Industrial Maintenance Roundtable NSW
Common Interest Workgroup (CIWG) Report
from Meeting on 1st July 2009

Overhead Crane Maintenance and Reliability CIWG

This document is compiled from discussions during the NSW IMRt Common Interest Workgroup (CIWG) on 1st July 2009.
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Overhead Cranes
Common Interest Workgroup - NSW

Attendance List

Attendee	Organisation
Gus Ferguson	Alcoa
Jeremy Burns	ARC (OneSteel)
John Booth	Bluescope Steel
Peter O'Brien	Bluescope Steel
Richard Winwood-Smith	Bluescope Steel
Martin Johnston	Delta Electricity
Ashley Hobart	Hunter Water
Rowan Lonergan	Hunter Water
Sean Murphy	Newcrest Mining
Andrew Roberts	OneSteel
John Khair	OneSteel
Meelee Liew	OneSteel Reinforcing
Stephen Wright	OneSteel Reinforcing
Brent Fox	Orica
Jace Cann	Qenons
Duminda Perera	Qenos
Peter Todd	SIRF Roundtables
Garry Milburn	Sydney Ports
Peter Mitchell	Sydney Water
Rob Holloway	Sydney Water
Mike Sheridan	Sydney Water/ Transfield
Michael Crebert	Tomage
Peter Fishburn	Tomago
Chris Davis	Xstrata Coal

Introduction

The NSW Industrial Maintenance Roundtable (IMRt) held a Common Interest Work Group (CIWG) meeting on overhead crane Maintenance and Reliability. This meeting was held on March 1st July 2009 at the Asquith Leagues Club in Sydney. The meeting was attended by 24 people from 13 different organisations. The information and ideas included in the document came directly from the discussions that took place at the meeting. Only first names and company names have been used in the report so peoples full names don't register with web search engines (to improve privacy). The full name list of attendees is provided at right in a picture format.

This meeting was the first CIWG meeting focused on Overhead Crane Maintenance and Reliability for the NSW IMRt.

The IMRt is a maintenance networking organisation coordinated by SIRF Roundtables (SIRF Rt) www.sirfrt.com.au. This report gives feedback to meeting attendees and other interested parties. The meeting included the development of a comparison matrix, which is shown on the following page. This matrix was filled out by attendee organisations to enable comparisons to be made between organisations on some of the issues discussed.

Overhead Crane Comparison Matrix

	Overhead Cranes CIWG	Qenos	Xstrata - Bulga Coal	Bluescope Steel	Tomago Aluminium	OneSteel Reinforcing
1	**How many overhead cranes are on your site (0 to 5 T, 5T to 30T & 30 T Up)?**	5T - 1 Off < 5T - 10 Off 30T - 1 off	0-5T X3 5- 30T X3 30T+ X5	0-5T - Aprox 40 5-30T - 70 30T up - 70 (up to 470t)	26 off 25T cranes Around 300 cranes all up	5T - 53 5 to 30T - 2
2	**What are the age ranges of your cranes?**	All about 27 years	Age Range - 10 to 28 years	1930 -2009	2 years to 26 years	6 Months to 40+years
3	**Who are the maintainers of your cranes? In-house or Contractors (Company Name). For areas of Ropes, Lifting Gear, General Mech & Elect, Structural, General Inspection.**	Maintainers Outsourced (Morris Powerlec) Lifting Gear Inspections ? Structural - In-house General - Barry Evans Lifting World	Ropes - A&D Lifting Lifting Gear - A&D Lifting General Mech/Elect - A&D Lifting Structural - Bureau Veritas General Inspection - A&D Lifting and In-house	In-house management of maint by- Transfield - Mech & Elec Maint & Inspection Kone - Mech & Elec Maint & Inspection Thomas & Coffee Mech & Elec Maint & Insp. Always - Rope Inspection and Changes Bullivants - Lifting gear Inspection & rope supply	In-house + Contractors Ropes ECL Structural - Bureau Veritas Recart Work - Demag	Contractors EMS Action (Mobile) Kone Bullivants (Lifting Gear) CraneTec
4	**What are the main maintenance and reliability problems with your cranes (Mechanical, Controls, Structural, Operator Damage)?**	Reliability Problems - Mechanical (General Wear) - Controls	Main Problems - Coming up to end of design life	Structural Cracking Wheel wear DC Contactors	Hoist upgrades - Controls	Controls Operator Damage EOL
5	**What are your practices around operator training, pre-start checks, incident reporting, etc?**	Operator Training - Operated by Riggers (or supervision by a rigger) Pre start checks - (Visual, Stop/Start) Incident reporting - Captured as 'Safety Incident' and reported	Operator Training - External and In-house training , assessing and authorisation Pre-Start Checks - By Operators Incident Reporting - Internal	Operator Training - Formal Training & refreshers All pre-op checks Incident Reporting - Crane Safety Committee Code of Practice	Pre-flight checks Form Training	Pre-Start checks Theory & Practical Assessments every year for operators Codes of Practice (OneSteel) National Operating Standards (OneSteel)

Overhead Cranes CIWG		OneSteel OPEX (Newcastle)	Sydney Ports	Sydney Water	Alcoa	Hunter Water
1	**How many overhead cranes are on your site (0 to 5 T, 5T to 30T & 30 T Up)?**	1) S&T Distribution 5-10T 124 total - 116 > 10years (Kone) 2) SSM	0-5T - 8 5-30T - 2	0-5T - 24 5-30T - 300	0-5T - Aprox 30 off 5-30T - Aprox 20 off 30T + - 10 off	Total 220 0-5T - 210 5-30T - 10
2	**What are the age ranges of your cranes?**	1-25T >15yrs 22 total Ropes & Lifting Bullivants Gen Kone, REMS & In-house	2 to 10 years	1895 (114 yrs in Service) to 2009	Age 2 weeks to 30 years	10% - 0 to 5 yrs 90% - 5yrs to 45yrs
3	**Who are the maintainers of your cranes? In-house or Contractors (Company Name). For areas of Ropes, Lifting Gear, General Mech & Elect, Structural, General Inspection.**	(REMS is a corporate in-house group) 3) Market Mills Newcastle 1-100T - 50+ REMS, Demag & Kone 4) General Structural - Austech NDT CM - OPEX & REMS (In-house) Lifting Gear - In-house	Maintenance - Hiab & Demag Lifting Fear - Allsafe Lifting Inspection - Engineering Companies	Mainly In-house Partly Contractors Transfield Kone Cranes Hoisting Equip Specialists Powerlec Demag	Kone Cranes are our single source supplier of all crane services and engineered lifting gear. (except for complications relating to warrantee issues)	Contractors Morris Powerlec (Scheduled & Breakdown) ECL, Kone, MP (Structural, Replacement, Repairs)
4	**What are the main maintenance and reliability problems with your cranes (Mechanical, Controls, Structural, Operator Damage)?**	Crab Wheel wear Operators	Salt Water Corrosion Electronics Floating Plant	Corrosion Age - Compliant with current Std's Structural Damage due to operators	I can't think of a problems we haven't had. We have a big variety of problems due to the variety of cranes & duties. We spend a huge amount of time managing Kone Management. This will be the next focus.	Meeting WorkCover Requirements - Very Infrequent Use - Accidental damage
5	**What are your practices around operator training, pre-start checks, incident reporting, etc?**	Pre-Start Checks - Good Near miss reporting - Poor Training??	Operator Training by External Instructors Pre-Start Check Log Books Incident Reporting through HR/Maintenance	Reactive	Pre-op check per crane per shift. Injury free events are reported & corrective actions undertaken.	Pre-Start Checks - Developing Incident Reporting - As per corp policy, Near-miss etc.

Attendee Introductions

To start off the meeting all the attendees introduced themselves.

