Twenty Years of Beltcon and its Contribution to the Development of South African Overland Conveyor Technology

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Introduction

There is a saying in Politics that “Cometh the time, cometh the man !“. In preparing this paper I have come to the conclusion that maybe in the engineering of conveyors that this saying can be paraphrased as “Cometh the time, cometh the conveyor”.

You will undoubtedly ask the question why ? and it is my intention to illustrate that, at least here in South Africa if not elsewhere in the World, conveyor design has been the product of the Social, Political and Economic factors ruling over the past 20 years.

As if to add weight to my premise, it will be seen that, in the main the most local advances in conveyor use and technology has been in coal transportation.

Twenty years ago, in 1983, Johannesburg hosted Beltcon 2, and at first sight that would be the ideal starting point for this paper. However on further thought one cannot simply compare the conveyor designs, the clients wish lists nor the general requirements of the Industry without examining a host of other factors. In so doing many of these factors will be unknown to engineers who have still to see 35 years of age and perhaps forgotten by those who will never again see 35.

Thus in this paper I intend taking you back in time, first to the 1980’s then to the 1990’s before coming up to date in the 2000’s and then ending on a glimpse into an unknown future the 2010’s and Beltcon 16 in 2011.

Beltcon 2 1983

You, my mythical engineer, are now sitting here at Beltcon 2 eager to hear about the latest conveyor technology and how it can benefit your particular industry. You are about to hear from knowledgeable authors from overseas and of course also South African designers and suppliers.

As a junior engineer you arrived here today from one of the Transvaals' Witbank coal mines on a relatively unbusy highway in your new BMW 316 for which you paid between eleven and fifteen thousand Rand. You are relaxed and looking forward to a 3 day break, confident that back at work your colleagues are perfectly capable of carrying on without you. Two rows back from you is a contingent of your engineering superiors from Head Office and colleagues from sister companies.

You wonder which of the supplier companies will look after you tonight and where you will go to for dinner and other joys. That there will be a well lubricated party is certain and hopefully you won't feel too bad in the morning.

Come the weekend your brother will be home on leave, hopefully unscathed, from the War in Angola, a war fought against Cuban's armed by Russia, in aid of Jonas Savimbi's UNITA movement, which in turn is armed by the USA via South Africa. Come Saturday you will probably go to a Currie Cup Rugby game, since most International Sport is not available to us because of sanctions.

Apartheid is well and living and the country, as President P.W Botha informs us we are facing a total onslaught from both Russia & the West.

With the country divided into so called independent homeland states, a policy of strict influx control is in force. While a Decentralisation Board concentrates in forcing industry into these Bantustan development areas.

Where agriculture is concerned 1983 is in the middle of a drought which results in Maize being imported. On the mining front the Gold price has fallen from its high 1980 price of $ 850 per ounce to below $ 413 which at the rate of exchange of $ 1.00 = R 1.09 equates to R 450. The Prime Rate stands at 14%, with inflation at 17% and worse of all the Country's growth rate shows a horrifying minus 3.2 % !!
The national debt is a massive $ 65.8 Billion.

This all contributes to conspire to bring together all the weaknesses in the Economic system and its inability to export, either to the West or to Africa, in order to substitute for the wasting Export asset, Gold.

However within the Mining Industry Cinderella is putting on the Glass Slipper and is about to become the Belle of the Ball in the form of Coal.

Coal became high profile to feed Eskom's plant need renewal, particularly since the civil war in Mozambique deprives us of the expected electricity supplies from Cabora Bassa (Now Cahora Bassa). Also, despite sanctions, the West needs steam coal, as Europe's supply dwindles and their electricity demand increases.

The Gold mining industry continues however to thrive, together with Diamonds and with the advent of Black Mountain, Lead and Zinc. For conveyors, these industries are no cornucopia since they all have embarked upon increased productivity via the route of trackless mining. New developments include the new underground mines of Finsch, Koffiefontein, Black Mountain, 5 Shaft Free State Geduld, 10 Shaft Free State Geduld, Oryx, Beatrix and Joel, but all trackless.

While in coal the trend is to the euphemistically called open pit, but with typical South African innovation not open pit at all but longitudinal "Box Cut" with overburden thrown by blasting over the cut. Here at last, because of the advancing nature of the box cut and therefore increased distance from either washing plant or power station is an opportunity for conveyors.

Such new coal mines include Arnot, Middelburg, Rietspruit, Kleinkoppjie, Arthur Taylor, Duhva, Khutala, New Vaal and underground mines like Khutala, Koornfontein's Gloria, Majuba, New Denmark, Goedehoop, Kriel, Ermelo, the Sasol Secunda complex and Matla to name a few. These underground mines while following Gold's example also opted for trackless mining, but rapid face advance meant that trunk conveyors became a must.

So who are the owners of these mines and who are the designers and suppliers of conveyors ?

First the owners :-

Rand Mines, often in partnership with Shell Coal, Rietspruit being a good example of such joint ownership.
JCI again with partnership from Shell and then Total.
Gencor through its TNC (Transvaal Navigation Collieries).
Anglo.
Iscor.
Sasol.

