BELTCON 1

BELT CONVEYORS - DESIGN, OPERATION AND OPTIMIZATION

PAPER B3

OPERATING AND MAINTENANCE COSTS OF UNDERGROUND COLLIERY CONVEYORS

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SYNOPSIS

This paper investigates the variation in the value of the 'Cost per tonne kilometer' variable with Conveyor capacity and length. Although the variable is often taken to have a fixed value applicable to all conveyors the results of this study show that the variable is dependent on conveyor width, length and average capacity utilisation.
The theoretical prediction of conveyor operating and maintenance costs is dependent on wear life models for the various 'wear components' of a conveyor.
The most important of these models is for conveyor belt wear life prediction as the greatest single contributory component to the total conveying cost is that for belt replacement.
On the basis of the scant data available a wear life equation for conveyor belts used in underground collieries has been proposed.
This study considers conveyor widths of 900 mm to 1500 mm and conveyor lengths of up to 1500 m.

Lachmann (3) in an article which surveys 'Conveyor belt Technology' makes no specific mention of wear life prediction. Lachmann does suggest as a rough guide that the limiting impact energy of single particles on the belt be determined by the formula:

$$E < 0,4.tB$$

Where E = energy (kgf.m)
E = 20 kgf.m for a 10kg lump falling through 2m.
tB = belt breaking strength in kgf/cm
(1 kgf/cm = 0,981 kN/m)

The limiting energy gives a rough indication of the point at which particles with blunt edges will penetrate the carcass of a conveyor belt.
Where sharp-edged lumps are conveyed the limiting energy will be lower. Lachmann (3) therefore suggests that the maximum energy be kept at 0,75 E.

Goodyear (4), suggests that the wear life prediction of belts is 'next to impossible' by means of any universal formula. The Goodyear design manual (4) does however state that cover wear is generally in proportion to load depth (i.e Conveying side cover wear follows a pattern similar to the load cross section).
Typical wear rates measured by Goodyear (4) for RMA Grade 1 covers when conveying coal are :

0,025 to 0,050 mm per million tons.

In certain instances this has been measured to be as high as 0,17 mm per million tons.
(RMA Grade 1 cover is a stacker quality cover).

From discussions the authors have had with manufacturers it would appear that a higher wear rate can be anticipated for underground conveyor belting.

For a given set of operating conditions a belt manufacturer is able to specify the most suitable belt. The tension specifications will be dependent on the length and capacity of the conveyor whilst the bottom and top covers of the belt will be specified according to the lump size and abrasiveness of the material. Manufacturers therefore often talk of belt life for a properly selected belt operating under design conditions. This would represent the ideal. Alternatively, where the conveyor belt characteristics are the limiting constraint a conveyor may be designed to suit the belt characteristics.

For conveyor belts of 1050 mm - 1350 mm width operating at 2,56 m/s, of approximately 1000 m length and conveying R.O.M. coal (run of mine coal) with a maximum lump size of 250 mm, three local manufacturers of fire resistant conveyor belting gave the following wear life information.

1. INTRODUCTION

The operating and maintenance costs of belt conveyors are often calculated on the basis of a fixed value of the variable 'cost per tonne per kilometer'. In practice the value of the operating and maintenance variable is updated with time as costs increase and as new data becomes available from belt conveyor users who detail their operating and maintenance costs.
Although those who make use of the all embracing 'costs per tonne per kilometer' variable may instinctively feel that this variable is dependent on the tonnage which a particular conveyor may transport or on the length of the conveyor, it is often not easy to determine by how much it varies.

This study considers the variation in operating and maintenance costs for a range of underground conveyors, namely 900 mm to 1500 mm wide conveyors.
The costs are calculated for conveyor lengths of from 100 m to 1500 m long. To be able to derive a theoretical operating and maintenance cost model the wear life of conveyor components had to be predicted. Very little statistical data exists for wear life prediction and in most instances the author has relied on qualitative information collected from users on the collieries and from manufacturers and suppliers.
Where wear life predictions are available, as for conveyor idlers, these would not appear to give a true reflection of actual performance.

The first section of this paper considers wear life prediction while in the following sections the prediction of operating and maintenance costs and the results of this study are discussed.

2. THE PREDICTION OF WEAR LIFE OF CONVEYOR COMPONENTS

In this section the wear life of the conveyor components listed below is considered :

2.1 Conveyor belting
2.2 Conveyor idlers - troughing
 - return
2.3 Belt fasteners
2.4 Other mechanicals (includes motor; transmission; coupling; pulley and bearings)

2.1 THE WEAR LIFE OF CONVEYOR BELTING

Spain (2) in a paper on the prediction of the reliability of conveyor belting discusses the difficulty of using laboratory techniques and laboratory data to predict belt wear life. He suggests that service records must be used in conjunction with any available laboratory data to establish a correlation for a particular application. In the case of cover abrasion, as a wear life mechanism Spain (2) suggests that 'field tests and service records are virtually the only dependable source of information upon which to base performance predictions'. Spain (2) further comments that 'Abuse (especially impact and cutting) and abrasion resistance usually demand far more attention in beltwear life prediction than any of the other characteristics'.

Manufacturers	Life Capacity	Av. Conveying Capacity	Life (Hrs) (000's)	Life (Yrs)	Cycles (000's)
A	6-8 Mt	400t/h	15-20	3,7-5,0	69-92
B	6-10Mt	350t/h	17-28	4,2-6,9	78-129
C	8-10Mt	350t/h	23-28	5,8-6,9	108-129

TABLE 1: Belt Wear Life

From discussion with manufacturers and users it has been assumed that the primary factors in belt deterioration are :

1. the belt loading conditions;
2. the belt average carrying capacity; and
3. belt cycles

To be able to mathematically model the wear life of a belt these factors should be taken into account.
This study only considers conveyors travelling at 2,56 m/s and hence feeding chute geometry is uniform and the differential velocity of the coal particle and conveyor belt will remain constant. The belt loading is a variable in this study and therefore must be taken into account in the equation.
The belt cycle time is a direct function of the conveyor length and speed.

Using the data in Table 1 as a starting point and by making some very broad assumptions about the relative effects of the factors mentioned above the following wear life equation was derived :-

$$L = 0{,}102\ (LC)^{0{,}5}\ (2 - P/100)^{0{,}9} \qquad (1)$$

LC = Length of conveyor (m)
P = Percentage of full capacity (%); L = Life (Yrs)
(The equation as stated is for a conveyor speed of 2,56 m/s)

The derivation of this equation is set out in Appendix 1. Although no experimental data is available to verify equation 1 it has been used in this study as an improvement on assuming a fixed belt wear life independent of length or loading. A second justification for its use is that the cost of belt replacement calculated from wear life is one of many costs which is summated to give a final operating and maintenance cost. Any inacuracies in the belt replacement cost will produce an error which is reduced in proportion when all the individual costs are summated.

The graph of belt wear life as a function of conveyor length and conveyor loading is given in Figure 1. It will be seen that for a conveyor length of 1000 m the belt life varies from 3,2 years at 100% capacity to 5,3 years at 25% capacity.

The normal operating averaged capacity of 50% gives a belt life of 4,75 years which would appear to tie in with the manufacturers' predicted wear life expectancy.
For this study the approximation that the belt wear life is independent of belt width has been made. This may not be true.

2.2 THE WEAR LIFE OF IDLERS

TROUGHING IDLERS

The wear life of troughing idlers is dependent on the average loading, impact loading, cycles of operation, speed and environmental operating conditions.
This list is not necessarily complete but gives an indication of the complexity required of any mathematical model to predict idler wear life for given operating conditions.

CEMA (1) suggests that as a wear life design procedure is available for idler bearings that this be applied to the wear life of idlers as a benchmark.
Given in Appendix 2 are the calculations according to CEMA. These show that to attain a probability of 90% of idler bearings being operational after 30 000h (5,3 yrs) requires CEMA class C5 idlers.
These are classified as medium duty idlers. Although the worst possible cases of operating conditions and maintenance were assumed only a medium duty rated idler is required to attain the 5,3 yr life time by the CEMA design method. As stated by CEMA this should be modified for the application of the idlers.

From Colliery experience within Rand Mines Ltd the following 'first estimate' data is suggested:-

Troughing Idler Life (Years)	Conditions of Operation and Maintenance
0-1	Very poor
2	Poor
3	Average
4	Good
5	Excellent

TABLE 2: Idler Wear Life

As a first approach for this study an idler life of 3,5 years has been assumed for all troughing idlers. A wear life of 2,5 years has been assumed for the return idlers. The lower wear life is due to increased shell wear owing to greater coal particle contact on the dirty side of the belt and to the less favourable bearing operating conditions. The troughing idler spacing is taken as 1,35 m and the return idler spacing as 3,0 m.

2.3 WEAR LIFE OF BELT FASTENERS

The replacement costs of belt fasteners is calculated on the basis of a fixed fastener wear life of 2000 hours (0,36 years) irrespective of loading. It is assumed that one fastener per 200m of belting is used per conveyor. This may be far more than is used on the larger capacity conveyors considered in this study.
However it was included as an average for all conveyors.
The cost assigned to replacing a worn belt fastener was that for the hook and eye type of mechanical fastener.

2.4 'OTHER MECHANICALS' WEAR LIFE

The wear related costs included in this category include the replacement costs of mechanical transmission items. The elements of the conveyor transmission and drive system which one could expect to replace periodically are :

- the gearbox bearings
- drive and snub pulley bearings
- tail pulley bearings
- lagging on the drive pulley

Where the transmission is not correctly sized for the particular application those transmission and drive elements which should last for the expected conveyor lifetime may require early replacement. Examples are the :

- transmission gears (where service factors are not as designed for originally ; poor lubrication)
- drive pulleys (where fluid couplings are not correctly filled or the time delay between primary and secondary drive start up is excessively long)

For this study a figure of 5% per annum of capital value wear cost allowance has been made to take poor maintenance and severe operating conditions into account.

3. LABOUR COSTS RELATED TO CONVEYOR OPERATION AND MAINTENANCE

The operating labour requirement of conveyors has been divided into fixed and length dependent requirements. A conveyor drive (head end) and a transfer point operator (tail end) have been included as fixed labour for each conveyor. The following labour has been included as being conveyor length dependent :-

1 conveyor cleaner per 500 m of conveyor.
1 labour supervisor per 6000 m of conveyor.
1 beltsman, 7 labourers } per 15 000 m of conveyor for conveyor extensions and belt repair.