Mike, Peter and Rob attended from Sydney Water. Mike is involved in general mechanical and electrical maintenance and is interested in improving lifting gear & cranes and works for Transfield. Peter is a Crane Inspector. Rob works at the sub branch maintenance engineering section and looks after pressure vessels, welding, painting, cranes, lifting equipment, etc.

Andrew, Harish, Paul, Stephen, MeeLee, Jeremy and John attended from OneSteel. Andrew is from the equipment integrity group in Newcastle and he is involved with management of the maintenance of cranes across their business. Harish is a OneSteel graduate engineer. Paul attended from the Condition Monitoring Group in Newcastle and he is interested in understanding the real condition of cranes and doing more than just visual inspections. Jeremy is from the OneSteel ARC plant in Victoria. Stephen is the maintenance manager for OneSteel reinforcing in NSW and they have 55 overhead cranes on 14 sites. John is the mechanical services leader for the Sydney rolling mill and one of his roles is looking after cranes.

Garry attended from Sydney Ports and he is involved with general maintenance of wharf equipment including cranes.

Gus attended from Alcoa Rolling Mill at Yennora and is the reliability strategist for their hot line and is heavily involved with crane maintenance. He also has had extensive experience with crane maintenance from previous jobs.

Chris attended from Xstrata and works at Bulga open cut coal mine and is a mechanical engineer with responsibility for cranes.

Brent attended from Orica and works in their Kooragang plant. Brent's role is in pressure systems management and has also just been handed the additional role of managing critical structures, which includes cranes and he attended to get a grounding in crane issues.

Sean attended from Newcrest Mines at Orange and looks after mechanical services for both their underground and open cut mining areas. He looks after both mobile and overhead cranes at their sites.

Duminda and Jace attended from Qenos. Duminda is involved with condition monitoring and Jace is involved with cranes and rigging issues.

Martin attended from Delta Electricity and is a mechanical engineer. He currently has the responsibility for the maintenance of feed pumps and cranes at their central coast power stations.

Peter and Mick attended from Tomago Aluminium. Peter is a fitter and team leader and the crane owner for the cast house cranes. Mick is a tech adviser for the pot lines and looks after all the cranes in that area.

Peter, Richard and John attended from Bluescope steel. Peter manages an inspection services group that provides various inspection services across Bluescope Steel. Richard is a mechanical design engineer and he looks after design and engineering issues with cranes at

the steelworks. John is the team leader for the crane inspection group that looks after structural inspection of all cranes in their steelworks.

Ashley and Rowan attended from Hunter Water. Ashley is involved in the servicing and end of life issues with cranes. Rowan also has a regular involvement with cranes and is particularly interested in requirement for their low usage cranes, some of which only get used once a year.

Contracting Out Crane Maintenance

Martin from Delta Electricity asked a question about what crane maintenance contractors others recommend for maintenance that could service their central coast location. Martin indicated that they have about 60 cranes at their two power stations. They are interested in contractors that could do their 3 monthly and 12 monthly inspections and also to provide a breakdown callout service responding within 12 hours. They currently use Kone. Gus from Alcoa indicated that they recently brought a crane from ECL and have received good initial warrantee service and would recommend them. He also recommended Eilbeck Cranes. David from Bluescope suggested Demag and said that all the major crane suppliers can also provide maintenance service to both their cranes and to other brands. Gus from Alcoa suggested that ECL based out of Tomago Aluminium in Newcastle should be able to provide this service as well as Kone, their current contractor. Peter from Tomago indicated that they use ECL for all their rope changes and highly recommend them.

Sean from Newcrest indicated that they use Kone cranes for all their 3 monthly crane inspections and breakdown work and highly recommend them. Newcrest made a special request to Kone to base someone in their area, which they have done and this has greatly reduced the emergency response time for problems. They have a 12 monthly contact that gives them priority over other local crane work and the arrangement is based on set rates with callout rate paid for breakdown work. When they have more significant work going on, Kone bring in additional labour to ensure that someone is available for breakdown support.

Mick from Tomago indicated the ECL gives them an emergency callout response time of 1 to 2 hours. All their basic mechanical and electrical maintenance on cranes are handled by Tomago personnel and the only day to day regular work ECL has is on maintaining the roping systems. All their structural and engineering issues on their cranes are handled by ECL as well as any upgrade and recertification work.

John from the OneSteel Sydney Steel Mill indicated that they use both Kone & Eilbeck with Bullivants doing the rope work plus they have some of their local labour doing some of the inspection work. He suggested that they are more comfortable with using multiple sources of crane maintenance support so they have more options if there are problems.

Gus from Alcoa indicated that they have gone with Kone which are their sole provider of crane service labour and support (apart from warrantee work). Gus indicated that there are positives and negatives with this arrangement. He indicated that Kone have some very good tradespersons and who do an excellent job but sometimes they have problems with the flexibility of the Kone management. Gus's biggest problem is that he can't get a report of the work required to be done in computerised format so that he can manage the information efficiently. One major advantage of their arrangement is that Kone provide a full time crane coordinator and they have on average six Kone tradesmen on-site working on cranes each

day. Reliable cranes are vital to their operating process and so they need to be very well maintained and any problems quickly responded to.

Brent from Orica in Newcastle indicated that they have just contracted Bullivants to do the inspections on their lifting gear and asked what their performance was like. John from OneSteel indicated that their performance is good but suggested that you need to ensure that they understand 'what your expectations are' and to follow up when required. John from Bluescope indicated that they did use Bullivants for their rope work but now uses Always Rigging and are happy with what they are doing and suggested they have some good systems.

Quality of Crane Inspections

Paul from OneSteel suggested the most important thing is the quality of the inspections carried out. He went on to say that often crane inspections are just tick box affairs with little quantitative assessment and no wear limits. His opinion was that unless there is some quantitative basis for an inspection then it is very hard to have confidence in them.

John from Bluescope indicated that Kone have a grading system of priority and condition severity of 1to 9. He said Bluescope has had 4 rope failures this year, all in smaller service centres that were wholly looked after by contractors including Kone, Demag or Eilbeck, using tick and flick type inspection systems. John suggested that there are some tradesmen that do a great job but it is dangerous to assume that the person that might replace them will have the same attention to detail. He said that it is up to the customer to be checking and demanding the right standard of quality. John suggested that the average quality of crane inspection reports is poor. He gave the example of a crane up in Brisbane that had a rope failure. The inspection item was for the rope and rope anchor and there had been no comment on the rope for 6 years. The rope had multiple broken wires and had been continually ticked off as OK. John suggested that contracting the maintenance out to the 'experts' will not save you in court if someone gets hurt, as you can't contract out your responsibility for 'due diligence'. You still have a responsibility to ensure that the contractor is doing an acceptable job.

Stephen from OneSteel Reinforcing in NSW agreed that you can't contract out your statutory responsibility. He indicated that he has a OneSteel National Operating Standard that he has to abide by and he put that standard out to 4 different crane companies and only two were able to meet their requirements, which are EMS and Kone. EMS now service most of the NSW sites. The contactors both have a standard tick type inspection sheet, which is not acceptable to Stephen. To win the contract is was necessary for them to detail exactly what is meant by the tick and the assessment process that is behind this system. They also have defined the training their tradesmen have been given to competently carry out the work to turn them from just a fitter or electrician into a competent crane technician. Stephen is very happy with the level of information and tradesperson training supplied by EMS. Kone has now supplied equivalent information and he has started to use them in locations where EMS struggle to give support.

John from the OneSteel Sydney steel mill indicated that he now has a good arrangement for getting quantitative measurements recorded for his cranes from both Kone and Eilbeck. He now has wear measurement and limits on pullies, wheel diameters, brakes, wheel flanges, etc. Eilbeck is currently best at doing quantitative recording as they already had a standard for this available for them to follow. John indicated that he had to use some of his commercial

muscle with theses suppliers and with Kone he had to go higher in their management to get a positive response.