Export being normally through the Transvaal Coal Owners Association, an essentially selling organisation for both local and export sales.

Exported coal is shipped, in small parcels out of Durban but with a new giant in embryo, Richards Bay Coal Terminal (RBCT) about to enter centre stage.

Who then supply conveyors and technology to these potential clients ?

They are mainly :-

Jeffry Manufacturing.
Edward L Bateman.
Cable Belt.
Krupp.
Robins Conveyors.

The technology available must now stand forward and be counted, and what of computers and dynamic analysis.

Well in the early seventies in the Rand Mine's Head Office we had a Technical Computing division which ran a Hewlett Packard 1130 computer using punchcards and idiot lights, it boasted one of two map plotters in Johannesburg and ran what to my knowledge was the only computerised conveyor design programme, that belonging to Hewitt Robins. Incidentally it was on this same computer that Noel Zollezsi of Rand Mines did his initial low coal ash calculations.

By 1983 we mostly use the ubiquitous hand held Hewlett Packard HP 41 CX with a main memory of 2,237 Bytes and ran design programmes using Basic. These programmes are stored on insertable mag strips which boosted the memory to an astounding 6,437 Bytes. The cost was in the order of R 1 600.

The Worlds first truly portable computer had been invented early in 1981 by Adam Osborne, there were obviously giants alive at that time because this "Truly Portable" portable weighed in at an impressive 10.5 kg !

By the end of 1981 some 24 companies had sold between them 724,000 personal computers for a total price of $ 1.8 Billion, by the end of 1982 over 100 companies had sold 2.8 million units for $ 4.9 Billion. Estimates for the number in use by the end of the Century are as high as 80 Million!

My Company has one of the first fax machines in town, before even Anglo, with a technology similar to VCR's, with Beta and VHS, in that you have the choice of two operating systems, where one can only communicate with a compatible system. There is no such thing as a cell phone and on major projects all dealings are with the clients Head Office and his team of Consulting Engineers, Subordinate Consulting Engineers, Junior Consulting Engineers, Junior Consulting Engineers in Training and Assistant Junior Consulting Engineers in Training.

Appointments are required for all Head Office meetings, and suits are the order of the day. Indeed for Anglo American your suit had better be pin- striped and your tie, varsity or learned association, if you are a Rhodes Scholar then the Sky is yours.

Let us now examine some of the papers :-

Piet Steynberg, who is Iscor's manager of Mechanical & Electrical Engineering delivers a paper entitled "Belt Conveying in South Africa, State of the Art". He begins by stating that while truck and rail haulage were historically the prime transporting system in the mining industry, spiraling fuel cost requires evaluation of alternative methods.

The advantages of conveyors are seen as :-

High availability.
Ability to operate in inclement weather.
Low labour requirements.
Independence from uncontrolled oil fuel costs.
Minimal environmental impact.

Such conveyors needed to be able to handle increased loading capacities and faster handling rates. In order to change direction overland conveyors require the use of several transfer points, although he adds that horizontally curved conveyors are beginning to be proved viable.

On the subject of availability Mr Steynberg presents figures showing conveyor availibilities of over 96% compared with main transport stream of 86%.

He goes on to show that previous attitudes resulted in conveyors being bought on price with little attention being given to design details in contrast to the detail brought to bear in evaluated the purchase of other capital plant. Thus conveyors tend to be too narrow, underpowered and generally underdesigned. Iscor's records showed that if insufficient capital was invested in conveyors then the capital savings were soon squandered in additional running costs, in as little as 2 to 3 years.

There were records to show that 60% of pulley failures were due to shaft and bearing design shortcomings and the same applied to idlers. Problems had even been experienced with too narrow belts, poor chutes, inadequate stringer centres, incorrectly calculated vertical radii and take up towers incapable of carrying the necessary counterweight mass to prevent belt slip on start up.

Primary areas of concern with regard to design include the lack of emphasis between peak tph and annual average tph and unwise assumption of high drive pulley friction factors.

He now details factors that should be paramount in conveyor specifications :-

Sticky & moist material.

Chute layouts.
Conveyor inclinations.
Take up layouts.
Vertical radii.
Transition distances.
Belt carcass.
Pulleys.
Drives.
Reducers.

These were all important as both conveyor lengths, speeds and tonnes carried were on the increase in South Africa, for example there were now single flight conveyors in use of more than 5 km in length.

Looking to the future he predicts a wider use of conveyors in in-pit and hard rock applications with trends towards wider, longer and faster conveyors, citing German lignite mines where 6 m wide belts and 10 m/s were not uncommon. He makes no further comment in respect of 10 m/s conveyors but does add that Iscor had used 6 m/s but 4 m/s was the more common speed.

An added rider was that for this to come about, many physchological and technological barriers needed to be overcome.

Our friends Messrs. Harrison & Roberts all the way from Australia, discuss "Trends in the Application of Troughed Conveyor Belts " from the basis of the need to move away from high safety and other design factors which are expensive and unwarranted.

This could be achieved by the application of engineering dynamics and economic analysis which could result in reducing existing safety margins from 10:1 to as low as 3:1.

