THE USE OF CONVEYORS UNDERGROUND FOR THE HOISTING OF ORE - POST COMMISSIONING LESSONS LEARNT

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CONTENTS

SYNOPSIS
The total underground production at Premier Mine is handled by two multi-belt inclined conveyor systems each approximately 1,4 km long. These systems deliver ore from the haulage levels and crushing stations on 800m level to the loading station on the 500m level of the vertical hoisting shaft.

This paper is a follow on of the paper previously presented prior to full commissioning. It is not intended to reject the use of inclined conveyor systems as an alternative to vertical hoisting systems. The paper highlights the post commissioning problems experienced and provides some guidelines on actions to be taken to ensure system reliability. A brief comparison of inclined vs vertical hoisting is also discussed.

The paper concludes that whilst the use of conveyor belts in this application is not new, many unique problems were experienced. A strategy needs to be formulated to overcome these problems. This includes detailed technical investigation and design audit; action plans; sound maintenance and operating procedures; and ongoing performance measuring and monitoring.

1. INTRODUCTION

1.1 HISTORICAL BACKGROUND

Premier Mine was started in 1902 by Thomas Cullinan. He was from the Eastern Cape, a builder by trade, later prospector, and industrial entrepreneur. The mine became famous world wide after the discovery of the Cullinan Diamond in January 1905. Weighing 3016 carats, it remains the largest gem diamond ever found. The two largest stones cut from the Cullinan Diamond are now found in the crown jewels in Britain.

The mine closed in 1932 during the great depression and only re-opened in 1945, after the Second World War.

The Premier pipe has a surface area of 32 ha. It is oval in shape, with the east/west axis approximately 900m long and the north/south axis 450m. A main feature is a band of hard volcanic waste rock, formed many millions of years ago, which cuts across the pipe at around the 500m level (this geological feature is known as the Gabbro Sill).

Mining started from surface. As the hole deepened and the slopes of the host rock steepened it became more dangerous to mine from within the hole. In 1947 the shafts were sunk to create access to the orebody at deeper elevations.

Underground operations were originally established at the 310m level and extended to the 500m level as the ore reserves became worked out in the upper levels.

Proven ore reserves below the sill to a depth of ± 763m level necessitated a further "drop down" to extend the life of the mine.

The shaft system hoisted ore from 500 m level and in order to mine at the new depth, ground handling infrastructure was required. Initially consideration was given to deepening the existing No.1 shaft down to the new mining level. Another alternative was the establishment of a new shaft complex. These alternatives were rejected due to the high capital cost and the estimated duration.

The third alternative was the installation of two large conveyor systems, required to deliver ore from the haulage levels and crushing stations at ± 800m below surface to the loading station on the existing No.1 shaft on the 500m level.

These conveyor systems are installed on either side of the pipe (Figure 1). Development work to accommodate the conveyor systems commenced in 1978 in order to meet the production requirements from below the sill. No. 2 winze conveyor system was commissioned (on schedule) in early 1986, whilst No.3 winze conveyor system commenced full production in 1991 (12 months behind schedule).

1.2 GENERAL LAYOUT AND DESCRIPTION OF SYSTEMS

Haulage and crushing system

Ore is mined from the block cave draw points and trammed using 3,8m^3 L.H.D's. The ore is tipped into ore passes after having passed through a grizzly which is cleared by a hydraulic rockbreaker unit. This ore is then trammed from the ore passes to the main tips along the four haulages on the 763m level (viz. NE, NW, SE, SW haulages - Figure 1).

At the main tips the ore passes through another grizzley. The minus 150mm fraction reports directly to a fines pass, whilst the larger rocks report to the coarse ore pass. The +150mm rocks are crushed by a 48 x 42 (inch) jaw crusher. The fines and crushed ore report to the "picking" belt (The first of the conveyor belts) on 805m level via feeders.

"Picking" belt level

The first belts of the conveyor belt systems are situated on the 805m level. These are short 1500mm wide horizontal conveyors which transport the ore at 1,1 m/s to the incline conveyor systems.

Two types of feeders are utilised to transfer the ore from the passes onto these horizontal belts, namely vibrating and apron feeders. Weightometres are mounted on the first of the incline conveyors. These are link via PLC to the variable speed controllers for the feeder motors. This allows accurate control of the feed rate.

Incline Conveyor Systems

The main incline conveyor systems each consists of four conveyors of approximately equal length, at an inclination of 14° to the horizontal. The design capacity of each system is 800 tons an hour. The total lengths of each system are:

No.2 Winze = 1402m
No.3 Winze = 1368m

The conveyor equipment schedule is contained in Appendix 1 and a typical general arrangement is depicted in Figure 2. Head and tail sections are fabricated from heavy steel sections. The stringer sections which carry Garland type idlers, consist of lighter pipe sections.

Each drive arrangement was originally specified as 160kW 500V motors, coupled via fluid drives (for equal power distribution) to helical gearboxes. The drive pulleys arrangement was the double wrap system (Figure 3) with Falk type holdbacks mounted on the primary drive pulleys only.

Due to the size of excavation required to accommodate a conventional gravity take-up unit these were rejected at the design stage and alternatives were sought. The "state of the art" alternative at that time was the trolley & winch type. This consisted of a take - up trolley unit with a deflecting pulley mounted in its frame (Figure 4). The trolley travels on a fixed set of rails over a distance of 7 metres, allowing approximately 14 metres of take - up on the conveyor belt. The trolley is connected to a 5 ton winch by means of a cable. The winch operates automatically on signals received from a Piab load cell installed "in-line" on the cable which detects the tension in the cable.

The conveyor sections are only equipped with deck-plates at the head area. V - plough scrapers are fitted at the tail end, however no scrapers were originally fitted at the head (discharge) end.

The floors under the conveyors are concreted along their entire length, with concrete plinths to support the stringer uprights. The floors slope to a drain along the side of the conveyor (Figure 5). This drainage system allows for spillage removal, whereby any spillage is washed to the bottom of the winze excavation. A roadway is provided to facilitate vehicle access for maintenance.

Waste/ore arrangement

The final conveyors are designed to allow the system to handle both ore (blue ground) and waste with deposition into separate ore boxes (Figure 1). This is accomplished by means of a reversible conveyor on the No.3 Winze, and a shuttle conveyor on the No.2 Winze system.

