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Rerouting of Middle Bench Conveyor System in Mine for Optimization of Length and Power Consumption

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Abstract: ***In Neyveli Lignite Corporation, belt conveyors are used for transporting coal and overburden soil from mines to storage yards and dump yards respectively. Conveyor belt with carrying capacity upto 20,000T/hour is used for transportation of materials. The power consumption of the conveyor system depends on the length of the conveyor. Power consumption is high for a long routed conveyor system and less for a short routed conveyor system. The conveyor system is rerouted to the shortest possible way for optimizing length and power consumption of the conveyor system. By this rerouting, the cost of power consumption will be reduced.***

Keywords: conveyor system, power consumption, rerouting, mine, length

I. INTRODUCTION

In mine 1(A), there are four conveyor systems used for the transfer of coal and overburden soil. The first three conveyors, top, middle and middle bench conveyor systems were used to transport overburden soil to the dump yard.

The last conveyor system called the lignite bench is used to transport lignite to storage yards. In our project, the middle bench conveyors system is rerouted to the shortest possible way for optimization of length and power consumption.

The power consumption of the middle bench conveyors system will be optimized for reducing the cost of power. There are six conveyors used to transport overburden soil to the dump yard.

II. CONVEYOR SYSTEM IN THE MINE

This figure 1 shows the present conveyor systems position of mine 1(A):

1) The routes of top, middle and middle bench conveyor systems and route of lignite bench conveyor system were drawn in this picture.

2) There are six conveyor systems used for the transfer of coal and overburden soil at the middle bench conveyor system.

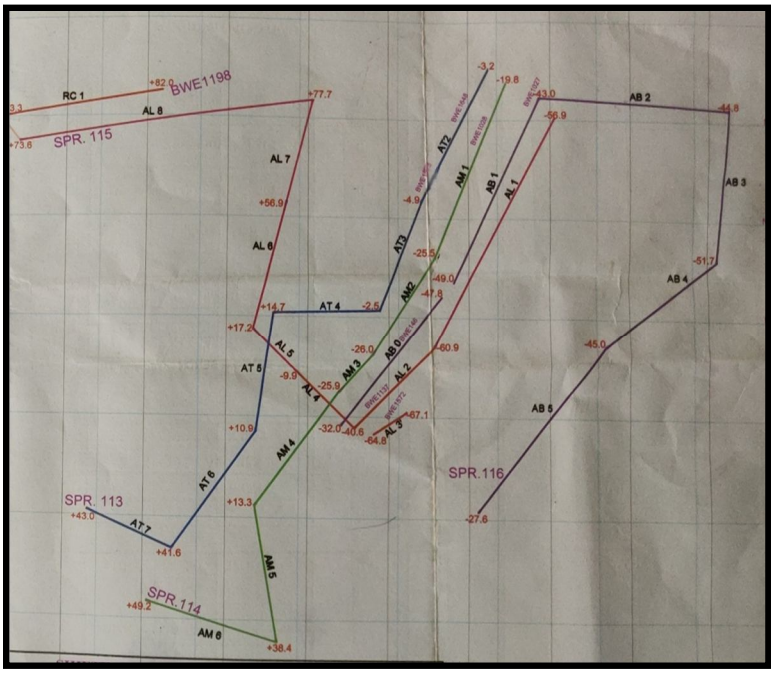

Fig1: Conveyor System Blueprint (before rerouting)

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This figure 2 below shows the present position of the middle bench conveyors:

At present, there are six conveyors used to transport overburden soil to the dump yard. AM1 and AM2 are face conveyors, AM3 and AM4 are link conveyors. The overburden soil is fed into these face conveyors while other conveyors were used to transport overburden soil to the dump yard.

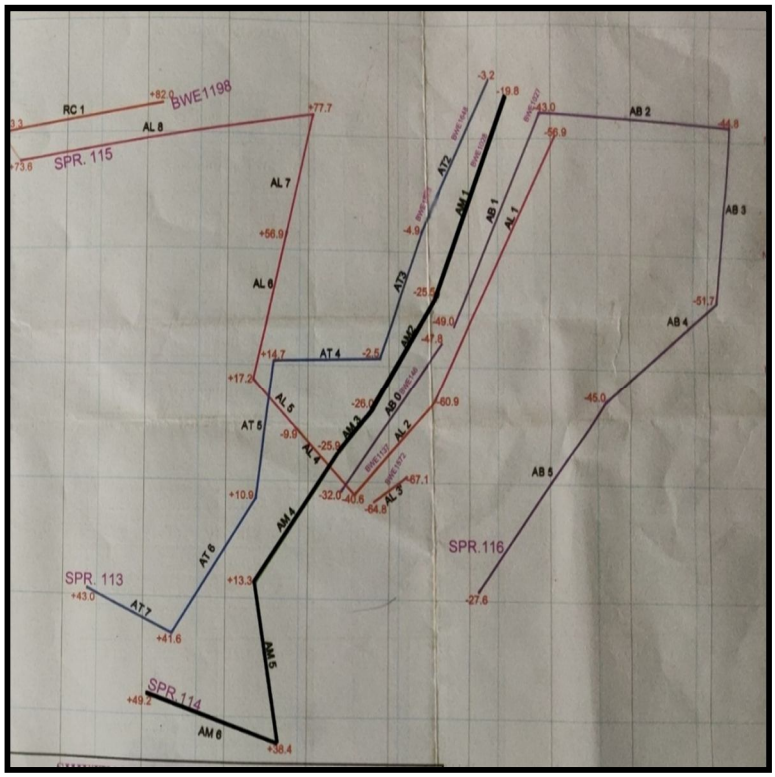

Fig2: Middle Bench Conveyor (before rerouting)

Below is the table with the specifications of the middle bench conveyors before rerouting.