Areas of research and understanding are discussed such as :-

Reduction in Belt Safety Factor

Australian data showed that 6.67:1 was common but could possibly be reduced to 4.5:1. However the data showed no supporting argumentation although in a later paper a safety factor of as low as 3:1 is discussed.

New Belt Materials

The use of Kevlar and other polyester derivatives, is discussed, as possible alternatives to steel cord on the basis that their lightness reduced overall belt mass. However they are subject to problems such as flexibility, adhesion and weakness in compression (Kevlar in particular).

Rubber

Additives employed for fire retardation and antistatic properties (FRAS) result in reduced flexibility. Research has shown that belt flex and age increase the work hardness, on reaching 75 to 80 degrees the cover will crack and extend into the bonded layer. Since this also affects splice strength the Authors strongly recommended that safety oriented groups did not try to enforce the use of totally FRAS belting.

Increased Belt Speed

Economic models established by both the CSIRO and Newcastle University showed that conveyors should operate as fast as possible and that they should be narrow.

Conveyor Monitoring

This was an on site system using a Conveyor Belt Monitor (CBM) and was stated to be gaining acceptance in South Africa and Germany.

Total System Design.

The need for a holistic approach embodying energy losses and environmental issues such as noise, water pollution dust etc.

They conclude by predicting that conveyor systems up to 100 km could become feasible and that already the belt conveyor was more attractive than road or rail for distances up to 30 km. Indeed a curved overland conveyor system was operating in Australia in excess of 10 km.

An interesting paper from England is “Steelcord Drift Conveyor at Selby Colliery” in which P D H Comley the Selby Chief Engineer echoed much of Piet Steynberg’s views in reiterating that Reliability, Safety, Optimum Life Ratings and Maintenance Requirements were more important than initial capital cost.

He further goes into the need for the smoothest start possible, where high tonnage and fast conveyors are concerned. For lower powered installations the use of scoop controlled fluid or eddy current couplings were available but other means were required for high powers.

These he lists as :-

Slip ring induction, with liquid controller.
Cycloconverter- Variable Speed AC drive.
DC winder type motor.

Again he concurs with Piet Steynberg on the subjects of Take-ups, Support structure, idlers and chutes.

The Selby Conveyor system so described handled :-

5,000,000 tpa.
5 000 hrs/a.
Receives coal from all or any combination of 11 bunkers.
Must not add appreciably to the ambient temperature of 25 – 30 dgr.

It is interesting to hear the Chairman of Cable Belt Conveyors (Pty) Ltd, Ian Thompson then describe " The Cable Belt Conveyor at Selby Mine ".

We also hear from the Users Society for Engineering Resources and Services (USERS) in a paper representing the joint views of Iscor, Escom and AAC being entitled " Belt Conveyors an Expression of the USERS Viewpoint" whose Authors are R G Van Heysteen, L Zeederberg and W Spencer.

They support the view that the use of conveyors is growing faster than wheeled transport and pipelines and that conveyor projects of R 10 M to R 20 M are becoming commonplace.

There were trends towards mining methods being designed to reduce lump size in order to facilitate conveyor usage and towards longer conveyor systems.

The example of a 16 km system carrying 3 200 tph at 8 m/sec on a 1 300 mm belt and having a lift of 1 000 m was quoted. Unfortunately no other details are given but we assume that from the belt speed this was a lignite operation in Germany.

Once again the subjects of Specification and Standardisation are discussed and it is interesting to reflect on some of these :-

Standardisation and Quality
Despite reluctance from some suppliers these aspects are receiving attention but more work is required on the quality of designs.

Pulleys
The major users are considering approaching the SABS to develop a pulley specification. This situation has arisen due to high incidence of pulley failures which caused a major user to investigate and compare local and International design capabilities. This led to the conclusion that local designs were

inadequate and the reactions of these suppliers being considered uncooperative.

Idlers
Dimensionally to SABS 1313 - 1980 but no performance or critical design factors are included due to lack of acceptance by the SABS committee.

Pulley Bearings
The two major suppliers have different dimensions and geometry and current designs are not in accordance with users requirements. An SABS standard is required.

Future Standards
An important need to review current standards and to draft standards where they do not exist. One User has at considerable expense embarked upon an exercise to update their current conveyor design specifications. In so doing they found that the old one contained over 30 different friction factors taken from suppliers technical data . The new standard uses one, which is close to ISO, that being 0.022. It also for the first time includes the mass of revolving parts, being information that suppliers had previously refused to divulge.

Beltcon 2 is now over and our Engineer sets off for home, for him now there is a time of reflection on the conference and some worries for the future. Were the last three days useful ? if so what were the important points raised.

Yes, he totally agrees with the need for improvements in standards and quality in order to reduce his operating costs but what about these other fancy ideas. “Engineering Dynamics“ whatever that is and what’s all this talk about the environment ? we had better watch out for these “ Bunny Huggers “ or we’ll never know what can happen next.”

Does he have the courage to choose his next conveyor system on the basis of quality of design and not cheapest cost and will he dare to specify 1 800 tph on a 1 200 mm belt at 4 m/s instead of the usual 1 000 tph at 2.5 m/s on a 1 500 mm belt?

