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TRANSPORT OF PIPELINE OPTIMISATION

ABSTRACT

Transport of Pipeline Optimisation was announced as the winner of the IADC's Safety Award 2017. The aim of the IADC Safety Award is to further the development of safety skills in the workplace and reward those who clearly show that they are concerned with safety. Formulated and submitted by Maarten Tronckoe, Simon Van den Berghe and Pieter Verpoest of Jan De Nul Group, the solution improves each facet of the process involved in the transportation and handling of pipelines.

On both reclamation sites and logistics yards, dredge pipes with and without flanges are being lifted by crane and transported with trucks. In regards to securing these heavy loads to flatbeds, the conventional method does not explicitly address the task which involves workers hand-placing wooden beams beneath pipes. The award-winning safety solution begins with the use of specially-designed cradles (Dhatec) which are secured to a trailer's flatbed to facilitate stacking. Manual adjustment to the wooden beams is no longer required, keeping workers away from heavy loads during their placement.

As for the pipe-lifting process, the precursory pipe hook has been replaced with a C-shaped alternative. Conventional metal lifting chains were subsequently exchanged for lightweight soft slings. A spreader beam is placed between the soft slings to further minimise the overall weight handled by riggers. Attached to the hooks, guidelines are then held by riggers on the ground, letting them easily manoeuvre the pipes while loading and unloading the trucks from a safe distance. The optimised process presents an ergonomic benefit for workers.

INTRODUCTION

Transport of Pipeline Optimisation was announced as the winner of the Safety Award 2017. Formulated and submitted by Maarten Tronckoe, Simon Van den Berghe and Pieter Verpoest of Jan De Nul Group, the solution improves each facet of the process involved in the transportation of pipelines. By proactively eliminating risk to workers engaged in the transportation process, the solution is aligned with the award's mission of increasing safety in the dredging industry.

On a regular basis, dredge pipes are delivered by truck to project sites all around the world. First, on a storage yard, four pipes – weighing at least four tonnes each – are individually lifted with a crane, placed and stacked onto a flatbed truck, and secured with straps. Each operation can result in at least a 16-tonne load which reaches almost four metres in height. For a single project, this operation can be repeated one hundred times. One-by-one, these heavy loads then hit the road to deliver their cargo to their intended destination which can be as far as a few thousand kilometres away from their starting point.

The team's rationale for optimising the process was a proactive choice to reduce risk in everyday operations. JDN's core business is dredging and the most important element in a project is the vessel. Therefore, the handling and transportation of pipelines is considered to be a sideline activity and is not the most risky of operations performed.

Maarten Tronckoe portrays it as common practice: 'We've done it all day long and for dozens of years. Therefore it came as a surprise that improvement could have been gained in this kind of operation.'

Above: Whether floating on water or sitting on land, discharge pipelines – whether one or many – may traverse a work site for kilometres. Comprised of 12–metre-long sections bolted together, the pipelines are shipped by land or even sea depending on where the project is situated. Photo Jan De Nul Group.

Figure 2. The team chose to proactively eliminate the potential risks to safety by replacing accepted norms within the loading process with certified alternatives.

Figure 3. To begin loading pipes onto the truck's flatbed, bottom section cradles are placed atop an anti-skid mat.

Figure 4. Workers place a mid-section cradle atop the first layer of pipes which will support the second tier of pipes.

The team's upgrades to the lifting, stacking and securing of pipes ensures accountability that the logistics task is executed safely, a benefit to both employees and the public. In addition to increasing safety in regards to shipyard storage, crane lifting and flatbed truck securing practices, the solution heavily considers the ergonomics of the process for workers partaking in the process which takes place around the clock, all day long.

