



Industrial Maintenance Roundtable NSW  
Common Interest Workgroup (CIWG) Report  
from Meeting on 9<sup>th</sup> July 2009

# Conveyors CIWG



Underground Inclined Conveyor Northparkes Mine

This document is compiled from discussions during the NSW IMRt Common Interest Workgroup (CIWG) on 9<sup>th</sup> July 2009.

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# Conveyors Common Interest Workgroup

## Attendance List

### Introduction

The NSW Industrial Maintenance Roundtable (IMRt) held a Common Interest Work Group (CIWG) meeting on Materials Handling Conveyors. This meeting was hosted by Troy Hopley at the Northparkes Mines site on July 9<sup>th</sup> 2009 at Parkes. The meeting was attended by 29 people from 6 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 Materials Handling Conveyors for the NSW IMRt.

The IMRt is a maintenance networking organisation coordinated by SIRF Roundtables (SIRF Rt) [www.sirfrt.com.au](http://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.

Attendee	Organisation
Gary Allen	Newcrest Mining
Graham Warner	Newcrest Mining
Joshua Davey	Newcrest Mining
Mick Dewar	Newcrest Mining
Phil Jeffrey	Newcrest Mining
Tom Mackay	Newcrest Mining
Tim Bieler	Newcrest Mining Telfer
Andrew Hubbard	Northparkes Mines
Chris Norris	Northparkes Mines
Jeff Kelley	Northparkes Mines
Kirk McGinnes	Northparkes Mines
Marcus Morrison	Northparkes Mines
Mark Turnbull	Northparkes Mines
Matthew Betts	Northparkes Mines
Nel Huggett	Northparkes Mines
Scott Rauchle	Northparkes Mines
Tony Melhuish	Northparkes Mines
Troy Hopley	Northparkes Mines
Wayne Tucker	Northparkes Mines
Tom Hawkes	OneSteel
Wayne Bissett	OneSteel
Matthew Anstey	Orica
Scott Petersen	Orica
Tony Ng	Orica
Cain James	Port Waratah
Gary Valaire	Port Waratah
Michael Newman	Port Waratah
Howard Witt	Ex ANSTO
Peter Todd	SIRF Roundtables



# Conveyors Comparison Matrix

Conveyors Comparison Matrix	ORICA (Kooragang Island)	Newcrest	Northparkes Mines	Port Waratah Coal Services	OneSteel
1 How many conveyors does your site have <100m <1000m >1000m	20<100m	<100m=20 (Telferx10 CUOX10) <1000m=22 (Telferx10 CUOX12) >1000m=3 CUO (RAW)	OPD 14 = 2,345m UG 9 = 12,691m	>60 over 1000m (up to 3000m), 40@ around 100m (eg. trailers, feeders/boom belts)	100 off < 100m ? 100<1000m
2 What are the typical characteristics of the conveyors – Inclines, widths, Tons/yr, thickness, product type etc	Neoprene, Fras Rated, 3 ply. 600-900mm wide, 1 in 5 incline, hot spliced	Telfer – Average 1000-1200TPH CUO – Average RW=1000TPH, CAD=2200 TPH	450-600-1200MM Multi Dive max 600kw, OPD Single 200KWx1 – 10x2,12x3,11x1,13x1.	KCT – 800 to 10000t/hr, 2000mm-3200mm, Steelcore, 'M' & 'A' Class (inclines (20Deg) and sprags), CCT – Fabric+Cores, 2500 t/hr, Gravity Winch Take-ups	2.8 mt/year magnetite, 4.0 mt/year haematite (wide range , types, widths, thicknesses)
3 What are the major cost issues with your conveyors?	Lost production is biggest cost. Then cost of belt replacement.	Average width CUO-1050mm, Telf-1200mm	Repeat Work, Inspection frequency (too many) not accurate, Scrapers, repairs, damage, roller replacements, labour.	Replacement / Idler exchange / Downtime / Frames / Pulleys (bolt)	Belt damage, Chute wear, Gearbox – product surge – anti run back failure, Wear, Dust build up/cleaning.
4 What are the major availability and reliability issues with your conveyors?	Failed splice, wear on belt from skirts, tracking, seized idlers, buildup on idlers	G/Boxes – Rossy's (NOT GOOD), IDLERS- Brings issues, SENSOR LOOPS-Damage/Fail, BEARINGS-set up (initial), IMAC System.	Blocked chutes, Belt drift, mud slides, skirt damage, tramp damage	Tracking giving Downtime (\$360k/hr)	Dirt ingress, poor lube, poor maintenance practices, tracking/costing, operational damage – tears.
5 What are your biggest training opportunities with conveyors	Training for operators	Reliability program, Conveyors Coordinator, Design Service Factors (C/East) Telf, Belt Rip, Chute design, Scrap Maintenance.	ALL - Rollers, Patches, Tracking, Setup, Comprehensive range - Train for ownership - scraper adjustment/installation	Through pain comes growth, Buddy training, Interaction with vendors/engineers.	Tracking – Set up/ Installation, Correct operation, Lubrication management.
6 What current improvement activities or projects do you have around your conveyors?	Improved PM'S, ITP's and Q.A. Material spec review.	Uniformed approach across site – Newcrest □ COP'S, Development/Training in on site/Inhouse Patch testing, Contamination control management training, Six Sigma Process applied to improvement opportunities.	MHS Champions, Cost analysis (Pareto), Lube Volume Frequency, SPL's EM, ReTender Service Provider, Partnership Focus.	CBM on motors and gearboxes. "A" & "M" class belts – yard and wharf. (Mass chargeout of "OLD" belts), Trackers, Hydrocarbons, Tacho replacement – encoder and mounting. MFL installation (hardware).	Condition Management, conveyor PM Rollout – Specific Conv. Strategies, Lube training, Ingress Control/ Operator Golden Rules.

## ***Introductions***

The meeting started off with the attendees introducing themselves.

Noel, Tony, Matthew, Scott, Wayne, Troy, Andrew, Kirk, Mark, Chris, Marcus and Jeff attended from Northparkes Mines. There were also some Northparkes attendees that were not available at the time of the introductions due to work in the mine. Noel is the Maintenance Superintendant for the Ore Processing Plant and has worked for 12 years at the site. Tony is the reliability planner for Northparkes and is interested in reliability improvements for conveyors. Matthew is the Engineering Manager at Northparkes and as their mine is going to incline conveyors rather than hoisting systems to bring the ore to the surface they are very interested in learning more about conveyors. Scott is the Ore Processing Process Coordinator who looks after the dayshift crew that does the minor ongoing maintenance for the conveyors. They do routine inspections and minor upgrades on things like conveyor scrapers and are currently trying to standardise on scrapers across their plant. This makes spares and planning a lot easier. Wayne is the Mechanical Coordinator at Ore Processing and he indicated that they are installing more impact beds on bi-directional belts and is interested in others experience with them. Troy is the underground Maintenance Superintendant who is interested in cost benchmarking on conveyors, conveyor condition monitoring and getting solutions to problems quickly through networking. Andrew is the Maintenance Planner for Ore Processing and he suggested that they do a reasonable job of conveyor maintenance without much downtime. He indicated that an area of improvement for them is doing more condition monitoring. Chris and Jeff are Maintenance Planners for Ore Processing. Kirk is the underground Mechanical Coordinator for fixed plant and his topic of interest was Scraper tip longevity and carry back issues with what tip suits what product best.