There was discussion about the advantages of training in-house personnel to carry out critical inspections and other crane activities. A few attendees indicated that it is not practical for them to use in-house resources because of their low number of personnel. Also, when their plants come down, to give access to do the crane maintenance, the local tradespersons have higher priority work elsewhere on their plant. Brent from Orica suggested that the biggest issue contracting out activities like crane maintenance is when contracts are awarded on a lowest cost basis without any quality basis for the decision. He suggested that Orica has had problems with crane contractors doing poor support. The previous contractor stopped attending their site to the maintenance of cranes because they knew if they attended they would have to take cranes out of service because of their condition, which would have interrupted operation. They chose not come to their site so they would not have to make those difficult decisions.

There were discussions about generating the inspections sheets for cranes locally so that they can be tailored for the specific requirements and to have them as live documents that are continually being improved. There were also suggestions from Alcoa that they have lot of inspection that are generated on different frequencies and there is a need to combine these to ensure tradespersons are not going up onto cranes multiple times where they could do just one visit.

Brent from Orica asked what the inspection assessment requirements are in the Australian standards. It was suggested that the standards give detail of the maximum wear requirements but don't define in detail the reporting systems to achieve this. Richard from Bluescope suggested that AS2550 part 1 has examples of very basic check sheets in the appendix. It was suggested that many of the cheap and nasty check sheets used by contractor are just taken directly out of this standard. Brent wants to go out to crane contractors soon and so was interested in getting examples of better inspection formats to use as an example of what they should specify.

John from Bluescope suggested that at the end of the day you have to set the inspection standard yourself. He suggested that most of the contractors have a tendency to over rate the issues found to 7, 8 or 9's, so that if anything does go wrong they are protected because they have given a rating that suggests that action was required. Where a contractor is making the call on the criticality of a problem and is getting the repair work that results, there needs to be a good verification process to ensure decisions made was fully justified. Stephen from OneSteel suggested that the same contractor both doing the inspection and quoting for the repair is the most efficient approach, as it reduces the likelihood of the contractor exaggerating equipment condition issues. This is because verification of condition issues can usually be made from any parts removed etc.

John from Bluescope strongly suggested that if a crane contractor comes to your site and does an inspection and rates a problem as requiring a repair relatively urgently (8 or 9) then they should physically show an appropriate person, such as the crane planner, the problem before they leave. If this is not done, when the report comes through, the person who did the inspection is usually off doing an inspection elsewhere and is not available to talk to get more details. He suggested that this also helps with the tendency to exaggerate condition problems to generate additional work. There were discussions around the need to have someone in-

house with the skill and knowledge to make the assessment on crane condition and safety issues because if you don't you are at the mercy of the crane contractor to generate work.

John from OneSteel also suggested that you should try to get consistency in which crane technician you get for a particular crane. For his two biggest cranes he has just one technician from the crane company that looks at it all the time. This person then becomes the owner of the crane and can monitor changes in condition closely over time and can help with managing and minimising some of these issues. They currently get the same technician to a particular crane about 80% of the time. Gus from Alcoa indicated that they get consistency by having one fully dedicated crane supervisor from Kone on-site and he is very knowledgeable about their cranes and is a great asset for them.

Planning & Scheduling for Crane Maintenance

Stephen from OneSteel reinforcing indicated that at his particular site they have 22 cranes. Within 2 days of his crane contractor's inspection he has a fax and email of the recommended work that is required with a quote. Steve looks at the work and assesses its criticality and signs off on the work that he wants done and faxes back the repair authorisation. In the authorisation process he is thinking in detail about the real safety requirements of all the recommendations. The contractor does their planning and gets the resources, eg trades team, ropes, parts, etc. and coordinate with Stephen's planner to schedule the repair timing. He indicated that this system works very smoothly and quickly for them. Stephen indicated that every part of their operation relies on the reliability of their cranes and crane failures will result in delayed deliveries to their customers. Cranes are the most important equipment reliability issue for their business.

Gus from Alcoa indicated that their system does not work so well. Currently coming back from their inspections is a very long list of issues in a format that is difficult to manage. For a number of reasons this list of issues does not come back with a quote and so it is more difficult to get smooth implementation of repairs. John from OneSteel suggested that from his experience, the best way to manage reporting issues is to get the crane contractors upper management involved to help get the problems addressed. He indicated that he is given a spreadsheet of the issues found and the cost to repair and then he will go and check the details himself before authorisation. John suggested that out of a list of 10 urgent items, typically 4 don't have to be done yet. Gus from Alcoa indicated that they don't have an issue of their crane contractor generating additional work and their main issue is getting fair and reasonable quotes for any work that has to be carried out.

Rob from Sydney Water made the observation that people were complaining in the meeting more about detailed inspection and planning issues than failure and reliability issues and so the repair and service work done must generally be successful. Gus agreed that most crane technicians are good tradesmen and they do a good job and understand the consequence of not getting it right. He also suggested that maintenance on cranes is that much harder than other types of maintenance, as everything is in the air, with the problems and restrictions that causes.

John from OneSteel indicated that one scheduling issue they have is where there are no crane maintenance bays. This requires a lot of coordination so that the location chosen to do a major maintenance task has no products in that area that might require a movement. Another safety system used is Rail Stops to eliminate crane access to the maintenance area with tape

attached that hang down from the Stops so that the other crane operators can easily identify where the Rail Stops are located.

Operator Issues and Operator Training

Martin from Delta Electricity indicated that their internal maintenance service provider numbers have reduced from about 2000 to around 700 and so that issues like cranes maintenance is now outsourced. As a lot of the crane usage is for maintenance they have found that since local people now don't have to repair any damage done to the cranes their level of care has reduced and the number of damage issues has increased with possible overloading issues. Sean from Newcrest indicated that their cranes are also mostly used for maintenance but are generally operated by contractors that come in and they have found that their contractors take the right level of care with the equipment. Since the usage on the cranes is low the maintenance requirement is also very low. There was discussion on the importance of how management at a site react to thing like operational damage to ensure that the right level of care is taken.

It was suggested that operator training might be an issue with some of the damage. Stephen from OneSteel suggested that if a crane operator does something stupid and someone gets hurt, the organisation has to show documentation that the operator had been trained and assessed by an appropriate Cert IV person. If not then the company is likely to be considered liable. Peter from Bluescope Steel suggested if they had an incident with an operator that did something seriously wrong, then he would be taken out of the crane immediately and sent for drug and alcohol testing and probably sent home from work to think about what he has done. There were discussions on the need to make sure that operators don't get any benefits from damage or things going wrong with their cranes. The suggestion was made that when problems occur, the crane operator should be immediately put on some not so pleasant cleaning duties, like cleaning and scrubbing down the crane. If operators get to sit in crib rooms and have an easy time when there is a crane breakdown, then problems will be more likely to occur.

Stephen from OneSteel indicated that they have yearly theory and practical competency assessment for their crane drivers, which are carried out by an external competent trainer. Even Stephen and others that don't drive cranes have to do this training as well so that they fully understand the requirements that drivers and others should be working to. The person doing their training has recently retired so they are going to have this role performed by someone inside their organisation. On average 3 to 4 people fail the assessment every year and are immediately taken off crane duties. If they don't pass it on their second go they are taken off crane duties altogether.

Rob from Sydney Water indicated that their central support group spend time to build relationships with crane operators to ensure that if they have any problems or issues they are not afraid to raise them so that any lifting and other crane operations problems are eliminated before serious issues occur.

John from Bluescope suggested two tools to help manage damage and safety incidents are 'Pre-start checks' and 'Crane Incident Reports', which are both a WorkCover requirement. If a driver has done his checks before he starts his shift and does not find any problems then he can't claim that damage was done by someone else.

