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# CBM – South Bulli Drift Conveyor

## Maximising the return on your assets

## Conveyor Belt Monitoring (CBM) Australia

**SUMMARY**

A direct savings of over $ 1,050,000 by the South Bulli Coal mine has resulted from deferring the purchase of new replacement steel cord belting for over 9 years, for its Overland Drift conveyor. The deferral of this capital expenditure and the resultant savings to the mine is the direct result of regular belt condition monitoring of the Drift belt utilising the Conveyor Belt Monitor - CBM.

**THE SOUTH BULLI DRIFT CONVEYOR**

The South Bulli underground coal mine, owned by Austen & Bucta, is located in New South Wales, Australia. Annual production ranges between *1.5* to 2.0 million tonnes of coal. The mine currently utilises a single long drift conveyor to transport run of mine coal to the surface. The 10,000 Metres (32,800 ft) of belting on the conveyor is 914 mm (36") wide, rated at ST 2200, and is comprised of both Goodyear and Olympic steel cord belting. The 46 steel cords are 7.6 mm diameter at a 19.5 mm pitch. 23 stage 1 splices were installed during the original belting installation; however, belt replacement and repairs have increased this to the present 48 splices.

The original drift conveyor involved 14,000 Metres of belting, installed in two stages; 7,000 Metres in December 1969, and a second 7,000 Metres in December 1971. In 1980, a decision was made to increase the throughput capacity to accommodate anticipated production increases. As part of the modifications, the Drift conveyor was shortened to the current 10,000 Metres belt length, and belt speed increased from 3.0 to 3.9 Metres per second.

At the time the conveyor system was shortened, the most severely damaged belting was removed from the system. The sole criteria for the selection of belting to be removed was the visual condition of the belt. Despite having some severe visual damage, *2,500* Metres of this belting *was* rolled and stored on-site as emergency spare belting, in case of a serious belt rip or similar emergency.

**CBM – HISTORY OF MONITORING THE SOUTH BULLI DRIFT BELT**

At the time of original installation, both the engineers and belt manufacturers anticipated the belt life to be approximately *15-16* years. This would mean replacement would be expected to occur in 1984-1985. Using only visual inspection to evaluate the belt's condition, the Mine's engineers admit that the majority, if not all of the belt, would likely have been replaced as scheduled in 19*84-1985.*

As the target year for replacement approached, the Mine engineers learned of a ***non-destructive, belt condition monitoring system*** which had recently been developed. The system was called the Conveyor Belt Monitor - CBM. The Mine contacted Beltscan Pty. Ltd. - the sole world-wide licensee of CBM - and the initial monitoring scan of the drift belt was performed in 1981.

The results of this initial CBM scan were enthusiastically received by the Mine engineers. The CBM data revealed that the belt carcass was not in as serious a condition as regular visual inspections had indicated. In fact, ***much of the damage sustained by the belt was purely cosmetic damage to the rubber covers and edges***. The steel cords were generally in good condition for the majority of the belt length.

The most significant and immediate benefit of the CBM scan was ***the identification of the precise location of all areas in the belt involving serious cord damage***.

With this information in hand, the engineers were able to institute a belt maintenance program designed to remove all of the significant carcass damage.

Since that first scan, the Mine has employed Beltscan and the CBM system to conduct regular examinations of the belt. Initially, through the mid-l980's, these scans were performed at 12 month intervals. ***As belt damage generally remained minimal, the belt continued to operate past its originally projected replacement date of***

### RELATED SERVICES

- CBM – Conveyor System Inspection
- CBM – Remote Monitoring
- CBM – Semi-Remote Monitoring
- CBM – Steel Cord Belt Scanning
- CBM – Fabric Belt Scanning
- CBM – Driver / Idler Thermography
- CBM – Reporting
- CBM – Cover Thickness Testing
- CBM – Longitudinal Cover Thickness Testing
  Available From March 2011
- CBM – Longitudinal Rip Detection
- CBM – Vision and Profile Monitoring

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***1984-1985***. The CBM data and Beltscan reports were used by the Mine to immediately remove or repair significantly damaged sections of the belt. In most instances these areas involved only very short lengths of belt, less than 1 metre in length. During this time a close working relationship developed between the Mine engineers, Beltscan technical personnel, and the Mine's belting contractor, Illawara Conveyor Belt Services.

In the later part of the 1980's, it became evident from the CBM data that as the belt aged, the RATE of damage was also increasing. CBM monitoring was subsequently increased to 6 month intervals, and the process of removing and/or repairing the most severely damaged belting continued. In 1990, 6 years beyond the original projected replacement date for the belt, scanning frequency was further increased to 3 month intervals. This interval was determined by the deterioration rate of the damaged sections of the belting.

**REPLACEMENT SEVERELY DAMAGED BELTING**

By 1990, the CBM data revealed that the magnitude of damage sustained by some sections of the belting was considered to be extreme, and that reliable repairs were no longer possible to some areas. A decision was made by the Mine to replace the most severely damaged sections of belting, approximately *2,500* Metres.

