds of damage or worse still people are seriously injured or dead – he will wish that he had bothered to use them!
- Total ignorance of the need for them, usually coupled with an absence of any on the machine. In such cases it generally reflects back on the owner or employer a) in not training the operator properly and b) in not bothering to ensure that mats were provided.

remember to use decent mats, one aspect of the process looks like becoming entirely automated. An

increasing number of aerial lifts and cranes are now being fitted with automatic progressive sensors on the outrigger beams and pressure sensors on the outrigger jacks.

This ties in well with the increasingly versatile but more complicated load charts for cranes and lifts that allow multiple outrigger positions, including asymmetric settings. The provision of full outrigger sensing and automatic load chart selection seems like a good idea and could be a definitive aid to safety. For aerial lifts an increasing number of machines will limit or extend the outreach depending on the size of the outrigger base and the weight in the platform, something that is unquestionably advantageous and simple to use.

Load sensing specialist Moba is planning to introduce a new ultrasonic outrigger beam position sensor that will make it easier for manufacturers to build reliable position sensing into their products. The device sends a sound beam from the box end to the beam end of the outrigger assembly. The benefit is that nothing but a total sealed blockage of the inside of the box and beam will disrupt the signal, allowing the device to be fitted to existing machines without fear of disruption from internal hoses etc.



Here is an excellent set up with the mats stored close to the outriggers, with a ramp to help load and unload them. Behind is a neat storage locker for cribbing timbers

Taking control away

There will be those who argue that such devices take yet more control away from the operator. This is the same debate that we saw in North America over the implementation of Load Moment Indicators in the 1980's and 1990's. The fact is that operators need to be aware of and fully understand the need for correct outrigger set up. And anyway these automatic devices will only solve half of the problem - they will not detect the presence of a decent outrigger mat under each jack pad. However once widely fitted they should put a stop to the idiots who don't extend the outriggers at all or forget that they have not extended the beams behind them when they do an unplanned slew in that direction. Perversely the greatest danger might come when the majority of cranes and lifts are so equipped, causing accidents with those that are not?

So the need to hammer home the importance of outriggers will remain as important as ever.

Good mats well placed

One of the best things a crane or truck mounted lift owner can do is to purchase a decent set of outrigger mats suited to the size of the crane or lift. For cranes of 80 tonnes and less and all but the very

largest truck mounted lifts a set of high quality polythene/nylon or proper wood mats with a diameter of around 600mm/2ft will cover most eventualities with 300mm for the smaller truck mounts and trailer lifts and 800 to 900mm mats for larger units or for mid-sized machines on very soft ground.

Once the mats have been sourced they need to be stored on the machine and if they are to be used regularly the storage points need to be well placed and designed to allow the pads to be removed and replaced easily. This is particularly true of the larger ones. With manual lifting regulations restricting the weights that a single person should lift, the larger mats will benefit from a design that makes it easier to roll them out of their storage pockets.

Cribbing

On all but the smallest cranes and lifts, a few decent timbers used for cribbing can compensate for slopes or depressions or further spread the load by placing them under the regular mats. Once again good storage for these will ensure they are ready to hand and looked after. In the UK the Health & Safety Executive will stop a crane or lift if they see old split scraps of wood being used in place of mats or proper cribbing so not dealing with this issue can be costly on many levels.



This mat actually clips on to the machines outrigger pad



This neat little mat is used with van mount stabilisers rather than outriggers



While the use of wood squares is frowned up in some circles, it is far better than nothing and is a practical solution for lifts that simply require stabilising, or for firm ground.

Working on built-up platforms

This crane was well set-up in terms of mats, but the engineered aggregate platform - located near a stream - was compromised by heavy overnight rains and collapsed when the weight went over the outriggers closest to the edge.



Cribbing like this is highly dangerous

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Assessing mobile crane hardstands

Hardstand consideration and outrigger load spread continues to be a subject of protracted debate. Mike Allanson, operations manager for BFL Alimats and an Appointed Person (AP) for more than 15 years offers an interesting perspective.

After fifteen years of working with mobile cranes, it still surprises me how fragmented we are as an industry regarding ground assessment and outrigger loadings.



Mike Allanson

Having previously worked for a company which suffered mobile crane overturns caused by ground failure – I witnessed the aftermath and was also involved in one of the investigations, which left quite an impression on me. Fortunately, none of them resulted in injuries, due to good luck rather than good planning. Whilst I did not plan any of the failed lifts these experiences planted the serious seeds of concern which led to me to team up with Chris Massey of BFL to develop the Alimats system five years ago.