Supervisory Control System

The Cygnus Databased SCADA (Supervisory Control and Data Acquisition) System installed at Premier Mine, is based on an established multi user, multi tasking, real time operating system. The equipment in use is a generalised structured system for storing process information derived from various types of front end devices (PLC's etc.) The supervisory system is located on surface and is connected via an H1 Bus on the Ethernet local area network with star network topology and fibre optic cables to the underground PLC's. This allows for the production processes to be monitored and controlled from the surface control room. The winze conveyor system is connected to, and controlled via this system.

2. POST COMMISSIONING PROBLEMS

The No.2 winze conveyor system was commissioned in 1986. The system initially handled very low tonnages, mainly development ground. It was only when the below sill mining production picked up in 1990 and the tonnages handled approached the designed conveying capacity on a continuous basis that major problems were experienced. Belt breaks, resulting in downtime of up to 30 hours were a frequent occurrence. Some of the other problems were take-up failures; transfer point wear and spillage; waste/ore system defects; poor drainage with resultant winze bottom floods; and electrical faults. Overall system availabilities were very low and the desired production rates were not been achieved. During this period the No.3 winze system was being commissioned. Since all the problems had not yet been properly identified and rectified No. 3 winze suffered similar problems. The No.3 winze system was the first to be fully automated and controlled via the SCADA system at Premier Mine. The fact that the operations and maintenance crews were on a learning curve compounded the problems. The time spent on the breakdowns resulted in a typical fire-fighting situation existing. Obviously this had an adverse affect on the motivation and co-operation of the crews. Clearly the entire situation was unacceptable and needed to be addressed. Resources were limited and the production demands were increasing.

3. STRATEGY AND ACTION PLANS

An investigation of the ground handling system was conducted on mine in late 1991. Recommendations for upgrading of the entire below-sill ground handling system were made. Funds were approved and a construction crew commenced with some of the modifications. However it become apparent that this was not sufficient to ensure a reliable and less maintenance intensive operation. A total strategy was needed. This was formulated in mid-1992. Since implementation, constant improvement has been, and still is being, experienced.

This strategy incorporated the entire ground handling system from below sill ore passes and included the haulages; crushers and loading levels; winzes and conveyor systems; winze/shaft interface and shaft. (This paper intends to only address the conveyor systems since the other ground handling components are common to a shaft or inclined conveyor system).

Objective

The objective of the strategy was ensure that the ground handling system is upgraded, operated and maintained such that the required production rate of 3,3 million tons per annum could be handled in the most efficient and cost effective way.

The strategy addresses the following areas:

- Design Audit
- Simulation study
- Implementation of the action plan to modify and upgrade the system
- Organisational Structure and training
- Standards, procedures and maintenance programmes
- Measurement, monitoring and control

Design Audit

An independent belt design specialist was employed to do a full design audit of the conveyor system. This audit included a dynamic analysis. This dynamic analysis clearly showed the stresses and stress reversals which these long inclined conveyors were subjected to (example Figure 6 - Appendix 1). This highlighted the areas that needed to be redesigned and modified in order to reduce the number of belt failures. The three main areas which were re-designed and modified were:

- Drive arrangements
- Take - ups
- Transfer points, chutes and impact areas

Two modifications were done to the drive area viz:

- repositioning of the drive pulley lay-out to reduce the fatigue problems inherent in the original system;
- upgrading of the fluid-drive couplings to alter the start up characteristics.

The modified pulley configuration is shown in Figure 7.

The winch type take-ups (Figure 4), despite load cell control, were dynamically unacceptable for this conveying system. These take-ups could not provide the initial tension on start-up to take out the start-up stretch in the belt and guarantee a positive slack side tension at the drive pulley. This was one of the main contributing factors to belt splice overload/fatigue and subsequent belt failure. Another factor was the inability of this system to measure accurately, and respond accordingly to the actual tension at the take-up pulley. The efficiency of the sheave wheels was also questionable. The load cell could detect (to some degree) the apparent belt tension, however, taking sheave wheel efficiency into account, the true tension at the take-up pulley was significantly higher. At present two alternative take-up devices are installed. A gravity take-up unit which utilises the winch arrangement (Figure 8), and an eddy-current winch which has improved detection and response characteristics. The remainder of the take-ups are scheduled to be replaced in 1995. Both of these systems have proven to be successful and the decision as to which of these will be installed where for the remainder of the belts is based on the availability of space to install the gravity type unit.

Implementation of action plans

As mentioned above, an investigation of the conveyor systems was carried out in late 1991. Full details of the work to be done was specified, funds approved and a programme of implementation prepared. This programme commenced in 1992 and although the bulk of the programme has been completed, some work is still in progress in this regard. The main items on the upgrade action programme are listed in Table A - Appendix 2 (with relevant brief description). Further problems manifested themselves subsequently, resulting in additions to the list of outstanding work. These include the following:

- Intensive additional support work to the tunnel hanging walls and side walls.
- Major modifications at the "picking belt" level which consists of a vertical fines pass and an additional conveyor, as well as improvements to the variable feed control system.
- The installation of additional holdbacks for the secondary drive pulleys. This became necessary after a fluid drive coupling exploded seconds after the belt was stopped. An investigation showed that the belt was wet from handling wet

ground and ran through the primary drive pulleys (holdback fitted) and 'drove' the secondary drive pulleys in reverse. This in turn resulted in the gearbox driving the fluid drive in reverse. The fusible plug did not rupture since the pressure build up was instantaneous, whilst the temperature was still relatively low.

Organisational Structure and Training

Various initiatives were introduced in this regard and played a role in the improved operation of the system. These included the integration of the maintenance and operations sections into one division; multi-skilling; allocation of areas and equipment to be maintained; training; communication improvements; and promotion of ownership. The teamwork in this area of the mine is currently very good and efforts in this regard continue. The resistance towards new technology, especially by operations personnel is something which must not be understated. The introduction of Control and Instrumentation was poorly received initially and was seen as something which causes more problems than it solves. Through training and familiarisation of this new technology these perceptions and fears were overcome.

Standard, Procedures and Maintenance Programmes

In order to ensure that activities are carried out safely and efficiently standards were set, procedures prepared and maintenance programmes implemented. On shaft systems these aspects are of utmost importance and normally well established. These conveyor systems are, in effect, an extension of a shaft system. Consequently it was necessary to institute the necessary procedures and maintenance programmes to the same extent as is applied to shaft systems.

