THE CONTROL AND MONITORING OF CONVEYORS TO IMPROVE PROFITS

AUTHOR THOMAS VICTOR BELL

MANAGING DIRECTOR OF IVIC LTD

DIRECTOR OF BEBRO U.K. LTD

PAST BRANCH PRESIDENT OF THE NORTH OF ENGLAND BRANCH OF

THE INSTITUTION OF MINING ELECTRICAL AND MINING MECHANICAL ENGINEERS

OVER THE PAST TWO DECADES, WORLD INDUSTRY HAS BEEN SUBJECT TO EXTREME CHANGE, REQUIRING THE ADOPTION OF REVOLUTIONARY NEW TECHNIQUES AND SKILLS. THE INTERNATIONAL MINING INDUSTRY, OFTEN CONSIDERED SOME WHAT CONSERVATIVE, HAS HAD NOT ONLY TO FACE UP TO THESE CHANGES, BUT HAS SEEN MANY OF ITS TRADITIONAL MARKETS DECLINE, WITH CONSUMER DEMANDS FOR FUELS WHICH ARE SEEN AS MORE ENVIRONMENTALLY CLEAN. MINING, BY ITS VERY NATURE REQUIRES LONG LEAD TIMES FOR THE DEVELOPMENT OF NEW OPERATIONS, WHILST EXISTING MINING COMMUNITIES MAY BE FACED WITH THE TRAUMA OF DECLINING PROSPERITY.

INTERNATIONAL MINING HAS TAKEN A NEW DIRECTION, DEMANDING FLEXIBILITY TO ACCOMMODATE RAPID CHANGE, INNOVATION, PRECISE TIMING AND ABOVE ALL, THE ABILITY TO EXPLOIT APPROPRIATE NEW TECHNOLOGY IN THE PURSUIT OF PROFIT. THESE TACTICS ARE VITAL FOR SURVIVAL IN THE NEW WORLD MINING SCENE.

I QUOTE FROM AN ARTICLE IN A MINING JOURNAL THAT WAS PUBLISHED IN SOUTH AFRICA:- " THE PRIMARY OBJECT OF ALMOST ANY INDUSTRY ENGAGED IN THE MANUFACTURE OF A PRODUCT IS TO MAKE A PROFIT. AS PROFIT IS DIRECTLY RELATED TO THE AVAILABILITY AND EFFICIENCY OF THE PRODUCTION EQUIPMENT, ANY PROPORTIONAL INCREASE OF THE LATTER WILL HAVE POSITIVE EFFECTS ON THE PROFITS."

IN THE PURSUIT OF PROFITABILITY THE MINING ENGINEER MUST POSSESS A COMBINATION OF:-

MANAGEMENT

FINANCIAL AND

BROAD BASED ENGINEERING

SKILLS TO SAFELY MAXIMISE PRODUCTION AND INCREASE PROFITS WITH THE MINIMUM COSTS ASSOCIATED WITH HIGH CAPITOL INVESTMENT IN MACHINERY, MATERIALS AND WAGE BILLS.

THE MODERN HAZARDOUS AND ARDUOUS PROCESS INDUSTRIES SUCH AS

COAL

GOLD

COPPER

DIAMOND

AND OTHER MINING INDUSTRIES REQUIRE:-

- SAFE CONTROLS SYSTEMS FOR STARTING AND STOPPING MACHINERY
- EFFICIENT VOICE COMMUNICATIONS THE LIFE BLOOD OF LONG CONVEYOR SYSTEMS
- FAST, RELIABLE AND PRECISE INFORMATION RELATING TO THE CONDITION AND EFFICIENCY OF ALL MACHINERY

THESE THREE TOOLS, WHEN USED PROPERLY WILL ASSIST THE PRODUCTION AND MAINTENANCE TEAMS TO MAKE INFORMED JUDGEMENTS THUS AVOIDING DOWNTIME AND BREAKDOWNS WHICH AFFECT PROFITS.

ALL MACHINES, NO MATTER HOW WELL DESIGNED, NEED MAINTENANCE. IT IS NOT A MATTER OF " IF ", IT NEEDS MAINTENANCE, IT IS A MATTER OF HOW OFTEN IT NEEDS MAINTENANCE.

