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Tricky recovery

After lying on its back for five months in Peterhead, Scotland, the recovery of Whyte Crane Hires' overturned 500 tonne Liebherr LTM 1500-8.1 All Terrain crane has probably created a good deal of interest. The crane tipped over during the UK's early May bank holiday weekend and remained in that inelegant position all summer, before finally being recovered at the beginning of October. Cranes & Access spoke with Peter Issitt, managing director of Crowland Cranes which was contracted to carry out the recovery, the trickiest he has ever been involved with.

Crowland Cranes is the only independent crane recovery specialist recognised by insurance companies Aviva and Alliance, so it was no surprise when the primary insurer, Aviva, called the company in to oversee the planning and recovery of the stricken Liebherr. The ill-fated job on which the crane was engaged when it collapsed, was also only the crane's second commercial lift - having just been delivered - so both Liebherr and Whyte Crane Hire were closely involved.

That sinking feeling...

So how did the crane end up in its precarious position? After completing a lift for client Aquatic Subsea - an independent supplier of powered-reel and tensioner systems to the oil and gas sector - at its premises in Peterhead the ground failed under one of the rear mats and the outrigger sank around 2.5

metres through a hardcore base layer into a layer of clay below. All had appeared well with the set-up with the crane sitting on steel mats supplied by the client. However, as the crane tipped the outrigger and mat ended up several metres underground.

The operator had completed a lift over the side of the crane - loading out a test rig - with the top three boom sections extended and the boom at a high angle. He then decided to go for a break and slewed the superstructure to make it easier to exit the cab, putting the counterweight over one of the rear outrigger jacks.

As he climbed down, a loud 'bang' was heard which has still not been explained. At the time it was thought it may have been the load settling on the low loader or the outriggers. However the operator realised the crane was very slowly



The outrigger mat



The crane is finally lifted and rotated



How it landed

starting to move and got back into the cab trying to restart/reboot the crane. Unfortunately, with precious seconds taken up by computer pre-checks etc he was unable to slew the crane in time to recover the situation and had to jump clear. Fortunately no-one was injured although the hook block did swing back very close to the cab - had it made contact it could have been much worse.

The LTM 1500 came to rest with four points in contact with the ground. The chassis - several metres off the ground at its lowest point and inclined at an angle of about 45 degrees with the cab at a height of around 15 metres - was in contact via the sunken outrigger, which had just one section of the beam visible. The rear of the superstructure ballast was also resting on the ground, together with one of the Y-Guy arms with the other was about 1.5 metres off the ground. The impact of the crane

coming to rest caused one section (section four) of the six-section 84 metre main boom to buckle at its base, with the boom nose resting on the concrete (only the last three sections had been extended).

In that position, the whole structure was stable, however to recover the crane the boom would have to be cut at the point of failure and removed and the crane then lifted and rotated into the upright position and moved away from the area where the ground had given way. Not an easy task, given that the Liebherr LTM 1500 had a base weight of 96 tonnes plus a counterweight of 165 tonnes. When it tipped the crane weighed about 260 tonnes so the total lift was close to 280 tonnes.

Planning the recovery

There were several contributing factors that slowed the recovery process, including the fact that the incident occurred at the premises of a company operating in a sector



A very congested site!

which places a great deal of attention to safety.

"Aviva rang me after the bank holiday to see if I could help," said Issitt. "Given the crane was brand new, I advised involving the manufacturer, as agreeing the recovery process early on would lead to an easier final solution."

The fact that crane was just two weeks old, coupled with the unexplained 'bang' heard before

the overturn, and not being able to see the state of the buried outrigger, also meant that the manufacturer and crane owner needed to be involved, along with the Health & Safety Executive and the insurance company. Even with a perfect recovery and no further damage to the crane, the insurers' exposure could be in the region of £1 million. Further damage would of course have increased this to the

point where it could have been put beyond the point of economic repair.

"This is the first recovery where I have been able to analyse the crane's 'black box' which records the LTM's performance parameters at five second intervals, including when the crane was turned on and off, information on the lift including the load on each outrigger and even when the operator sat down and got out of the crane," said Issitt. "From

this we could see exactly what had happened before and during the entire incident, which helped us formulate a rescue procedure."