Tim, Mick, Tom, Graham, Gary, Phil and Josh attended from Newcrest Mining. Tim is a graduate engineer and works for Newcrest's Western Australian mine at Telfer and has a project to improve conveyor reliability in their plant. Mick and Tom are mechanical reliability engineers from Cadia Valley operations and are interested in conveyor condition monitoring and on some new conveyor installations that they have. Graham is the Acting Maintenance Manager for Cadia Valley and he has had an active interest for the last 20 years with material handling and conveyors with lots previous experience in Western Australia and then Hunter Valley. They current run a very large belt system carrying 6 million tonnes a year. They are about to embark on the 4<sup>th</sup> largest underground gold mine in the world at 24 million tonnes. Gary is the Mechanical Maintenance Superintendant at the Cadia Valley Operations processing plants. He indicated that a few years ago they went through a bad period with operations losses with breakdown and rework. Phil works in Ore processing on conveyors. Josh is the underground Mechanical Engineer at Ridgway Mine.

Gary, Mick and Cain attended from Port Waratah Coal Services (PWCS) in Newcastle. They load about 90 Million tonnes of coal onto ships a year with conveyors and they are very interested in the topic. Gary is an electrician at PWCS on conveyors. Mick is PWCS's Reliability engineer and indicated that they are currently installing \$10 million of belts a year to try to bring their conveyors up to good condition. They also have a focus on improving their drive system reliability and putting effort into surveying there conveyors to improve tracking as their plant in on the site of an old swamp and so foundations tend to be unstable. Cain is a mechanical tradesperson and is currently working on reliability projects.

Matt and Scott attended from Orica Mining Services in Newcastle. They produce about 400,000 tonnes of Ammonia Nitrate that mostly goes to Hunter Valley Mines. They have

problems with splicing, product build-up and abrasion. Tony Ng attended from Orica's plant in Botany, which produces water treatment chemicals and has a number of small conveyors.

Tom and Wayne attended from the OneSteel Operational Excellence Team based in Newcastle. Tom is a reliability engineer and indicated that they were attending because OneSteel have a number of critical conveyors at their Whyalla sites and want to improve their reliability. Wayne is the Reliability Manager for OneSteel and said that he had been previously been involved with conveyor Maintenance at a number the NSW power stations. He indicated that conveyors are an opportunity for OneSteel as they are currently spending \$8 million a year on them and half of that is in breakdown maintenance.

### ***Presentation by Matthew from Northparkes Mines***

Matthew the Engineering Manager at Northparkes gave a welcome introductory presentation about their site and their current mine expansion project. Being a Rio Tinto mine Matthew initiated a Safety Share before starting, two of which were focused on car driving safety and the third related an incident that had occurred on recent conveyor maintenance at Northparkes. During the maintenance a small crow bar had been left in the conveyor structure and on start-up it had fallen onto the return side of the belt and hit the angled return plough scraper and flew out at speed. There were people in the area but no one was hit. As the projectile was at head/ chest height the initial investigation put an action in place to install a heavy curtain material to slow down any future projectiles.

Matthew gave an overview of their mine, which is a joint venture between Rio Tinto and Sumitomo (80%-20%) and their main products are Copper and Gold (65,000t/yr Cu and 900,000oz/yr Ag). The mine life has now been extended to 2024 due to a large expansion project. Currently there are both underground and open cut operations and the ore is processed on-site into a copper concentrate and shipped to customers in India, China and Japan. The underground operation uses a block cave process. The presentation is available for download from the web page for this meeting.

Troy from Northparkes made a comment about their current operational stage, which is towards the end of the life of the current underground block cave. They are starting to get up to 12% clay with the ore. This clay causes significant conveying problem and is one of the issue for discussion in the meeting and details of the block mining process.

### ***Conveyor Spillage Cleaning***

One of the comments about the underground conveyors illustrated in Matthew's presentation was that that the conveyor structure was hung from the roof rather than supported from the floor (away from the conveyor head and the tail end). It was suggested that



this was a successful arrangement with few reliability problems. The other major advantage was that it made cleaning of any spillage much easier. What made it particularly easy was an automated scraper device with large wide paddles that fits onto a bobcat as an attachment, which Northparkes had purchased (See Photo above). The scraper section is only 350mm high so fits under the conveyor easily. This device scrapes any spillage from under the conveyor into the access way so that it can be picked up easily by some type of loader.



### ***Runback Protection***

Michael from PWCS asked about what runback protection Northparkes had on their incline conveyors. They said they had high speed sprag runbacks in their gearboxes. Michael indicated that they had just been through two studies with SKN to determine how to maintain their runback reliability. After \$35,000 they said just said ‘change them or pull them apart and inspect them every year’, which had what they had been doing anyway. Michael suggested that a sprag runback is usually the most sensitive component in a gearbox and will cause problems before anything else. This means that the gearbox oil needs to be well maintained. If you are using an external sprag runback, then if oil is used it needs to be very well maintained. If it is grease lubricated then grease purge lubrication is required to ensure the grease in the sprag is in good condition.

Matthew indicated that they just installed a new inclined conveyor to their E48 and that system had a low speed external anti runback and thought this was a better system. Newcrest Ridgway is using all low speed anti runback systems. Matthew from Northparkes indicated that they have had 2 runback failures in the last two years but their sprag runbacks are the secondary risk control as the drive brake is the primary safety control. Michael from PWCS indicated for some older systems they have been suggesting installing a failsafe breaking system to eliminate the significant operational consequence of a runback failure.

### ***Lubrication Management***

Michael from PWCS indicated that one of their biggest challenges with drive gearboxes has been to improve the lubrication management. They have been improving the filtration with kidney loop system but are not all the way to the way to where they would like to have it yet. He indicated that historically filtration has been 25 micron and so has been completely inadequate. Cain from PWCS indicated that one of their tradesmen usually takes oil samples for their oil analysis. He also indicated that their gearboxes are having some systems installed so that you can’t put the wrong oil in them. They have different sized fittings and they are all colour coded. They are also putting uniform sample points on to be able to easily take live samples.