The replacement options available to the Mine were few:

- Purchase and install new belting,
- Attempt to locate and install compatible used belting.

***A third option became available as a result of several discussions between the Mine and Beltscan***:

- The usage of 2,500 Metres of the original belting installed in 1969, but removed from service due to the conveyor modifications of 1980. This belting had been removed from the system, rolled into 8 rolls and placed in storage on the Mine Site.

However, the 'true' condition of the belt rolls, particularly the cords, was not known at the time of removal. This belting had been removed from the conveyor system in 1980, after 10 years of service, as it represented the most severely damaged belting at that time. Note that this decision to remove this belt was based solely on 'visual" inspection, as **it** occurred was 1 year BEFORE the initial CBM monitoring was performed on the belt.

During discussions with the Mine in 1990, no-one on the minesite could provide hard documentation as to the actual condition of these rolls of belting. Therefore the mine requested Beltscan to determine if any reliable monitoring of the belt could be effectively performed.

Beltscan and Illawara Conveyor Belt Services, jointly devised a procedure to scan the 8 rolls. A method of spooling each belt roll at a constant and acceptable speed through the CBM equipment was devised. ***The result was a complete set of CBM data for each roll that precisely identified all cord damage for the full length of the roll***.

The CBM data revealed that the majority of this belting was actually in very good condition, particularly when compared to some of the belting that was currently operating in the system. Based on these results, a belt replacement program was devised to remove the worst belting from the system, by making the most efficient use of the 8 rolls of "stored" belt. The most severely damaged sections of the operating belt were identified from the most recent CBM data of the belt. This replacement was successfully executed over the Christmas shutdown of December 1991 and January 1992.

The cost savings to the Mine from the re-installation of the removed belting was astounding, as noted below:

COST OF 2,500 M. OF NEW REPLACEMENT BELTING
USD$ 472,500.00

COST OF MONITORING 8 ROLLS OF USED BELTING ON SITE
USD$ 30,000.00

**DIRECT SAVINGS TO THE MINE**
**USD$ 442,500.00**

It has been assumed that the belt removal and replacement costs would be comparable, whether new or used belting was installed.

**COST BENEFIT ANALYSIS OF REGULAR MONITORING**

As of this date, the majority of ***the belting has exceeded its projected replacement date by 9 years***.

The postponement of the purchase and installation of a full replacement belt can be directly converted into a large dollar savings for the Mine's capital, maintenance and operating budgets. The REGULAR application of CBM belt monitoring to the 10,000 Metres of belting has provided enormous cost benetits and savings to the South Bulli Mine.

To simply assess at the actual annual cost benefits the Mine has realised, 3 items must be considered:

- The annual cost of CBM monitoring,
- The annual cost of belt maintenance directly resulting from CBM monitoring,
- The annual savings to the mine by deferring the capital purchase of new belting. This is taken as 10% of the replacement belt purchase cost.

These amounts are summarised in the chart and graph in Figures 1 and 2 below.

By subtracting the CBM and maintenance costs from the annual savings resulting from the deferral of new belt purchase, there has been a ***net savings of USD$ 1,057,689.00***.

Note that the annual savings has changed between 1990 and 1991 to reflect the installation of the *2,500* Metres of replacement belting installed. Had the spare belting not been available on site, *2,500* Metres of new belting would have been purchased and installed, thus reducing the overall annual savings. However, as previously noted, there also had been an immeliate_direct saving of USDS 502,500.00, since good quality used belting was available, and new belt did not have to be purchased. This is in addition to the total USD$ 1,057,689.00 annual savings total.

Furthermore, the total savings from 1985 to 1993 is a simple addition of the annual savings due to the deferment of the belt purchase. There has not been any additional cost benefits included that could result from any further investment of these annual savings.

It is evident from the graph that as the belt ages, the costs directly related to maintenance increase. It might be expected that operation of the existing belt should continue until the cost and the savings values become equivalent. However, there is an additional factor that must be considered: the inherent risk of catastrophic belt failure and its associated costs due to the natural ageing process of the belt.

## CATASTROPHIC BELT FAILURE COSTS

All conveyor belts age during normal operations. A steel cord belt is subjected to a myriad of tensions and stresses, all of which gradually fatigue the belting components, particularly the steel cords. As a result, the belt becomes more susceptible to damage with age. By extending the projected operational life of a belt, the internal components must function far beyond their design life. This significantly increases the risk of a catastrophic belt failure should an abnormal operating condition be encountered.

It is impossible to mathematically determine the precise time the belting has reached the "point of no return. However, regular CBM monitoring will provide the information from which all parties concerned can determine when the risk of failure is increasing faster than the ability to effectively maintain the belt in a safe operating condition. As the belt approaches and exceeds its projected life, monitoring is normally increased. The benefit to the belt operator is that maintenance can be directed to the areas of largest carcass damage, thus minimizing the chances of catastrophic belt failure.