I find the topic of ground consideration fascinating, thanks to the variety of differing opinions on the subject. When asked about the suitability of our three square metre mat area for a particular lift, it can be difficult to respond when prospective clients use such varied methods of calculating the proposed mat area.

We have noted a marked increase in demand for our mats in recent months, some of which is undoubtedly down to increased engineering input into ground load

bearing assessments. Safety factors are increasingly being applied by the specialist engineers as an integral part of their ground bearing capacity considerations. Some AP's not familiar with obtaining such detailed information are also unwittingly applying their own additional safety factors. This has resulted in some eyebrow-raising, huge mat requirements for relatively small mobile cranes, which threatens to undermine the current trend of improving standards regarding hardstand assessments and information provision from clients.

Contractors and AP's alike - reflecting on the clearly excessive conclusions of some of these 'calculations' – are questioning the merit of 'doing it properly'. We need to question the methodology rather than the need to obtain solid engineering input for a crane's hardstanding, which we should all encourage.

Inconsistent outrigger load calculation – an old concern

Temporary works engineers are often frustrated at the apparent inconsistency of outrigger load



The standard 3m² Alimats outrigger mat system

information provided by AP's. For a near identical lift using the same crane, it is not unusual for the engineer to be given an outrigger loading of say 20 tonnes by one AP and 50 tonnes by another. The problem stems from the different methods of calculation used. Guidance regarding the various calculation methods remains sparse, leaving many AP's to follow what they were taught during their training.

The three most common methods are:

- Actual predicted outrigger loadings from crane manufacturer's charts and software (e.g. Liebherr's LICCON system, Cranimax / Cranimation, etc).
- 75% of the gross weight of the crane plus the weight of the load, applied through a single outrigger
- 100% of the gross weight of the crane plus the weight of the load, applied through a single outrigger

All three have their own rationale and merit, but the end results are

drastically different – in some cases more than double. This is because actual predicted outrigger loads do not automatically include an additional safety margin (recommended for all lifts), whereas the other methods do, albeit not a defined factor.

Whilst many AP training courses advocate the 75 or 100 percent methods, it is clear that the actual loadings will be considerably less. The perceived wisdom behind this approach is that planning for the absolute worst case scenario will guarantee a satisfactory conclusion. However when a specific load bearing capacity is provided by an engineer, it normally already includes a significant factor of safety. When this is combined with worst case outrigger loadings, the resulting mat requirement can be unnecessarily large, impractical and uneconomic. So where a specialist engineer has calculated the loadings with a safety factor, the AP would do well to work with actual predicted outrigger loadings. This will result in a sensible, economic and safe specification of outrigger mat sizes.



In this example it is clear that the AP has worked closely with the contractors engineers



The short Alimats in four module set up

Some AP's already work in this way - particularly those who work directly for crane hirers - while many others continue to use the 75/100 percent methods which have evolved due to a widespread lack of engineering input into hardstands, leading to the adoption of worst-case planning by APs seeking a comfort factor.

Contractors are subsequently asked to prepare the hardstand to suit these worst case outrigger loads. The problem is that they are likely to be excessive, with requests for 80 tonnes per square metre and over not unusual. At the same time it is rare for contractors to confirm a bearing capacity of more than 30 tonnes per square metre where a specialist engineer is involved. Indeed sub 20 tonnes per square metre seems to be becoming the norm. If a contractor does sign-off a lift plan noting excessive requirements, the AP should probably question the competency of his engineering assessment. Instead many AP's take the view that signature is king, regardless of the competency of the person signing or lack of evidence to back up the signature.

Lack of ground load bearing information – still a major problem

An increasing number of contractors are developing a more proactive approach regarding

hardstand capabilities. This is leading to increased specialist engineering input and a growing demand for larger mats, as ground bearing capacities are considered in more detail. However, a large number of contractors still provide little or no information, regardless of their legal and contractual obligation to do so.

AP training courses tend to assume that a hardstand bearing capacity has been provided by the client and rarely provide training on to how to deal with an absence of such information. The result is a complex cocktail of self-assessments using CIRIA C703 outrigger foundation area charts, along with the 75/100 percent methods and visual evaluation based on previous crane use experience etc...