" MURPHY " IN HIS LAWS PERTAINING TO MAINTENANCE STATES:-

1) IF A COMPONENT CAN FAIL - IT WILL
2) FAILURE WILL USUALLY OCCUR AT THE MOST INCONVENIENT TIME
3) IN A FAILURE WHICH IS DIFFICULT TO DIAGNOSE, THE PROBLEM WILL MOST OFTEN BE FOUND IN A COMPONENT THOUGHT LEAST LIKELY TO FAIL.
4) FAILURES OCCUR MOST FREQUENTLY IN ITEMS WITH THE MOST DIFFICULT ACCESS AND FOR WHICH PARTS ARE NOT AVAILABLE

AS THE MEANS OF INCREASED PRODUCTION IN THE MINING INDUSTRY MOVE AWAY FROM BEING MANPOWER INTENSIVE TO MACHINE INTENSIVE THE ONUS FOR PROFITABILITY FALLS MORE AND MORE ON THE SHOULDERS OF THE ELECTRICAL AND MECHANICAL ENGINEER. THE ENGINEER, WHILST MAKING A MOST ACTIVE CONTRIBUTION TO THIS MOVE FORWARD INTO THE TWENTY FIRST CENTURY, SHOULD THEREFORE BE AWARE OF THE MONETARY RESULTS OF THEIR ACTIONS AND PLAN TO GET THE MOST OUT OF THE AVAILABLE CAPITAL. IT MUST ALSO BE BORNE IN MIND THAT A CERTAIN AMOUNT OF GROSS PROFIT SHOULD BE ALLOCATED TO MITIGATING THE EFFECT ON THE ENVIRONMENT WHICH EFFECTS US ALL TO SOME DEGREE.

THE INTENTION OF THIS PAPER IS TO PROVIDE AN INSIGHT INTO THE CONCEPT OF CONVEYOR MONITORING AND CONTROL UTILISING A GERMAN BASED COMPUTER CONTROLLED SYSTEM CALLED PROMOS.

THE PROMOS PROGRAMMABLE CONTROLLED SYSTEM WAS DESIGNED AND DEVELOPED SPECIFICALLY FOR UNDERGROUND APPLICATIONS IN BITUMINOUS COAL MINING AND IS SUITABLE FOR VIRTUALLY ALL MINING AUTOMATION TASKS.

PROMOS HAS ALL THE CHARACTERISTICS OF A FREELY PROGRAMMABLE CONTROLLER, BUT ALSO OFFERS SPECIAL SYSTEM FEATURES WHICH I WILL DISCUSS IN FURTHER DETAIL.

THE PROMOS SYSTEM CAN BE DIVIDED INTO TWO MAIN BUILDING BLOCKS. THESE BUILDING BLOCKS ARE THE CONTROL ROOM EQUIPMENT AND THE UNIVERSAL CONTROLLERS WITH ITS PERIPHERAL EQUIPMENT.

THE CONTROL EQUIPMENT, WHICH IS HOUSED IN AND ADJACENT TO THE CONTROL ROOM, COMPRISES OF :-

1) MASTER CONTROL COMPUTER WITH THE ABILITY OF STARTING AND STOPPING THE CONVEYOR SYSTEM.
2) MANAGEMENT INFORMATION COMPUTERS WHICH CAN BE CONFIGURED TO DISPLAY EVENTS RELATING TO "WHY" A CONVEYOR STOPPED AND HOW LONG IT STOPPED.
3) VAX STORAGE COMPUTERS FOR LONG TERM ANALYSIS OF INFORMATION
4) PROGRAMMING COMPUTER
5) DIAGNOSTIC COMPUTER
6) PRINTERS FOR HARD COPY
7) MODEMS WHICH CONVERT DATA COMMUNICATIONS INTO SIGNALS WHICH CAN THEN BE TRANSMITTED BY INTERNATIONAL TELEPHONE SYSTEMS TO ANY COUNTRY IN THE WORLD.
8) LOUDSPEAKING VOICE COMMUNICATIONS WITH KEY PERSONNEL ON THE PROMOS SYSTEM
9) SWITCHING COMPUTER

THE PERSONNEL IN THE CONTROL ROOM NORMALLY CONSISTS OF A SHIFT OPERATOR, PROGRAMMING OPERATOR AND A DIAGNOSTIC OPERATOR. THE LATTER TWO ARE NORMALLY ELECTRICIANS WHO ARE FAMILIAR WITH THE LAYOUT OF THE CONVEYOR SYSTEM.