## **Condition Monitoring**

Troy from Northparkes asked a question about what Condition Monitoring attendees are using on their conveyors. His areas of interest were drive units, drive rollers, lagging, belt thickness and rollers. Michael from PWCS indicated that they were doing 5000 points a month Vibration Analysis (VA) and he indicated that you could have 12 point on a drive from the motor through the pulley bearings. Troy was asked why they had selected monthly monitoring. Michael indicated that they have two sites, Kooragang and Carrington and the Kooragang site equipment is much more conservatively rated and they have just made the decision to start increasing the monitoring interval out to two monthly, due to the warning time for problems that they have been achieving. At the Carrington site the equipment is older and not so conservatively designed and the warning times are much lower and so they are staying with monthly VA monitoring. Troy asked about PWCS's use of Thermal Imaging and Oil Analysis on conveyors. Michael indicated that they have a thermal imaging camera but there has not been any regular effective conveyor inspection set up yet. They are currently taking oil samples of the drive gearboxes every four months and are looking to reduce this to every 3 months. Troy from Northparkes indicated that they were also currently doing vibration and oil analysis monthly and similar to PWCS has not setup thermal imaging inspection yet.

Wayne from OneSteel indicated that he has had a lot of experience of condition monitoring when he worked for Pacific Power International. He was involved with monitoring a number of power station conveyor systems as well of the conveyors for many of the conveyors in the Hunter Valley Xstrata Coal mines. His experience was similar to the PWCS Carrington experience in tht VA of conveyor main pulleys gave a failure warning time of about 6 weeks. If monitoring was pushed out to 2 monthly. the sites that did this started to suffer the pain of failures that slipped through the monitoring. The pulleys were the most critical of the conveyor drive system components with the motor or gearboxes giving much better warning times.

Wayne indicated at that a slower progressive bearing failure in a gearbox tended to give about 12 month failure waring but he always specified 3 monthly monitoring because of the variability in the quality of the oil sampling process and because there are lot of other things like contamination and incorrect oil added that can happen to a gearbox. He suggested with a bearing failure on a gearbox the first indication is 10 micron laminar wear flakes, as seen in a Patch test. When you see the wear flakes at about 50 microns, this is when you will start to get an indication from the high frequency vibration monitoring of the bearings. Wayne agreed with Troy that vibration monitoring of the gearbox could be pushed out to 3 months along with the oil with staggered timing.

Graham from Newcrest talked about the options for on-line monitoring with most plants having SCADA and PLC systems that are available for monitoring, even for just basic things like temperature monitoring. Michael from PWCS indicated that the 4 biggest gearboxes they have on their site are worth \$1.8 million each with two year lead time and they are not comfortable with the service they get from suppliers. He said that because of their risk exposure from these gearboxes they have intensions to install multiple accelerometers over them with online monitoring. Northparkes indicated that they have accelerometers installed on some of their underground gearboxes, which feeds back to their SCADA. Matthew from Northparkes asked if PWCS were installing accelerometers on pulley bearings. Michael indicated that for difficult to get to pulley bearings they have installed about 250 accelerometers that connect to junction boxes so vibration data can be collected during

routine monitoring. This will give PWCS the option to make this monitoring online in the future if they decide to. Troy from Northparkes gave the example of another plant that when a VA monitoring survey was performed, 25% of the required monitoring points were not being collected because either the points were not accessible or due to build-up of material around the points. Michael agreed that this is typical and that often an even bigger problem is that there is no ownership by local people for the CM system. He indicated that going back 4 years ago PWCS had that problem where bearings would fail after they had been detected by the VA monitoring but there had not been enough good communication between CM & maintenance to react in time. They have put a lot of effort into getting their condition monitoring system strongly connected into their maintenance workflow management system so when problems are detected the appropriate maintenance action is initiated. Now that they have good trigger limits and they often go to weekly or sometimes daily monitoring of a specific problem to make sure they can make it through to an outage to do the repair. Michael suggested that it gets a bit uncomfortable but it is the only way to maintain operation.

Wayne from OneSteel spoke of what they are doing at their Whyalla mine to get better integration and scheduling of their condition monitoring. They have staggered the scheduling of their inspection and have given the fitters \$4,000 Thermal Imaging cameras to do their conveyor and other inspections. They have given their lube guys an acoustic grease gun system so they can check equipment noises while they are greasing. They also stagger both the vibration collection and the oil sampling. All this separate monitoring gives many eyes looking and listening to the plant at different times, maximising the chance that problems will be picked up. Wayne suggested that their ideal is to have the CM guy to go-to person for equipment problems so that if an operator, a lube person or a cleaner see something they don't fully understand then the CM person is readily available enough on the plant that the problems are brought to them. That is one of the problems of hiring external CM resources that are not there 90% of the time, that they are not a resource that is accessible and that sees and understands the problem when things go wrong. Kirk from Northparkes agreed that they have that exact problem with their CM contractors that come to site 14 times a year. He suggested they meet with them when they come to site but that it is difficult give and receive good feedback and encourage the level of ownership that he thinks is required to do the job well. One of the issues is the turnover that occurs with the CM technicians.

Josh from Newcrest spoke about how their Telfer plant has 3 full time CM technicians and a CM manager, so that they don't have the same issues with ownership. Their technicians get much more involved with following through problems down to daily monitoring if they are trying to get an item to make it to an outage. Michael from PWCS indicated that they use CM contractors but their guys work full time on site. What they do is hold their CM guy very close and treat them like in-house people. The CM techs are encouraged to identify equipment issue outside their normal inspections and enter work directly into their CMMS system. The guys they get are probably not being paid very well as they tend to be recent immigrants or young guys either working their way through uni or just out of uni. The CM supervisor is in their office every week and has a formal weekly meeting with the PWCS CM Officer. They go through all outstanding issues and the preset limits. There is also a formal monthly meeting with the maintenance superintendents and other interested people and they go through everything for the whole month and set priorities. Since they have setup this system of close communication with the CM team they have only missed one failure and that was an issue of the tradesmen changing the wrong bearing and not getting back quickly enough to change the right bearing. Michael was asked why they don't just do the CM themselves and he indicated that Wayne's group at OneSteel can do that because they have

the enough technical people to support the CM activity but he suggested that currently PWCS would struggle to fully technically support a CM team themselves. They have currently put the priority of getting the Lube Management in house, putting on 6 Lube Techs to manage the lube side. There was general agreement that the common factor of success is not if they are in-house or contractors but if they are full time at a site so they can feel the pain at the production meeting if they miss a failure. Wayne from OneSteel suggested that the ideal person to do the CM for a plant is a tradesperson that understands and has an ownership and passion for the plant and has been trained up on CM. The person needs either hands-on skills with lube or vibration monitoring. In their system this guy would sit next to the planner for the area and works for the reliability engineer for the area. His job is to interpret all the information that comes from CM service providers.