PERCEIVED PROBLEMS WITH THE CONVENTIONAL WAY

Prior to Tronckoe, Van Den Berghe and Verpoest's innovation, the long-standing process for the transport of pipelines involved the use of metal chains which were susceptible to tangling, pipe hooks which needed to be manually positioned in and sometimes hammered out of the bolt holes in a pipe's flanges, and wooden beams which needed to be placed by hand beneath a pipe before the pipe could be finally lowered into position and released. To stack a second layer of pipes, workers needed to climb onto the first layer of pipes to again place wooden beams. To put it simply, Maarten Tronckoe states: 'It just felt unsafe'.

And before ultimately setting the vehicle into motion, drivers would double check their loads, taking extra time – as necessary – to secure the vehicle's cargo rather than leaving in a rush to arrive on time to a destination. 'If just one six-tonne pipe is not secure, it *will* be a big accident,' says Tronckoe.

In addition to his own concerns, he explains: 'In Europe, securing heavy loads on trucks in a safe manner is a top priority. Our trucks are frequently inspected because there is a lot of weight on the truck, it is an eye catcher.' So when a truck would be randomly stopped for an inspection, drivers must prove the load is secure from top to bottom. But how safe is a wedge nailed it to the floor of the truck? And how much force can a wooden wedge with a nail driven through it actually take? The rules and regulations for securing trucks are made for standard pieces of cargo such as wooden packages and pallets. Without a legislative manual specifying how to ship multiple pipes, the team decided it could no longer settle for the degree of variability and began its search for solution with a clear explanation.

OPTIMISING WAS OPTIONAL

Although JDN had no recorded incidents or legislation violations as a result of its conventional pipeline transportation practices, the team chose to proactively eliminate the potential risks to safety. In particular, the manual placement of wooden beams and wedges beneath six-tonne pipes and climbing atop pipe stacks by workers would need to be addressed (see Figure 2).

REPLACING WOODEN BLOCKS WITH CERTIFIED CRADLES

In the first phase of loading a flatbed truck, workers would employ a timbering process, setting wooden beams and wedges between pipes to provide support to the pipe stacks on the truck's flatbed. Pipes were placed between pairs of self-standing vertical poles

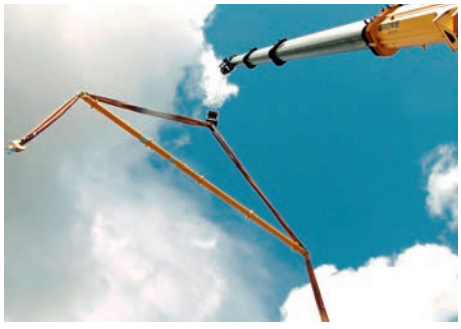

Figure 5. A modular spreader separates the soft slings – ensuring they are always ready to lift – as well as lightening the overall weight for riggers.

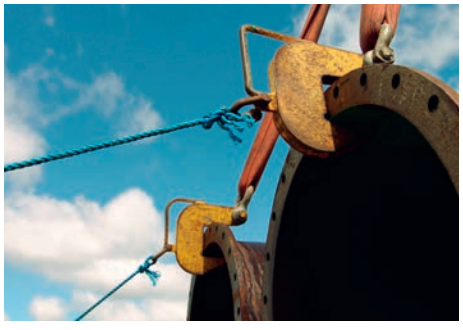

Figure 6. With the form of a C, the hooks have open ends which effortlessly encase the pipe's edge.

Figure 7. With a guideline in hand, riggers manoeuvre pipes into position. To hook off, riggers simply pull on the guideline after the pipe is in place.

Figure 8. Made of low-density polyethylene (LDPE), Dhatec's System88 cradles stack and hold pipes in a two-by-two configuration.

Figure 9. In the new procedure, pipes are lifted by C-hooks which are attached to soft slings.

which were positioned along the perimeter edges of the flatbed. While the vertical poles would effortlessly support the lower pipe layer, once the second pipe layer was set into place, the pipe's combined weight would visibly bend the poles outwards. Not to mention, workers needed to climb on top of the first pipe layer to again timber for the second layer of pipes. After searching for a much-needed alternative, Tronckoe stumbled across an existing product on Dhatec's website, the System88 cradles (see Figure 8). He knew he had found something that could replace timbering and self-standing poles in JDN's operations.