THE UNIVERSAL CONTROLLER WHICH IS NORMALLY HOUSED NEAR THE CONVEYOR DRIVE HEAD COMPRISES OF :-

1) ALL NECESSARY MONITORING OF THE CONVEYOR UTILISING " INTELLIGENT TRANSDUCERS" SUCH AS TEMPERATURE AND VIBRATION TRANSDUCERS WHICH PRODUCE ANALOGUE SIGNALS THAT ALLOW ALARM LEVELS AND TREND INFORMATION TO BE GATHERED AND STORED

2) AUTOMATIC CONTROLS FOR STARTING AND STOPPING THE CONVEYOR BY INTERPHASING WITH THE CONTACTORS IN THE POWER STATIONS OR GATE END BOX.

3) ACTIVATION OF SOLENOID VALVES FOR WATER DUST SUPPRESSION, AUTOMATIC FIRE FIGHTING AND OIL LUBRICATION SYSTEMS.

4) TWO WAY LOUD SPEAKING COMMUNICATIONS WHICH ALLOW FOR A MEANS OF QUICKLY CONTACTING KEY PERSONNEL ALONG THE WHOLE LENGTH OF THE CONVEYOR.

5) THE ABILITY TO BROADCAST HIGH DECIBEL TONES TO WARN PERSONNEL THAT THE BELT IS ABOUT TO START.

6) SAFETY FUNCTIONS WHICH CAN STOP THE CONVEYOR AND SAFELY LOCK OUT THE START FUNCTION ANY WHERE ALONG THE LENGTH OF THE CONVEYOR. THIS IS REFERRED TO AS THE STOP AND BLOCKING SYSTEM AND IS PEACE OF MIND TO A BELT PATROLMAN WHO KNOWS HE CAN SAFELY WORK ON A CONVEYOR WHICH WILL NOT INADVERTENTLY START, WHEN HE HAS ACTIVATED ONE OF THE STOP BUTTONS.

THE UNIVERSAL CONTROLLER AND ITS PERIPHERAL DEVICES IS DESIGNED TO COVER ALL CONVEYOR APPLICATIONS KNOWN TO DATE AND IS DESIGNED TO OPERATE ON :-

A SINGLE MOTOR DRIVE.

TWO, THREE OR FOUR MOTOR DRIVE

INBYE AND OUTBYE DRIVES

BOOSTER CONVEYORS

HYDRAULIC DRIVES

THYRISTOR MOTOR DRIVE

SLIP RING MOTOR DRIVE

THE RESULT OF A UNIVERSAL CONTROLLER FOR ALL APPLICATION MEANS A REDUCTION IN INVENTORY, SPARE PART STOCKING REQUIREMENTS AND UNIVERSAL INTERCHANGEABILITY IN THE CASE OF HARD WEAR FAILURE.

TO SUMMARISE THE INTEGRATED FUNCTIONS INCORPORATED IN THE UNIVERSAL CONTROLLER THEY ARE THE:-

CONTROLS TO THE POWER STATION OR GATE END BOX

TWO WAY LOUD SPEAKER INTERCOM SYSTEM

EMERGENCY STOP AND BLOCKING FACILITY

CIRCUITS FOR VISUAL AND AUDIBLE PRE START WARNING

DATA TRANSMISSION

POWER SUPPLIES FOR THE CONTROLLER AND PERIPHERAL DEVICES

CONTROL LOGIC

DISPLAY OF PLAIN TEXT MESSAGES ON A ALPHA NUMERIC DISPLAY LOCATED ON THE DOOR.

THE CONNECTION BY A SINGLE CABLE TO THE STOP AND BLOCK KEYS, TRANSDUCERS ACTUATORS AND AMPLIFIERS FROM THE UNIVERSAL CONTROLLER IS BY A PLUG AND SOCKET SYSTEM. THIS SYSTEM WAS DESIGNED ON THE PRINCIPAL OF THE HYDRAULIC STAPLE LOCK CONNECTOR WHICH IS WIDELY USED THROUGH OUT THE WORLD ON LARGE HYDRAULIC SYSTEMS BECAUSE IT IS SMALLER AND QUICKER TO INSTALL.