Pre-start Operator Inspections

There was discussion about the requirement for pre-start checks. This is required by the Australian standard to carry out operational function checks and physical checks by the crane operator at the start of every operational shift. Best practice for some organisations is that the sheets get collected every shift and others only collect the sheets if there is an outstanding issue. Sean from Newcrest indicated that the prestart checks that they get done come straight to him, so he can organise any repairs required. Others mentioned that they have similar responsibilities. It was suggested that if the proper level off attention is paid to completed pre-start sheets then it is much more likely that the crane operators will carry them out diligently, rather than just ticking the boxes and not fully doing the checks. An example was given for the OneSteel Sydney Steel mill where the pre-start checks were reviewed at the morning management meeting.

Andrew from OneSteel indicated that their smaller sites treat crane pre-start checks the same as for forklifts and EWP units. They have books with duplicate carbon copies and the training they receive indicates that any issues found should be raised straight away with a supervisor or manager and if serious, the equipment should not be used.

Stephen from OneSteel indicated that in the reinforcement division the value of pre-start check have been recognised and are being rolled out on all operated machinery as basic good practice.

Gus from Alcoa made the comment that you need to make sure your pre-start check sheets are not generic and refer to crane items and functions that are not there. If crane operators are being asked to check 2nd hoists, hook slews, etc when they are not there, it degrades the inspection and it will not be treated so seriously. His suggestion was that it should be made specific for each crane.

Incident Reporting

John from Bluescope suggested that they recently had an incident where a crane was run into the end stops and derailed the crab and caused extensive damage. It was not reported and no-one owned up to it. There were some underlying industrial issues. The same thing happened 5 or 6 weeks later and did about $120,000 worth of damage to the crane and the guy ended up being sacked over it. There were discussions about engineering slow down limit solutions for end stop issues but this can be difficult with DC powered cranes. John suggested that at the end of the day operator ‘due diligence’ needs to be the main solution for these sorts of problems.

Gus from Alcoa indicated that they have a system called Triple I, for recording what they call an Injury Free Event. If something bad happens that is not an injury they fill in a Triple I. They also fill out the same form if there is an injury, which then escalates into an A3 that is the first level of their formal problem solving process and is filled out by the operating line team. The A3 uses a 5-Whys and a Fish Bone problems solving process. Recording a Triple I event is regarded as very much a positive thing that is encouraged so that problems can be addressed before they can create injuries. Gus was asked for an example of a Ttriple I event and he indicated that the day before there was an electrical failure on a crane that was lifting an aluminium block, which was clamped with 30 tonnes of pressure. This meant that the block was being held just by the pressure held in the hydraulic accumulator. This was a concern to the operator working nearby and so a Triple I was initiated.

Paul from OneSteel in Newcastle indicated that they had a major crane incident a few weeks ago. The crane operator was lifting some rolls and he was having problems understanding the instructions from below and so attempted to lean out the window to hear better. In doing this his open jacket caught on the cross travel control lever, which sent the load into a brick wall demolishing it. Behind the wall was a work area for a person and just luckily the person was away from his work area at the time. Investigation so far has shown that the long travel control should have been neutral locking but it was not at the time of the incident. Also a rule about open jackets has also been initiated. They have retrained the crane operators related to incident.

Gus from Alcoa indicated that he gets crane incident reports from around the world from the Alcoa systems and one common issue is 'thing falling off cranes'. The example he gave was a bracket from a fan that had been removed in the past and an ols bracket worked itself loose and fell. Richard from Bluescope indicated that they had a spate of thing falling off cranes a few years ago, so they went through a series of inspections to identify redundant brackets, loose handrails, etc. There was a specific issue with cellular plastic buffers falling off and those types now usually come with an internal chain to manage this problem. Peter from Tomago indicated that they have recently carried out a study of everything that can fall off cranes and are starting to implement the finding across the plant. The process they used was to get maintenance, operations and others together to brainstorm all things that could fall off. Other things that were mentioned that tend to fall off were collector pads and lights. Another major problem is parts left on the crane after maintenance.

Management of Lifting Gear

Rob from Sydney Water indicated that they had a lifting incident recently where there was a concrete mounted I Bolt that was being used and it failed under load. The investigation revealed that the 'I Bolt' had not been a registered lifting point and had slipped through the quality control systems when the plant had been installed.

Brent from Orica indicated that they have a problem with lifting gear on their major Turnarounds/ Shutdowns. Contractors who come onto site are requested to provide their own lifting gear and what they find is that the good condition local lifting gear that Orica personnel use tends to be swapped with very poor condition lifting gear that the contractors bring to site. A number of the other organisations indicated that they have a rule that only local lifting gear that is well maintained is used and that contractors are not allowed to bring their own gear onto site.

Richard from Bluescope suggested that Bullivants and other contactors usually use a colour tag system when completing an inspection of lifting gear. This system is similar to that used on electrical leads that have a colour change every three months to show if an item has an up-to-date inspection. It was suggested that this inspection process does not take away the requirement for anyone using lifting gear to inspect it before use and have the training to do that competently.

Stephen from OneSteel indicated that their crane operator competency assessment includes all training related to use and inspection of lifting gear. He indicated that when Bullivants do the inspection of their lifting gear they go with enough spare components to replace any worn or damage items. Stephen suggested that he hates the 'Red Out-of-Service Tag' system as impatient people who want to use the Out of Service lifting gear will often just rip off the tag

and use it anyway. He suggested that it is much more efficient for the inspecting person to repair it right away and bring in the warn component in for inspection to verify that the repair was warranted. Stephen has about 220 pieces of lifting gear on his site and he probably replaces or repairs about 11 items each 3 months. He suggested that storage of chains and slings is an important issue as items that are just left on the floor are much more likely to get damaged. Proper storage racks are required for all lifting gear.

Electrical and Control Issues

Stephen from OneSteel was asked what crane remote controls they use. He indicated that they use the Alpha 3000 and find it a good durable unit. One important issue with remote controls is that unless they are attached to the crane operator with sash and sling they tend to get damaged or go missing (get left on the back of a truck). They have just retrained all their operators to reinforce that crane remotes have to be worn as some operators had gotten out of the habit.

Martin from Delta Electricity asked about older cranes that don't have upper hoist limits and if there is a requirement to retrofit them. Richard from Bluescope indicated that his interpretation of the requirement for limits to hoist in the current version of the design standard is not retrospective for cranes built prior to the standard. When the crane requires a major assessment however it is a requirement to either bring it into line with the current version of the standard or achieve an equivalent level of safety. The risk and actions need to be considered for the specific crane at this time and managed appropriately.

Stephen from OneSteel spoke about what he is doing with his hoist systems instead of doing a standard 10 years inspection of his 5 tonne cranes. He is getting EMS to pull the crab down and take it to their workshop. A new JDM 5 tonne hoist system is installed including all new electrics, painting, wheels machining, etc. This gives the advantage of getting up-to-date electrics and controls and getting rid of the old contactor systems. He has now done this for 5 hoists which now all have load limiting and anti-collision and the complete job is about $30,000. Stephen suggested this is a good option for him compared to doing an overhaul or replacement of the original 10 tonne Demag hoist system. Gus from Alcoa indicated that they have replaced two 20 tonne hot metal crane hoist systems. They put a Kone crab into set of old Demag girders. This setup has been their only problem free new crane.

Gus from Alcoa indicated that the new Kone Crab has hook anti-sway and asked if anyone else had experience with anti-sway systems. He indicated that some of their drivers like the anti-sway but other drivers switch it off. Stephen from OneSteel indicated that he is installing a JDM anti-sway system and their drivers like it after they become accustomed to the system. JDM have an anti-sway system called I-Glide, which is their proprietary system and is about a $7,000 option. He said it is very successful and there is no hook sway when the system is operating, even at 60 metres a minute for their fastest cranes. Stephen indicated that another good system of the JDM hoists is a Hyper Speed for lowering the hook when there is no load on the hook. This reduces some of their lifting cycle times.