The maintenance labour requirement for any conveyor has been set at 5% of an artisans shift time and 5% of the shift time of two engineering aides per 1000 m of conveyor. This percentage has been arrived at from a consideration of the conveyor stoppages encountered in practice on Rand Mines Collieries.

The labour rates used in the study are the total cost to the mine for any particular 'labour unit'.

4. OTHER ASSUMPTIONS RELATED TO THE STUDY

The capital cost of the conveyor has been taken as a fixed price per running meter of conveyor as a first approximation. This is used to calculate the annual insurance premium on the conveyor (as part of the capital equipment on a mine) and as will be seen from the results of the study, for an annual premium of 0,09% on the value of capital equipment the contribution of this amount to the operating costs is very small.

The conveyor speed for this study has been set at 2,56 m/s and the idler troughing angle at 35°. The angle of inclination is taken as 0°.

The wear life models assumed are dependent on average conveyor capacity. The time - loading profile of the conveyor may vary considerably for similar underground conveyor applications with the same average capacity. The maximum instantaneous loading experienced by any portion of the conveyor will therefore also tend to vary considerably.
However the accumulative effect of the various loading profiles of a conveyor, is assumed to be equivalent to that of the 'averaged capacity' effect on wear life.

5. PRESENTATION OF THE RESULTS OF THE STUDY

Given the assumptions of wear life and labour requirements made for this study, the operating and maintenance costs are broken down for five commonly used conveyor sizes in Tables 3 to 7. The prices used are as at July, 1981.
Seven conveyor lengths are considered in the study, namely:
100 m, 250 m, 500 m, 750 m, 1000 m, 1250 m, and 1500 m. The conveying capacities considered for each conveyor length are 100%, 75%, 50%, 25% 20% and 15%. The actual conveying capacities are calculated for a conveyor speed of 2,56 m/s and a troughing idler angle of 35° for each particular belt width. The operating and maintenance costs are seperately itemised and totaled so that the relative proportions of these costs may be appreciated. The total operating and maintenance cost for each case is expressed both as a c/t and c/t.km figure.
The data presented in Tables 3 to 7 is graphically reproduced in figures 2 to 5.

Included in the tabulated results are the conveyor characteristics. The 'Power Required' is that power supplied to the conveyor drive and hence allows for motor and transmission efficiency. The Motor size required as specified in the tables of results are the standard squirrel cage motor sizes applicable in each case.

In most instances a range of standard 'power pack' sizes are used to make up the required drive capacity in multiples of standard power pack sizes.
The maximum belt tension specified for each length of conveyor is that for 100% of conveying capacity. The class of belt required is that class of SABS belt required. In some instances a class of belt has been specified for the long conveyor lengths that is not a prefered class for the particular width considered.
The belt tension requirements have been specified for 100% volumetric loading implying that in certain cases a lower class of belt could be employed if the actual maximum carrying capacity of the conveyor was maintained at some lower capacity.
(i.e. Maintained at a loading capacity with an equivalent volumetric capacity less than 100%)

6. DISCUSSION OF THE RESULTS

Figures 2 to 5 graphically show how the total operating and maintenance costs for the five sizes of conveyor vary with length and average conveying capacity of the conveyor.
The more important trends are discussed in point form below:

1) The operating and maintenance cost of various conveyors expressed as a c/tkm figure is both length and capacity dependent.
The conveying cost increases exponentially with decreasing length. This suggests greater economy for applications where the length of individual conveyors is increased to a maximum allowable for the class of belt being used.

2) The conveying cost of operating an underutilised conveyor increases as the degree of underutilisation increases. Hence the conveying cost per tonne kilometer for a conveyor width is utilised to an average 50% of its full carrying capacity is lower that that for a conveyor utilised to an average 25% of its full carrying capacity. This is significant in underground colliery conveyor network design where the conveyors are designed to accomodate instantaneous peak loads. This is due to the nature of the loading of the conveyor network which occurs for the various mining methods. It is therefore desirable to smooth the loading of a conveyor network as much as possible. Hence the difference in cost when comparing two conveyors is made up of both the difference in capital cost and operating and maintenance costs.

3) For conveyors of equal length carrying coal at the same percentage of full capacity the cost of conveying decreases with increasing conveyor width. This is shown in Figure 6 which compares the conveying costs of 900 mm to 1500 mm wide conveyors carrying material at 50% of full capacity.
This variation decreases with increasing width and as can be seen from the tabulated data and Figure 6 the variation in conveying costs for the sizes 1350 mm to 1500 mm is small.

4) The belt replacement cost is the largest cost component of the total conveying cost. Using as an example a 1350mm wide conveyor of 1000m length at 75% of full capacity the belt replacement cost is 1,29c/t while the total cost is 2,38 c/t (or 54% of the conveying cost).
For the same conveyor operating at 15% of full capacity the belt replacement cost is 4,52 c/t compared to a total conveying cost of 9,17 c/t (or 49% of the conveying cost).

5) The cost components of the operating and maintenance cost totals are expressed as averaged costs per tonne. In practice these costs would be incurred as step functions on a time-cost graph. A plot of the accumulative average cost against tonnage conveyed for a conveyor which has operated for a number of years would more closely resemble the case presented here.

6) The three other most important cost components besides belt replacement are the operating labour cost, the power cost and the idler replacement cost. For a 1350 mm wide conveyor of 1000 m length at 50% of full capacity the following applies :-

Cost Component	c/t	% of Total Cost
Power cost	0,45	14
Operating labour cost	0,32	10
Idler replacement cost	0,54	17
Belt replacement cost	1,64	52
Fastener replacement cost	0,07	2
Mech & lube cost	0,09	3
Maint. Labour cost	0,06	2
Total Cost	3,17	100%

Shown in Figure 7 is the breakdown of Cost Components as a function of conveyor length for a 1350 mm wide conveyor at 50% of full capacity. This further illustrates the large proportion of the total conveying cost which is attributable to the belt replacement cost. For the assumptions made in this study it remains at approximately 50% of the total conveying cost for the range of conveying capacities and lengths considered.

7) The wear life model suggested in Section 2.1 was based on sparse qualitative data and has been suggested for want of a better model to use.
However, the relative importance of the model is borne out by the comments above and by Figure 7. Any further refinement of conveyor operating and maintenance cost prediction will be largely dependent on the correlation of experimental data would perhaps have to be modified by some statistical frequency of abnormal belt damage. This would account for belt damage by shovels, iron bars, and other tramp iron which is carried by the conveyor on occassion and may damage a belt at a transfer point.

7) CORRELATION OF THEORETICAL DATA WITH COLLIERY RECORDED DATA

This study will be useful in comparing theoretically derived operating and maintenance data based on anticipated wear life with Colliery reported data. Most mining houses will make use of some form of management accounting system to record the production costs for various collieries. On the basis of these reports Head Office management may order further investigation of specific costs or directly suggest corrective action. Where a mining house operates a number of underground collieries it will then also be possible to compare statistics that have been similarly compiled for different collieries. These comparative figures often set the in-Company standards.

The variation in the operating and maintenance cost of underground conveyors when calculated using conveyor wear life data as discussed in this paper can be useful in explaining the variations in cost data recorded for various collieries within a mining company.

8. CONCLUSION

The operating and maintenance cost of any particular conveyor can be expressed as a cost per tonne kilometer. Though this quantity can be recorded for various installations it is not always true that it can then be used as a fixed quantity to estimate the conveying costs for other conveyors. The conveying cost expressed as a cost per tonne kilometer has been shown to vary with conveyor width, capacity and conveyor length. Though the exact nature of these variations are dependent on the wear life models assumed for the various conveyor components it is felt that the variation can be theoretically predicted and also be observed to some extent in practice.

The greatest single cost component of the total conveying cost is the belt replacement cost. For the wear life model assumed the belt replacement cost represented approximately 50% of the total cost for the 900 mm to 1500 mm wide conveyers considered and for conveyor lengths of up to 1500 m. Any further refinement of this operating and maintenance cost study would largely be dependent on the verification and or modification of the belt wear life model suggested in this paper.