Both Wayne from OneSteel and Michael from PWCS gave a number of examples of the power of simple Patch Testing as the first level of oil analysis. They both gave some extreme examples where normal laboratory oil analysis had missed extreme issues with oil samples. Michael suggested that the resistance to using Patch Testing as the first level of analysis is that it is fairly resource intensive. Wayne indicated that their KPI's are 'Is it the right oil', 'Is it clean', 'Is it dry' and 'have we got a wear problem'. For Laboratory oil analysis they get a cost of \$30 a sample and that includes a Karl Fischer moisture analysis and a spectro analysis to confirm additives. Their lab is doing a patch test for them and they have given the lab guidance on how to do simple estimates of ISO Cleanliness. Wayne indicated that he is happy to share through the IMRt their guidelines around Patch Testing.

Cain from PWCS indicated that a service that Bureau Veritas their CM contractor provides them is they combine all their condition monitoring data from different sources such as oil analysis, vibration analysis, motor testing, etc into a combined report so that all issues for an item of equipment can be viewed in the same report. The report indicated who collected the most recent data and when. Issues have a priority ranking with comments and limits. Cain suggested that all the limits are locked in, which can only be changed with a management of change form.

### ***Inspection of Conveyors***

Graham from Newcrest indicated that he is passionate about getting people out there and walk the belts every day. He indicated with their belts they have about 10,000 idlers and failure of just one could destroy a belt. If they find a problem they find a time stop and change the idlers as they can't afford to damage a belt. He suggested that it is necessary to walk the belts as there are so many things that can go wrong that VA and other condition monitoring will not check. Having people with enough passion to get out there is critical and they need systems to demonstrate that they have done the job. Graham suggested that walking belts is a hard and boring job and his concern is for the risk that someone has just ticked the boxes and not really been out there. He is interested in scanner systems with mini data collectors but he has not seen them work successfully. Having to scan a point at a location proved that they have been there and so will have likely have done the inspection as it is easy once you are there. Graham also mentioned the use of temperature guns to collect temperatures as a way to collect data to make it hard for people to just tic the boxes of an inspection. The other data collection he mentioned was collection of air compressor hours and water meter hours to ensure people have got to the required locations. Graham agreed with Troy about the issue of build-up of materials being an important issue. In Newcrest underground operators and maintainers are the same people and they are the ones that need to do the cleanup.

The question was asked about how many of their people actually properly understand belts, scrapers, tracking issues, etc and what to look for on inspections and are there training courses out there that can help? Kirk from Northparkes indicated that they have a basic Standard Operating Procedure (SOP) for their belt runners. At Northparkes it is the operations guys underground that do the belt inspection. Kirk suggested that going back 12 months ago they were not getting the level of feedback from production about the belts that they thought they required. Similar to PWCS they were having communication problems. Maintenance took the step and started interacting more with operations about the belts and following up on issues individually with the operators that were doing the inspections to get more details of exactly what the problems were and if necessary sending maintenance guys down immediately to do a check. Now that they are regularly interacting with the operations guys doing the inspections, feedback on issues is coming thick and fast with positive results. Noel from Northparkes agreed that it is the operators that are with the equipment day in and day out that should be using their senses to pick up the obvious problems and to have the connection and communication between operations and maintenance.

Wayne from OneSteel talked about a \$25 million/yr maintenance contract start-up by Fluor Daniel down in Victoria in a brown coal mine that he had supported on the condition monitoring side. They trained about 6 CM Techs but they also got permission from Fluor to train the other maintenance and operations people so that they could achieve a team view of the CM program. The training was to focus people getting the equipment to run Cool, Clean, Smooth and Dry, which is the same focus they are currently promoting at OneSteel. When plant people found problems, they went the CM techs that had the focus of improving the condition of the plant rather than just finding defects. As the Fluor contract was performance based they tracked the saves, which gave some very interesting results. 20% of the equipment problems detected were from Vibration Analysis, 40% was from Oil Analysis and the other 40% was from basic 5 senses look listen and feel. It ended up being a case study site for Fluor. Wayne suggested it was a good example of integration of CM, good inspection operations and maintenance to give a good result. Troy from Northparkes indicated that people put most of their focus on VA, which at least in that case had the least impact, which Wayne agreed with.

### ***Training for Conveyors***

The question was asked again about training for conveyors knowledge. Graham from Newcrest indicated that he has worked on conveyors for years and he has yet to see a site where they actually train people on conveyors for what things are, what they do, what goes wrong, what to inspect, etc. What is one of the first jobs that are given to a young fitter when he starts is to walk the belts without knowing what to look for. Graham suggested that you could often have a belt that is destroying itself and an inexperienced person might see nothing at all. He suggested that a number of times he has gone out to a belt and there has been a big dark patch being rubbed into it but the guys doing the inspection had looking at it and not recognised it as a problem. Wayne from Northparkes indicated that Reliable organised some basic training on site a few years ago on conveyors, which was mostly focused on tracking. He suggested the training focused people on how to track down the source of tracking problems, which is always further back from the location of the tracking. It gave example of how hang-ups in chutes can cause tracking problems by redirecting material flows. The course was given by Peter Wheeler from Southern Conveyors but did not go into basic conveyor inspection as previously discussed. Wayne from OneSteel indicated that it is more than knowing what to inspect and understanding problems, it is also about setting standards

for what is acceptable. If you don't then people just walk by a problem every day because that is the way it has always been. Matthew agreed that most of their inspection sheets are not visual and are some tic and flick and he suggested more visual inspection standard would give people a much better idea of what was acceptable.

There was discussion on how best to organise training. The belt tracking training was an example where there was a specific issue and a supplier came up with an appropriate training course. It was suggested that this could be duplicated for other training. There were other comments that for some of the basic skills, suppliers are probably not the best source of information and that training might be better produced by on-site people.

Troy from Northparkes asked the question about what is the best way to train both operators and maintenance people on Conveyor issues. There was a suggestion that it would be other going out to the market and to see what training there is available. A suggestion was that APEX has some good training systems that would be worthwhile checking out. For operator training on conveyors it was suggested to not be that complicated and that the knowledge is already available in-house within the attending companies and it would be easy enough for someone to put together some PowerPoint slides. Troy from Northparkes indicated they have a specific operator role called 'Belt Runner' but looking at the data they tend to spend less than half their day doing that role. They don't get given any formal training, which suggests that a stronger focus on the importance of the role would be worthwhile. The suggestion was made that production supervisors have a lot of shorter term priorities and that they often deflect the 'belt runners' time to other thing. Matthew from Northparkes said if people are not doing what we want them to, it is because of how we training and supervise them as they need to be inspired to do the job required.