Stephen from OneSteel was asked about the anti-collision systems he is using. He indicated that anti-collision is a part of the OneSteel code of practice when there are multiple cranes in one bay. He is rolling through his sites installing the systems and they have been working well. The systems work using an ultrasonic sensor, which can start slowing the crane at nine metres from the next crane in the bay. The system cost about $2,500 per crane, so is $5,000 to

do a 2 crane bay. They have setup the system so that the cranes are only slowed to creep and so the cranes can still touch if required.

There were discussions about the automation of operator control function such as deceleration zones, anti collision detection, etc. There were a few of stories about when operators start to rely on these systems rather than being used as just an emergency function. This creates the possibility of much greater levels of damage occurring when these system fail. (Ed. Logging of counts of high speed entry into these emergency limits may be worthwhile to detect poor operator behaviour). There were also discussions about the negatives of taking skill off the crane operators by using systems like hook anti-sway.

Crane Flight Paths and Crane Interaction with People

Gus from Alcoa spoke about a system they are looking to use to limit access or speed of a crane to an operating area to try to limit the problem of people interfacing with carried loads. No one else had used automation for this but a number of attendees indicated that their plants use strict administrative controls. Andrew from OneSteel indicated that where the normal load flight path crosses a walkway they have a special orange and black striped marking and labelled Crane Path. It is a part of the normal induction process to train people to stop when reaching one of these crossings and look up. John from OneSteel indicated that they have what they call a bomb shelters in their warehouse, which is a steel structure that can take a 3 tonne load dropped on it and located where a main pedestrian path crosses a main crane load flight path.

Crane Structures

Brent from Orica indicated that they are currently trying to implement a Critical Structures Maintenance system, which will cover all structures as well as cranes. They are interested in using a Risk Based Inspection process and they have not found a system that someone can provide that risk rates structural issues using probability and consequence. He indicated that most services provided currently are just a structural engineer coming in and doing a qualitative assessment. Orica use a risk based inspection approach for the critical pressurised equipment and would like to do the same for critical structures.

Peter from Bluescope indicated that he has a general structural inspection team working for him which is separate for John's crane inspection team. There are three structural engineers and two structural inspectors in that team. The people in the team are Hatch personnel, even though they work directly for Peter but are available for external work. The group does a global inspection and audit of the steelworks structures and provide reports to the particular plant owners on the issues they have determined. The rating of the problem is on the likelihood and consequence risk matrix that the steelworks uses and indicates when actions are required to match budgeting cycles and when an issue needs to be rechecked.

Richard from Bluescope indicated they have 50 heavy lift heavy usage production cranes and many have had significant cracking problems over the years. He suggested that keeping a history of structural problems is important. They have been using FEA (Finite Element Analysis) modelling of the stresses in their critical crane structures using some special software through a guy call Peter Spry. The software can predict the rate at which a crack will grow, which is very useful for scheduling of repairs. For their 25 year structural inspections it is extremely difficult for them to get their production cranes off long enough to do the cleaning required to allow a propers inspection for cracks. What the software allows them to do is to identify the high stress areas where cracks are likely to occur and then just to the

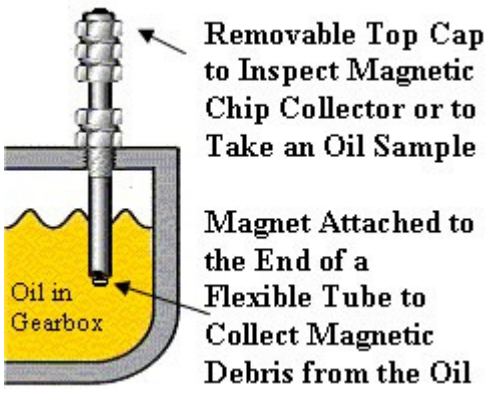
cleaning and inspection in these areas, plus any other areas that history has indicated may be a problem. Their experience with the system has been very good, as they tend to find cracks in exactly the areas that were predicted.

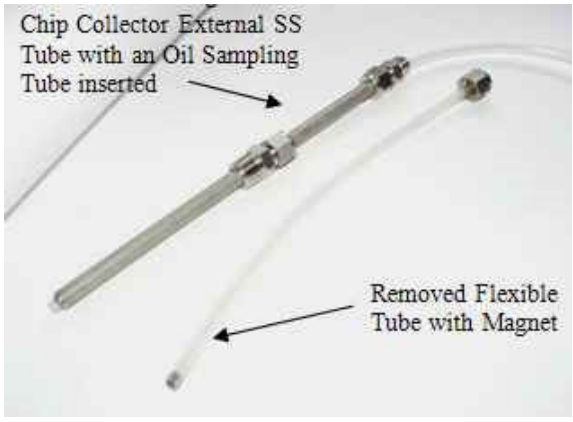
Condition Monitoring and Lubrication

There was a consensus that there is not much formal condition monitoring going on with cranes. Paul from OneSteel discussed some of the vibration monitoring work he has done on larger crane hoist gearboxes. He has detected bearing problems and gave the example of a win where he discovered a tapered shaft brake drum where the nut had come loose and was flopping about. Richard from Bluescope steel talked about the online vibration monitoring system that is installed on their No1 Charger Crane, which is their most critical steelworks crane. This system uses wireless transmission of the vibration information back to the maintenance office. He also indicated that the condition monitoring group that works for him has done crane vibration monitoring in the past with some success. It was suggested that vibration monitoring would probably only be useful for highly critical cranes where the breakdown cost would justify the expense or where there is a specific problem that needs to be diagnosed or investigated.

Both Paul from OneSteel and Gus from Alcoa spoke about the importance of being able to visually inspect what is happening on the crab area. Gus indicated that when required he gets permits filled out so that he can go up onto the crane and watch during operation. He also spoke on the advantages of using a stethoscope to listen to rotating equipment.

A number of attendees were using or had tried oil analysis on crane gearboxes. John from Bluescope indicated that one parameter to watch in oil analysis results is silicon level. If the silicon in the oil comes from sand or dust, that would indicate bearings may be a risk. Peter from SIRF indicated that a good simple CM technique for crane gearboxes is removable magnetic chip collectors (see pictures below). This allows monitoring of bearings and gears as any wear debris can be will be collected by the magnet and visually inspected during crane inspections. There were discussions on the advantages of removable magnetic chip collectors as a simple monitoring method for any gearbox. Gus from Alcoa suggested that a more detailed technical analysis of the wear debris can be carried out using a microscope analysis of wear debris collected from the end of the magnet. He indicated that he purchased a $100 200X powered microscope that is ideal for analysing and recording magnetic debris. The unit plugs into a standard PC USB port and displays the image on the computer screen. Both Paul and Gus spoke about what you can learn from looking at wear debris through a microscope.





There were significant discussions about breathers, including bladder type breathers and the need to keep the oil clean. Gus from Alcoa indicated that they make significant use of filter carts to improve the cleanliness of their gearbox lubricants and is a way they use to significantly improve the reliability of their gearboxes. Filter carts are made up of a pump and filter system on a trolley and Gus indicated that he sets the system up on a crane and leaves it there during crane operation until all the oil in the box has gone through the filter at least 7 times. He connects the filter system to the gearbox through quick connect couplings. He also indicated that he is using the filter carts to filter new oil going into the gearboxes. Often changing the oil in crane gearboxes is difficult because of access problems and the filter cart makes it much easier to do. Gus suggested that he applies the filtering whenever the oil analysis results show a poor reading. Gus indicated that they double the life of their oil through filtration. Duminda from Qenos also indicated that they were filtering oil when new oil was being added to a gearbox. Paul from OneSteel suggested that a major problem is people putting the wrong oil in a gearbox. He indicated that they are working towards a colour coding system for all their oil to make it obvious which oil needs to go in a particular box.