If our engineer is from one of the suppliers he has similar thoughts but in addition has had to face some humiliating comments from some of his clients.

The Years Between - 1983 to 1993
It would be nice to think that Beltcon 2 was catalytic in the events leading to Beltcon 7 in 1993.

The papers presented at Beltcon 3 were not in the main very inspiring with Sasol describing the uprating of Sasol 2 & 3’s conveyor systems and Cable Belt having two bites at the cherry with K G Milford describing the Selby (England) conveyor and there use in curved installations. The potential use of Kevlar fibre was highlighted by T Donkin & B Pulvermacher.

Although Dr Bahke of Krupp in discussing developments in design detailed the potential for curved conveyors in order to remove intermediate transfer stations. Intermediate and controllable speed drives were destined to assist the design engineer in this end.

Beltcon 4 was a different kettle of fish with some significant papers being presented. The case for dynamic analysis was presented in four separate papers by Larry Nordell, Proffesor Funke, W R Morrison and Athol Surtees. Conveyor drives also featured in three papers from Professor Funke, G N J Nel and S Gibson. This subject was continued in Trevor Page's paper "Large Conveyors - The Case for Total System Design".

Dynamics again featured at Beltcon 5 with a paper from Hector Dreyer, while belt speeds were discussed by A. Ullamnn and also H Lauhoff and Nigel Addyman. Two new subjects were "Instrumentation Control and Monitoring of an Overland Conveyor System " by C P Yelland and from Iscor's Willie Moller and Henry Ascuii a glimpse of the future with "The Planning of an Underground Manriding Conveyor System for Iscor's Tshikondeni Colliery". Finally Arnold Matthee made an impassioned plea for "The Need for Unified Standards for the SA Bulk Handling Industry".

Perhaps one of the most useful and yet simply stated papers is that by Graham Shortt in 1991 aptly called "Nuts and Bolts" which he presented at Beltcon 6.

In the same year several more complex papers examined the role of Conveyor Dynamics. These included work by Athol Surtees and S Zamorano.

1983's Beltcon 2 had seen much criticism leveled at the various equipment suppliers and at the SABC, not only for the paucity of Standards but at contradictory standards and even a reluctance to develop such standards.

Now at Beltcon 6 the topic of standards takes up a major share of the conference :-

> Adie Frittella presented "Conveyor Idler Standards".
> Michael-Stewart Lord discussed "Roller Bearing Characteristics for Maximising the Life of Conveyor Idler Rolls".
> "Conveyor Pulley Standards – A Possible Solution " was Max Schencks' contribution.
> Not be left out was Henry Simonsen who gave us "Standard for Conveyor Belt Covers".
> And, as if to ensure that the message was not lost, came papers from the SABS "SA Standards & their Relevance to Conveyors " by M Perrins and from P Eccleston " Engineering Standards & the SA Institute of Mechanical Engineers".

Suddenly there was, particularly in the Coal Industry, a proliferation of long and high tonnage conveyors. Some of these are listed below : -

1983	PPC Dwaalboom (Cement)	5 km @ 1 800 tph
1984	Optimum Colliery	6 km @ 1 200 tph & 3.57 m/s
1985	Eskom Tutuka	2 x 4 km @ 2 000 tph Ash
1986	Eskom Matimba	3.7 km @ 3 580 tph 3.7 m/s
1987	Khutala Colliery	2 x 755 m @ 2 400 tph with 155 m lift & ESVD
1990	Majuba Colliery	6 km @ 1 800 tph 4.5 m/s 3 km horizontal radius
1991	Sasol Syferfontein	1 x 8.8 km, 1 x 12.3 km both 1 200 mm belt @ 2 000 tph & 4.0 m/s
	Matla	1 x 3.7 km, 1 x 4 km both 1 500 tph 3.57 m/s
	Landau	3.2 km @ 1 350 tph 3.57 m/s 2 x 1 350 m radii

Beltcon 7 1993

We now revisit Beltcon 7 and our now Engineering Foreman works for the same Witbank Colliery and has traveled here in his new BMW 3 series which now costs him R 95,000. Whilst he works for the same mine, its parent company is different since in the intervening years there have been many changes in the coal industry.

Rand Mines has become Rand Coal and is about to disappear into Gencor. The TNC has gone and Shell Coal is on the verge of being sold to JCI Coal. Although Sasol, Iscor and Anglo are still in existence.

Even the main Conveyor Contractors have changed, so that :-

Hewitt Robins – gone.
Jeffry swallowed by Osborne (Joint Anglo and Gencor company).
ELB is now Bateman Materials Handling (BMH).
Krupp and Koch are still around.
LSL (Teckpro) have joined the scene together with Babcock and ETS.
Babcock.

Politically there are even more dramatic changes, the war in Angola is over, and in 1987 a US Presidential Candidate withdrew his bid when his extramarital affair became news. Still in the USA there were startling revelations regarding the covert

supply of arms by the USA in the Iran-Contra scandal, while the USA & Britain had been supporting Saddam Hussain's war with Iran.