### ***Splicing and Monitoring of Belts***

There were comments around the quality control of the belt splicing service providers and their difficulty in keeping experienced crews that can be trusted to do the job without supervision from the site. Michael from PWCS indicated that they have put on a belting supervisor to manage these quality issues. When they have a major job on they get their tradespersons to work as supervisors of contractors to help manage critical jobs like splicing. Before Michael started at PWCS, people had identified that their belting systems had been run down. They now have a belting specification and a splicing procedure and specification, which the splicing contractors are obliged to follow although they can have input into what is done. Having a procedure and specification gives the basis for a quality job, which the contractors are held accountable for.

Michael indicated that they are installing belts 92 cords across with permanent MFL sensors so that they can monitor cord migration. Their fitters do belt thickness and belt hardness monitoring. They currently have good condition information about belts and about drives and main pulleys, where they currently are lacking is on the idler roll systems. There are also issues with belt cleaning.

### ***Idlers Rolls and Pulleys***

Michael from PWCS spoke about their problems with some of their 25 year old idler roller frames that are starting to fatigue and fail. He mentions that Cain did a quick plant survey recently and took some photos and found 'pizza cutters' everywhere. Michael sees that getting onto Thermal Imaging is a priority for their conveyor inspections to be able to pick up issue before they become dangerous rather than let dragging and seized rollers become a risk

to belts. At the moment the local fitters know the idlers are bad and it pisses them off that they have to work on equipment that has been let run down in condition. They have been over to visit the OneSteel guys to get a better handle on Thermal Imaging approaches for inspection.

Kirk from Northparkes indicated that they install their idler rollers in batches and monitor the wear on the shells and when their selected test point in an area get down to 1.2mm they change out the whole area, which could be 200 idlers. A lot of the idlers maybe still good but they just change to lot. Cain from PWCS indicated that they only tend to do batch changes on areas like shuttle cars that may be difficult to access for inspection. He said that another test they do is a bang test to test for rust. Michael from PWCS indicated that they have not yet fully won the financial argument on the importance of upgrading the condition of the idlers and frames.

Gary from Newcrest asked Cain how they use contactors for their conveyor work. Cain from PWCS indicated that one of the major problems with contractors is they have a higher tendency to hurt themselves. He spoke about getting their area shift tradesmen to supervise a group of contractors for changing out idler rolls or idler frames. Gary from Newcrest suggested that all their tradesmen step-up and to supervise contractors when required. He indicated that for many years they have got contractors in the do their pre shutdown inspections to identify items that need to be changes and to do the work planning. Their experience is that there are always things missed and Gary suggested that there was a problem in getting ownership of the job by contractors which there was general agreement with.

Michael from PWCS indicated that in the last 18 months they have done a pulley specification that went through all the failure modes of pulleys. They even did testing on the adhesives used on the pulleys. The specification included NDT and materials requirement, manufacturing and even balance requirements. PWCS have had a couple of pulley failures and they are extremely damaging to structures and drives. Michael said that they had two gearbox failures that were traced back to the shock loading that had occurred in a previous pulley failure. They have had shaft, shell and ring fetter failures with things like fatigue cracks from the disc to the shell where they have traced it back to the weld procedure that was wrong. They still had some old dead shaft pullies that they now get rid of when they find them. They have been rationalising their pulley designs as with the question of why did they need 65 different pulley designs. They have been working with the manufacturing companies and their NDT Company to put those things in place and it will take a while to get payback but it is a good foundation for the future.

Cain from PWCS indicated that they have a lot of experienced fitters on shift that have been there for a long time and each has a section of plant. Their plant runs very hard with few stoppages for and some of the problems areas are 25 metres in the air. Getting issues like the 'pizza cutters' repaired is not always easy but there now seems to be a greater focus identifying what needs to be changed out and getting the required level of resources in on their 2 monthly outages.

Wayne from OneSteel asked if anyone was using one of the software systems that were able to track patterns of idler use to identify problem. He suggested they should enable the use of Rash Charts or similar reliability engineering techniques. A few indicated that they knew of systems that were available but were not using anything.

## ***Energy Efficiency***

Michael from PWCS raised the issue of energy efficiency of idler rollers as they have been offered energy efficient rollers. Northparkes indicated that they have looked at lighter weight rollers for manual handling issues with better energy efficient being an advantage as well. Matthew from Northparkes indicated that they have about 40 Energy Efficiency Opportunity (EEO) projects linked with both federal and state programs. One of the opportunities they have looked at is for a new 2km curved overland conveyor they will be installing. They have base-lined that with normal covers and standard sized idlers and comparing this with low rolling resistance covers and oversized idlers. The special covers give 5 to 7 % reduction in consumed power. The larger diameter idlers give an additional improvement as they produce less indentation in the belt giving lower rolling resistance. Peter from SIRF mention information from a Rio Tinto project in WA where thinner belts were used to be reduced rolling friction.

Wayne from OneSteel mentioned another initiative is to use Thermal Imaging inspection of your idler populations and to change out any idler that is running 20Deg C higher temperature than the population. This will remove any roller that has a serious friction problem and this save cover wear and removes rollers that are at risk of seizure.

Michael from PWCS indicated that they have made a change in their belt specification from A Class belt or an M class belt and some samples were passed around. Changing to the M class belts will be reducing their energy usage.

## ***Belts, Chutes and Skirts***

Michael from PWCS talked about their belt specifications. A class belts are used in high wear areas but they are harder, use more energy and are more affected by UV light. The harder belts were being used everywhere because that is what had originally been installed. They are now using soft loading chutes that places the coal onto the belt at around belt speed, which minimises wear issues so the A grade belts are no longer required. Michael from PWCS spoke about a belt condition study they had done. What was found was for their hard belt grade was major internal belt deterioration at the trough angle change line at the valley roll and that it would eventually produce longitudinal splitting, which is difficult to repair.

There were discussions about condition monitoring of belts. Graham from Newcrest was sceptical about the quality and effectiveness of some belt condition monitoring. He indicated that it does not replace knowledgeable visual inspection and simple measurement, as most of the problems monitored by belt condition monitoring are also evident visually. Also inspection can be easily carried out at a lot higher frequency than what is typically done for belt CM. Gary from the Newcrest process plant told a story of their CBT belt where they have a 6 monthly full carcass and thickness scan with a full condition report. They also do their own condition checks. One of the belt condition reports said no change since last report and predicted life of another 12 months but visual inspections showed that the belt cables coming through and required a change before it was budgeted for. Gary indicated that they are currently not getting value for the money they are spending. Graham from Newcrest suggested that his recommendation is for a site to have a conveyor coordinator that has the expertise to make educated visual assessments of belt condition and be able confirm the quality and usefulness and any formal condition monitoring used. Most belt condition monitoring measures the thickness or wear on the belt. With metal cord belts electronic

signature of the internal belt structures are recorded to see if there are changes in areas like splices.