The process

With the crane still under warranty and Liebherr scheduled to carry out the repairs, there was a strong focus on avoiding overstressing the chassis, slew ring or boom etc..which a 'normal' recovery might have inflicted. With Liebherr



The cold cutter in position



Cutting sections of the boom



The cold cutter with the telehandler drip tray underneath



Cutting the boom



Boom removed and draining all the oil into the telehandler mounted plastic container



Excavating around the sunken outrigger



Attaching slings



One of the four collars - each weighing two tonnes



Ready to lift



Up she goes

involved and supplying technical dimensions, weights and input into how to recover the crane with minimal damage, the team had a good chance of achieving that aim. "Had it been an older crane, out of warranty, the recovery would have taken less than two weeks," said Issitt. "But working for the insurance company which aims to look after the client's interest, we had to ensure that the recovery was carried out with as little damage to the crane as possible, ultimately resulting in a quicker, easier and cheaper refurbishment. We were mindful of taking the time to carefully plan the recovery rather than going in quickly. This is one of the reasons why we are the only non-manufacturer in the UK approved by Aviva for crane recovery and repair. At the start of the process it was clear that Whytes had concerns about carrying out the recovery on their own. Liebherr were also watchful, given that this was the first recovery of a new 500 tonner and given its precarious position. There was a lot of discussion covering all aspects of the lift, which helped ensure its overall success. Crane recovery is totally different to general lifting, so each company was able to input its expertise, bouncing ideas off each other to end up with the best solution."

Whyte Crane Hire did the specific lift plan - including where the three recovery cranes were to be positioned, using the lift capacities and radii from Liebherr and Crowland. After excavating and exposing the buried outrigger, the crane had to be lifted vertically out of the ground and then rotated in the air into a level position before being lowered to the ground. There was also a great deal of interest in the condition of the outrigger but it was fully intact and was found to have



Raising slowly up



Almost out



The sunken outrigger is clear



Upright

punched into the ground without collapsing.

To achieve the lift four special collars, each weighing two tonnes, were manufactured by Liebherr and fitted to the crane's four outrigger beams, close to the chassis. These were braced by two heavy chains underneath and one on top, each able to carry loads of 100 tonnes pulling through a sling.

"There were also lots of discussions on loadings, and this is where our practical knowledge of recovery came into play," said Issitt. "We needed a 125 tonne snatch block for one of the cranes to lift on the 'Y-Guy' arm and Liebherr said it would supply one from a 750 tonne LTM 1750. However the only wire rope that can be used with that block was way under capacity, so we had to source a 200 tonne

block to accommodate the 84mm diameter rope, which gave us the required 105 tonne rope capacity."

"We would normally have lifted on the crane's main boom but Liebherr insisted that it was better to hook onto the Y-Guy arms to avoid stressing/damaging the main boom. In the end we pooled out experience and expertise to come up with the best solution. All the details were put into the substantial, detailed lift plan which was also reviewed by the HSE. Even though we are experienced in the recovery of cranes, this was particularly tricky and I lost some sleep before hand," said Issitt. "We are not the only company capable of recovering cranes, but we are involved in around eight out of 10 crane recovery incidents in the UK."

Other factors including method



On the ground minus the bent boom



Removing the ballast once upright

statements, manufacturing the outrigger collars, arranging the lifting slings, organising the three 500 tonners and agreeing details between personnel in the UK and Germany all extended the process.

You raise me up....

The whole lifting operation and getting the crane in road-going trim was completed in five days. The three 500 tonne recovery cranes - one supplied by Edinburgh-based Bernard Hunter Cranes and two from Whyte Crane Hire - arrived, together with a three man team from Liebherr, headed by Aaron Willis with a welder and engineer and four from Crowland, including Issitt, a crane engineer, Appointed Person and a welder. Crowland also supplied everything below the hook - apart from the Liebherr manufactured collars.