A critical aspect, in terms of maintenance, is the conveyor belt condition survey and splice maintenance system. Regular audits and inspections by mine personnel, belting suppliers and belt repair companies are conducted. The results of these audits as well as the belt history, splice details, splice positions etc. are recorded. The average splice life is also calculated (Tables B & C - Appendix 3 & 4). In this way the splice repair and belting replacement forecasts are facilitated.

Measurement, monitoring and control

Equally important is the provision of adequate means to measure performance and to monitor and control. It is in this area that the SCADA is of particular value. Not only can the production rate be measured in whatever time unit is desired, but also of immense value is the ability to measure and plot the motor current, take-up tensions, feeder rates, run hours, stops/trips, etc.

These reports are used to monitor production and also to analyse system performance, specifically after breakdowns have occurred.

4. COSTS

The relative costs of deepening and equipping the existing shafts compared to a conveyor system were quoted in the previous paper as follows (1978 Costs):

° Sinking and equipping the present shaft = R4.5 mil.
° System as installed = R5.6 mil.

The additional costs for the upgrade as outlined in section 3 of this paper is in the region of R2,8 million.

The costs of additional modifications and upgrade which became necessary after the initial upgrade programme was embarked upon are as follows:

- ° Installation of improved fines pass and additional conveyor R1 414 000
- ° Additional support work in winzes - R878 000
- ° Installation of hold-backs on the secondary drives - R560 000

The operating (and maintenance) cost of a conveyor system exceed the incremental costs to operate and maintain a vertical shaft. Table D outlines the comparative cost per ton handled, and illustrates this point:

YEAR TO DATE COST SUMMARY

DESCRIPTION	CONVEYING						HOISTING					
	PROD	R/T	MAINT	R/T	TOTAL	R/T	PROD	R/T	MAINT	R/T	TOTAL	R/T
PAYROLLS	1156032	0.84	1658248	1,21	2814281	2,05	10119953	0,74	505951	0,37	1525904	1,11
STORES	75285	0,06	1165042	0,85	1240326	0,90	46139	0,03	372278	0,27	418418	0,30
POWER	1041600	0,76	0	0,00	1041600	0,76	886800	0,65	0	0,00	886800	0,65
TOTAL COSTS	2272917	1,66	2823290	2,06	5096207	3,71	1952892	1,42	878229	0,64	2831122	2,06

TABLE D

5. **INCLINED VS VERTICAL**

The use of conveyors for hoisting ground from underground is not new concept and is employed in many mines. In instances where these are used in inclines many factors need to be considered, particulary if this means of hoisting is being considered as an alternative to vertical hoisting in a shaft. These factors can be summarised as follows:

5.1 **CAPITAL COSTS**

The relative capital costs for all alternatives should be considered. The capital estimates must be as detailed as possible to ensure no aspects have been omitted. In addition it is recommended that a contingency for post-commissioning problems is included, particularly if the application is new to the type of ore to be handled.

5.2 WORKING COSTS

Conveyor systems are undoubtedly more maintenance intensive and are more costly to operate. The manpower alone to operate a conveyor system (even if a SCADA system is installed) is substantially more than for a shaft.

5.3 RISKS

The risks associated with operating and maintaining shafts for the hoisting of ore have been minimised through years of experience. When operating a inclined conveyor system new risks are introduced. These risks cannot always be identified up-front and must never be under estimated.

6. CONCLUSION AND RECOMMENDATIONS

The winze conveyor system in use at Premier Mine is now operating successfully and production targets are been achieved (and even exceeded) although this is still below the design capacity.

The resulting recommendations are listed below:

- prior to deciding on conveyor systems for this application all alternatives should be fully investigated.
- No compromise should be made in terms of the design and planning, and this should include a full design audit, complete with dynamic analysis and simulation study.
- Installations on other mines should be visited and benchmarks set.
- The framework of a maintenance and operating strategy must be prepared up front and continually reviewed and updated during installation, commissioning and after full production commences.

7. ACKNOWLEDGEMENTS

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8. REFERENCE

(1) B.H. Brasher - 'The use of conveyors underground for the hoisting of ore' paper presented at the AAC Group Engineering Symposium 1987.

9. APPENDIX

APPENDIX 1 - TABLE A	**-**	**WINZE CONVEYOR SYSTEM UPGRADE PROGRAMME**
APPENDIX 2 - TABLE B	**-**	**CONVEYOR SPLICE SERVICE RECORD NO. 2 WINZE**
APPENDIX 3 - TABLE C	**-**	**CONVEYOR SPLICE SERVICE RECORD NO. 3 WINZE**
APPENDIX 4 -		**CONVEYOR EQUIPMENT DETAILS**

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TABLE A
WINZE CONVEYOR SYSTEM PROGRAMME

PROBLEM AREA	ACTION
DRIVE ARRANGEMENT	Pulleys repositioned Fluid drive couplings upgraded
TAKE - UP SYSTEM	Alternative systems installed - gravity take-up - eddy current Load cell - winch system upgraded
CONVEYOR BELTING - too many splices - specification inadequate (class and bottom cover) - not fire - retardant - difficulty in handling belt rolls	Programme of belt change-out implemented. (Note: due to cage size restrictions each conveyor has a minium of 6 splices when installed, thereby reducing the F.O.S.) Belt handling facilities provided
WASTE - ORE ARRANGEMENT - high belt wear - poor operation	Discharge section modified Shuttle conveyor system upgraded
SPILLAGE	Chutes modified Scrapers fitted Drainage modified Covers fitted
DAMAGE DUE TO TRAFFIC MOVEMENT	Minimise traffic movement - gates fitted at all entrances and instituted procedure
WINZE BOTTOM - FLOODING	Pumping system modified Sludge removal improvements done Flood controls and alarms installed
ELECTRICAL SUPPLY PROBLEMS	Load flow study done, supply upgraded and delay on sequence start optimised
SCADA SYSTEM - damage to equipment - spurious trips	Equipment repositioned and/or protection provided Override facilities installed
MAINTENANCE AND OPERATION ACCESSIBILITY	Overhead crawls fitted at every drive Additional stairways and platforms installed
SAFETY AND HEALTH ASPECTS	Pull wire trips re-positioned and extended Guards modified Cubbies in roadways concreted Roadways upgraded and treated for dust Communication system provided