PWCS was asked about wear on their belts from their conveyor skirts. Michael indicated that they use steel with a softer rubber skirt, which is adjusted just off the belt. The function of the rubber skirting for them is to minimise dust and spillage.

Northparkes indicated that their new Microledge head chute in their new mine section has only had one day's operation but the indication is that there will be no spillage issues as the dirt goes nowhere near the skirts. This is a huge improvement (See photo right). Graham from Newcrest indicated for their Microledge chute they went from 8 weeks to 15 weeks life. One thing they tried is to change out parts of the chute but they have found that it is best to change out the ledge in one go to get the full 22 weeks life. The whole focus of the design is to get the flow right and to put the material on the centre of the belt at the right speed and away from the skirts. Graham indicated that he prefers not to use skirts at all if it can be avoided. In hard rock applications, larger rocks can jam in the skirts and cause significant damage and quickly wear out a belt.



### ***Belt Rip Detection***

One of the key agenda items for this meeting organised by Troy from Northparkes was to get Graham from Newcrest to present a belt rip detection system developed by him. Troy believed that this system represented a significant improvement over previous systems. A short overview of the information presented by Graham is given below and a copy of his presentation is given in Appendix 1.

One of the highest risk problems with conveyor belts is a longitudinal rip in the belt. The most common system used to detect belt rips is the Goodyear Sensor Guard that uses sensor loops, which are imbedded antennas every 50 meters in the belt. If there is a belt rip then one of these loops will be eventually be broken and a sensor can detect the broken loop. Graham from Newcrest has had a 25 year history of involvement with belt rip detection systems both from as a supplier, service organisation and from a belt user point of view. Graham's view of these systems is that they have had a poor record of performance with sensor loops having a habit of failure and the systems being generally unreliable. The result is that they are often switched out of service.

Graham has developed a system that he believes is far superior to the sensor Guard system. Newcrest has allowed Graham to patent his system and it is now commercially available to



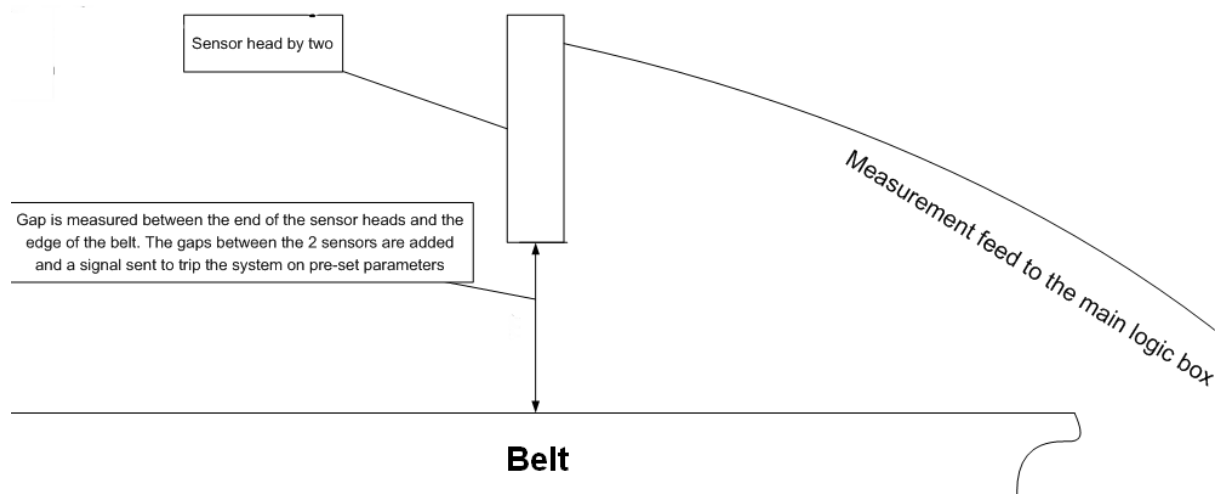
purchase through his company. The system is made up of three components, the second and the third items of which is patented by Graham.

- An improvement to the standard return carryover piano detection system using a laser
- Sets of angled trough idlers that will open any belt rip that occurs. The angle set on the side trough rolls sets the belt opening force applied.
- Sets of ultrasonic proximity position sensor that measure the location of both belt edges so that if a gap opens up from a rip it will be easily detected. The system identifies the belt edge defect locations to avoid false alarms. The system will also monitor belt tracking problems.

Graham's recommendations for belt rip detection in order of simplicity and cost.

- Most cost effective protection is to have a piano wire or laser detection trip system just behind the most likely location of a rip initiation located just above the return run of the belt. Graham suggested that in situations where a belt rip occur, some material will get through the rip and be carried on the return belt below. When the material on the return of the belt hits the piano wire (or laser) and trips the conveyor.
- The next stage of protection is with the addition of the angled trough rollers to guarantee that material will fall to the return belt if there is a rip.
- The full system of protection is with the active belt edge sensing so that when the when the belt edges moved apart due to a rip, the conveyor will trip after another 250mm of travel.

The complete system would be about \$35,000 and just the angle trough rollers would be about \$8,000.



## ***Gearboxes***

Michael for PWCS was asked about the rating for their gearboxes. He indicated that most of their gearboxes for belt drives have a service factor of around 2.2 or 2.3 minimum. He suggested there is some initial indication of their boom conveyor drives may be working a lot harder than that but he still has to do that investigation. Peak loads are also very important.

## ***Motors and Controls***

Northparkes were asked what the new drives they were using and they indicated that they were Fuji VVVF drives. Gary from PWCS asked about what testing Northparkes do on their

motors. They indicated that they get ABB in to do their motor condition testing and the biggest problem they have is flashover of their wound rotor LR motor brush gear. There was a discussion about cleaning of brush gear and Northparkes indicate they only vacuum the carbon dust because of concerns with carbon dust and the effect on people. Gary from PWCS indicated that they have never had a flashover of their wound rotor LR motor brush gear in 20 years and they blow out the carbon dust every 72 days on their motors. Gary indicated that the guys that blow out the motors use face masks and clear the area before they blow. They also did a change of carbon brush specification a few years ago to reduce carbon build-up.

Gary said that PWCS also get Wayne Cox from EMT in the do off line high voltage partial discharge testing of their motors. What they do with the results is rank all their motors from best to worst and so they know which one should be changed out next. They have decided not to change out on age. Gary indicated that they were also using on-line partial discharge testing. This was done by just attaching some coaxial cable to the motor RTD's. Motor spares storage was raised and Gary indicated that their spare high voltage motors have motor heaters and they have PM's to make sure the heaters are working. They also do high voltage testing of any motor before it is installed.