9. ACKNOWLEDGEMENTS

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10. REFERENCES

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TABLE 3

TABLE OF OPERATING AND MAINTENANCE COSTS FOR UNDERGROUND COLLIERY CONVEYORS

PRICES AS FOR 28/ 7/81
A. BELT WIDTH= 900.00
CONVEYOR SPEED=2.56M/S
IDLER TROUGHING ANGLE=35 DEG

DIST (C TO C) (M)	% OF FULL CAP	CAPC (AVE) (T/H)	POWER REQD (KW)	MOTOR SIZE REQD (KW)	MAX BELT TENS (KN)	CLSS OF BELT REQD SABS	CAPIT COST OF CONVEY R/P	OPERATING COSTS: INSUR -ANCE COSTS C/T	OPERATING COSTS: POWER COSTS C/T	OPERATING COSTS: OPER ATING LABR COSTS C/T	OPERATING COSTS: TOTAL OPER ATING COSTS C/T	MAINTENANCE COSTS: IDLER COSTS C/T	MAINTENANCE COSTS: BELT COSTS C/T	MAINTENANCE COSTS: FAST ENER COST C/T	MAINTENANCE COSTS: MECH AND LUBR COST C/T	MAINTENANCE COSTS: LABR COST C/T	TOTAL MAIN TENAN COST C/T	OP+MAINT COSTS: TOTAL OP AND MAINT COST C/T	OP+MAINT COSTS: TOTAL OP AND MAINT COST C/TKM
100	100	612.0	16.3	18.5	9	630	220	.000	.05	.40	.45	.05	.43	.01	.01	.01	.49	.95	9.47
100	75	459.0	14.0	18.5	9	630	220	.000	.06	.53	.59	.06	.46	.01	.01	.01	.56	1.15	11.50
100	50	306.0	11.6	18.5	9	630	220	.000	.08	.80	.87	.10	.59	.01	.02	.01	.73	1.60	16.03
100	25	153.0	9.3	18.5	9	630	220	.000	.12	1.60	1.72	.19	1.03	.02	.03	.03	1.30	3.02	30.24
100	20	122.4	9.3	18.5	9	630	220	.000	.15	2.00	2.15	.24	1.26	.03	.04	.03	1.60	3.75	37.47
100	15	91.8	9.3	18.5	9	630	220	.000	.20	2.66	2.86	.32	1.63	.04	.05	.05	2.09	4.96	49.56
250	100	612.0	32.6	37.0	13	630	220	.000	.11	.38	.49	.12	.67	.01	.02	.02	.85	1.33	5.34
250	75	459.0	27.9	37.0	13	630	220	.000	.12	.51	.63	.16	.73	.02	.03	.02	.96	1.60	6.38
250	50	306.0	24.4	37.0	13	630	220	.000	.16	.76	.92	.24	.94	.03	.04	.03	1.28	2.20	8.81
250	25	153.0	19.7	37.0	13	630	220	.000	.26	1.53	1.79	.48	1.63	.05	.08	.07	2.32	4.10	16.41
250	20	122.4	18.6	37.0	13	630	220	.000	.30	1.91	2.22	.60	1.98	.07	.10	.09	2.84	5.06	20.24
250	15	91.8	17.4	37.0	13	630	220	.000	.38	2.55	2.93	.80	2.58	.09	.13	.12	3.73	6.66	26.62
500	100	612.0	60.4	75.0	33	630	220	.000	.20	.41	.61	.24	.95	.03	.04	.03	1.30	1.90	3.81
500	75	459.0	52.3	75.0	33	630	220	.000	.23	.55	.77	.32	1.04	.04	.05	.05	1.50	2.27	4.54
500	50	306.0	44.2	75.0	33	630	220	.000	.29	.82	1.11	.48	1.32	.05	.08	.07	2.01	3.12	6.23
500	25	153.0	36.0	75.0	33	630	220	.000	.47	1.64	2.11	.97	2.30	.11	.16	.14	3.68	5.78	11.57
500	20	122.4	34.9	75.0	33	630	220	.000	.57	2.05	2.62	1.21	2.81	.14	.20	.17	4.52	7.14	14.28
500	15	91.8	32.6	75.0	33	630	220	.000	.71	2.73	3.44	1.61	3.65	.18	.27	.23	5.94	9.38	18.76
750	100	612.0	86.0	90.0	47	630	220	.000	.28	.36	.64	.36	1.17	.04	.06	.05	1.68	2.33	3.10
750	75	459.0	76.7	90.0	47	630	220	.000	.33	.48	.82	.48	1.27	.05	.08	.07	1.96	2.78	3.70
750	50	306.0	62.8	90.0	47	630	220	.000	.41	.73	1.14	.72	1.62	.08	.12	.10	2.65	3.79	5.05
750	25	153.0	51.2	90.0	47	630	220	.000	.67	1.45	2.12	1.45	2.82	.16	.24	.21	4.88	7.01	9.34
750	20	122.4	48.8	90.0	47	630	220	.000	.80	1.82	2.61	1.81	3.44	.20	.30	.26	6.01	8.63	11.51
750	15	91.8	46.5	90.0	47	630	220	.000	1.01	2.42	3.44	2.41	4.47	.27	.40	.35	7.91	11.34	15.12
1000	100	612.0	114.0	110.0	62	630	220	.000	.37	.37	.75	.48	1.35	.05	.08	.07	2.03	2.78	2.78
1000	75	459.0	100.0	110.0	62	630	220	.000	.44	.50	.93	.64	1.47	.07	.11	.09	2.39	3.32	3.32
1000	50	306.0	83.7	110.0	62	630	220	.000	.55	.75	1.29	.97	1.87	.11	.16	.14	3.24	4.54	4.54
1000	25	153.0	68.6	110.0	62	630	220	.000	.90	1.49	2.39	1.93	3.26	.22	.32	.28	6.01	8.40	8.40
1000	20	122.4	66.3	110.0	62	630	220	.000	1.08	1.87	2.95	2.41	3.97	.27	.40	.35	7.40	10.36	10.36
1000	15	91.8	62.8	110.0	62	630	220	.000	1.37	2.49	3.86	3.22	5.16	.36	.54	.46	9.74	13.60	13.60
1250	100	612.0	144.0	150.0	78	800	220	.000	.47	.38	.85	.60	1.51	.07	.10	.09	2.37	3.22	2.58
1250	75	459.0	124.4	150.0	78	800	220	.000	.54	.51	1.05	.80	1.64	.09	.13	.12	2.79	3.84	3.07
1250	50	306.0	105.8	150.0	78	800	220	.000	.69	.77	1.46	1.21	2.09	.14	.20	.17	3.81	5.27	4.21
1250	25	153.0	86.0	150.0	78	800	220	.000	1.12	1.53	2.66	2.41	3.64	.27	.40	.35	7.08	9.74	7.79
1250	20	122.4	82.6	150.0	78	800	220	.000	1.35	1.92	3.27	3.02	4.44	.34	.50	.43	8.73	12.00	9.60
1250	15	91.8	79.1	150.0	78	800	220	.001	1.72	2.56	4.28	4.02	5.77	.45	.67	.58	11.50	15.78	12.62
1500	100	612.0	173.3	185.0	94	1000	220	.000	.57	.39	.96	.72	1.65	.08	.12	.10	2.68	3.64	2.43
1500	75	459.0	147.7	185.0	94	1000	220	.000	.64	.53	1.17	.97	1.80	.11	.16	.14	3.17	4.34	2.90
1500	50	306.0	126.7	185.0	94	1000	220	.000	.83	.79	1.62	1.45	2.29	.16	.24	.21	4.35	5.97	3.98
1500	25	153.0	104.7	185.0	94	1000	220	.000	1.37	1.58	2.95	2.90	3.99	.33	.48	.42	8.11	11.06	7.37
1500	20	122.4	100.0	185.0	94	1000	220	.001	1.63	1.97	3.61	3.62	4.86	.41	.60	.52	10.01	13.62	9.08
1500	15	91.8	95.3	185.0	94	1000	220	.001	2.08	2.63	4.71	4.83	6.32	.54	.81	.69	13.19	17.90	11.94

TABLE 4

TABLE OF OPERATING AND MAINTENANCE COSTS FOR UNDERGROUND COLLIERY CONVEYORS

PRICES AS FOR 28/ 7/81
A. BELT WIDTH=1050.00
CONVEYOR SPEED=2.56M/S
IDLER TROUGHING ANGLE=35 DEG

DIST (C TO C)	% OF FULL CAP	CAPC (AVE)	POWER REQD	MOTOR SIZE REQD	MAX BELT TENS	CLSS OF BELT REQD	CAPIT COST OF CONVEY	INSUR -ANCE COSTS	POWER COSTS	OPER ATING LABR COSTS	TOTAL OPER ATING COSTS	IDLER COSTS	BELT COSTS	FAST ENER COST	MECH AND LUBR COST	LABR COST	TOTAL MAIN TENAN COST	TOTAL OP AND MAINT COST	TOTAL OP AND MAINT COST
	CONVEYOR CHARACTERISTICS							OPERATING COSTS				MAINTENANCE COSTS						OP+MAINT COSTS	
(M)		(T/H)	(KW)	(KW)	(KN)	SABS	R/M	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/TKM
100	100	848.0	22.1	22.0	10	800	250	.000	.05	.29	.34	.04	.36	.00	.01	.00	.42	.76	7.56
100	75	636.0	18.6	22.0	10	800	250	.000	.06	.38	.44	.05	.39	.01	.01	.01	.47	.91	9.10
100	50	424.0	16.3	22.0	10	800	250	.000	.08	.58	.65	.08	.50	.01	.01	.01	.61	1.27	12.65
100	25	212.0	12.8	22.0	10	800	250	.000	.12	1.15	1.27	.16	.87	.02	.03	.02	1.09	2.37	23.68
100	20	169.6	11.6	22.0	10	800	250	.000	.14	1.44	1.58	.20	1.06	.02	.03	.02	1.34	2.92	29.19
100	15	127.2	10.5	22.0	10	800	250	.000	.17	1.92	2.09	.27	1.37	.03	.05	.03	1.75	3.84	38.40
250	100	848.0	41.9	45.0	19	800	250	.000	.10	.28	.37	.10	.57	.01	.02	.01	.71	1.08	4.34
250	75	636.0	36.0	45.0	19	800	250	.000	.11	.37	.48	.14	.62	.02	.02	.02	.81	1.29	5.16
250	50	424.0	30.2	45.0	19	800	250	.000	.14	.55	.69	.20	.79	.02	.03	.02	1.07	1.77	7.07
250	25	212.0	24.4	45.0	19	800	250	.000	.23	1.10	1.33	.41	1.37	.05	.07	.05	1.94	3.27	13.10
250	20	169.6	23.3	45.0	19	800	250	.000	.27	1.38	1.65	.51	1.67	.06	.08	.06	2.38	4.04	16.15
250	15	127.2	20.9	45.0	19	800	250	.000	.33	1.84	2.17	.68	2.17	.08	.11	.08	3.12	5.29	21.16
500	100	848.0	76.7	75.0	36	800	250	.000	.18	.30	.48	.20	.80	.02	.03	.02	1.09	1.56	3.13
500	75	636.0	66.3	75.0	36	800	250	.000	.21	.39	.60	.27	.87	.03	.05	.03	1.25	1.86	3.71
500	50	424.0	55.8	75.0	36	800	250	.000	.26	.59	.85	.41	1.11	.05	.07	.05	1.68	2.54	5.07
500	25	212.0	43.0	75.0	36	800	250	.000	.41	1.18	1.59	.81	1.94	.09	.14	.10	3.08	4.66	9.33
500	20	169.6	40.7	75.0	36	800	250	.000	.48	1.48	1.96	1.01	2.36	.11	.17	.12	3.79	5.74	11.48
500	15	127.2	38.4	75.0	36	800	250	.000	.60	1.97	2.57	1.35	3.07	.15	.23	.17	4.97	7.54	15.09
750	100	848.0	111.6	110.0	58	800	250	.000	.26	.26	.53	.30	.98	.03	.05	.04	1.41	1.93	2.58
750	75	636.0	95.3	110.0	58	800	250	.000	.30	.35	.65	.41	1.07	.05	.07	.05	1.64	2.29	3.05
750	50	424.0	81.4	110.0	58	800	250	.000	.38	.52	.91	.61	1.36	.07	.10	.07	2.22	3.13	4.17
750	25	212.0	62.8	110.0	58	800	250	.000	.59	1.05	1.64	1.22	2.37	.14	.20	.15	4.08	5.72	7.63
750	20	169.6	59.3	110.0	58	800	250	.000	.70	1.31	2.01	1.52	2.89	.17	.25	.19	5.03	7.04	9.38
750	15	127.2	57.0	110.0	58	800	250	.000	.90	1.75	2.64	2.03	3.76	.23	.34	.25	6.61	9.25	12.34
1000	100	848.0	150.0	150.0	80	800	250	.000	.35	.27	.62	.41	1.13	.05	.07	.05	1.70	2.33	2.33
1000	75	636.0	129.1	150.0	80	800	250	.000	.41	.36	.77	.54	1.24	.06	.09	.07	2.00	2.76	2.76
1000	50	424.0	108.1	150.0	80	800	250	.000	.51	.54	1.05	.81	1.57	.09	.14	.10	2.71	3.76	3.76
1000	25	212.0	84.9	150.0	80	800	250	.000	.80	1.08	1.88	1.62	2.74	.18	.27	.20	5.02	6.90	6.90
1000	20	169.6	80.2	150.0	80	800	250	.000	.95	1.35	2.29	2.03	3.34	.23	.34	.25	6.19	8.88	8.48
1000	15	127.2	75.6	150.0	80	800	250	.000	1.19	1.80	2.98	2.70	4.35	.31	.45	.33	8.14	11.13	11.13
1250	100	848.0	186.0	185.0	86	1000	250	.000	.44	.28	.72	.51	1.27	.06	.08	.06	1.98	2.69	2.16
1250	75	636.0	159.3	185.0	86	1000	250	.000	.50	.37	.87	.68	1.38	.08	.11	.08	2.33	3.20	2.56
1250	50	424.0	134.9	185.0	86	1000	250	.000	.64	.55	1.19	1.01	1.76	.11	.17	.12	3.18	4.37	3.50
1250	25	212.0	105.8	185.0	86	1000	250	.000	1.00	1.11	2.10	2.03	3.07	.23	.34	.25	5.91	8.02	6.41
1250	20	169.6	100.0	185.0	86	1000	250	.000	1.18	1.38	2.56	2.54	3.74	.29	.42	.31	7.29	9.86	7.88
1250	15	127.2	94.2	185.0	86	1000	250	.001	1.48	1.84	3.33	3.38	4.86	.38	.56	.42	9.60	12.93	10.34
1500	100	848.0	222.1	220.0	104	1000	250	.000	.52	.28	.81	.61	1.39	.07	.10	.07	2.24	3.05	2.03
1500	75	636.0	189.5	220.0	104	1000	250	.000	.60	.38	.98	.81	1.52	.09	.14	.10	2.65	3.63	2.42
1500	50	424.0	160.5	220.0	104	1000	250	.000	.76	.57	1.33	1.22	1.93	.14	.20	.15	3.64	4.96	3.31
1500	25	212.0	125.6	220.0	104	1000	250	.000	1.18	1.14	2.32	2.43	3.36	.28	.41	.30	6.77	9.10	6.06
1500	20	169.6	118.6	220.0	104	1000	250	.000	1.40	1.42	2.82	3.04	4.09	.34	.51	.37	8.36	11.18	7.45
1500	15	127.2	112.8	220.0	104	1000	250	.001	1.77	1.90	3.67	4.06	5.32	.46	.68	.50	11.01	14.69	9.79