APPENDIX 2

TABLE B

2 WINZE — CONVEYOR SPLICE SERVICE RECORD — 16/08/94

CONVEYO NUMBER	SPLICE NUMBER	LENGTH APROX(M)	DATE DONE	DATE REMOVED	PRESENT AGE (MONTH	REMARKS
BELT LENGTH 45m / MIN SPLICES = 1 / ACT = 3						
21A CONV	HE 556		12/09/90		47.15	ESTIMATED DATE
21A CONV	HE 9-12		02/10/92		22.46	INSERT ACROSS HOLE
21A CONV	HE 556		02/10/92		22.46	INSERT ACROSS HOLE
BELT LENGTH 587m / MIN SPLICES = 5 / ACT = 5						
21 CONV	HE 94-43	58	26/07/94		0.70	
21 CONV	HE 93-45	129	17/07/93		13.00	NEW BELT
21 CONV	HE 93-74	129	10/10/93		10.20	NEW BELT
21 CONV	HE 93-75	132	10/10/93		10.20	NEW BELT
21 CONV	HE 93-76	117	10/10/93		10.20	NEW BELT
BELT LENGTH 745m / MIN SPLICES = 6 / ACT = 8						
22 CONV	HE 93-35	123	29/05/93		14.61	
22 CONV	HE 93-67	120	02/09/93		11.45	
22 CONV	HE 93-68	129	06/09/93		11.32	
22 CONV	HE 93-63	132	01/09/93		11.48	NEW BELT
22 CONV	HE 93-61	99	25/08/93		11.71	
22 CONV	HE 93-37	4	29/05/93		14.61	
22 CONV	HE 93-43	20	11/07/93		13.19	
22 CONV	HE 93-44	78	11/07/93		13.19	
BELT LENGTH 771m / MIN SPLICES = 6 / ACT = 9						
23 CONV	HE 93-73	66	01/10/93		10.50	
23 CONV	HE 94-6	133	31/01/94		6.49	
23 CONV	HE 94-5	50	26/01/94		6.65	
23 CONV	HE 94-4	66	26/01/94		6.65	
23 CONV	HE 94-8	40	04/02/94		6.36	INSERT
23 CONV	HE 94-9	129	04/02/94		6.36	INSERT
23 CONV	HE 94-31	36	07/06/94		2.31	
23 CONV	HE 94-32	16	09/06/94		2.25	
23 CONV	HE 94-41	12	09/07/94		1.26	
BELT LENGTH 706m / MIN SPLICES = 6 / ACT = 9						
24 CONV	HE 94-39	66	12/06/94		2.15	
24 CONV	HE 93-11	42	13/02/93		18.06	
24 CONV	HE 94-33	133	11/06/94		2.18	
24 CONV	HE 94-34	42	12/06/94		2.15	
24 CONV	HE 94-35	133	12/06/94		2.15	NEW BELT
24 CONV	HE 94-36	35	12/06/94		2.15	
24 CONV	HE 93-65	12	01/09/93		11.48	
24 CONV	HE 93-86	124	15/11/93		9.02	
24 CONV	HE 94-37	96	23/06/94		1.79	
BELT LENGTH 128m / MIN SPLICES = 1 / ACT = 1						
25 CONV	HE 99-66	128	01/09/93		11.48	NEW BELT
			AVERAGE AGE		9.53	MONTHS

APPENDIX 3

TABLE C

3 WINZE CONVEYOR SPLICE SERVICE RECORD 16/08/94

CONVEYO NUMBER	SPLICE NUMBER	LENGTH APROX(M)	DATE DONE	DATE REMOVED	PRESENT AGE (MONTH	REMARKS
BELT LENGTH 25m / MIN SPLICES = 1 / ACT = 1						
31A CONV	PDM	25	30/06/93		13.55	
BELT LENGTH 748m /MIN SPLICES = 6 / ACT = 9						
31 CONV	HE 94-22	70	20/05/94		2.90	
31 CONV	HE 93-31	129	15/05/93		15.07	NEW BELT
31 CONV	HE 93-40	135	12/06/93		14.15	NEW BELT
31 CONV	HE 93-78	133	19/10/93		9.91	NEW BELT
31 CONV	HE 93-56	126	08/08/93		12.27	NEW BELT
31 CONV	HE 93-54	42	06/08/93		12.34	
31 CONV	HE 93-55	12	06/08/93		12.34	
31 CONV	HE 93-58	12	13/08/93		12.11	
31 CONV	HE 93-57	21	13/08/93		12.11	
BELT LENGTH 550m / MIN SPLICES = 5 /ACT = 7						
32 CONV	HE 93-72	48	25/09/93		10.69	
32 CONV	HE 94-17	89	25/02/93		17.66	
32 CONV	HE 12-30	153	11/12/92		20.16	NEW BELT
32 CONV	HE 94-15	138	24/02/93		17.70	
32 CONV	HE 94-16	20	24/02/93		17.70	
32 CONV	HE 93-69	117	25/09/93		10.69	
32 CONV	HE 94-21	58	09/05/94		3.27	
BELT LENGTH 858m / MIN SPLICES = 7 / ACT = 12						
33 CONV	HE 94-24	133	29/05/94		2.61	NEW BELT
33 CONV	HE 94-25	54	29/05/94		2.61	
33 CONV	HE 94-26	133	29/05/94		2.61	NEW BELT
33 CONV	HE 94-27	50	29/05/94		2.61	
33 CONV	HE 94-28	43	29/05/94		2.61	
33 CONV	HE 94-29	28	30/05/94		2.57	ACROSS HOLE
33 CONV	HE 94-30	12	29/05/94		2.61	
33 CONV	HE 93-49	6	28/07/93		12.63	
33 CONV	HE 94-16	165	19/03/94		4.94	
33 CONV	HE 94-19	27	11/04/94		4.19	
33 CONV	HE 94-18	6	08/04/94		4.28	CUT OUT HOLE
33 CONV	HE 94-42	28	11/07/94		1.19	
BELT LENGTH 740m / MIN SPLICES = 6 / ACT = 9						
34 CONV	HE 94-10	117	07/01/94		7.28	
34 CONV	HE 94-1	135	16/01/94		6.98	NEW BELT
34 CONV	HE 94-12	46	16/01/94		6.98	NEW BELT
34 CONV	HE 94-13	75	16/01/94		6.98	
34 CONV	HE 93-89	12	21/11/93		8.82	INSERT ACROSS HOLE
34 CONV	HE 93-88	18	21/11/93		8.82	INSERT ACROSS HOLE
34 CONV	HE 94-11	133	22/01/94		6.78	
34 CONV	HE 94-14	120	22/01/94		6.78	
34 CONV	HE 94-20	45	28/04/94		3.63	
BELT LENGTH 123m / MIN SPLICES = 1 / ACT = 1						
35 CONV	HE 9-14	123	03/10/92		22.43	
			AVERAGE AGE		8.60	MONTHS