Made of low-density polyethylene (LDPE), Dhatec's durable and flexible system can be adjusted to hold multiple pipe diameters with locking pins in a two-by-two configuration. Another benefit is the system will not damage the pipe or its coating and is suitable for use in any climate. The reusable product had already been tested by TÜV Nord Mobilität and certified according to a worldwide safety standard. 'By using these cradles, we are 100 per cent certain we are following regulations,' says Tronckoe.

The system is used universally across JDN's operations for consistency. Easy to use, the system begins with workers setting the bottom section atop an anti-skid rubber mat on the flatbed (see Figure 7). The bottom section receives the first layer of pipes which are then clamped into place. Workers put the mid-section cradle (see Figure 8) on top of the first layer of pipes – which is also clamped into place – to receive the next and final layer of pipes which are again clamped with the mid-section.

The system accommodates different truck types and can go the distance, travelling over 280,000 kilometres for one project alone without replacing a single cradle or damage to the equipment.

FISHING FOR PIPES WITH C-HOOKS

The former lifting hook was a conical pin which was inserted into the bolt holes of a pipe's flanges, originally intended for connecting pipes end-to-end on site as shorelines. To ensure the hook and pipe were ready to be safely lifted by crane, workers climbed on top of a pipe to position the hooks into the bolt holes. 'If pipes are stacked three-high on top of each other, you need to climb onto the stack to make sure the pins are in the holes but it is not safe to climb on top of the stack,' says Tronckoe. When it was time to hook off, the same problem was encountered, with workers again climbing pipes to hammer conical pins out of bolt holes. Aside from causing a bit of damage to the material of the pipes, the conical pin had a weight limitation of approximately 2.1 tonnes. Since pipes now weighed up to six tonnes, the conical pins were no longer ideal for lifting and an alternative was necessary.

Enter the C-hook (see Figure 6). With the form of a C, the hook has an open end which effortlessly encases the pipe's flanged edge, eliminating a tedious alignment process. Similar to fishing, riggers cast the guideline to catch the hook onto the end of a pipe. When the pipe is starting to be lifted, the hook will automatically position and secure itself in the correct manner. To hook off, riggers simply pull on the guideline after the pipe is placed (see Figure 7). The new lifting hook is safer in relation to the weight of pipes. In fact, the C-hook can be used with many pipeline types and prevents the equipment from being damaged.

But the C-hook has its one disadvantage. They are more solid and as a result are more heavy for riggers to manoeuvre than its predecessor. Working with the new hooks caused some difficulties and led to feedback from the riggers which was not that positive. Therefore we looked for a more ergonomic way of working. The result of these efforts were the spreader bar and the soft slings which were for ergonomic reasons to make it easier for riggers.

SOFT SLINGS REDUCE WEIGHT

When loading vessels, the standard lifting tool includes steel slings – or even metal chains – because they can sustain heavy loads. These standard steel slings or chains are also quite heavy on their own. When the optimised C-hooks were attached to the metal chains at JDN's storage yard, the overall weight of the lifting tool – while loaded with a pipeline as well as unloaded – was noticeably heavier for riggers because of the newer, heavier hooks.

As a worker prepares to move a pipeline, a bunch of lifting slings and hooks are suspended from a crane directly above the centre of the pipeline to be lifted. Since a pipeline spans 12 metres in length, a worker must pull a sling and hook apart and guide it for six metres to begin 'fishing' for the end of the pipeline. Three times heavier than the previous hook, the C-hook and its added weight certainly made the task more demanding for workers, especially to perform all day long.