TABLE 5

TABLE OF OPERATING AND MAINTENANCE COSTS FOR UNDERGROUND COLLIERY CONVEYORS

PRICES AS FOR 28/ 7/81
A. BELT WIDTH=1200.00
CONVEYOR SPEED=2.56M/S
IDLER TROUGHING ANGLE=35 DEG

CONVEYOR CHARACTERISTICS								OPERATING COSTS				MAINTENANCE COSTS						OP+MAINT COSTS	
DIST (C TO C)	% OF FULL CAP	CAPC (AVE)	POWER REQD	MOTOR SIZE REQD	MAX BELT TENS	CLSS OF BELT REQD	CAPIT COST OF CONVEY	INSUR -ANCE COSTS	POWER COSTS	OPER ATING LABR COSTS	TOTAL OPER ATING COSTS	IDLER COSTS	BELT COSTS	FAST ENER COST	MECH AND LUBR COST	LABR COST	TOTAL MAIN TENAN COST	TOTAL OP AND MAINT COST	TOTAL OP AND MAINT COST
(M)		(T/H)	(KW)	(KW)	(KN)	SABS	R/M	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/TKM
100	100	1128.	26.7	30.0	11	800	320	.000	.05	.22	.26	.03	.34	.00	.01	.00	.38	.65	6.47
100	75	846.0	22.1	30.0	11	800	320	.000	.05	.29	.34	.04	.37	.01	.01	.01	.43	.77	7.70
100	50	564.0	18.6	30.0	11	800	320	.000	.07	.43	.50	.07	.47	.01	.01	.01	.56	1.06	10.59
100	25	282.0	15.1	30.0	11	800	320	.000	.11	.87	.97	.13	.81	.02	.02	.02	1.00	1.97	19.72
100	20	225.6	13.9	30.0	11	800	320	.000	.12	1.08	1.21	.16	.99	.02	.03	.02	1.22	2.43	24.29
100	15	169.2	12.8	30.0	11	800	320	.000	.15	1.44	1.60	.22	1.29	.03	.04	.03	1.60	3.19	31.93
250	100	1128.	53.5	55.0	22	800	320	.000	.09	.21	.30	.08	.53	.01	.01	.01	.65	.95	3.80
250	75	846.0	45.3	55.0	22	800	320	.000	.11	.28	.38	.11	.58	.01	.02	.01	.73	1.12	4.47
250	50	564.0	38.4	55.0	22	800	320	.000	.14	.41	.55	.16	.74	.02	.03	.02	.97	1.52	6.08
250	25	282.0	30.2	55.0	22	800	320	.000	.21	.83	1.04	.33	1.29	.04	.06	.04	1.75	2.79	11.17
250	20	225.6	27.9	55.0	22	800	320	.000	.25	1.04	1.28	.41	1.57	.05	.07	.05	2.15	3.43	13.72
250	15	169.2	26.7	55.0	22	800	320	.000	.32	1.38	1.70	.55	2.04	.07	.09	.06	2.81	4.51	18.03
500	100	1128.	98.8	110.0	44	800	320	.000	.18	.22	.40	.16	.75	.02	.03	.02	.98	1.38	2.76
500	75	846.0	83.7	110.0	44	800	320	.000	.20	.30	.49	.22	.82	.03	.04	.03	1.13	1.62	3.25
500	50	564.0	69.8	110.0	44	800	320	.000	.25	.44	.69	.33	1.04	.04	.06	.04	1.51	2.20	4.40
500	25	282.0	54.7	110.0	44	800	320	.000	.39	.89	1.28	.66	1.82	.08	.11	.08	2.74	4.02	8.04
500	20	225.6	51.2	110.0	44	800	320	.000	.45	1.11	1.56	.82	2.22	.10	.14	.09	3.37	4.94	9.87
500	15	169.2	48.8	110.0	44	800	320	.000	.58	1.48	2.06	1.10	2.88	.13	.18	.13	4.42	6.48	12.96
750	100	1128.	144.2	150.0	59	800	320	.000	.26	.20	.45	.25	.92	.03	.04	.03	1.27	1.72	2.29
750	75	846.0	123.3	150.0	59	800	320	.000	.29	.26	.55	.33	1.01	.04	.06	.04	1.47	2.02	2.70
750	50	564.0	101.2	150.0	59	800	320	.000	.36	.39	.75	.49	1.28	.06	.08	.06	1.97	2.73	3.63
750	25	282.0	80.2	150.0	59	800	320	.000	.57	.79	1.36	.99	2.23	.12	.17	.11	3.61	4.97	6.63
750	20	225.6	75.6	150.0	59	800	320	.000	.67	.99	1.66	1.24	2.71	.15	.21	.14	4.45	6.10	8.14
750	15	169.2	72.1	150.0	59	800	320	.000	.85	1.31	2.17	1.65	3.53	.20	.28	.19	5.84	8.01	10.68
1000	100	1128.	189.5	185.0	77	800	320	.000	.34	.20	.54	.33	1.06	.04	.06	.04	1.53	2.06	2.06
1000	75	846.0	161.6	185.0	77	800	320	.000	.38	.27	.65	.44	1.16	.05	.07	.05	1.78	2.43	2.43
1000	50	564.0	133.7	185.0	77	800	320	.000	.47	.40	.88	.66	1.48	.08	.11	.08	2.40	3.28	3.28
1000	25	282.0	105.8	185.0	77	800	320	.000	.75	.81	1.56	1.32	2.57	.16	.22	.15	4.42	5.98	5.98
1000	20	225.6	100.0	185.0	77	800	320	.000	.89	1.01	1.90	1.65	3.13	.20	.28	.19	5.45	7.34	7.34
1000	15	169.2	94.2	185.0	77	800	320	.000	1.11	1.35	2.46	2.20	4.08	.26	.37	.25	7.16	9.62	9.62
1250	100	1128.	236.0	220.0	96	1000	320	.000	.42	.21	.63	.41	1.19	.05	.07	.05	1.77	2.39	1.91
1250	75	846.0	201.2	220.0	96	1000	320	.000	.48	.28	.75	.55	1.30	.07	.09	.06	2.07	2.82	2.26
1250	50	564.0	166.3	220.0	96	1000	320	.000	.59	.42	1.01	.82	1.65	.10	.14	.09	2.81	3.81	3.05
1250	25	282.0	131.4	220.0	96	1000	320	.000	.93	.83	1.76	1.65	2.88	.20	.28	.19	5.19	6.95	5.56
1250	20	225.6	124.4	220.0	96	1000	320	.000	1.10	1.04	2.14	2.06	3.50	.25	.35	.23	6.39	8.54	6.83
1250	15	169.2	117.4	220.0	96	1000	320	.000	1.39	1.39	2.77	2.75	4.56	.33	.46	.31	8.41	11.18	8.95
1500	100	1128.	281.4	275.0	115	1250	320	.000	.50	.21	.71	.49	1.30	.06	.08	.06	2.00	2.71	1.81
1500	75	846.0	239.5	275.0	115	1250	320	.000	.57	.28	.85	.66	1.42	.08	.11	.08	2.35	3.20	2.13
1500	50	564.0	197.7	275.0	115	1250	320	.000	.70	.43	1.13	.99	1.81	.12	.17	.11	3.20	4.32	2.88
1500	25	282.0	157.0	275.0	115	1250	320	.000	1.11	.85	1.97	1.98	3.15	.24	.33	.23	5.92	7.89	5.26
1500	20	225.6	148.8	275.0	115	1250	320	.000	1.32	1.07	2.39	2.47	3.84	.30	.42	.28	7.31	9.69	6.46
1500	15	169.2	139.5	275.0	115	1250	320	.001	1.65	1.42	3.07	3.30	4.99	.39	.55	.38	9.62	12.69	8.46