CONVEYOR EQUIPMENT DETAILS

PICKING BELTS

Feeders	:	Osborn 4812VF205
Conv. gearbox	:	David Brown B3 200
Motor	:	22kW 500 VOLT
Fluid Drive	:	Voith 366TV
Belts & beltspeeds	:	1500mm wide x 128 metre horizontal 1.11m/s

INCLUDED CONVEYORS (DUAL DRIVE)

Gearboxes	:	David Brown B3-355
Motors	:	160kW 500 Volt
Fluid Drives	:	Voith 487 TSS
Hold backs	:	Falk 120 NRt mounted on drive pulley shaft
Belts	:	1200mm x 740 metre 14° incline 2.1m/s

DISCHARGE CONVEYORS

Gearboxs	:	David Brown worm C4-800
Motors	:	18.5kW 500 Volt
Fluid Drives	:	Voith 247 DT
Hold backs	:	Not required
Tension	:	Screw base
Belts	:	1200mm x 25 metre horizontal 1.78m/s

BELTING SPECIFICATION

Class	:	1000/4
Top Cover	:	8mm
Bottom Cover	:	3,2mm
Designed tonnage	:	800 tons per hour

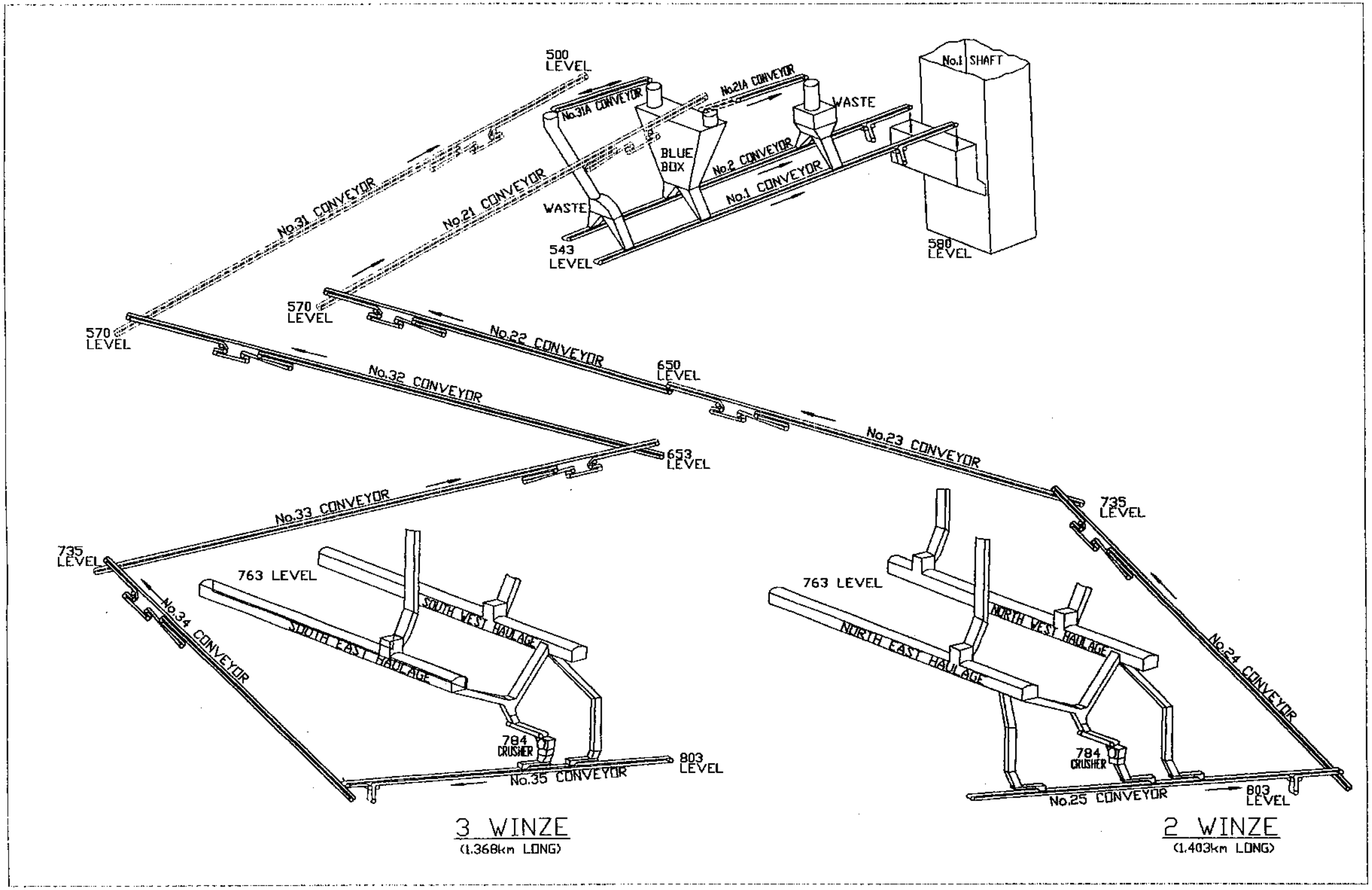

No.1 SHAFT
580 LEVEL
WASTE
No.21A CONVEYOR
No.31A CONVEYOR
500 LEVEL
BLUE BOX
No.2 CONVEYOR
No.1 CONVEYOR
WASTE
543 LEVEL
No.31 CONVEYOR
No.21 CONVEYOR
570 LEVEL
570 LEVEL
No.22 CONVEYOR
650 LEVEL
No.32 CONVEYOR
No.23 CONVEYOR
653 LEVEL
735 LEVEL
No.33 CONVEYOR
735 LEVEL
763 LEVEL
SOUTH WEST HAULAGE
SOUTH EAST HAULAGE
No.34 CONVEYOR
784 CRUSHER
803 LEVEL
No.35 CONVEYOR
3 WINZE
(1.368km LONG)
763 LEVEL
NORTH WEST HAULAGE
NORTH EAST HAULAGE
No.24 CONVEYOR
784 CRUSHER
No.25 CONVEYOR
803 LEVEL
2 WINZE
(1.403km LONG)