THE INTRODUCTION OF SUCH A CONNECTOR WHICH DOES NOT REQUIRE ANY SPECIAL TOOLS HAS MEANT THAT THE PERIPHERAL DEVICES SUCH AS TRANSDUCERS CAN BE QUICKLY INSTALLED AND SALVAGED, AND DOES NOT NECESSARILY REQUIRE SPECIALISTS. FAULT FINDING AND THE REPLACING OF SYSTEM MODULES SUCH AS AMPLIFIERS, SENSORS, STOP AND BLOCK KEYS IS EASILY AND QUICKLY DONE THEREFORE AVOIDING COSTLY DOWNTIME, THUS IMPROVING PROFITS.

SENSORS AND ACTUATORS ARE CONNECTED TO STUB SOCKETS OF THE QUAD ADAPTORS VIA A FOUR CORE CABLE. IN TURN THESE INTELLIGENT DEVICES ARE CONNECTED TO THE CONTROLLER VIA A SEVEN CORE CABLE NAMED THE BRANCH CABLE.

THE PERIPHERAL DEVICES SUCH AS THE TRANSDUCERS ARE CONNECTED TO THE BRANCH VIA QUAD ADAPTORS. THESE TAKE MANY FORMS AND WHEN PROGRAMMED CAN ACCEPT OR DISTRIBUTE ANY COMBINATION OF INTELLIGENT OR PASSIVE SIGNALS ANY WHERE ALONG THE CONVEYOR SYSTEM. ALSO CONNECTED INTO THE BRANCH IS THE STOP AND BLOCK KEYS AND THE LOUD SPEAKING AMPLIFIERS.

THE BRANCH CABLE CONTAINS:-

THE POWER SUPPLY FOR ALL THE PERIPHERAL DEVICES

THE SYSTEM BUS OR DATA TRANSMISSION

THE STOP AND BLOCK CIRCUIT

THE AUDIO LOUD SPEAKER INTERCOM SYSTEM.

THREE MUTUALLY INDEPENDENT BRANCHES CAN BE CONNECTED TO EACH UNIVERSAL CONTROLLER :-

ONE BRANCH TO CONTROL THE MAIN CONVEYOR

ONE BRANCH TO CONTROL THE AUTO LOOP TAKE UP DRIVE

ONE BRANCH FOR THE CONTROL OF THE FINES OR SPILLAGE CONVEYOR

THE DATA TRANSMISSION FROM THE UNIVERSAL CONTROLLER TO THE MAIN CONTROL ROOM IS VIA A CABLE CALLED A LINIE. ALL CONNECTED UNIVERSAL CONTROLLERS HAVE THE ABILITY TO EXCHANGE INFORMATION WITH EACH OTHER AND CAN BE LOADED WITH THEIR APPLICATION PROGRAMME FROM THE MAIN PROGRAMME COMPUTER VIA THE LINIE.

THE HEART OF THE SYSTEM IS THE PROGRAMMING AND DIAGNOSTIC COMPUTERS GENERATING MOST OF THE COST SAVINGS. THESE COMPUTERS ARE NORMALLY HOUSED IN A ROOM ADJACENT TO THE PRODUCTION CONTROL ROOM.

WHEN THE PROGRAMMING COMPUTER AND THE SWITCHING COMPUTER WORK IN CONJUNCTION IT ALLOWS :-

1 DATA TO BE SWITCHED FROM LINIE TO LINIE

2 PROVIDES PROCESS COMPUTERS WITH INFORMATION

3 SWITCHES THE PROGRAMME COMPUTER TO THE LINIE

4 BUFFERS DATA ARRIVING IN THE CONTROL ROOM WHEN THERE HAS BEEN A COMPUTER FAILURE.

BUT ITS MOST IMPORTANT BENEFIT TO THE IMPROVEMENTS IN PROFITS IS IT ALLOWS PROGRAMS AND CONTROLS WHICH CATER FOR LOCAL CONDITIONS TO BE GENERATED ON SITE. THESE GENERATED CONTROLS WHICH ARE IN THE FORM OF TEXT ARE THEN LOADED VIA THE LINIE TO THE DESIGNATED UNIVERSAL CONTROLLER.