There were discussions around the use of remote grease lines. Different attendees had experimented with different tubing materials but the consensus was that the most viable option was stainless steel tubing. A few of the attendees spoke about the negatives of using remote grease lines, as there were a number of stories about bearings not being greased because of problems with the remote greasing system. It was suggested that grease block remote systems have to be checked regularly at the grease application point to make sure grease is actually getting through. PermaLube type lubricators were discussed but some people had a bad experience with them. A number of attendees suggested that there is an advantage of grease lubrication at the bearing and to make the activity ‘lubricate and inspect’ so that other problems can be found and addressed. Colour coding grease guns and grease nipple using plastic caps and discs was also discussed.

John and Peter from Bluescope spoke about their use of Thermal Imaging on crane electrical panels and for detection of hot joints on electrical live rails. They also have used it on sheave blokes that are exposed to extreme temperatures when charging furnaces, to understand the temperature that the bearing greases have to withstand. Gus from Alcoa spoke about temperature indicating stickers and thermocromic paints. These change colour at set temperatures and can show the maximum temperature that an item has reached in service.

Wheel Flange Wear

John from the OneSteel Sydney rolling mill warehouse cranes suggested that he has the cranes with the widest bridges in OneSteel (35m) and he has a serious wheel flange wear issue with these cranes. He indicated that he has spent lot of money doing rail alignment, changing wheels and reboring bogie pins and they still have the problem, although it is somewhat reduced. They still have to change the wheels every year. They are currently measuring wheel wear ever month and graphing the result. There were comments from the group about the loading that is created in the building and crane structure caused by crane crabbing.

There was discussion about how best to mount wheel or rail lubrication to reduce the wear.

Crane 25 Year Condition Assessments and Recertification

There was significant discussion around the need to recertify cranes after 10 years for the mechanical and 25 years for the structural items. There were concerns from some of the attendees that many of their low usage cranes were at ages well above the possible need for recertification. Richard from Bluescope indicated that the real criterion for the requirement for major inspections is based on whether the crane has reached the end of its design life. This can be determined by looking at its original duty classification and its usage history. Llow usage cranes may not have reached their design life and hence do not yet require a full major assessment.. Even though there may nbe not a full recertification requirement there is still a requirement to check that the number of load cycles that the crane has seen is assessed and no other issues exist which would necessitate a full recertification. It was suggested that Hatch provide such a Reliability Survey. Kone also have a similar system called CRS (Crane Reliability Survey). A standard 25 year inspection recommended by one of the crane contractors will usually cost at least $7,000 and will often lift the crab down and open up the gearboxes. John from Bluescope suggested that the very detailed and expensive 25 year inspections that crane contractors recommend are not legislated and are just a guide. As Bluescope have a very detailed maintenance management system with cranes, WorkCover has indicated that the Bluescope maintenance systems well exceed the requirements for a 10 yearly inspection and so they are not carried out. Richard indicated that for low utilisation cranes the loading cycles may never reach the requirement for a full 25 year Assessment but you need to do an assessment of the crane load cycle history to make this decision. This cycle assessment should be very simple for very low usage cranes.

Gus from Alcoa indicated that for all their 25 year inspections to date, they have not gone to the extent of removing crabs or opening gearboxes. The process they use for a 25 year inspection is to get an experienced crane engineer to go over the crane in a lot of detail and locate all structural cracks and other problems.

Stephen from OneSteel reinforcing indicated that he has done 27 off 25 year inspections of his cranes in the last 18 months and he has replaced 11 of his high usage cranes. He was asked if his new cranes were running any better than his old cranes and he suggested that he has significantly reduced his maintenance spend on cranes by installing new cranes. Stephen indicated that he is using JDM Mono Cranes from Melbourne for his new cranes and is very happy with their performance. Most of his cranes are smaller capacity with the maximum of 16 tonnes with 15 to 22 meter spans and would be usually a maximum $130,000 replacemetn cost each. Because of the safety requirement related to cranes, he doesn't have too many problems getting capital approved to replace his older cranes. His management are very focused on safety and they are also a self insurer, which saves OneSteel NSW $16 million dollars a year and so is worth the effort to ensure there are not safety problems.

Gus from Alcoa suggested that their cranes are much larger, heavier and more complex with specialised equipment for handling their coils. Alcoa's cranes would be over a million dollars to replace and makes justifying new cranes much more difficult. Gus suggested that the cost in maintaining their cranes also makes the decisions on what needs to be done for any particular repair issue much more difficult. Also because a new crane for them is not a mass produced item as it is with the smaller cranes, the performance of his new cranes often does not match his older units.

Passing a 25 year inspection does not give you another 25 years of life it only gives you another 10 years of life.

Some organisations like OneSteel Reinforcing and Alcoa were making the 25year recertification a capital project rather than on the maintenance budget.

Gus from OneSteel indicated that the job of collecting utilisation data for a large number of medium to heavy use cranes to determine the 25 year recertification cycle life can be a reasonable sized job. It was strongly suggested that an independent person, rather than crane contractors do this cycle estimation job, as it is too easy for a crane contractor to be conservative to help generate extra work.

Crane Operators Tickets

There were discussions on the requirement for crane operator tickets. Any crane that is operated from an operator cabin requires a ticket. A crane that has only 3 axes of movement eg hoist, long travel and cross travel and is operated from a pendent or remote control does not require a formal ticket. There must be appropriate training and competency testing provided and the completion of the training and any reassessment needs to be recorded. An additional movement on the crane, such as a hook slew, means a ticketed operator is required.

Heritage Listed Cranes

Rob from Sydney Water indicated that they have a number of heritage listed operating cranes, with the oldest being from 1895. Their problem is in getting engineers to make the assessment and put their name onto an engineer's report to say it is still suitable and safe for the purpose. Rob indicated that Sydney Water has some marvellous old operating cranes with things like pull wire operated functions and he thought it will be shame if they are just pushed aside and be left to rust away. These cranes are not high usage and might be only be used 4 times a year but when they are required they need to work. They have worked this long so Rob saw no reason why they should not keep working. Gus from Alcoa suggested that he knew an experienced Crane Engineer for old old cranes who he thought may be interested in getting involved and they agreed to discuss afterwards.

Corrosion

Rob from Sydney Water indicated that they have a lot of cranes that exist in a salt water affected environment and even have situations where fans draw in salt water laden air to the crane location. It badly affects all the electrical equipment and electrical contacts. They try to protect the equipment by wrapping it up in Denso tape but they find that they can't fully control it and corrosion just keeps on coming back. He is interested in use of stainless steel fixtures and fitting but he was not sure about local supply of some of these items.

Brent from Orica indicated that the only solution tends to be more inspections, more painting, more surface conditioning and more maintenance. He indicated that at Orica they suffer badly from stress corrosion cracking from their ammonia nitrate environment affecting their steelwork. Their only protection is just to do more maintenance plus repair and replacement as required.

Garry from Sydney Ports indicated that they had two marine grade cranes installed on their fire fighting tugs. One is still operating and the other one rusted away. This suggests that it is hard to predict if protection will work. Gus from Alcoa indicated that they had an Aluminium crane structure at one stage but Richard from Bluescope suggested that there are much more significant structural ccranking problems with Aluminium.