In 1988 Russia withdrew her troops from Afghanistan after 9 years of conflict, while a year later the USA invaded Panama and "arrested" the Panamanian dictator. China was also not without problems when in the same year students braved tanks in Tiananmen Square demonstrating for Democracy.

However the most dramatic and unexpected event of 1989 was the collapse of the Berlin Wall which paved the way for far reaching changes in Russia.

As if the events of 1989 were not enough then 1990 was to continue the trend with the reunification of Germany after 45 years and here at home the release of Nelson Mandela from jail after 27 years. Just as the Soviet Socialist States of Russia were in their death throes so was Apartheid in South Africa with free elections being scheduled for 1994.

Just when you thought it safe, the USA and its Allies invaded Iraq following that country's occupation of neighbouring Kuwait.

Technology had also had its ups and downs, in 1986 the Space Shuttle Challenger exploded on take – off and in Russia a nuclear reactor at Chernobyl went into "Meltdown" causing a huge radioactive fall-out across Europe.

The Gulf war brought communication technology into the living room as the TV industry capitalised on Satellite transmission of live TV and telephony which required neither a TV Studio nor elaborate outside broadcast equipment.

Our humble hand held Hewlett Packard has graduated into desk top or lap top personal computers of 286, or if you are lucky 386 and there is even talk of colour screens. CAD systems are in great use and a 50 Mhz processor with a 486 DX mainboard and 32 MB hard drive will set you back R 11 000-00.

Our Engineer takes his seat in the Auditorium and looks around, here and there he sees some old faces but very few from head office and there are even a few black ones. The paucity of Head Office faces is due to "Rationalisation" and the resultant cut back in personnel to be replaced by "Outsourcing". While the war in Angola is over and his brother is home safely there is talk of big trouble during the elections next year, with the AWB predicting all out civil war.

The Gold price has fallen to $ 372 and with a $ / R 3.3 exchange rate this equates to R 1203 /oz , the Prime Rate shows little change at 16.25 %, inflation having dropped to 10% but the growth rate shows improvement having moved from minus 3% to zero !. The national debt is an improved $ 28.4 Billion.

The first paper to be presented is a joint Anglo American / Bateman Materials Handling collaboration "Belt Conveying Trends in the Nineties" in which Messrs. Page, Hamilton, Shortt and Staples described the 3.2 km long Landau conveyor.

This conveyor was initially designed in accordance with Anglo's standard design procedure followed by a Dynamic Analysis on a 386 Personal Computer using Advanced Continuous Simulation Language (ACSL) to mathematically model and analyse the behaviour of the conveyor in a continuous time system. ACSL had been in use since 1989.

In modeling the conveyor two drive systems were evaluated. A fluid coupling and an electronic variable speed drive. While the former was chosen the EVSD was assessed by the University of the Witwatersrand and found to be suitable.

Finally a design audit was carried out using software designed by Conveyor Dynamics Inc of the USA.

R Fauerbach of Krupp South Africa examines "Possible Trends in Belt Conveyor Technology " in which he states that "no one knows what the future holds…".

However he does predict a replacement of truck haulage by conveyors due to the high cost and high cost increases experienced with trucks. Such conveyors would need to be faster than the common 4.2 m/s of South Africa and elsewhere and would approach the norm of 7.2 m/s as was the case in German Lignite mines where speeds up to 15 m/s are being considered as feasible.

Such increase in speed will need to be accompanied by a reduction in down time but these will only by achieved with attention to : - Material Flow, Equipment and Control Systems.

Since there is load variation onto the belt on average the conveyor only operates at 60% of its design capacity therefore smoothing of loading rate by means of controlled feeding of properly sized material and the use of silo's and stockyards are all musts.

With increases in speed comes the requirement for smooth and controlled start up and this aspect is covered by Marion Otrebski in his paper "Attempts to improve Start – Up of Conveyors Fitted with Fluid Couplings of a Constant Filling Type ".

This subject is continued, in association with the monitoring of such systems, in the joint paper by A J Surtees and S Curry entitled “Refining Conveyor Specifications and Operating Procedures to Cut Running Costs and Downtime.

The subject of intermediate drives, raised by Dr Bahke in 1985, is enlarged upon and heralded as having an important role to play in Peter Gilberts paper “Tripper/ Booster Driving – Advantages and Trends in the Nineties”.

S P Zamorano in his paper “Mean & Lean, Conveyor Design for the Nineties“ advocates several requirements, which to many in the audience may seem impractical. In essence he advocates longer and faster conveyors as a means to reduce operating costs, quoting a 6 km belt carrying 2 000 tph at 5.8 m/s on a 1 050 mm belt. He goes on to recommend deep groove ball bearing as a means to lower rolling resistance and couples this to improved belting properties such indentation and flexing resistances. Stringer designs should also be improved since they not only add mass but contribute to noise through resonance. He ends by discussing of all things the, to many listeners far fetched, potential for carrying material on the return strand of a conveyor !!.

The Years Between - 1993 to 2003

Another ten years pass and in this period it is noticeable that many of the predicted developments come to fruition. This period, however can be best typified by being a period of dramatic and rapid change. Change in local politics, change in Mine ownership, change in operational thinking but perhaps the most important of these the acceptance of change.