BECAUSE THE PROGRAMME IN A UNIVERSAL CONTROLLER HAS BEEN REMOTELY WRITTEN AND REMOTELY LOADED THEN IT MUST FOLLOW THAT SIMULATION OF THE PROGRAMME CAN BE DONE REMOTELY. AN EXAMPLE OF ONE OF THE BENEFITS GAINED IN THIS TYPE OF PROGRAMMING IS THAT IF A PARTICULAR TRANSDUCER NEEDS ITS ALARM LEVEL CHANGED, THIS CAN BE MODIFIED FROM THE CONTROL ROOM AND DOCUMENTED WHILE IT IS ON LINE WITH OUT STOPPING PRODUCTION. CERTAIN TRANSDUCERS WHICH HAVE BEEN PHYSICALLY DAMAGED AND STOP PRODUCTION BUT DO NOT EFFECT SAFETY CAN BE BYPASSED FROM THE CONTROL ROOM UNTIL RENEWED. THE FIRST BENEFIT WHEN THE PROBLEM HAS BEEN DIAGNOSED IS THAT PRODUCTION IS QUICKLY RESTORED WITHOUT WAITING FOR AN ELECTRICIAN TO BE ON SITE.

DIAGNOSTICS FEATURE PROMINENTLY IN THE PROMOS SYSTEM AND A MANY DIAGNOSTICS HAVE BEEN BUILT INTO THE SYSTEM TO CATER FOR " ON LINE ROUTINE CONDITION MONITORING "

EACH QUAD ADAPTOR, AMPLIFIER, AND STOP AND BLOCK SWITCH ON THE BRANCH HAS BUILT INTO IT AN ELECTRONIC CHIP THAT IDENTIFIES THAT PIECE OF EQUIPMENT AND MEASURES AND MONITORS VOLTAGES IN THE SAFETY CIRCUITS. IF THE VOLTAGE LEVELS DETERIORATE AT A CERTAIN POINT ALONG THE LENGTH OF THE CONVEYOR DUE TO DAMPNESS THEN PRE SET VOLTAGE LEVELS ACTIVATE ALARMS IN THE DIAGNOSTIC COMPUTER WITHOUT STOPPING PRODUCTION. THIS ALLOWS PLANNED CHANGES OF EQUIPMENT TO BE ACTIVATED, THEREFORE AVERTING COSTLY FAULT FINDING AND DOWNTIME WHICH AFFECT PROFITS

IF DURING PRODUCTION THE ELECTRICAL POWER HAS BEEN DISCONNECTED FROM A UNIVERSAL CONTROLLER DUE TO A FAULT. THEN THERE IS A FACILITY WHICH ALLOWS THE DIAGNOSTIC COMPUTER TO SWITCH ON A BATTERY IN THE CONTROLLER FOR A SHORT PERIOD SO THAT DIAGNOSTICS IN THE CONTROLLER CAN REPORT WHY THE POWER WENT OFF SO THAT THE APPROPRIATE ACTION CAN BE TAKEN.

EARLIER IN THE PAPER I INFORMED YOU THAT EACH UNIVERSAL CONTROLLER HAD ON ITS DOOR AN ALPHA NUMERIC DISPLAY AND THAT BY UTILISING THE NUMBERED KEYPAD ANY UNIVERSAL CONTROLLER COULD INTERROGATE ANY OTHER UNIVERSAL CONTROLLER AND HAVE THE INFORMATION DISPLAYED.

THIS FACILITY OF INTERROGATION ALLOWS FOR MANAGEMENT, CRAFTSMEN OR BELT PATROL MEN MEANS TO DETERMINE WHY A CONVEYOR SYSTEM HAS STOPPED. IF THE STOPPAGE IS DUE TO A FAULT, APPROPRIATE PERSONNEL CAN BE SUMMONED VIA THE COMMUNICATION SYSTEM TO THE FAULT.

THIS INFORMATION DEPENDS ON THE TRANSDUCERS THAT ARE ATTACHED TO THAT PARTICULAR UNIVERSAL CONTROLLER, AND COULD TAKE THE FORM OF:-

TRANSDUCERS IN THE POWER CENTRE OR GATE END BOX THAT CONTROL THE DRIVE MOTORS :-

1) VOLTAGE
2) CURRENT
3) OVERLOAD
4) EARTH LEAKAGE
5) SHORT CIRCUIT
6) OVERLOAD SETTINGS
7) CONTACTOR OPEN
8) CONTACTOR CLOSED