Gary from Newcrest indicated that they were looking at using Dry Ice Blasting to clean out the motors on their SAG Mill. There was general agreement that Dry Ice was an excellent method of cleaning in difficult applications.

Troy from Northparkes indicated that their electrical guys also use thermal imaging for their electrical gear.

The issue of Taco reliability for units directly mounted on motors was discussed. The problems usually occur on shutdown. The direction people were going was to use encoders, such as a hollow shaft encoder that can be easily mounted without alignment. Alignment of encoders is a major issue and a solution recommended is to use a garden hose as the coupling and this eliminates the problem with the very fiddley encoder alignment.

### ***Scrapers and Belt Cleaning***

Marcus from Northparkes indicated they use Razor H & P type, which has been pushed recently and underground they have had Hoch for a number of years. Michael from PWCS indicated that Razor are being used by them as well. He suggested some of their problems with scrapers are where the carbide tips start delaminating off the frames and as some of their bars can be up to 4.5 metres long they get bar deflection. Michael has been told that the Razor scrapers have been based on the Belle Banne scrapers, which are supposedly better quality. Graham from Newcrest indicated that he had some lab tests on the materials in the Razor and Belle Banne scrapers and confirmed that the materials were not the same as claimed but that the Belle Banne materials were higher quality. Gary and others from Newcrest spoke positively about the Belle Banne scrapers they use. Kirk from Northparkes indicated that he currently has a side by side comparison between the Razor and Belle Banne scrapers.

Matthew from Northparkes indicated that they see a big difference in scraper requirement with the length of belt. On their shorter belt they can get away with ESS scrapers but with the longer belts were material has had a chance to settle out and stick to the belt, makes for a much harder application. Graham from Newcrest indicated that they still use ESS blade scrapes on their fabric belts but they struggle with the clay and in that situation the secondary and tertiary scrapers do a lot of work. He indicated that on longer belts there also tends to be

much more damage, which also has an effect on scraper tips life and on scraper performance. Graham also suggested that another factor is the tip loading. He suggested that some research that was done by SECV in Victoria a number of years ago indicated that an 18 kgs loading for Belle Banne tips was optimal, rather than the 12kg that is normally recommended. There was a lot of discussion about the specifics of setting up scrapers with the angle requirements, tension, issues of washout, etc. There was a suggestion that many of the suppliers have not a high level of expertise of setting up scrapers and often tend to be more salesmen than technicians. Also it was suggested that everyone tends to be an expert at setting up scrapers with all having slightly different ideas of what is ideal. Andrew Palmer is an expert that Newcrest brought up from Victoria to help them with their scraper problems.

A question was asked about water sprays on scrapers. Graham from Newcrest indicated that he recommends that water sprays never be used unless there is absolutely no option. He suggested that water can be very damaging for steel cord belts as one nick can be an entry for moisture which allows the cords to start corroding. He also suggested that if water gets inside a fabric belt it can pump through the belt and be damaging. Graham suggested that you should put two or three scrapers on a location before you consider having to put water on.

Clay in product was a topic of discussion and the blockages that this material causes. There did not seem to be too many solutions available. Running slower was discussed as a solution, which seemed to work sometimes. One win Northparkes has had is with the purchase of a pencil jet high pressure water spray system to clean out clay build-up from chutes etc. Rather than trying to wash the clay out with a normal water hose the pencil jet can cut the clay to remove it. The secondary advantage is that a lot less water is used. See photos below.



**Site Tour of the Northparkes Mine**



# Appendix 1

## ***Belt Rip Protection Presentation***



## Conveyor Belt Rip Detection





# **Belt Rip Detection**

## **Here at last!**

**–Over 12 months in developing and reviewing.**

**–Why?**

**After over 25 years in mining and researching to find a system that actually worked and “stayed working” and easy to use**

**Now there is a system designed by someone who understands belts and uses the belts natural functionality to report back and manage belts as required.**

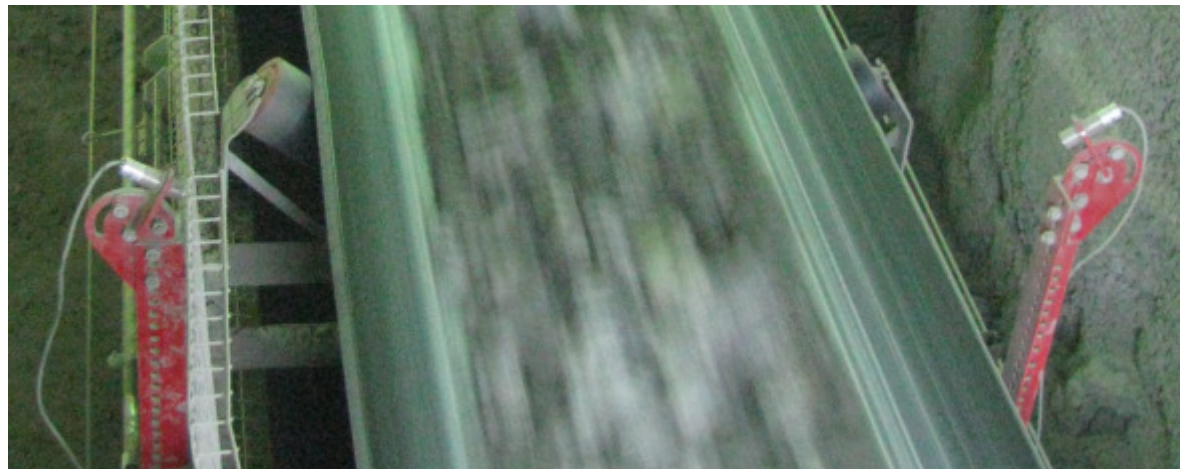
**This system will not only pick up Belt Rips but also Edge Damage, Belt Wander, Carry Back and Height issues.**



# Belt Rip Detection

## How it works

- Gap is measured between the end of two sensor heads and the edge of the belt.
- The gaps between the 2 sensors are added and a signal sent to Trip / Alarm the system on pre-set parameters.
- Sensors in the edge of the allow the system to know where the belt is and able to re-set itself in relation to any preset exclusions due to pre-known damage which has been blocked out.
- Idlers are placed prior and just after the area which steer the belt apart if the The belt receives a rip.