"The ground where the Bernard Hunter crane was set up was the worst so laser levels were installed on the outriggers to check for any movement while carrying out a test lift. We certainly didn't want another crane going over and one of its outriggers was precariously close to the area that had given way."

By Wednesday morning the cranes were set up and the team was ready to remove the top three boom sections.

Boom off

Plumb lines were placed on the stricken crane, in order to immediately spot any unplanned movement. The top boom sections were then supported by two cranes

(a 500 and a 100 tonner) while an opening was flame cut into section four to allow the team to see the telescope cylinder close to the point of failure. The hole was then enlarged in order to accommodate a hydraulic powered cold-cut saw - usually used for underwater cutting - and put into place by Issitt and Willis working from two 65ft Genie S65 boom lifts.

Liebherr had insisted on the cold cut method because of the potential fire risk from 1,000 litres of hydraulic oil in the telescope cylinder. Although no-one had used the cold cutter before, it worked well. However before the cylinder could be cut, the oil had to be drained. The solution was to use a telehandler with a large plastic container on the forks, acting as a massive drip tray. This was raised up under the boom and caught all of the oil without spillage.

Lift in operation

Once the 20 tonnes of boom sections had been removed, it was time to lift the rest of the crane. The team thought it might shift sideways and so chains have been installed from the bottom of the counterweight to the outriggers to prevent the superstructure moving during the lift.

"Each collar around the outrigger was secured with chains and tensioned to protect the chassis from stress. The biggest load was at the rear of the chassis - 102 tonnes between the collars - a steel chain of this capacity would have resembled the anchor chain of the Titanic, so we used a 125 tonne

endless sling between the two and an endless sling to lift the chassis front, back and on both Y-Guys", said Issitt.

The precisely positioned recovery cranes were each given their loads and radii. One crane had to pick up 40 tonnes at 10 metres at the start, increasing to 82 tonnes at 15 metres radius as the lift proceeded. Another would hold 92 tonnes for the entire lift. Throughout the lift Issitt was kept in constant contact with all three crane operators by radio, telling them exactly what to do.

"All the drivers were good, keen to listen and take instructions," he said. "The 285 tonne crane was very slowly raised up, rotated and then set down exactly as planned, the total lift taking close to five hours. Rotating it was the hardest aspect but the loads supplied by Liebherr were very accurate - within 10 percent of the actual figures.

This small variation was OK as I had included safety factors of between 30 and 50 percent. This may sound a lot, but a crane good for 140 tonnes lifting 92 tonnes only needs a small increase in radius before it approaches its limit."

"If I had to do it all again I would not change the set up at all. Originally we considered using a 300 tonner on the front and two 500s on the chassis. However the 300 tonner might have run out of lift height with 41 metres of main boom. So I decided to use another 500 tonner with 46 metre boom, losing a couple of tonnes of capacity but ensuring we didn't run out of lift height."

"Once the crane was upright again we plumbed in our power pack, got the electrics working and the boom down, folded the 'Y-Guys' and removed the ballast. In fact there was very little damage to the crane and within two days, it was driven down to the Liebherr facility in Biggleswade, Bedfordshire. The main damage was the boom section which had been cut and some damage to the rear axle torsion bars that bent as it went over. It took a day to get the bottom engine running as oil had travelled up to the topside - typical in these cases - and a second day installing the new torsion bars - testament to the fact that the machine recovery went so well.

"A recovery plan is totally different to a normal crane lift, in that it is not a 'tick box' lift but really structured," says Issitt. "Lifting a tree comes close in that it is an unknown quantity. A video we posted online had 116,000 views and 2,000 comments from all over the world. It was good to see people in the industry appreciating that this was not a straightforward lift. I really enjoyed the whole experience and the challenge."



The leg of the Bernard Hunter crane was very close to where the crane sank

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LIFETIME EXCELLENCE

A middle-aged man with grey hair and a beard, wearing a dark jacket over a blue sweater and a plaid shirt, stands in the foreground. In the background, a red PALFINGER crane is lifting a white and blue motorboat from a red trailer at a marina.

JEFF KOSCHINSKI
SALES REPRESENTATIVE

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