It is interesting, while reviewing the last twenty years to find subjects being both repeated and developed. The former tend to come from Companies who are beating their own drum, while the latter are more likely to take up from where a previous author had left off. Typical of the former is Peter Gilberts 1995 paper “Tripper Driving in Multiples” and of the latter there are several examples such as Larry Nordells‘“ Rubber’s Impact on Belt Power, Strength and Life“, Philip Venter’s “Intelligent Conveyors – Dynamic Adjustment of Conveyors Under Variable Load Conditions” and “The Two Dimensional Dynamic Behavior of Conveyor Belts“ by Dr Gabriel Lodewijks, all of these from 1995.

The last cable belt conveyor installed in South Africa is the one at Middelburg Mine Services which was installed in 1982 t was interesting therefore to read

Messrs. Connell & Milfords paper “Cable Belt PVL Conveyor – Technology on the Move”.

1997 saw a major leap forward in not only conveyor technology but also in the courage of both client and design team, a project that embodied many of the thoughts and predictions of Beltcon authors over the years. I speak now of the 15.6 km single flight conveyor at ZISCO in Zimbabwe.

While carrying only 500 tph of iron ore at 4.25 m/s on a 750 mm belt , this conveyor has a horizontal curve and several vertical curves and is powered by four 250 kW ESVD . Most obvious when examining the conveyor is the total lack of stringers and the 5 m carry and 10 m return idler spacing.

This Conveyor was described in detail at Beltcon 9 in two papers, one by E. L Du Toit and A E W Fletcher and the other by Larry Nordell. Until 2001 this South African Conveyor was the longest single flight conveyor in the World.

Several other Beltcon 9 papers discussed fluid drives and EVSD, while further topics were on the subjects of flow control and chute design.

Perhaps not as high profile as the Zisco conveyor was Avmin’s man riding conveyor since this was a technology that had been used in Europe for many years it had rarely been contemplated in our mines. C P Hughe’s “An Overview of the Installation of the First Man Riding Belt Conveyor in a South African Gold Mine“ was perhaps also an example of the acceptance of change.

Meanwhile not to be outdone Matla Colliery installed a single flight 3 300 m long conveyor, underground, carrying 2 500 tph on a solid woven 1 250 mm belt at 3.8 m/s utilising tripper drives. Alan Exton presented details of this installation in his paper“ Tripper Driving by Means of Viscous Friction Transmissions in South Africa”.

Environmental issues were beginning to be felt as we entered 1999 and these were discussed in various papers by Hector Dreyer, Steve Brown, A E W Fletcher and E L du Toit with the legal aspects explained in two papers by Kosta Babich and Abe Bosman. Safety was also a major topic of discussion and was covered by Messrs. James & Walker in their paper “The Need and Practice of Design Risk Assessment” while Louis Pinel went further into the subject with his presentation of “Risk Assessment at Rietspruit Mine Services”.

As if to presage this paper Dr Gabriel Lodewijks opened 2001’s Beltcon 11 with a paper entitled “Two Decades Dynamics of Belt Conveyor Systems” which as the title suggests dealt with the developments in the field of dynamic simulation.

This was followed by Ian McTurk’s description of the 13.3 km system at Middelburg Mine Services. Following from Zisco this 3 belt system furthered the use of a stringer - less construction, has idler spacing of 4.5 m carry and 9 m return, utilised ESVD on the 8.9 km section and Drain type couplings on the other two. Interestingly

the 3.1 km first conveyor used structure, idlers and belting from the now defunct Majuba Colliery.

Alan Exton brought us up to date at Matla in his paper entitled “Matla Coal Revisited – Evaluation of Past Performance”.

Elsewhere Chute design and drive technology were once again topics for debate with the conference ending with a paper which had caused much debate within the Beltcon Committee and was to cause debate amongst those who attended the conference. Here I speak of “Power Belt Technology“ by Andries Wiid & M Bagus, which described a decision by Eskom to invest a large R& D budget into a totally new and untried conveyor technology and “to go where no man has gone before”. Taking the idea of a tripper belt to its logical conclusion it utilises a carrybelt driven by contact between it and a drive belt running below it. I do not intend to say much more since the Authors are scheduled to bring us up to date at this conference. It does however reinforce my contention that where conveyor design is concerned the bywords are acceptance of change and courage to do so.

There are several additional belt systems which by virtue of having just been completed or still in construction do not feature in any technical paper these include : -

1996	Syferfontein	1 x 4.9 km @ 5 m/s, 1 x 6.7 km & 1 x 4.3 km All are 1 050 mm carrying 1 600 –1 800 tph with last 2 @ 6 m/s
2003	Savmore Colliery	7.5 km 1 000 tph ROM coal 1 050 mm belt at 5 m/s
2003	Optimum Colliery	21 km system 1 x 3.7 km, 1 x 2.7 km, 1 x 3.1 km & 1 x 5.3 km all @ 5.7 m/s and 1 x 6.1 km @ 6.9 m/s.
2002	Namaqua Sands	7 km Double Strand (see Beltcon 12).
2003	Kriel	7.5 km (Under Construction).
2003	Khutala	3.5 km woven cord belt. (Under Construction).