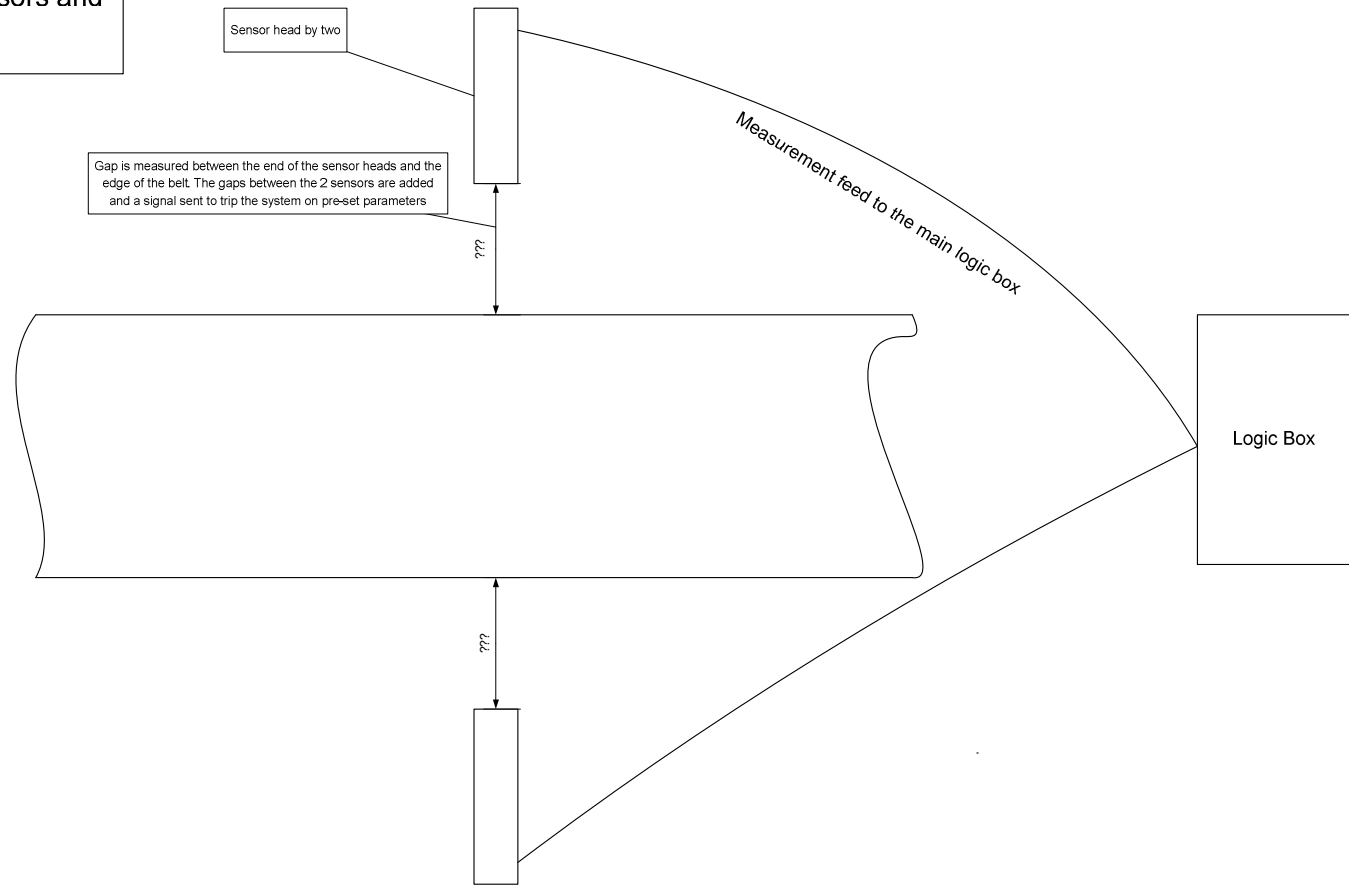




# Belt Rip Detection

## How it works

DESCRIPTION  
Figure B Edge Belt Sensors and Logic Box





# Belt Rip Detection

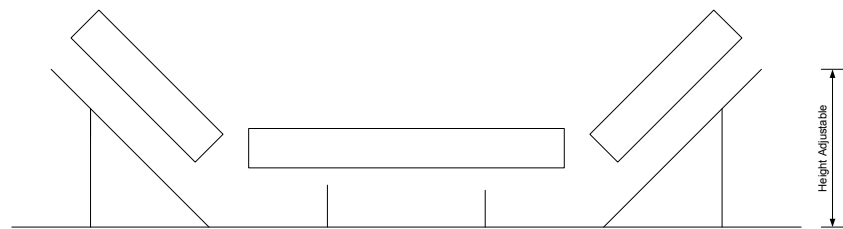
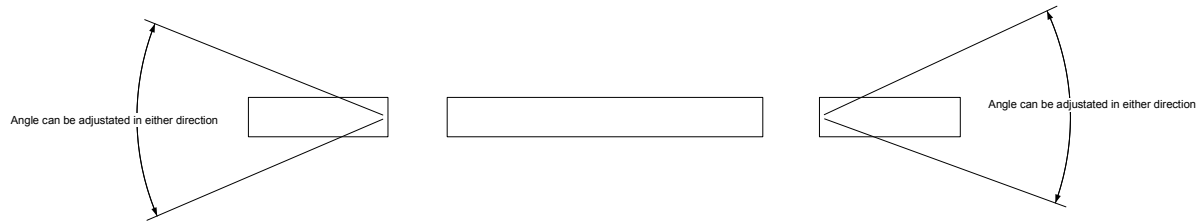




# Belt Rip Detection

A conveyor can easily be tracked in the longitudinal movement of the belt. By installing idlers sets which are set up correctly in the event that a rip occurs the belt will be drawn apart. As the belt is drawn apart a change in width is obtained which can be monitored and picked up by the side sensors.

LABEL  
Figure A. Idler Adjustment





# Belt Rip Detection

## Advantages

- Amount of belt that is exposed is limited to the distance from transfer to The detection unit. In most cases this will be about 10 meters.
- Unit will detect along the entire length of the belt.  
(Measures approx every 250mm.)
- New system will pick up edge damage where the old system would allow us to lose up to 100mm of edge either side.
- New system is easily set up and extremely simple in its programming and functionality.
- Can be wireless or hardwired in.
- Reports can be easily obtained on belt width and changes if required.
- Damaged areas can easily be blocked out so the belt can operate with known damaged areas without exposing the rest of the belt.
- System can also double up as a belt tracking system.
  - Where as normal belt wander switches will trip, this system can both alarm and trip at set points.



# Belt Rip Detection

## Advantages

- Unit is easily serviceable and repaired while the system is running.
- Fraction of the cost of other systems
- Allows sites to use the full thickness of return cover and more without reducing risk in identifying rips
- Do not get locked into some more expensive belt due to having to have their sensors placed in the belt
- System will work on any existing Conveyor System and will pay for itself after identifying only one rip.
- Changes will enhance the current material spillage wire trip system.