TRANSDUCERS THAT ARE MONITORING THE CONVEYOR VIA THE BRANCH

1) STOP AND BLOCK KEY NUMBERS
2) TEMPERATURES
3) BLOCKED SHUTE
4) SPILLAGE
5) TORN BELT
6) ROTATIONAL SPEED MONITORS (BELT SLIP, BELT SEQUENCE)
7) LEVEL INDICATORS
8) PRESSURE SWITCHES
9) VIBRATION MONITORS
10) OIL DEBRIS ANALYSIS
11) FLOW SWITCHES
12) PROXIMITY SENSORS
13) STRAIN GAUGES FOR AUTO LOOP TAKE UP
14) WATER VALVES
15) OIL LEVELS
16) OXYGEN SENSOR
17) METHANE SENSOR
18) CARBON MONOXIDE
19) SMOKE DETECTORS
20) AIR FLOW
21) ON LINE BELT WEIGHING MACHINES

A CROSS SECTION OF THESE ARE THE MOST COMMON TRANSDUSERS ON A CONVEYOR SYSTEM, BUT OTHERS COULD BE USED

THE RELIABILITY OF TRANSDUCERS HAS BEEN DRAMATICALLY IMPROVED BY THE DEVELOPMENT OF THE ELECTRONIC CHIP WITH ITS INTEGRATED CIRCUITS. THIS HAS BEEN POSSIBLE WITH THE INTRODUCTION OF SURFACE MOUNT TECHNOLOGY COMPONENTS. A TYPICAL PRINTED CIRCUIT BOARD USING SURFACE MOUNT TECHNOLOGY IS APPROXIMATELY ONE FIFTH THE SIZE OF THE EQUIVALENT PRINTED CIRCUIT BOARD OF THE 1970s. SOLDERING IRONS ARE NO LONGER USED TO FIX COMPONENTS IN PLACE.

THIS IS NOW ACHIEVED USING SOLDER INK AND COMPUTERS TO PLACE OR POPULATE THE PRINTED CIRCUIT BOARDS WITH MINIATURE COMPONENTS. THE INK AND COMPONENTS ARE FUSED BY PASSING THE CIRCUIT BOARD THROUGH AN INFRA RED OVEN, WHERE THE TEMPERATURE IS ACCURATELY CONTROLLED. DRY SOLDER JOINTS NOW ACCOUNT FOR LESS THAN 0.1% OF FAULTS REPORTED ON PRINTED CIRCUIT BOARDS. SOLID STATE INTELLIGENT TRANSDUCERS WHICH INVOLVE NO MOVING PARTS ALSO PLAY THEIR PART IN IMPROVING RELIABILITY, REPEATABILITY AND ACCURACY OF INFORMATION VIA THE PROMOS SYSTEM TO THE CONTROL OF THE CONVEYOR.

MODERN INTERNATIONAL COMMUNICATION SYSTEMS ALLOW INFORMATION DATA TO BE TRANSMITTED QUICKLY AND CLEANLY. IT NECESSARILY FOLLOWS THAT IF MODEMS ARE INSTALLED IN THE CONTROL ROOM AND THE MAIN OFFICES OF PROMOS, THEN FULL DIAGNOSTICS ARE AVAILABLE TO THEIR EXPERT SOFTWARE WRITERS, WHO MAY PROVIDE A BACK UP SERVICE.

HOWEVER WE MUST NOT MAKE THE SAME MISTAKE AS MANY GOOD ORGANISATIONS IN BELIEVING THAT A GOOD COMPUTING SYSTEM WILL SOLVE ALL MANAGEMENT PROBLEMS. COMPUTERS CAN BE A POWERFUL AND HELPFUL FACILITY, BUT THEY ARE OPEN TO ABUSE. THEY SHOULD BE SEEN AS A TOOL FOR MANAGEMENT AND AS IN MOST OCCUPATIONS, GOOD TOOLS MAKE A GOOD CRAFTSMAN BETTER. A GOOD COMPUTER SYSTEM IS UNLIKELY TO IMPROVE A BAD MANAGER, AN ASPECT OF COMPUTER SYSTEMS WHICH IS FREQUENTLY OVERLOOKED.

BEFORE I CONCLUDE I WOULD LIKE TO HIGHLIGHT SOME PRACTICAL CONSIDERATIONS WHICH MAY GIVE YOU FOOD FOR THOUGHT WHEN NEW CONVEYOR SYSTEMS ARE BEING CONSIDERED.