A 'no information-no lift' policy would be utopia, but in the real world there will always be clients who cannot be expected to provide such information, such as a domestic customer requiring a hot tub lift. It is therefore important that AP's are able to use their judgement and have methods such as those outlined in CIRIA 703 to apply to such cases. Other clients such as contractors, could and should significantly improve the provision of ground bearing information to AP's. If the AP is not happy with the level of information provided,

"No information – no lift" would be the ideal situation.



they should not, in theory, proceed with the lift. Certainly some AP's simply don't try hard enough to obtain the required information, after all, if you don't ask you don't get.

Safety factors are the latest buzz word

AP's and specialist engineers need to ensure that overly cautious outrigger loadings are not used where adequate safety factor are already included in the ground bearing calculations. The engineer will get it in the neck when clearly excessive mats are used, but they can only work with the outrigger loadings provided by the AP. Many AP's are not used to working with specialist engineers and some are not familiar with actual predicted outrigger loads. Perhaps training providers could offer additional options for this element of crane planning? I am sure demand would be high for a one day course on the subject. Apart from being of great benefit to AP's who are uncomfortable with self

Equally, we need to ensure that when a specialist engineer is not involved, a suitable stability safety factor is incorporated into the ground assessment and mat area calculation. Actual predicted outrigger loadings should only really be used in combination with an appropriate stability safety factor. CIRIA C703 – Crane Stability on Site outlines the safety factor recommendations, but some AP's are either not aware of the requirement or choose to ignore it.

If a company has historically planned lifts without additional stability factors, it can be difficult to start including them for commercial reasons - who will pay for the larger mats?

The encouraging news is that as contractors become more aware of their responsibilities to ensure that ground considerations are addressed, they are also increasingly prepared to pay to ensure adequate outrigger load



assessment, it would be of interest to scores of contracts/site managers looking to obtain a better understanding of their responsibilities under CDM.

Bigger mats - or better ground?

Some temporary works engineers reason that if there is a need for a mat area of more than 3m² for sub 100 tonne mobile cranes, you will struggle to justify driving the crane into position if you were to check the axle loads applied through the wheel footprint. For this reason, an increasing number of specialist engineers will work to a maximum mat of three square metres and enhance the hardstand with additional capping formation if required. AP's appreciate engineers working this way, rather than specifying ever larger mats, which causes logistical problems for all concerned.

spreading. Indeed many crane hirers are beginning to regard mat provision as a better earner than the crane itself. The same applies to lifting sub-contractors.

I am not a fan of ambiguous guidance or regulation for regulation sake, but it is clear more needs to be done concerning crane stability and ground assessment. We must ensure that as we address the issue, we are not over-zealous or it could prove counter-productive as clients reflect negatively on the wisdom of providing decent ground bearing information. We should all try to encourage the provision of better information and support AP's as they strive to obtain it. We should also encourage honest debate on the subject and work together to improve standards and protect the safety of the site operatives, the reputation of our companies and ultimately our livelihoods depend on it.



Timber mats

Timber is still a popular choice for large outrigger mat areas, although the days of using old railway sleepers (railroad ties) has now long gone.

The market today is served by a number of companies - mostly of Dutch origin - which import highly sophisticated products, machined with lifting brackets/eyes, chamfered edges and bolted together to produce wider units. Some suppliers use a combination of hardwoods within a bolted mat to improve durability and enhance performance.

In recent years the availability of an increasingly widespread rental service for mats, particularly the larger ones has proved attractive to crane rental companies and contractors. However it is for crawler crane mats where timber really comes into its own - there really is no alternative. Thicknesses vary up to 300mm, depending on how heavy the loading is likely to be, widths range from 200mm upwards with 200mm beams being bolted together to form larger units. Standard lengths are typically up to 12 metres - longer spans are

available usually by special order.

The big suppliers, Sarum Hardwood, Welex, Timbermat and GTP offer a range of services, including customising mats to suit the contract, while holding large stocks of mats for immediate delivery. The array of different timber used can provide a fascinating study subject in its own right. The key requirement is for a high-density, tight wood grain that will avoid splitting, decay and deformation. Preferred woods for heavy duty crawler mats include Azobe/Ekki also known as Red Ironwood, Mora, Wamara and Cumaru and Greenheart, while more familiar woods such as oak can be acceptable for outrigger matting and cribbing.