FIGURE 1

General Arrangement of Incline Conveyor

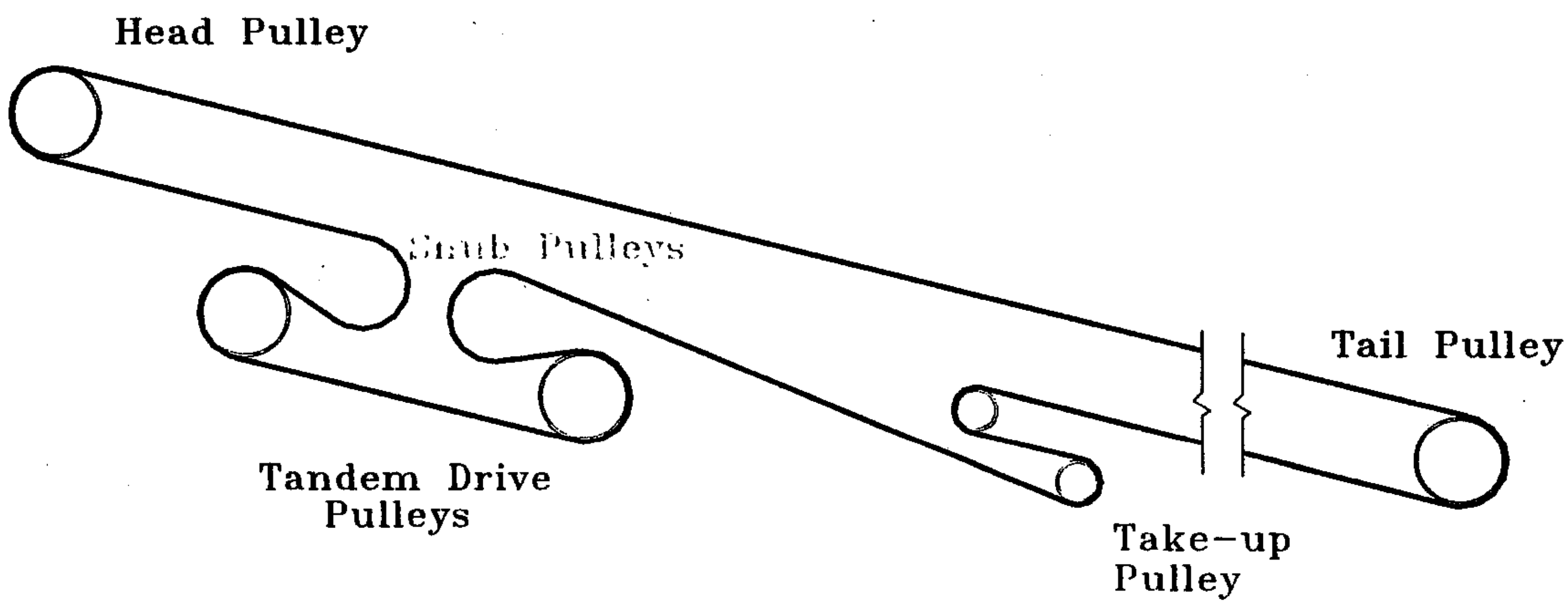


Figure 2

Drive Arrangement
Original Pulley Configuration

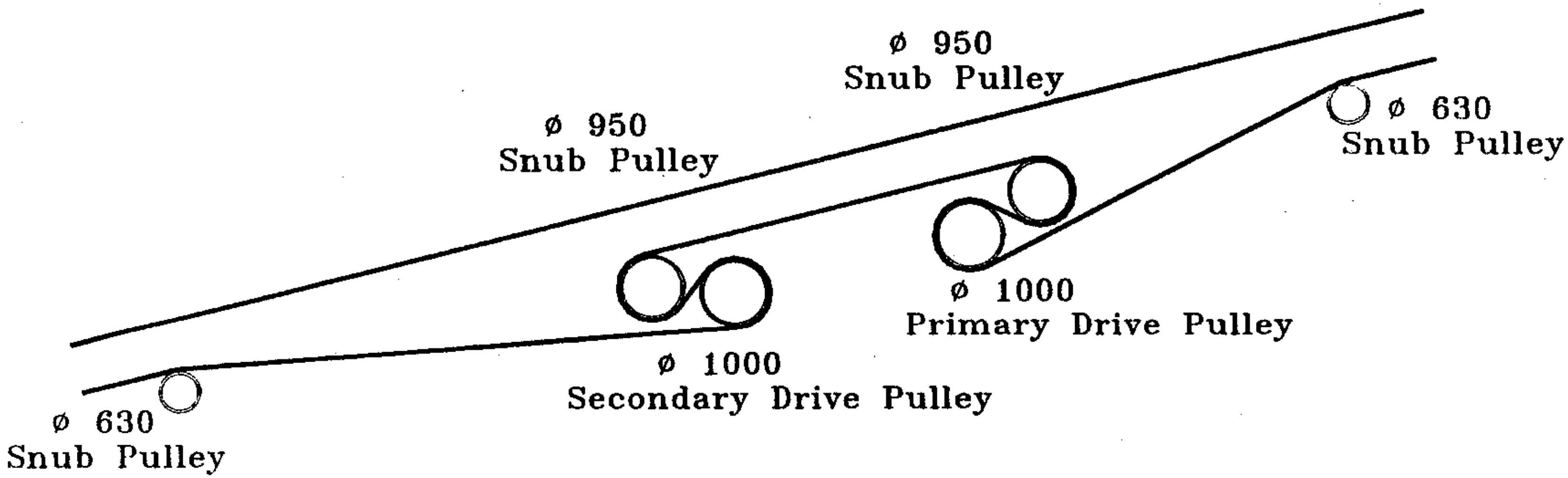


Figure 3