TABLE 6

TABLE OF OPERATING AND MAINTENANCE COSTS FOR UNDERGROUND COLLIERY CONVEYORS

PRICES AS FOR 28/ 7/81
A. BELT WIDTH=1350.00
CONVEYOR SPEED=2.56M/S
IDLER TROUGHING ANGLE=35 DEG

CONVEYOR CHARACTERISTICS								OPERATING COSTS				MAINTENANCE COSTS						OP+MAINT COSTS	
DIST (C TO C)	% OF FULL CAP	CAPC (AVE)	POWER REQD	MOTOR SIZE REQD	MAX BELT TENS	CLSS OF BELT REQD	CAPIT COST OF CONVEY	INSUR -ANCE COSTS	POWER COSTS	OPER ATING LABR COSTS	TOTAL OPER ATING COSTS	IDLER COSTS	BELT COSTS	FAST ENER COST	MECH AND LUBR COST	LABR COST	TOTAL MAIN TENAN COST	TOTAL OP AND MAINT COST	TOTAL OP AND MAINT COST
(M)		(T/H)	(KW)	(KW)	(KN)	SABS	R/M	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/TKM
100	100	1438.	32.6	37.0	12	1000	400	.000	.05	.17	.22	.03	.37	.00	.00	.00	.41	.63	6.27
100	75	1079.	27.9	37.0	12	1000	400	.000	.05	.23	.28	.04	.41	.00	.01	.00	.46	.74	7.36
100	50	719.0	23.3	37.0	12	1000	400	.000	.06	.34	.40	.05	.52	.01	.01	.01	.59	1.00	9.99
100	25	359.5	17.4	37.0	12	1000	400	.000	.10	.58	.78	.11	.90	.01	.02	.01	1.05	1.83	18.31
100	20	287.6	16.3	37.0	12	1000	400	.000	.11	.85	.96	.14	1.10	.02	.02	.01	1.29	2.25	22.53
100	15	215.7	15.1	37.0	12	1000	400	.000	.14	1.13	1.27	.18	1.43	.02	.03	.02	1.68	2.96	29.58
250	100	1438.	66.3	75.0	24	1000	400	.000	.09	.16	.25	.07	.59	.01	.01	.01	.69	.94	3.76
250	75	1079.	55.8	75.0	24	1000	400	.000	.10	.22	.32	.09	.64	.01	.02	.01	.77	1.09	4.37
250	50	719.0	46.5	75.0	24	1000	400	.000	.13	.33	.45	.14	.82	.02	.02	.01	1.01	1.47	5.86
250	25	359.5	36.0	75.0	24	1000	400	.000	.20	.65	.85	.27	1.43	.03	.05	.03	1.81	2.66	10.64
250	20	287.6	33.7	75.0	24	1000	400	.000	.23	.81	1.05	.34	1.74	.04	.06	.04	2.22	3.26	13.05
250	15	215.7	31.4	75.0	24	1000	400	.000	.29	1.08	1.38	.45	2.26	.06	.08	.05	2.90	4.27	17.09
500	100	1438.	122.1	132.0	44	1000	400	.000	.17	.17	.34	.14	.83	.02	.02	.01	1.03	1.37	2.74
500	75	1079.	103.5	132.0	44	1000	400	.000	.19	.23	.42	.18	.91	.02	.03	.02	1.16	1.59	3.18
500	50	719.0	84.9	132.0	44	1000	400	.000	.24	.35	.58	.27	1.16	.03	.05	.03	1.54	2.12	4.25
500	25	359.5	66.3	132.0	44	1000	400	.000	.37	.70	1.07	.54	2.02	.07	.09	.06	2.78	3.85	7.69
500	20	287.6	62.8	132.0	44	1000	400	.000	.44	.87	1.31	.68	2.46	.09	.11	.07	3.41	4.72	9.44
500	15	215.7	58.1	132.0	44	1000	400	.000	.54	1.16	1.70	.90	3.20	.12	.15	.10	4.47	6.17	12.34
750	100	1438.	177.9	185.0	64	1000	400	.000	.25	.15	.40	.20	1.02	.03	.03	.02	1.31	1.71	2.28
750	75	1079.	151.2	185.0	64	1000	400	.000	.28	.21	.49	.27	1.11	.03	.05	.03	1.50	1.98	2.64
750	50	719.0	124.4	185.0	64	1000	400	.000	.35	.31	.66	.41	1.42	.05	.07	.04	1.99	2.65	3.53
750	25	359.5	96.5	185.0	64	1000	400	.000	.54	.62	1.16	.81	2.47	.10	.14	.09	3.62	4.77	6.36
750	20	287.6	90.7	185.0	64	1000	400	.000	.63	.77	1.40	1.02	3.01	.13	.17	.11	4.44	5.85	7.79
750	15	215.7	86.0	185.0	64	1000	400	.000	.80	1.03	1.83	1.36	3.92	.17	.23	.15	5.82	7.65	10.20
1000	100	1438.	234.9	220.0	86	1000	400	.000	.33	.16	.49	.27	1.18	.03	.05	.03	1.56	2.05	2.05
1000	75	1079.	198.8	220.0	86	1000	400	.000	.37	.21	.58	.36	1.29	.05	.06	.04	1.80	2.38	2.38
1000	50	719.0	162.8	220.0	86	1000	400	.000	.45	.32	.77	.54	1.64	.07	.09	.06	2.40	3.17	3.17
1000	25	359.5	126.7	220.0	86	1000	400	.000	.70	.63	1.34	1.09	2.85	.14	.18	.12	4.38	5.72	5.72
1000	20	287.6	119.8	220.0	86	1000	400	.000	.83	.79	1.63	1.36	3.48	.17	.23	.15	5.38	7.01	7.01
1000	15	215.7	112.8	220.0	86	1000	400	.000	1.05	1.06	2.10	1.81	4.52	.23	.31	.20	7.07	9.17	9.17
1250	100	1438.	291.9	275.0	106	1250	400	.000	.41	.16	.57	.34	1.32	.04	.06	.04	1.80	2.37	1.89
1250	75	1079.	247.7	275.0	106	1250	400	.000	.46	.22	.68	.45	1.44	.06	.08	.05	2.08	2.75	2.20
1250	50	719.0	202.3	275.0	106	1250	400	.000	.56	.33	.89	.68	1.83	.09	.11	.07	2.79	3.67	2.94
1250	25	359.5	158.1	275.0	106	1250	400	.000	.88	.65	1.53	1.36	3.19	.17	.23	.15	5.10	6.63	5.30
1250	20	287.6	148.8	275.0	106	1250	400	.000	1.03	.81	1.85	1.70	3.89	.22	.29	.18	6.27	8.12	6.50
1250	15	215.7	140.7	275.0	106	1250	400	.000	1.30	1.09	2.39	2.26	5.06	.29	.38	.25	8.24	10.63	8.50
1500	100	1438.	348.8	350.0	126	1250	400	.000	.49	.17	.65	.41	1.45	.05	.07	.04	2.02	2.67	1.78
1500	75	1079.	295.3	350.0	126	1250	400	.000	.55	.22	.77	.54	1.58	.07	.09	.06	2.34	3.11	2.07
1500	50	719.0	241.9	350.0	126	1250	400	.000	.67	.33	1.01	.81	2.01	.10	.14	.09	3.15	4.16	2.77
1500	25	359.5	188.4	350.0	126	1250	400	.000	1.05	.67	1.72	1.63	3.49	.21	.28	.18	5.78	7.50	5.00
1500	20	287.6	177.9	350.0	126	1250	400	.000	1.24	.84	2.07	2.03	4.26	.26	.34	.22	7.12	9.19	6.13
1500	15	215.7	167.4	350.0	126	1250	400	.001	1.55	1.12	2.67	2.71	5.54	.35	.46	.29	9.35	12.02	8.02