Azobe and Ekki essentially different names for the same wood tend to come from Africa while the latter three are more South American. Guyana Timber Products (GTP) takes a slightly different approach to some of the other suppliers in



Timber is king when it comes to big crawler mats - note the aggregate platform below



A heavy duty 300mm x 1,200mm 12 metre long Greenheart mat

that it combines woods such as Mora and Wamara or Cumaru and Wamara to create a compound mat that provides a combination of hardness and durability, it sources all of its wood from state owned forests in Guyana.

All of the suppliers are committed to sourcing from sustainable sources and naturally this is becoming an increasingly important issue for many users. The fact that

the woods mentioned above are highly resistant to damage and decay does mean that they have a far longer life than most wood products. As the woods mentioned are extremely hard, they literally have to be drilled and machines along the lines of steel, most suppliers are equipped to do this either at their holding yards in Holland or Belgium or in the case of Timbermat in the UK.

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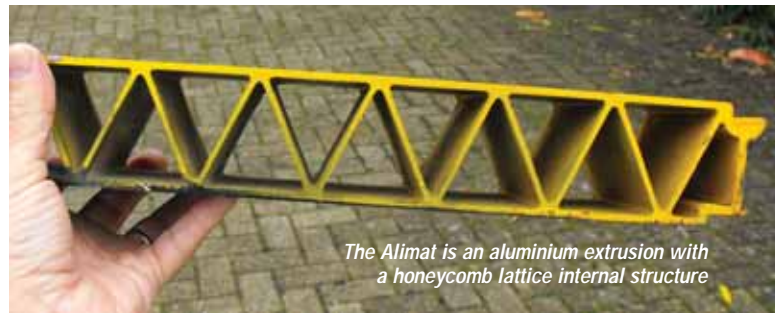
Over past few years we have covered a number of different outrigger mat systems from wood to various polymers and synthetics to fabricated steel.

Alimats are different in that the mats are made from an aluminium honeycomb extrusion which is then treated with a thick non-slip paint finish. The paint not only provides a better surface for outriggers to sit on, but also hides the fact that they are made from aluminium, possibly helping reduce or even eliminate theft.

The mats or rather mat system have until now been available in a single size of 1,740 x 580 x 60mm thick. The mats click together and the standard configuration is to have three modules on the bottom and a further two on top at 90 degrees, to create a solid three square metre mat area. A shorter system with 1,160mm long by 580mm wide mats is now being introduced with three units creating

a 1.3 square metre mat area, ideal for loader cranes, aerial lifts, smaller mobile cranes or for larger cranes where higher ground loadings are permissible.

The longer mats are classically used in a three by two configuration to give 3m² surface area



The Alimat is an aluminium extrusion with a honeycomb lattice internal structure

The longer mats weigh 38kg each, while the short ones are just 25kg. The advantage is that they can be transported in the back of a van and easily set up by two men.

The company initially refused to sell the mats, preferring instead to rent them to crane companies, this changed earlier this year when it received a large order from the UK Fire service. It is now offering the mat system for sale and is seeking wider distribution.

Berry Crane Hire of Towcester, Northamptonshire was the first crane rental company to buy the mats, owner Neil Berry said: "I particularly liked the documented

justification of load spread capability which is increasingly requested by clients. Their ease of transportation is also a major advantage."



Alimat's new short mats are ideal for smaller cranes



A short Alimat in the boot/trunk of a car

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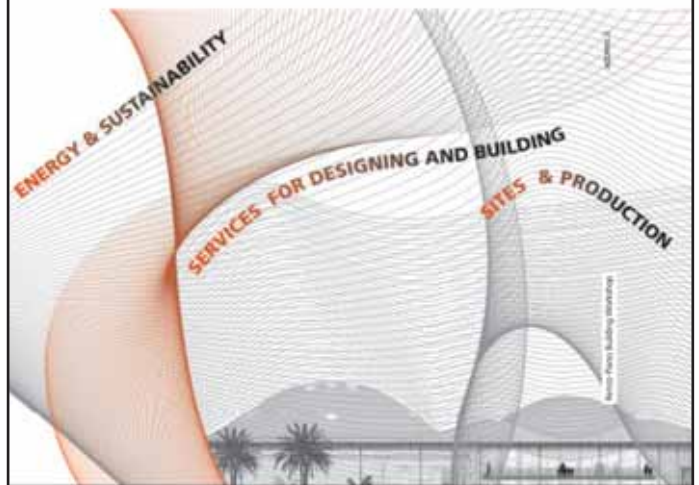
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