In addition several companies have carried out feasibility studies for long overland conveyor systems, many of these projects have yet to reach fruition if indeed they do come about.

They include : -

Ingwe	48 km system.
Sasol	30 km system.
Ingwe	15 km system.
Sasol	Syferfontein upgrade.
AngloCoal	14 km system.
Eskom	60 km system.

And so here we are today and what of our Engineer, now twenty years older still on the same mine in the Witbank area, which is now in Mpumulanga and not the Transvaal. However the mine has yet another new owner, a black owned mining group. He now operates, as do many of his colleagues on other mines and other mining groups with a reduced staff but an increased production requirement. His chief concerns now are safety, operating costs, environment issues and profit.

With reduced labour he outsources much of his maintenance requirements and with little or no Head Office staff he outsources his project studies.

He arrived to day in a new BMW 318 that just set him back a cool R 220,000-00, he will be in touch with the mine while at the conference not only by his colour photo capable cell phone, but in emergency the mine SCADA system via his wireless “Blue Tooth“ lap top computer.

His latest personal system is a Pentium 4 2.4 GHz with a 40 GB hard drive and all ancillaries now cost an astonishing R 9 200-00.

With all the problems in the world today it was perhaps not surprising that the death in March this year of a man who changed the world went unnoticed. He was Adam Osborne the inventor of the worlds first “truly Portable“ personal computer.

The World is in a period of uncertainty following September 11 and the terror attack on New York, which culminated in the USA’s war on terror, with the Afghanistan war and the Iraqi war. Meanwhile there is an ongoing “war“ against globalisation with ongoing protests worldwide.

Meanwhile the wars against aids, malaria, TB and poverty continue with no end in sight.

South Africa is now a “Rainbow Nation” having lived through a miracle of peaceful change and survived the peaceful 1994 democratic election. The AWB has disappeared with its’ leader in jail, not for treason, but for assaulting a petrol pump attendant.

We have admitted to having, and have destroyed, an arsenal of atomic weapons. From being an International pariah with sport and cultural sanctions against us for many years, we now tread a new path.

65 International Airlines grace the runways of the re-named Johannesburg International Airport, bringing us last year 1.5million visitors, to make us the fastest growing tourist destination in the World.

We have hosted, and won a World Championship Rugby Tournament, a World Sustainable Development Conference and earlier this year the World Cricket Tournament which, other than our teams performance, was a resounding success.

The Gold price is up again to $ 345 from the mid $ 200's while the Rand Dollar rate which slumped to almost R13 to the Dollar early in 2003 has strengthened to just over R7 = $ 1.0. Despite a growth rate of 3% this year our Prime Rate still stands at 17%. Inflation which reached as low as 7% has climbed back to 10 %. The National debt is stable at $ 41.8 Billion.

It is interesting here to compare the National debt in Rand terms over the past 20 years , thus :-

			2003 Rand
1983	R 65.8 Billion	=	R 281.2 Billion
1993	R 91.8 Billion	=	R 61.3 Billion
2003	R 33.5 Billion	=	R 33.5 Billion

While urbanisation and the creation of a black middle class have raised our tax & consumer base the spectre of Aids hangs over us all.

Our Export goods are to be found not only all across Africa but in Europe, the USA, China & Australia. We export cars and engines, and surprise, surprise the local BMW quality was rated, by a German quality company, better than that of its German parent.

So why all these long overland conveyors ?

There are several reasons, all products of economics, social and political change, but when summed up all relate to change and our acceptance of it.

First and foremost was the recognition of the need to sell all the coal in any mine at a profit. In the 1980's and into the nineties our coal mines were divided into three main categories namely :-

Eskom
Export
Domestic

Early in the 1990's Messrs. Michael & Hand of the then Rand Mines propounded the idea that Mine A as an Eskom mine sold Export Coal to Eskom in addition to its PS Coal and Mine B next door being an Export mine, left PS Coal in the ground. This they said did not make sense. Thus Middelburg (an Export Mine) was joined to Duhva Colliery (an Eskom mine) to make MMS. Via a rail link between the two export coal from Middelburg South (was Duhva) is sent to the Middelburg North's Plant and PS Coal is sent in the opposite direction. This project being completed in 1996.

It would be nice to think that such a project would today be carried out using a double strand conveyor.

This change in thinking led to the opening up of the Klipfontein section whose coal now became economic when viewed as a two product reserve and hence the Middelburg 15 km conveyor system, described in Beltcon 11.

Since then events took another turn, perhaps equivalent to the fall of the Berlin Wall. The Mining Houses changed again, perhaps by virtue of economics, politics (Black Empowerment) and the Mining Charter (Use it or Loose it).

Firstly they concentrated on their core business that of producing coal and this led to the demise of their traditionally large in house engineering and technical departments. They then, to use the buzzword, un-bundled and in the process sold off mines and certain reserves to Black Empowerment Companies and the so-called Juniors.