MODERN WELL DESIGNED BELT CONVEYORS WILL BE AVAILABLE FOR MATERIAL TRANSPORT AT LEAST 96 PER CENT OF THE TIME. TWO CONVEYORS, ONE FEEDING THE OTHER HAVE 96% * 96% = 92 PER CENT AVAILABILITY, AND TEN IN SERIES REDUCE THAT FIGURE TO 66 PER CENT. WILL TECHNOLOGY OF THE TYPE THAT I HAVE DESCRIBED INCREASE CONVEYOR AVAILABILITY TIMES, THUS INCREASING PRODUCTION AND IMPROVING PROFITABILITY?

WILL CONTROL AND MONITORING SYSTEMS OF THIS TYPE STRENGTHEN THE CASE FOR VARIABLE SPEED DRIVES. FOR EXAMPLE, ON A TYPICAL 6000KW LARGE DRIFT CONVEYOR, AROUND 1000KW IS ACCOUNTED FOR BY THE POWER TO RUN THE BELT EMPTY. LET US SUPPOSE THAT THE 6000KW IS REQUIRED TO HANDLE PEAK TONNAGE OF 2000 TONS PER HOUR, DOUBLE THE USUAL TONNAGE OF 1000 TONS PER HOUR. CONSTANT MONITORING BY POWER TRANSDUCERS OF THE VOLTAGE AND CURRENT GENERATED BY THE MOTORS ENABLES THE COMPUTER TO ADJUST BELT SPEEDS, DEPENDING ON THE LOAD CARRIED. REDUCING THE SPEED OF THE BELT BY HALF WILL SAVE 500KW OF POWER, AND THIS IS ONLY POWER CONSUMPTION. ALL THE MOVING PARTS BENEFIT FROM RUNNING MORE SLOWLY, NONE MORE SO THAN THE BELT. EXPERTS TEND TO AGREE THAT BELT LIFE IS RELATED TO THE NUMBER OF TIMES THE BELT GOES AROUND THE SYSTEM. HENCE, RUNNING AT THE LOWEST SPEED CAN DRAMATICALLY INCREASE BELT LIFE, AND SINCE THE BELT IS ALMOST CERTAINLY THE LARGEST SINGLE ITEM OF COST , THIS INVESTMENT IS WORTH PROTECTING. HENCE GREATER PROFITS MAY BE ACHIEVED THROUGH SAVINGS IN POWER AND PARTS.

ON LONG CONVEYORS, FACTORS OF SAFETY IN THE REGION OF 8:1 FOR BELTS ARE CONSIDERED TO CATER FOR THE 200% OVERLOAD ON START UP. WILL MORE RELIABLE CONTROL AND MONITORING OF ITEMS OF PLANT SUCH AS CONTROLLED LOOP TAKE UPS, THYRISTOR DRIVE MOTORS FOR SPEED CONTROL ON START UP AND BOOSTER CONVEYORS REDUCE THE FACTORS OF SAFETY BUILT INTO BELTS? IF THE WEIGHT OF THE BELT IS REDUCED ,THEN THE CAPITAL COST OF THE BELT MUST BE REDUCED AND LESS POWER REQUIRED TO MOVE THE BELT OVER THE SAME DISTANCE.

IT HAS BEEN MY INTENTION IN THIS PAPER TO PROVOKE NEW THINKING ON THE CONTROL AND MONITORING OF CONVEYORS BY IMPROVING ENGINEERING STANDARDS. I HAVE ATTEMPTED TO SHOW HOW UTILISING ONE OF THE LATEST CONCEPTS IN COMPUTER CONTROL CAN ULTIMATELY LEAD TO INCREASED PROFITS BY

1) REMOTE PROGRAMMING AND DIAGNOSTICS
2) PROVIDING MANAGEMENT INFORMATION SYSTEMS
3) REDUCING INSTALLATION TIME
4) UTILISING A VERSATILE SYSTEM

I HOPE THAT I HAVE SUCCEEDED IN STIMULATING THOUGHT ON THE POSSIBILITIES OF THIS NEW TECHNOLOGY AND WOULD LIKE TO THANK THE ORGANISERS OF THIS CONVENTION FOR PROVIDING THE OPPORTUNITY TO SPEAK TO YOU TODAY.