TABLE 7

TABLE OF OPERATING AND MAINTENANCE COSTS FOR UNDERGROUND COLLIERY CONVEYORS

PRICES AS FOR 28/ 7/81

A. BELT WIDTH=1500.00
CONVEYOR SPEED=2.56M/S
IDLER TROUGHING ANGLE=35 DEG

CONVEYOR CHARACTERISTICS								OPERATING COSTS				MAINTENANCE COSTS						OP+MAINT COSTS	
DIST (C TO C)	% OF FULL CAP	CAPC (AVE)	POWER REQD	MOTOR SIZE REQD	MAX BELT TENS	CLSS OF BELT REQD	CAPIT COST OF CONVEY	INSUR-ANCE COSTS	POWER COSTS	OPER ATING LABR COSTS	TOTAL OPER ATING COSTS	IDLER COSTS	BELT COSTS	FAST ENER COST	MECH AND LUBR COST	LABR COST	TOTAL MAIN TENAN COST	TOTAL OP AND MAINT COST	TOTAL OP AND MAINT COST
(M)		(T/H)	(KW)	(KW)	(KN)	SANS	R/M	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/T	C/TKM
100	100	1792.	39.5	45.0	13	1250	450	.000	.04	.14	.18	.02	.40	.00	.00	.00	.43	.61	6.10
100	75	1344.	33.7	45.0	13	1250	450	.000	.05	.18	.23	.03	.43	.00	.01	.00	.48	.71	7.08
100	50	896.0	26.7	45.0	13	1250	450	.000	.06	.27	.33	.05	.55	.01	.01	.00	.62	.95	9.48
100	25	448.0	20.9	45.0	13	1250	450	.000	.09	.55	.64	.09	.96	.01	.02	.01	1.09	1.73	17.27
100	20	358.4	19.8	45.0	13	1250	450	.000	.11	.68	.79	.11	1.17	.02	.02	.01	1.33	2.12	21.23
100	15	268.8	18.6	45.0	13	1250	450	.000	.14	.91	1.05	.15	1.52	.02	.03	.02	1.74	2.78	27.84
250	100	1792.	81.4	90.0	26	1250	450	.000	.09	.13	.22	.06	.63	.01	.01	.01	.71	.93	3.72
250	75	1344.	68.6	90.0	26	1250	450	.000	.10	.17	.28	.08	.69	.01	.01	.01	.79	1.07	4.27
250	50	896.0	55.8	90.0	26	1250	450	.000	.12	.26	.39	.11	.87	.02	.02	.01	1.03	1.42	5.67
250	25	448.0	43.0	90.0	26	1250	450	.000	.19	.52	.71	.23	1.52	.03	.04	.02	1.84	2.55	10.28
250	20	358.4	40.7	90.0	26	1250	450	.000	.23	.65	.88	.28	1.85	.04	.05	.03	2.25	3.13	12.53
250	15	268.8	38.4	90.0	26	1250	450	.000	.29	.87	1.16	.38	2.41	.05	.06	.04	2.94	4.10	16.39
500	100	1792.	148.8	150.0	47	1250	450	.000	.17	.14	.31	.11	.89	.02	.02	.01	1.05	1.35	2.71
500	75	1344.	125.6	150.0	47	1250	450	.000	.19	.19	.37	.15	.97	.02	.03	.02	1.18	1.56	3.11
500	50	896.0	102.3	150.0	47	1250	450	.000	.23	.28	.51	.23	1.23	.03	.04	.02	1.55	2.06	4.12
500	25	448.0	79.1	150.0	47	1250	450	.000	.35	.56	.91	.46	2.15	.06	.08	.05	2.79	3.70	7.40
500	20	358.4	74.4	150.0	47	1250	450	.000	.42	.70	1.11	.57	2.62	.08	.10	.06	3.42	4.53	9.07
500	15	268.8	69.8	150.0	47	1250	450	.000	.52	.93	1.45	.76	3.40	.10	.13	.08	4.47	5.93	11.85
750	100	1792.	218.6	220.0	71	1250	450	.000	.24	.12	.37	.17	1.09	.02	.03	.02	1.33	1.70	2.26
750	75	1344.	183.7	220.0	71	1250	450	.000	.27	.17	.44	.23	1.19	.03	.04	.02	1.51	1.95	2.60
750	50	896.0	150.0	220.0	71	1250	450	.000	.33	.25	.58	.34	1.51	.05	.06	.04	1.99	2.58	3.43
750	25	448.0	116.3	220.0	71	1250	450	.000	.52	.50	1.02	.68	2.63	.09	.12	.07	3.59	4.61	6.14
750	20	358.4	109.3	220.0	71	1250	450	.000	.61	.62	1.23	.85	3.20	.12	.15	.09	4.41	5.64	7.52
750	15	268.8	102.3	220.0	71	1250	450	.000	.76	.83	1.59	1.14	4.17	.16	.19	.12	5.77	7.36	9.82
1000	100	1792.	287.2	275.0	104	1250	450	.000	.32	.13	.45	.23	1.26	.03	.04	.02	1.58	2.03	2.03
1000	75	1344.	241.9	275.0	104	1250	450	.000	.36	.17	.53	.30	1.37	.04	.05	.03	1.80	2.33	2.33
1000	50	896.0	197.7	275.0	104	1250	458	.000	.44	.25	.70	.46	1.74	.06	.08	.05	2.39	3.08	3.08
1000	25	448.0	152.3	275.0	104	1250	450	.000	.68	.51	1.19	.91	3.04	.12	.16	.09	4.32	5.51	5.51
1000	20	358.4	143.0	275.0	104	1250	450	.000	.80	.64	1.44	1.14	3.79	.16	.19	.12	5.31	6.74	6.74
1000	15	268.8	134.9	275.0	104	1250	450	.000	1.00	.85	1.85	1.52	4.81	.21	.26	.16	6.95	8.81	8.81
1250	100	1792.	355.8	350.0	116	1250	450	.000	.40	.13	.53	.28	1.40	.04	.05	.03	1.81	2.33	1.87
1250	75	1344.	300.0	350.0	116	1250	450	.000	.45	.17	.62	.38	1.53	.05	.06	.04	2.07	2.69	2.15
1250	50	896.0	244.2	350.0	116	1250	450	.000	.55	.26	.81	.57	1.95	.08	.10	.06	2.75	3.56	2.85
1250	25	448.0	189.5	350.0	116	1250	450	.000	.85	.52	1.37	1.14	3.39	.16	.19	.12	5.00	6.37	5.10
1250	20	358.4	177.9	350.0	116	1250	450	.000	.99	.65	1.65	1.42	4.14	.19	.24	.15	6.14	7.79	6.23
1250	15	268.8	166.3	350.0	116	1250	450	.000	1.24	.87	2.11	1.90	5.38	.26	.32	.20	8.06	10.17	8.13
1500	100	1792.	422.1	400.0	137	1600	450	.000	.47	.13	.61	.34	1.54	.05	.06	.04	2.02	2.63	1.75
1500	75	1344.	355.8	400.0	137	1600	450	.000	.53	.18	.71	.46	1.68	.06	.08	.05	2.32	3.03	2.02
1500	50	896.0	289.5	400.0	137	1600	450	.000	.65	.27	.91	.68	2.14	.09	.12	.07	3.10	4.01	2.68
1500	25	448.0	224.4	400.0	137	1600	450	.000	1.00	.54	1.54	1.37	3.72	.19	.23	.14	5.65	7.18	4.79
1500	20	358.4	210.5	400.0	137	1600	450	.000	1.17	.67	1.85	1.71	4.53	.23	.29	.18	6.94	8.79	5.86
1500	15	268.8	197.7	400.0	137	1600	450	.001	1.47	.89	2.37	2.28	5.90	.31	.39	.24	9.11	11.47	7.65

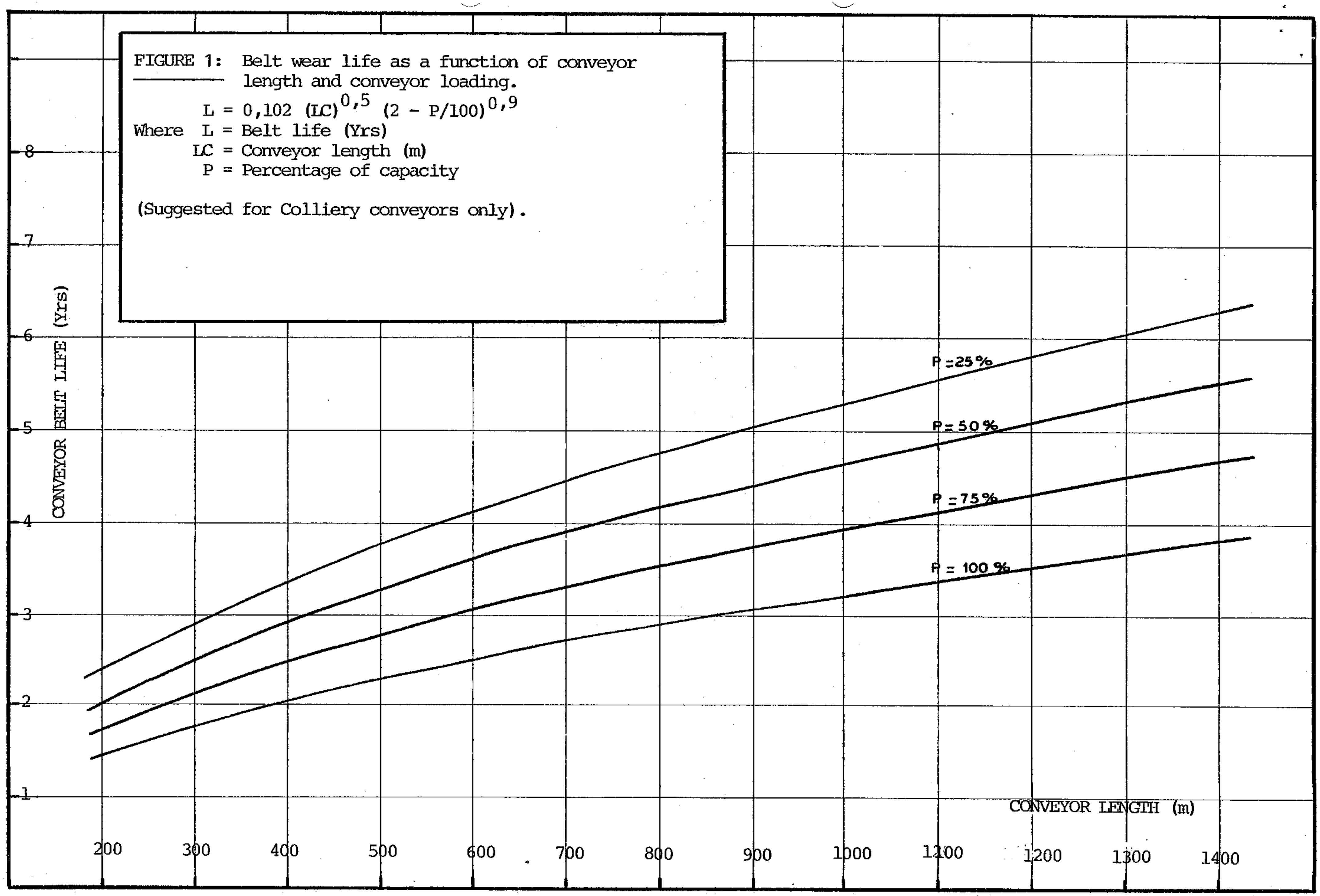

FIGURE 1: Belt wear life as a function of conveyor length and conveyor loading.

$$L = 0{,}102\ (LC)^{0{,}5}\ (2 - P/100)^{0{,}9}$$

Where L = Belt life (Yrs)
LC = Conveyor length (m)
P = Percentage of capacity

(Suggested for Colliery conveyors only).