All of this combined together to result in the various Mining Houses pulling down their own “Berlin Walls” and not only talking to one another but actually exchanging reserves, of which more later, and in some cases forming joint ventures. It is also noticeable that ties are no longer required for Head Office visits, let alone suits.

In addition in May last year Eskom suddenly announced that, probably, as a result of the Country’s expected growth rate , the lack of Cahora Bassa and Eskoms own electricity Export plans, it needed an additional 30 million tonnes per year.

Who are these Coal Mining Groups ? and how did they come about ?

Anglo Coal.
Ingwe part of BHPBilliton made up of Rand Mines & Gencor mines.
Xstrata (Owned 40% by Glencore) was Duiker & before that JCI and Shell.
Kumba from Iscor unbundling.
Sasol Coal.
Eyesizwe BEE with mines from Ingwe & Anglo.
LME with ex Anglo KwaZulu Natal Mines.
Kangra.
Afriore.
And several more “juniors“.

Evidence for their working together abounds, to name but a few :-

The formation of Eyesizwe.
Cerrejon in Colombia , owned by Anglo, BHPBilliton & Glencore.
Optimum’s mining of ex Anglo reserves South of Arnot.
The swap of Sasols’ Kriel open-pit reserves South of Kriel with Anglos’ underground reserves contiguous with Sasols’ Syferfontein open pit high wall.

Similarly the main Conveyor Design/ Contractor base has also changed with : -

Bateman.
Krupp.

ETS.
Sennet.
Nepean.
Koch.
Roymec.

perhaps being prominent. With further changes imminent brought about by the requirements for BEE participation.

And so the stage is set for Beltcon 12 and there will be no need for me to describe the papers before you, however as was the case at Beltcon 2 let me attempt to make some predictions for the future.

Beltcon 17 – 2013

One thing is certain 2013 will be different from today, since the only thing that is certain today is change.

Definitely the requirement for long overland conveyor systems will increase, as will the use of underground conveyors and double strand conveyors. This will be as the result of several factors such as : -

Eskom requirement for coal from areas other than existing “tied mines” due to increased Eskom output demands and depletion of tied reserves.

The extension of existing coal process plant by the mining of adjoining reserves, taken over from another Group, the development of which by them would have been uneconomic as a new Greenfields mine.

Increased underground production and productivity brought about by improvement in the production capability of the mining methods and equipment. This is typified by Matla's short wall shearer, which while currently producing at 4 500 tph has a design capability of almost 7 000 tph.

The prohibitive cost of long truck haulage.

The recognition of the economy of such systems by other mines such as Platinum.

The prohibitive cost of rail transport . One must add here that a long conveyor is not feasible when compared with the cost of extending an existing tied rail line with existing rolling stock.

As the demand for these conveyors rise several other requirements will become necessary such as :-

Increased speed with 10m/s perhaps being attainable.

The necessity to design Environmentally acceptable systems from the points of view of noise, spillage prevention and visible appearance. Where noise is concerned a joint industry (User & supplier) research project will be required.

With increased speed, idler and pulley design must keep step.

Improvement in belt rip detection devices.

Closer liaison with local belting manufacturers regarding forward planning so that their own production can be planned to meet demand, Failure to implement this will result in an increased dependence on imported belt. Similarly the local suppliers will need to keep abreast of belting technology.

Increased dependence by users on out-sourced maintenance contracts.

A move by users to the use of "Toll " handling systems.

The designers/ contractors meanwhile will be faced with their own problems requiring them to make changes : -

There is already a shortage of human resources in most engineering fields and many of the current contractors are headed up by "Gray Beards". Urgent attention is therefore required to the identification and training of new blood.

As Conveyor systems increase in length they also increase in capital cost. In order to ensure continuity and accountability the Client will be focussing more on the financial standing of Contractors and their ability to meet and stand by their liabilities.

BEE requirements are being forced down onto all suppliers including contractors, a problem exacerbated by the two points above.

Environmental and Safety requirements bring with them additional risks and costs to be borne by Contractors, these in turn will be passed onto the client and therefore must play a role in his adjudication process.

Taking all of the above into account it seems likely that the number of Contractors, in particular, will be reduced to embrace only those with sufficient resources, both human and financial. This will have particular relevance where "BOO" or "Toll" systems are concerned.

There will be an increase in joint ventures and "strategic alliances", both between Contractor & Client and Contractor & Contractor.

Conclusion

This journey through time has for me been immensely interesting and hopefully to the reader equally rewarding.

First and foremost is the need to understand the mechanics of change required to bring about the development of technology. It should be remembered that one of the greatest eras of technological advancement was that which occurred during the 1940's, because of World War II.

Next is the amount of information contained in the collected Beltcon papers , these should be recommended reading for all young Materials Handling engineers.

It would appear that when reading through these that Beltcon has provided the forum for debate and the basis for the courage necessary to change and to develop technology.

I can therefore only look forward to Beltcon 17 with anticipation and presumably it will be from my armchair at home via the wonders of Holographic Virtual Reality Conferencing.

Relaxing ? yes . Convenient ? yes , Educational ? definitely. Fun ? no ! since nothing can replace face to face interaction and the hopefully incisive question and answer sessions.

Author

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