Gus from Alcoa indicated that he had a look at some cranes that were being made in Norway for use on the North Sea oil rigs. All electrical enclosures were intrinsically safe and there was a very sophisticated epoxy paint specification for the structure to make it suitable for its operating environment. John from Bluescope indicated that they have an in-house paint specialist that creates the paint specifications for their equipment. Rob from Sydney Water indicated that a good paint specification works well for the main crane structure but does not help for things like cable trays etc. Brent indicated that Orica owns Dulux but with all their specialists they still can't keep paint on in their most arduous corrosion areas. Those can have salt water, chlorine, ammonia nitrate, etc. He suggested that the secret to making a good paint specification work is in the quality control of the preparation, which is possible to control during original manufacturing but is normally very difficult or sometimes impossible to achieve on-site with installed structures and equipment. Generally crane bridges are normally made locally in Australia so should be possible to influence paint specs and quality control.

John from OneSteel indicated that when he worked in a Visi paper mill the cranes that operated over the paper machine, with its wet humid environment, had an ongoing corrosion problem. Their solution was to once a year to remove the rust from underneath the crane and repaint. Brent agreed that once the surface membrane is broken and the corrosive environment gets underneath the paint, you just can't stop it. In these types of situation he suggested that a good painting maintenance plan is often better than to attempt an expensive once off solution that will probably not work. An option suggested by Rob from Sydney Water was the use of weather resistant steel and Brent agreed that it should solve the corrosion problem as it is used in many salt water or chemical corrosion situations but he was not sure if it would be suitable for the fatigue cycle loads in a crane structure.

Emergency Egress from Cranes

Gus from Alcoa indicated that they have done a lot of work in this area. Their worst case situation is to have a mill fire where the driver can't get to his normal egress point and where there are urgent reasons for the crane driver to evacuate the crane. Mill bad mill fires are a real possibility for their mill as they use kero as a lubricant. He indicated that the cranes used to have wire rope ladders that the drivers could throw out. When this was reviewed it was agreed that this was an unacceptable solution as rope ladder are hard enough to use for people who are young and fit, which did not match their average crane operator. At the time when they did this analysis there were not any acceptable Control Decent Devices available and so they engineered a ladder exit up to the crane girder so the driver could exit the building along the crane runway. This was a very expensive solution.

There was general agreement that the current technology of Control Decent Devices were good but it was suggested that some crane operators might prefer to try a less safe climb out routes from the crane, than to put the harness on and jump over a 6 to 8 meter drop.

An issue that was common to a number of sites was the concern expressed by crane operators of what could be done to get them out of the crane cab if they suffered a heart attack. The standard solution was to get a boom lift to get another operator into the crane to move it to the normal egress location. Gus from Alcoa indicated that on one crane, where this was a particular concern, an emergency remote control was installed that could override the normal operator controls.

Martin from delta asked if there were any other options to the standard controlled Decent Devices. Sean from Newcrest indicated that their excavators have the operator cabin 9 meters in the air and they use a chute device made of strong polymer plastic that works very well. Sean had done training in this system and he suggested you can control your decent speed easily by use of your arms. They are setup as a concertina and when released they just fall to the ground.

The issue of moving cranes that can't be moved under its own power was discussed. It was suggested that if one crane is being used to move by another, the situation should be properly assess before it is carried out and obvious items like brakes partially being released and buffer alignment should be addressed.

Out of Service Cranes

The issue of Out-of-Service cranes was discussed, where a decision is made that a crane will no longer be used but is left in position due to the cost of removing it or where it may need to be recommissioned at some later time. John from Bluescope indicated in that situation the crane would be electrically isolated and disabled, pendants or other controls would be removed and any item that could possible deteriorate and fall off such as hook blocks, ropes, etc would be removed. He indicated that they would do a yearly quick walk over inspection of the structure to ensure there is not major corrosion or items about to fall off.

It was suggested that information about any crane that is still physically on-site should be kept in case a future decision is made to put it back into service, even if this is unlikely.

Legislation for Cranes

Duminda from Qenos asked a question about what legislation was applicable for cranes. Richard from Bluescope Steel indicated that AS1418 is the design standard for cranes and so all new cranes have to comply with this and is legislated as mandatory. He indicated that the crane maintenance standard is AS2550 is a Code of Practice is so is not mandatory. This means it is just a recommendation that does not have to be complied with if the crane owner organisation believes there is a good engineering basis for not doing so and they believe they can achieve an equivalent level of safety. If an organisation does not follow the code of practice and there is an injury then it would be taken as evidence against the organisation in any proceedings. Richard indicated that AS2550 was originally written for overhead cranes and then generalised to suit other crane types and so some of the information in the inspection activities, etc can seem a bit strange.

Martin from Delta indicated that their crane contractors have suggested that their cranes that are often not used within 3 months have to be inspected every 3 months because of the information given in AS2550. John from Bluescope indicated that that is not the case. For Bluescope cranes that might be used less than once per 3 months they tend to go to an inspect before use strategy, which is applicable to some maintenance specific cranes that might only be used once every 6 months or a year. There was discussion around the primary need to maintain a safe workplace and the need to put whatever systems and controls in place that makes you confident that you won't injure people.

Another issue raised was about the use of the wording of Competent Person relating to the yearly inspections of a crane. It was suggested that competency would indicate some years of experience with crane inspection activities and is trusted for this activity.

There was discussion around structural inspection of cranes. Richard from Bluescope indicated that there are several types of inspections defined in the AS2550 standard. There are routine inspections and periodic inspection and items in the periodic inspections includestructural inspections. He indicated that as the Bluescope operation loading environment is so arduous they tend to do this structural inspection every 6 months. The inspection does not have to be carried out by an engineer but does have to be someone experienced at doing structural inspections and finding structural cracks. A structural engineer would need to assess any cracks found. Richard suggested that for a crane that had heavy usage, if structural inspection were left to the 25 year recertification inspection, then the structure may be in a very poor condition. He suggested it is much cheaper and safer to catch and repair problems early. Stephen from OneSteel indicated that he has formatted his service level agreement so that every service is a periodic service to increase his security. He indicated that he over inspects for structural issues, as if a critical crane had to be taken out of service for serious structural issues it would have a major impact on their business. There was discussion on what training is required to make a crane technician competent to inspect structures.

Appendix 1 – BlueScope Steel Crane Operator Pre-Start Checks

Crane Drivers Daily Crane Inspection Report

Department: _____ Date: _____ Shift: _____

Crane No: _____ Capacity: _____Type: - Cabin ☐ Infra-red ☐

Radio ☐ Pendant ☐

W A R N I N G

1) **PLACE PERSONAL LOCK ON CRANE ISOLATION SWITCH BEFORE INSPECTING CRANE**
2) Do not operate radio controlled cranes at distances greater than 20 metres
3) Ensure that walkways are clear
4) Report any safety defects to your supervisor and get shift crew to fix safety defects immediately

✓ Tick if checked OK X Cross if requires attention N/A N/A if not applicable

Check following items are in working order or in place

	C A B I N		Fire Extinguishers
	Crane Isolation switch		Drivers seat
	Protective Panel		**C R A N E**
	Emergency Stop Button		L/T Access Switches
	Motion Controllers		X/T Access Switches
	Radio On – (Red Light Indicates Radio On)		Scrap or loose material on crane
	Magnet PP Off – (Green Light On)		Ropes on Rope Drum – Main Hoist
	Magnet Controller		– Aux Hoist
	Warning devices		Ropes on Sheaves – Main Hoist
	Main Hoist – Shunt Limit		– Aux Hoist
	– Full Current Limit		Full Current Limit Striker Bar – Main Hoist
	Aux Hoist – Shunt Limit		– Aux Hoist
	– Full Current Limit		Long Travel Drive
	Shunt By Pass Button – Main Hoist		Cross Travel Drive
	– Aux Hoist		Magnet Cable Connections – On Cable
	Brakes – Main Hoist		– On Magnet
	– Aux Hoist		Fire Extinguishers in/near control panel
	– Long Travel		Handrail Condition
	– Cross Travel		Walkway Condition
	– Foot Break		