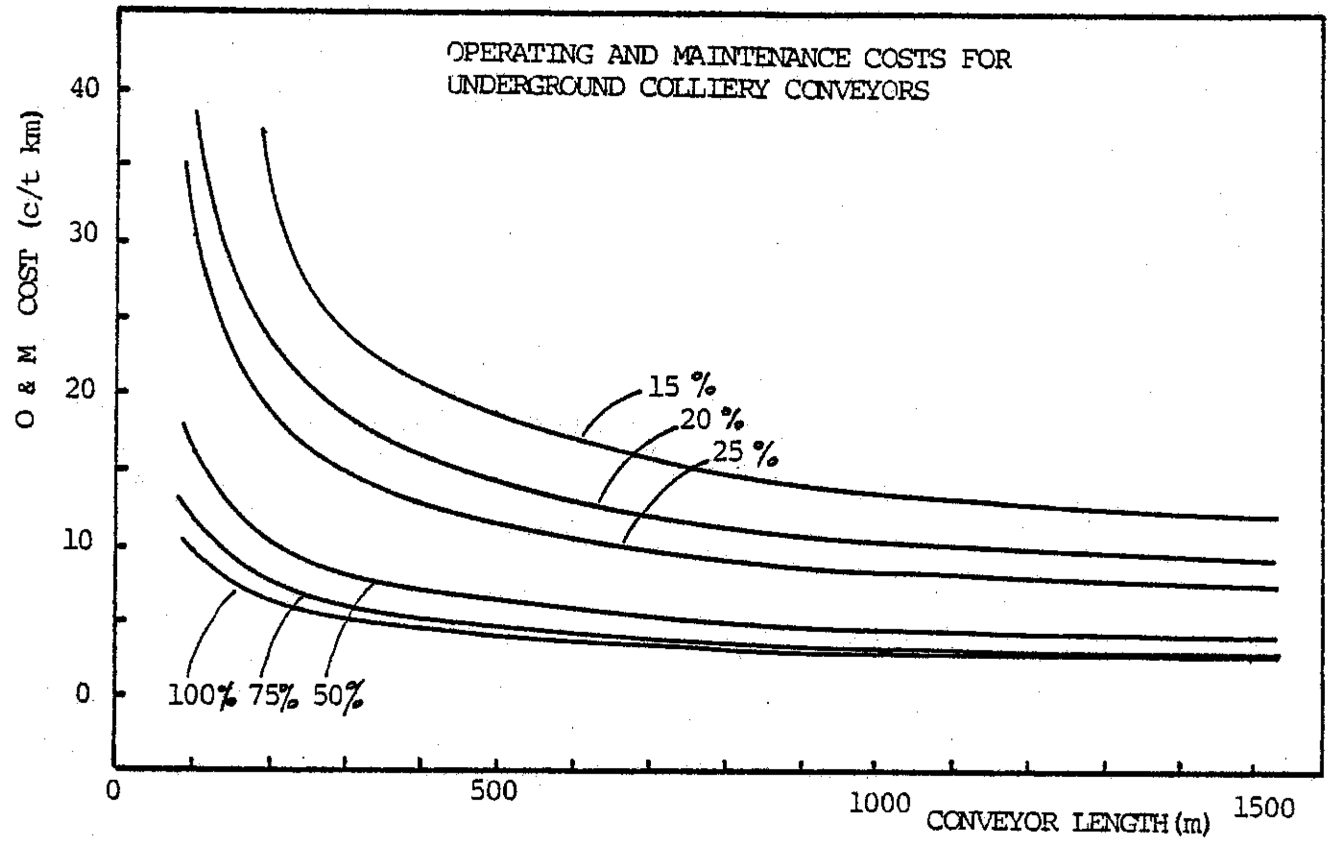

FIGURE 2: Operating & Maintenance costs for 900 mm wide conveyors

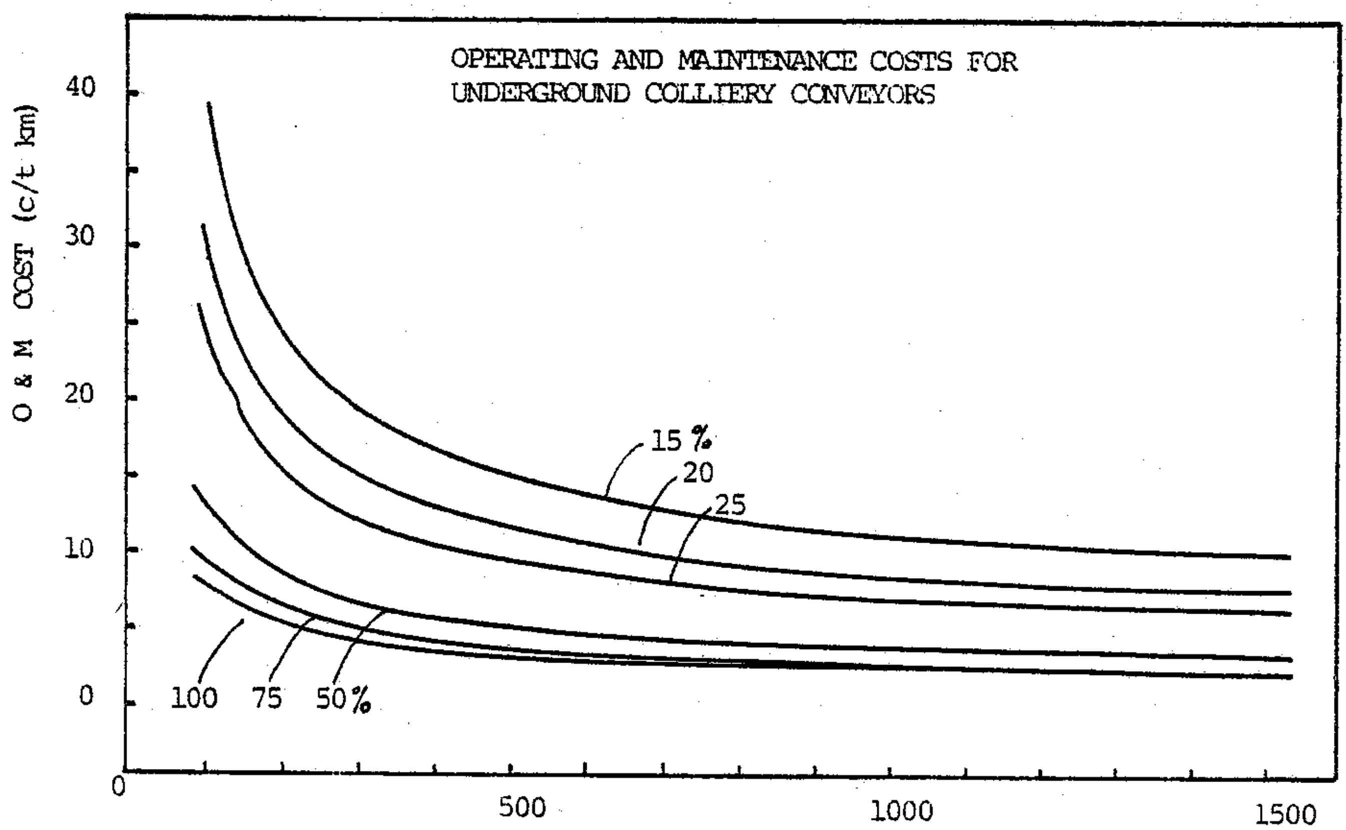

FIGURE 3: Operating & Maintenance costs for 1050 mm wide conveyors

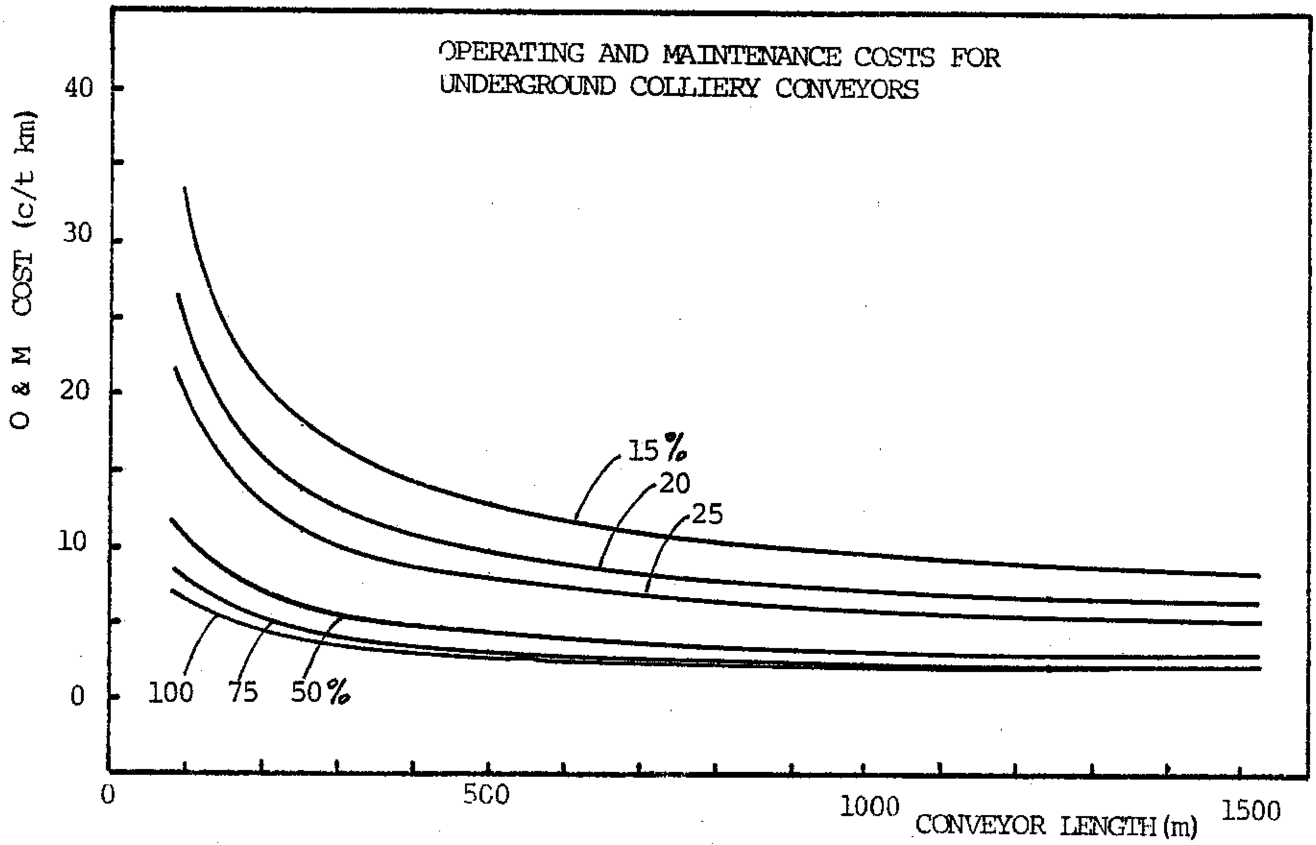

FIGURE 4: Operating & Maintenance costs for 1200 mm wide conveyors

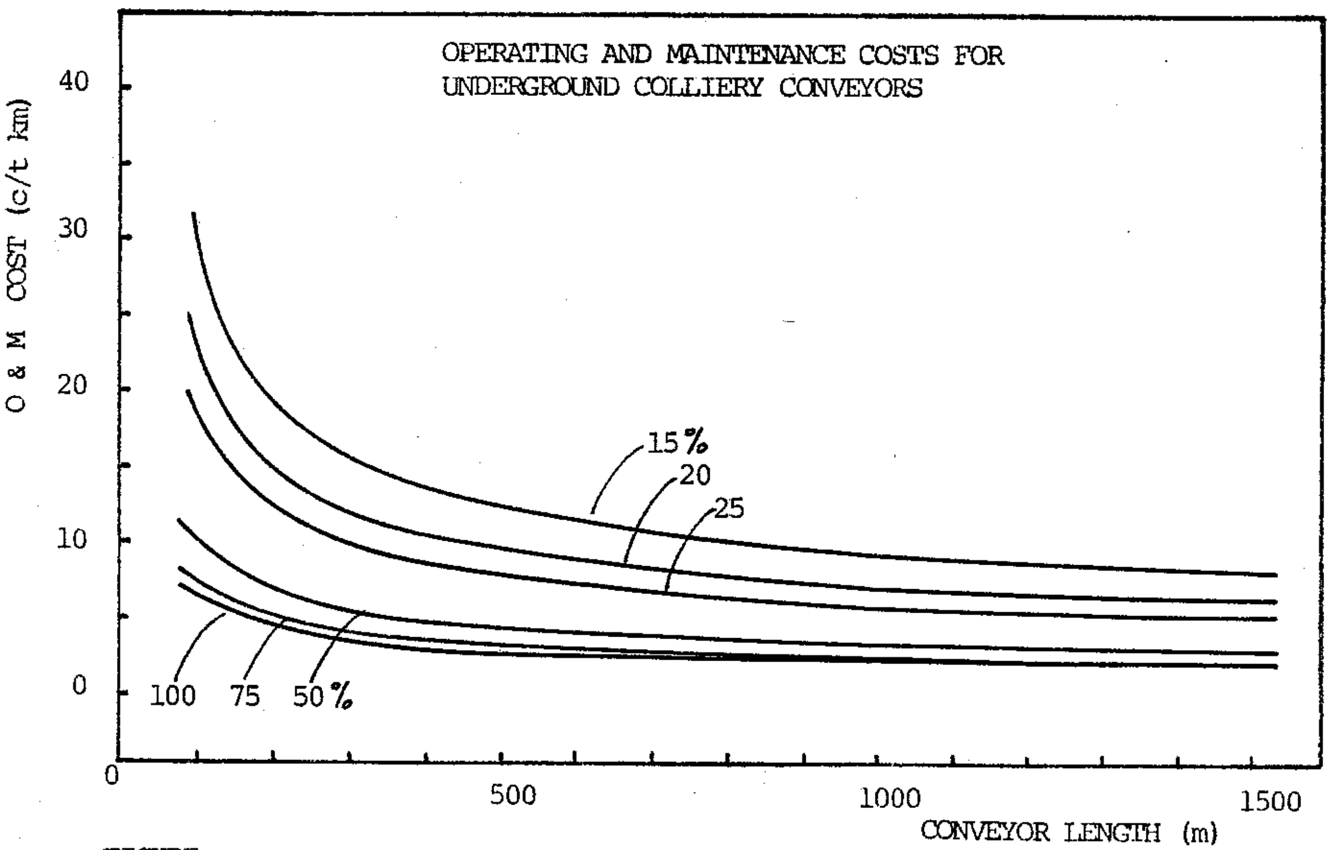