Original Take-up Arrangement

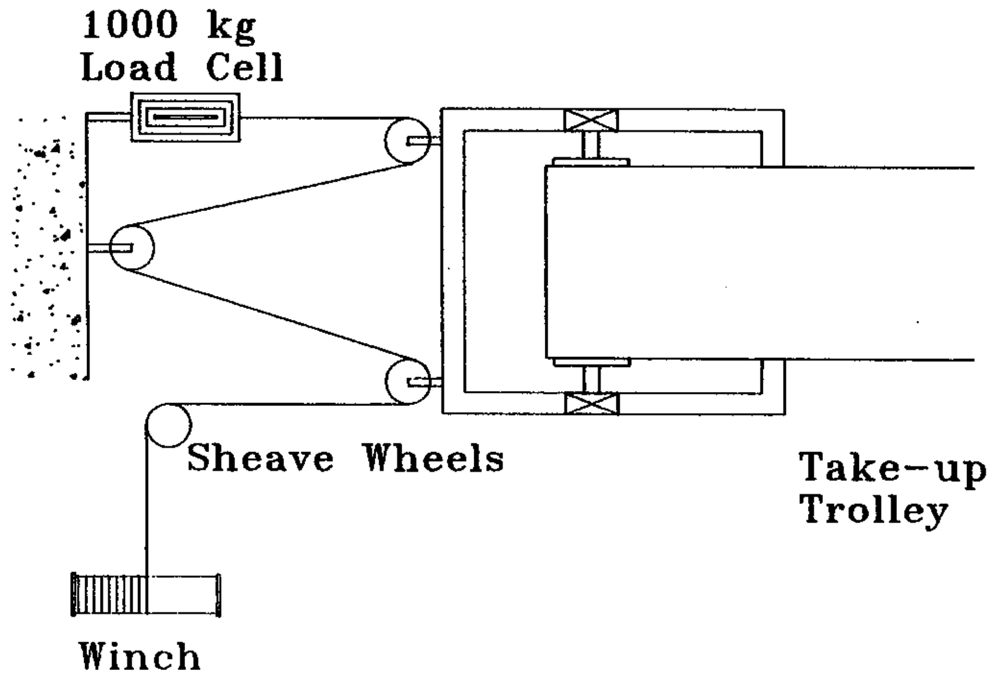


Figure 4

Cross-section Of Conveyor Winze

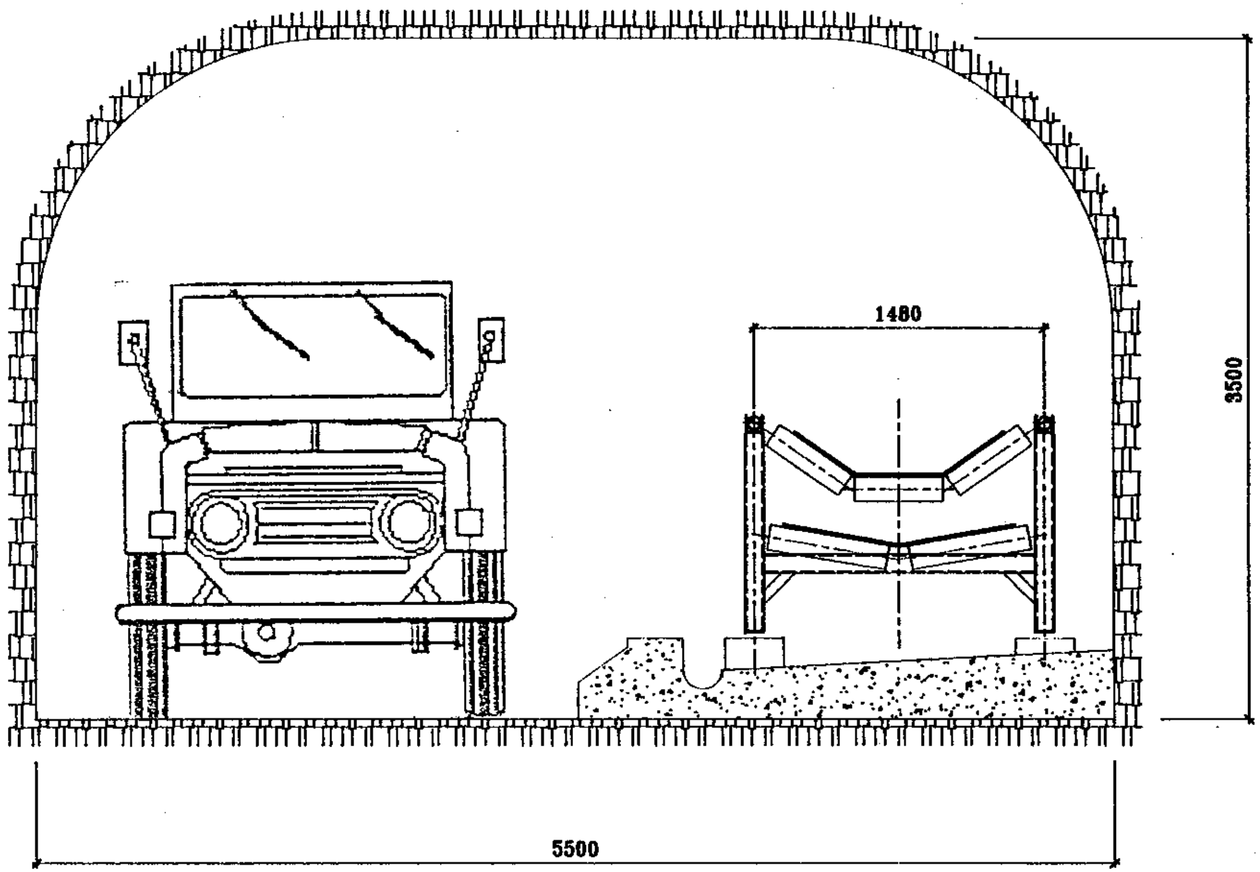
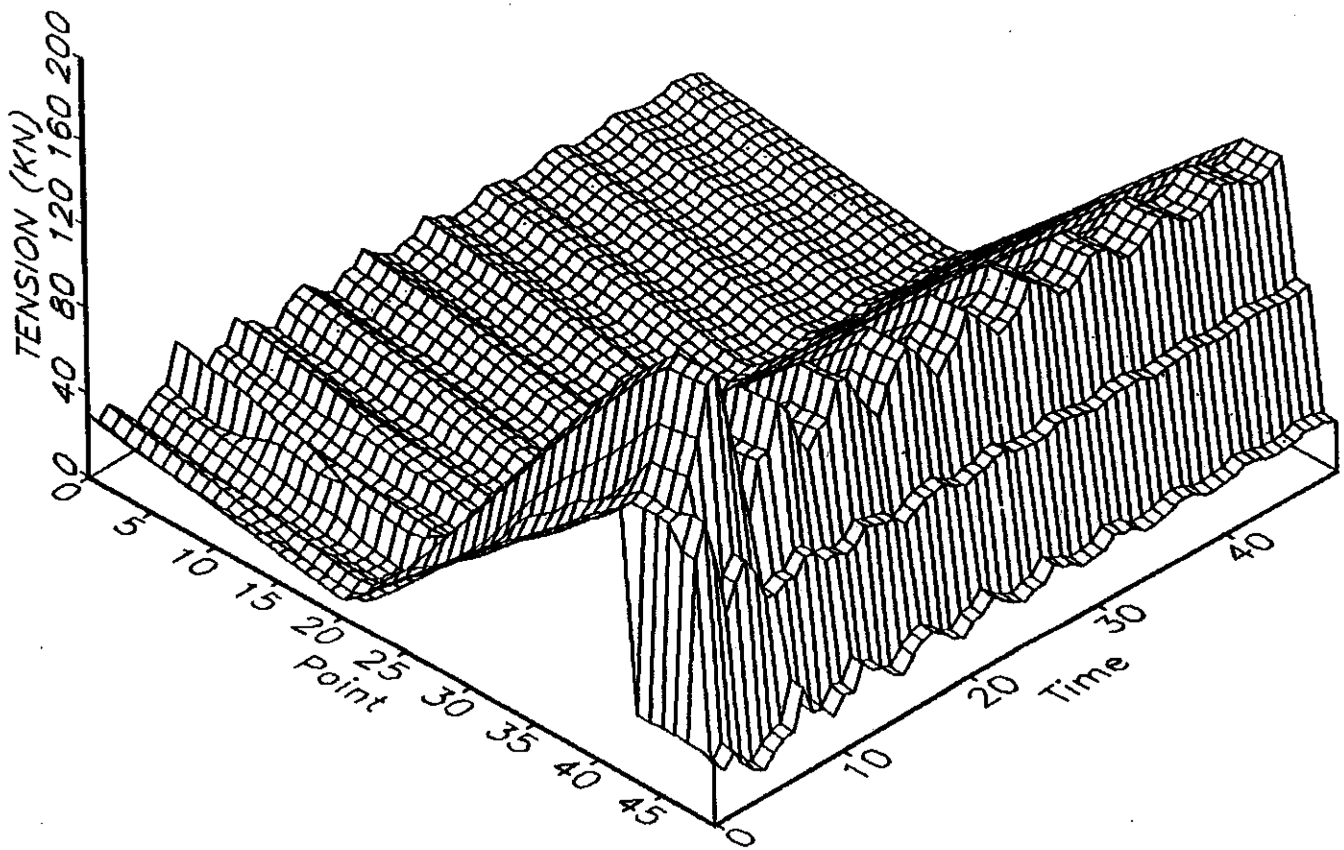