Comments:

Crane Drivers Name: _____ Signature: _____

(Please Print)

CRANE PRE-OPERATIONAL CHECK LIST

Date:	Shift:	Operator:	Crane No.:

CHECK THE FOLLOWING WITH THE "POWER OFF"

ISOLATE, LOCK, & VERIFY	DONE

ITEM	ITEM CONDITION	OK	NOT OK
Isolation Switch	Operating correctly		
Safe Working Load	Displayed on Crane		
Hoist Limit	Striker bars in place		
Hoist Rope	Alignment, damage		
Rope sheaves	Rope in place, visibly OK		
Ladders, handrails and walkways	Damage, loose or broken		
Guarding	Missing, damaged, not in place		
Lighting	All lights working		
Long travel	Visual of equipment - everything in its place.		
Cross travel	Visual of equipment - everything in its place.		
Bridge Housekeeping	Loose objects, rubbish		
Oil leaks	Excessive leaks that present a hazard		
Crane structure	Obvious damage, cracks		
Electrical cabinets	Damage		
Electrical cables, catenary's	Damage, broken, hanging		
Fire extinguisher/s	Cabin and/or bridge		
Cabin Housekeeping	General rubbish, hygiene		
Seat	Functionality		
Hook block	Damage, latch working		
Lifting equipment	If attached - damage, working OK		

CHECK THE FOLLOWING WITH THE "POWER ON"

ITEM	ITEM CONDITION	OK	NOT OK
Start button	Operation and functionality		
Emergency Stop	Operation and functionality		
Motion Controllers	Operation and functionality		
All Hoist Shunt limits	Operation and functionality		
Long travel brakes	Operation and functionality		
Cross travel brakes	Operation and functionality		
Hoist brakes	Operation and functionality		
Warning devices	Operation and functionality		
Abnormal noises	Operation and functionality		

REPORT ANY PROBLEMS REQUIRING ATTENTION.

Comments:

.....

.....

.....

Supervisor .....

Appendix 2 – Proposed Recertification and Inspection Process

1. Verify Crane Details including;

- Crane Registration Details and classification
- Description
- Rated Capacity
- Commissioning date and details
- Available drawings and documentation

2. Analyse Past History and Crane Utilisation including;

- Usage patterns
- Load cycles
- Maintenance schedules and history
- Operating manuals and procedures
- Crane incidents

3. Assess Proposed Future Crane Utilisation

- Proposed length of service and duty

6. Analyse Crane Structure

- Use analyse methods such as FEA / Fatigue assessment / fracture mechanics and maintenance History to determine which components are most likely to experience failures.
- Build a detailed inspection platform to identify and create unigue identifiers for each and every structural connection and inspection points.

7. Conduct Major Inspection

- Prepare a project plan and schedule resources to conduct the major inspection based on the required inspection requirements.
- Carryout the Major inspection to minimise plant disruption

8. Reporting

- Preparation and distribution of Crane inspection report and repair / crane upgrade recommendations and estimates.

9. Re Certification

The crane is recertified pending review of data, inspection findings and gaps to current standard, etc and implementation of the recommendations of the Certifying Engineer**.**

Appendix 3 – National Crane Assessment Program

http://cranesafe.com.au/Web/assessment_program/vic_crane_assess_prog.htm#2.3%20Choices%20of%20Qualified%20Assessors

Appendix 4 – Bill Sinclair's Comments on Some Items in the Report

Bill is a very experienced Structural and Crane person from Bluescope Steel Port Kembla

Bill's Comments

I've been reading with interest the transcript of the CIWG meeting, 1st July 2009, Overhead Crane Maintenance and Reliability. The subjects covered were certainly wide ranging and it would seem that the discussion was lively with good information disseminated.
I would like to make some additional observations on the subjects covered.

Management of Lifting Gear

Also to be considered is the production type lifting equipment, ie tongs, c-hooks, lifting beams etc. Where these items of equipment have been designed with a 'rated capacity' in accordance with the crane code AS1418.1, each item should have an inspection and maintenance plan to ensure the item's integrity and fitness for operation. AS2550.1 provides some guidance on the minimum inspection frequencies, according to the classification.

Wheel Flange Wear

Wheel flange wear is problem with some of the high duty cranes at BSL. Some of the issues that affect include,

- Rail alignment, keeping the runway rails to gauge and aligned to the runway girders. Note, it is important the rails run parallel, even if not in gauge, so the crane is not 'pulled' apart as it travels down the runway
- Driven wheel diameters must be the same, or very close, so that the crane is not steered down the track
- Wheel treads need to cylindrical- conical treads will steer the crane and affect flange wear
- Bogie pins and bogies need to square to track so that the wheels don't lay across the track and force the crane to steer into its corners.

In short, crane structural alignment is crucial to given the crane the best chance of minimising wheel flange wear.

Of course as the crane and the support structure deteriorates with age and service, coupled with enforced economies on the maintenance budget, a system of flange lubrication will extend the life of the wheels.
Wheel material specification is also crucial. BSL have had good success over many years with quenched and tempered alloy steel wheels. The wheels are equivalent to AS1444, gr 4150 specification, 340-380 HBN. These wheels are reasonably hard enough for the former BHP specification crane rails and still retain sufficient ductility so that flanges tend to bend off rather than suddenly snap.

Heritage Listed Cranes

I agree with the sentiments of the person from Sydney Water, there isn't a reason why the crane, provided they are serviceable could not continue operating.
As cautionary point though, the structures are probably made from wrought iron, so would not lend them selves to an easy repair. Should a member be damaged, then it would require complete replacement with a steel section of equivalent section properties.
The fixing of a repaired section could also cause problem. It is likely that the crane is riveted together. Should the rivet become loose or, as in above, a section need replacing, then the rivets should be replaced with high tensile structural bolts, the holes in the existing joint on the crane would need to be reamed out to suit the closest next size up in bolt.

Don't be tempted to use 'Huck' bolts. Some publications suggest that these bolts are a ready replacement for rivets. The problem with 'Huck' bolts is that the high clamping force exerted by the bolt onto the joining parts may split the member out from the hole. BSL has experienced some of these problems in the past and found correctly installed structural bolts are quite sufficient for holding the crane together.

Corrosion

The use of weather resistant grade steels was mentioned as a possible solution to some corrosion problems. However the fatigue performance was questioned.
The fatigue strength of the WR350 steels is the same as the normal structural grades, with good weldability.
However these steels are expensive and don't always work as well as one might hope, especially in a marine environment.
The best idea is stick to the normal structural steel grade AS1678 and 79 and make sure the structures are painted correctly.

Emergency Egress from Cranes

Something that should be considered with any emergency egress devices mentioned in the conversation is training personnel how to use coupled with regular practice. These devices are ok and provide a level of reassurance to the operators, however it important with and 'rescue' type device that regular training and refresher training is applied so people are familiar with the equipment.
Part of that training would need to include a risk assessment component, so the operator assess whether it is safe to descend to the floor, ie no obstructions, voids in floor etc, or remain with the crane. Alternatively the crane could incorporate a cabin design that is a safe haven for the operator until someone else can make the assessment it is acceptable to leave the crane by whatever designated method.

Out of Service Cranes

I would like to emphasise that where it mentions the crane should be isolated electrically, this means removal of the downshop collector shoes. By doing so any chance of the crane being made 'live', inadvertently, is removed.
Also, where the crane can be accessed from runway or cabin platform, it is strongly recommended that the accesses to the crane are removed or blocked off so that stray or curious pedestrians can be kept off the decommissioned crane.

Trust these few comments will add to your knowledge on cranes problems and solutions

Kind regards

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