FIGURE 5: Operating & Maintenance costs for 1350 mm and 1500 mm wide conveyors.

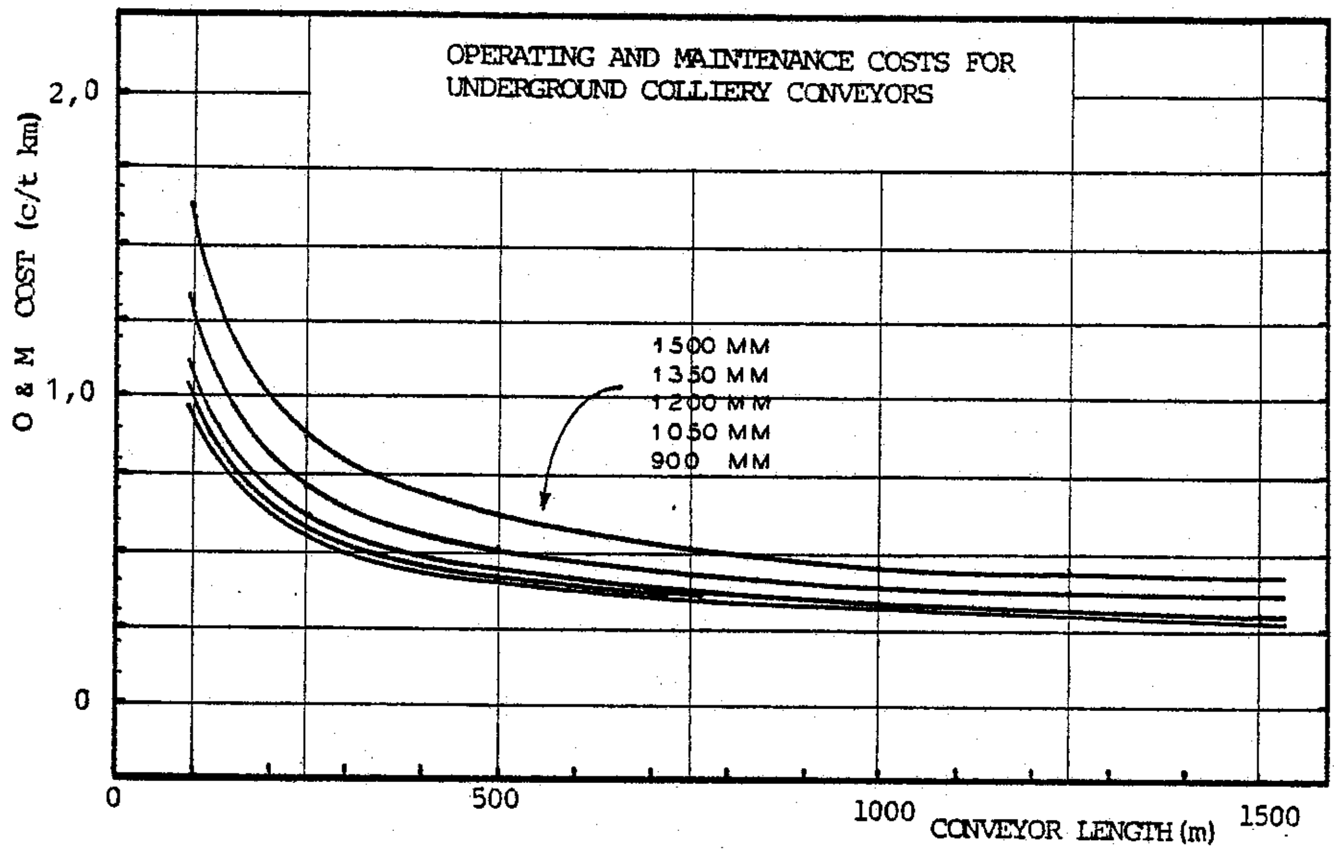

FIGURE 6: A comparison of conveying costs of 900mm to 1500mm wide conveyors at 50% of full capacity

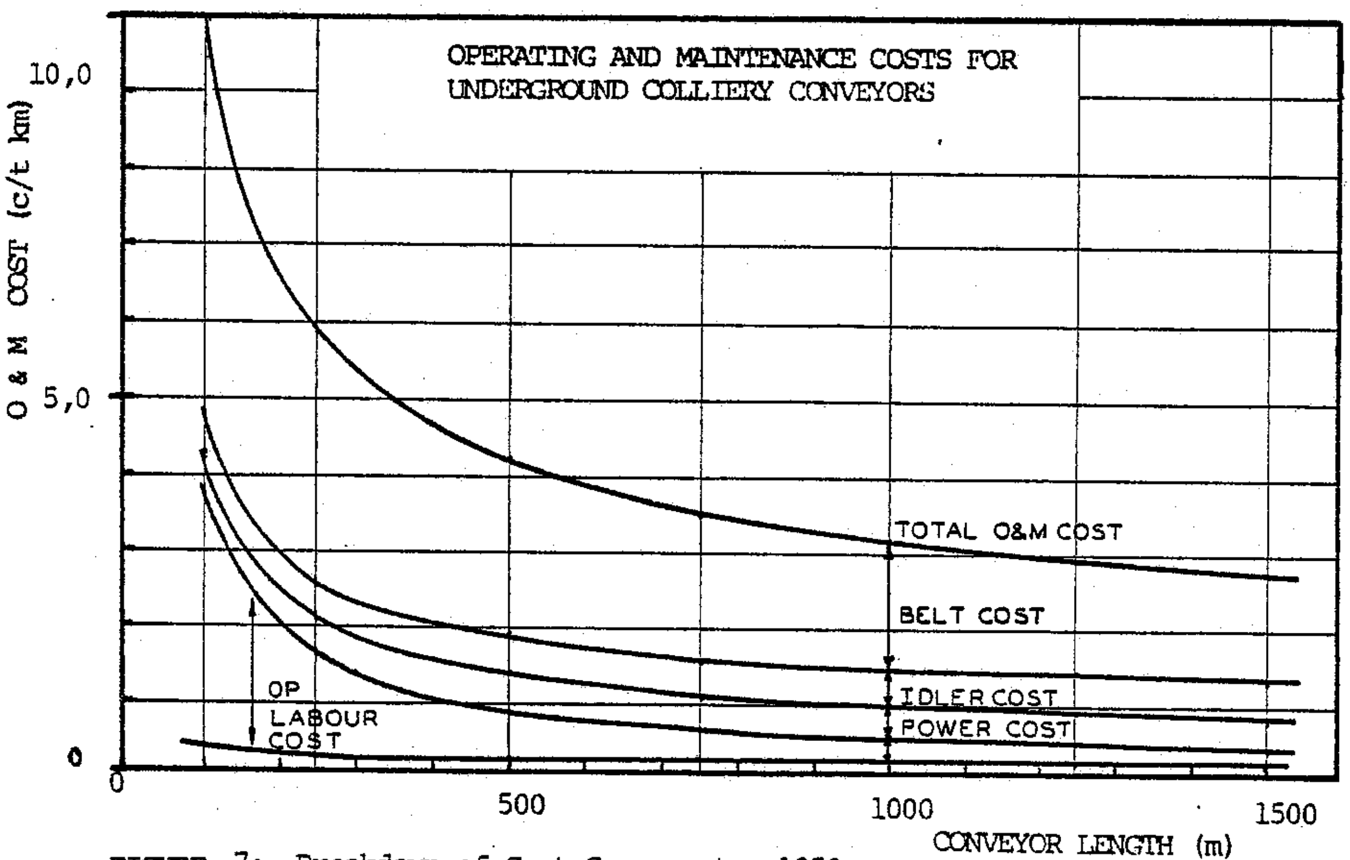

FIGURE 7: Breakdown of Cost Components, 1350mm wide conveyor at 50% of full capacity