Figure 5

C D I Apr. 3, 1992 3:01:00 PM



START UP 800tph 25kN FIXED TAKE UP TSS 562 COUPLING
PREMIER MINE CONVEYOR C34

CLIENT: PREMIER MINE	CONV: INCLINE CONV 34	FIRST	BELTFLEX ANALYSIS
PROJECT: DYNAMIC ANALYSIS	04-03-1992 REV:	VSTART6.34F	CONVEYOR DYNAMICS, INC.

FIGURE 6

Modified Drive Pulley Configuration

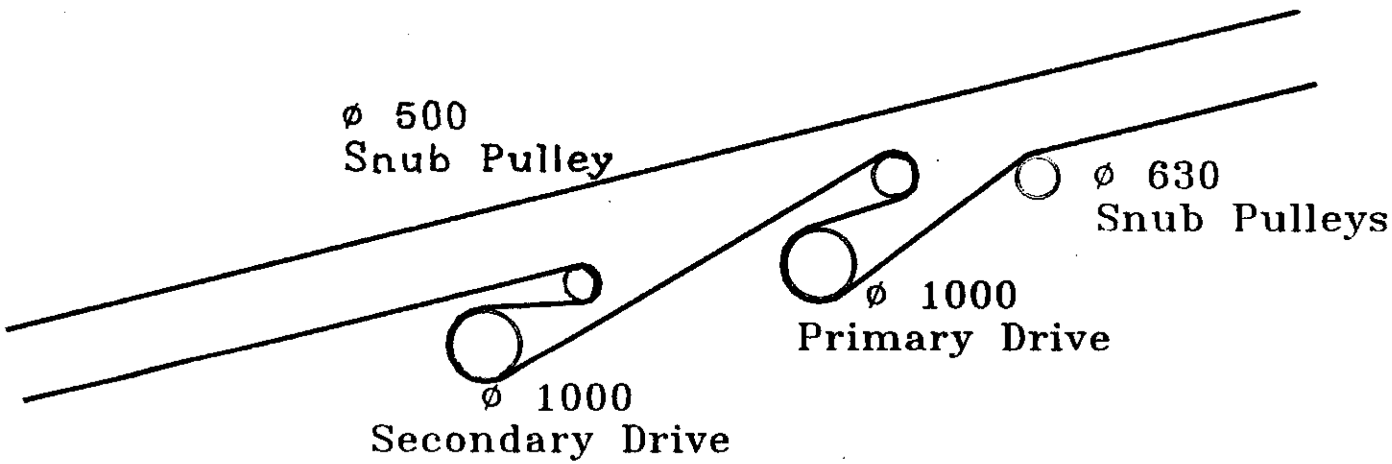


Figure 7