It has been estimated by the Mine and belt contactor that a catastrophic belt failure or rip to this belt would result in a belt shutdown of up to 120 hours. Since such a failure would result in total shutdown of the mine, the value of the loss of production could exceed USD$ 1.85 million.
Average Mine Output 600 tonnes/hour
Average product price per tonne USD $ **40.00**
Cost of 120 hour belt failure USD$ 2,880,000.00

Although it cannot be stated with certainty that regular CBM monitoring prevented such a catastrophic accident, there is no doubt that the probability of such an occurrence has been reduced. This is the direct result of the regular identification and removal of severely damaged belting.

**Annual savings from deferment of new belt purchase**

| YEAR | CBM COST | MAINTENANCE | SAVINGS |
|---|---|---|---|
| 1985 | 5,142 | 30,000 | 195,000 |
| 1986 | 5,142 | 33,750 | 195,000 |
| 1987 | 9,963 | 37,125 | 195,000 |
| 1988 | 14,784 | 39,153 | 195,000 |
| 1989 | 18,642 | 40,500 | 195,000 |
| 1990 | 52,927 | 42,525 | 195,000 |
| 1991 | 24,427 | 43,875 | 146,250 |
| 1992 | 26,356 | 47,250 | 146,000 |
| 1993 | 29,250 | 50,250 | 146,250 |
| | 186,633 | 364,428 | 1,608,750 |

Figure 1
*(All figures in US Dollars)*

**CBM Cost + Maint Cost (Light) Vs Savings (Dark)**

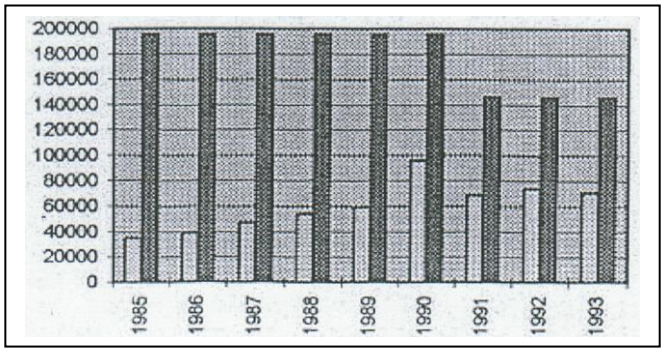


Figure 2

## CONCLUSION

***The usage of CBM monitoring and prioritised maintenance has allowed for continued operation of the majority of the original belting far beyond its expected 15 year life. The result has been an annual savings of over USD$ 1,000,000.00 from the deferrment of the capital cost of purchasing new replacement belting. In addition, a one-time savings of over USD$ 500,000.00 was realised by the usage of spare belting.***

***The CBM system is a modern preventative maintenance tool, tried and proven on hundreds of steel cord conveyors throughout the world. This illustration of the Drift conveyor at the South Bulli Mine is just one instance where CBM monitoring has assisted in:***

- ***Significantly minimise the risk of operating important conveyor installations,***
- ***Extend the SAFE operating life of existing belting to its maximum,***

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- ***Maximise the usage of belt maintenance budgets through accurate identification and assessment of cord damage,***
- ***Save captial and maintenance budget money by assisting the belt operator in predicting/budgeting belt replacement and repairs.***

*Details of the CBM monitoring program: The South Bulli Mine first appeared in a paper by Mr. W. Heslop, Chief engineer, in Mining Technology, the journal of the Institution of Mining Electrical and Mining Mechanical Engineers, and we are grateful for their permission to reproduce this information.*

## ABOUT CBM

In the preceding article regular reference is made to "Beltscan" which is one of the previous owners of Conveyor Belt Monitoring

Conveyor Belt Monitoring (CBM)International Pty Ltd is an International Organization based in Sydney, Australia, that has been condition monitoring conveyor belting since 1980.

During that time CBM has been able to develop the most comprehensive conveyor belt condition monitoring program available in the world today.

***Our Aim –***

***"To Extend The Safe Working Life Of All Conveyor Belting".***

CBM now uses the most up-to-date reporting techniques available. Data from your belt is stored digitally and over time becomes part of a database. This database is carefully analysed by a professional engineer, using intelligent propriety software, from which conclusions and recommendations are made. These are passed on to you either on an "exception only basis", or in the form of a comprehensive written report – whichever you prefer. The written report format has been very carefully structured to make it easy to read, understand and to act on. The report is available in hard copy, on CD Rom or can be directly downloaded if you desire.

## CBM PARTNER'S STATE

***CBM is a worldwide leader in Conveyor Belt Monitoring. With millions of kilometres of belt monitored. CBM has a long tradition of R&D and bringing to market beneficial technologies.***

***Technical knowledge and constant training of staff and distributors, ability to provide timely targeted information, are strengths that we appreciate.***

***CBM is completely independent of the conveyor belt manufacturers. Their systems are designed to work on all conveyor belts, of any speed and all material types.***

***This ensures safety and security for the companies that we service.***

## CBM INTERNATIONAL P / L

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