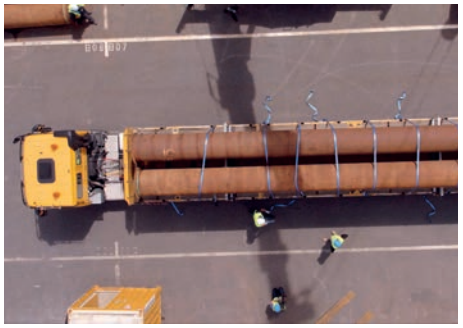

Figure 10. JDN developed an entry sheet which calculates the number of tie-downs needed to secure each load.

MAARTEN TRONCKOE
is the Transport Supervisor at Jan De Nul Group. He is involved in all worldwide project-related shipments and responsible for getting huge shipments to the most exotic locations on time. Since many parties are involved in the process, he maintains the key to achieving success is to make sure everyone is on the same page.

SIMON VAN DEN BERGHE
is the Team Leader for JDN's warehouse in Zelzate, Belgium. He coordinates all warehouse operations on site and carries out a crucial role as the first link between workers and management. Supported by JDN's Imagine Think Act campaign, his hands-on and lead-by-example approach results in awareness and change.

PIETER VERPOEST
is the Assistant Manager responsible for activities at warehouses in Zelzate and Kuhlmannkaai in Ghent, Belgium. His experience as a former JDN project transport organiser combines with his current role of general management at both sites. Based in the Zelzate office, he concentrates on the optimisation of logistical and operational processes.

Figure 11. On behalf of his colleagues, Maarten Tronckoe (left) accepted the Safety Award 2017 bestowed by IADC's President Frank Verhoeven (right) during the Annual General Meeting in Marseille, France.

To lighten the overall weight in workers' hands, a soft sling was introduced (see Figure 9). Although metal chains can sustain heavier loads than soft slings, their lightweight quality presented by the textile material could comparably perform the task of lifting pipelines. With the lighter alternative in place, one concern persisted: workers must still cover a long distance of six metres to manoeuvre each sling.

MODULAR SPREADER ELIMINATES MORE THAN TANGLES

While dangling from a crane, four slings and their hooks become easily entangled, and the slings cannot be twisted around while lifting. Therefore a worker must first check and make sure they are untangled, pull them apart and oriented correctly before hooking them onto the pipeline's ends, which are six metres away from the pipeline's centre point.

The team first suspended a spreader beam from the crane's hook and then connected two slings to both of its ends (see Figure 5). This configuration ensures the slings are always in the correct position for the riggers. If the spreader is ten metres and the pipe is twelve metres, then there is only one metre of distance left to walk with or pull the hooks. By putting the spreader between the slings, the working method became easier and lighter for the riggers.
While standing near the pipeline's end, a rigger steers the hook's movement using a guideline. 'The advantage is that we no longer have to climb onto the pipes, thus avoiding the risk of falling,' says Simon Van den Berghe.

FINISHING UP BY TYING DOWN

Before putting a vehicle into drive, the cargo must be strapped to its flat bed to finalise the loading process. JDN developed an internal entry sheet which determines the number of tie-downs necessary to secure a load. Once the cargo's type and weight are entered, the file calculates the number of straps which must be affixed to ensure it is secure (see Figure 10).

CONCLUSIONS

The team's upgrades to the lifting, stacking and securing of pipes ensures accountability that the logistics task is executed safely, a benefit to both employees and the public.

In addition to increasing safety in regards to shipyard storage, crane lifting and flatbed truck securing practices, the solution heavily considers the ergonomics of the process for workers partaking in the process which takes place around the clock, all day long.

Innovative elements are:
- use of Dhatec chairs to store the pipes
- use of C-shaped pipe hooks with lanyards
- lifting assembly comprised of soft slings separated by a spreader for ergonomic benefits for riggers

This solution is beneficial for other parties for lifting and transportation of pipes, both with and without flanges.

The method has already been implemented globally for lifting and transporting pipe within JDN and is in use on all JDN logistical yards and reclamation sites which require many land dredge pipes. Feedback shows users feel much safer than before and work is carried out more efficiently.