TABLE 1
Specifications of the Middle Bench Conveyors(before rerouting)

SI.NO	CONVEYOR NO 1600mm	LIFT	LENGTH IN (m)	POWER CONSUMPTION IN KW
1.	AM1	-5.7	694.1	438.28
2.	AM2	-0.5	585.0	497.95
3.	AM3	0.1	253.8	306.81
4.	AM4	39.2	706.7	1330.126
5.	AM5	25.1	677.1	1041.89
6.	AM6	10.8	677.6	899.512
	TOTAL		3594.3	4505.118

The total power consumption of the conveyor system before rerouting is 4505.118 kw.

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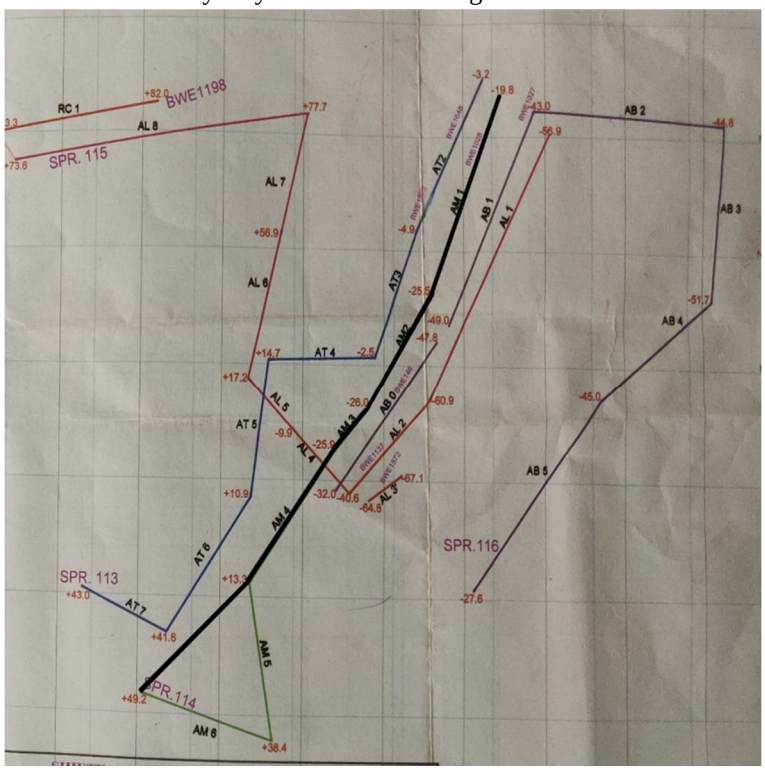
III. REROUTING OF CONVEYOR SYSTEM

For the optimization of the power consumption in the mine, length of the conveyor must be decreased. The conveyors AM5 and AM6 are replaced with a single damp conveyor. The new damp conveyor reduces the number of conveyors in the mine and reduces the length of conveyor system. So the rerouted middle bench conveyors system requires only five conveyors to transport overburden soil into the dump yard.

The rerouted blueprint of the middle bench conveyor system is shown in figure 3.



By this rerouting, the power consumption of the middle bench conveyors system will bereduced by 684.122KW

IV. POWER OPTIMIZATION

A. Formula Used

P= (0.596*C*L) + 19.23(H+5)

Where,

C- Resistance factor

L-Length of the conveyor

H-Lift

Normal lift= 5 metres

Using the above formula the power consumption of new damp conveyor introduced by replacing AM5 and AM6 is calculated.

B. Rerouted Conveyor AM5

L= 692.89 m

C=1.14

H = 35.9

P = (0.596*1.14*692.89)+19.2(5+35.9) =470.7+786.5

P=1257.2 KW

TABLE 2
Specifications of the Middle Bench Conveyors(before rerouting)

SI.NO	CONVEYOR NO 1600mm	LIFT	LENGTH	POWER CONSUMPTION IN KW
1.	AM1	-5.7	694.1	438.28
2.	AM2	-0.5	585.0	497.95
3.	AM3	0.1	253.8	306.81
4.	AM4	39.2	706.7	1330.126
5.	AM5	35.9	692.89	1257.28
	TOTAL		2932.49	3820.996

By this rerouting,
The conveyors system length will be optimized to the shortest possible way.
The length of the middle bench conveyors will be reduced by 3594.3-2932.4= 661.9 meters.
The power consumption of the middle bench conveyors system will bereduced by 684.122KW

V. RESULTS

A. Cost Saving

Cost of power consumption per annum= working hours per annum* power consumption *unit cost.

Power cost before rerouting = 6000*4505.118*4
=Rs.108,122,832

Power cost after rerouting = 6000*3820.996*4
=Rs.91,703,904

By this rerouting, the power cost of the middle bench conveyors system will be saved by Rs.16,418,928 per annum it means it saves up to 18% of the cost used for power consumption in Middle Bench Conveyor per annum.

VI. CONCLUSION

The middle bench conveyor system of mine-1A was rerouted to the shortest possible way. By this rerouting, the length and power consumption of the belt conveyor system was optimized. So the conveyor system will run with minimum power consumption by this rerouting and the power cost of the conveyor system will be saved effectively.
The middle bench conveyor system of mine 1A has a length of 3594.3m and power consumption of 4505.118KW. And we rerouted the middle bench conveyor system and reduce the length to 2932.49m and the power consumption to 3820.996KW. By rerouting, the power is reduced by 684.122KW. By this rerouting, the power cost of the middle bench conveyors system will be saved by Rs.16,418,928 per annum. It saves up to 18% of the cost used for power consumption.

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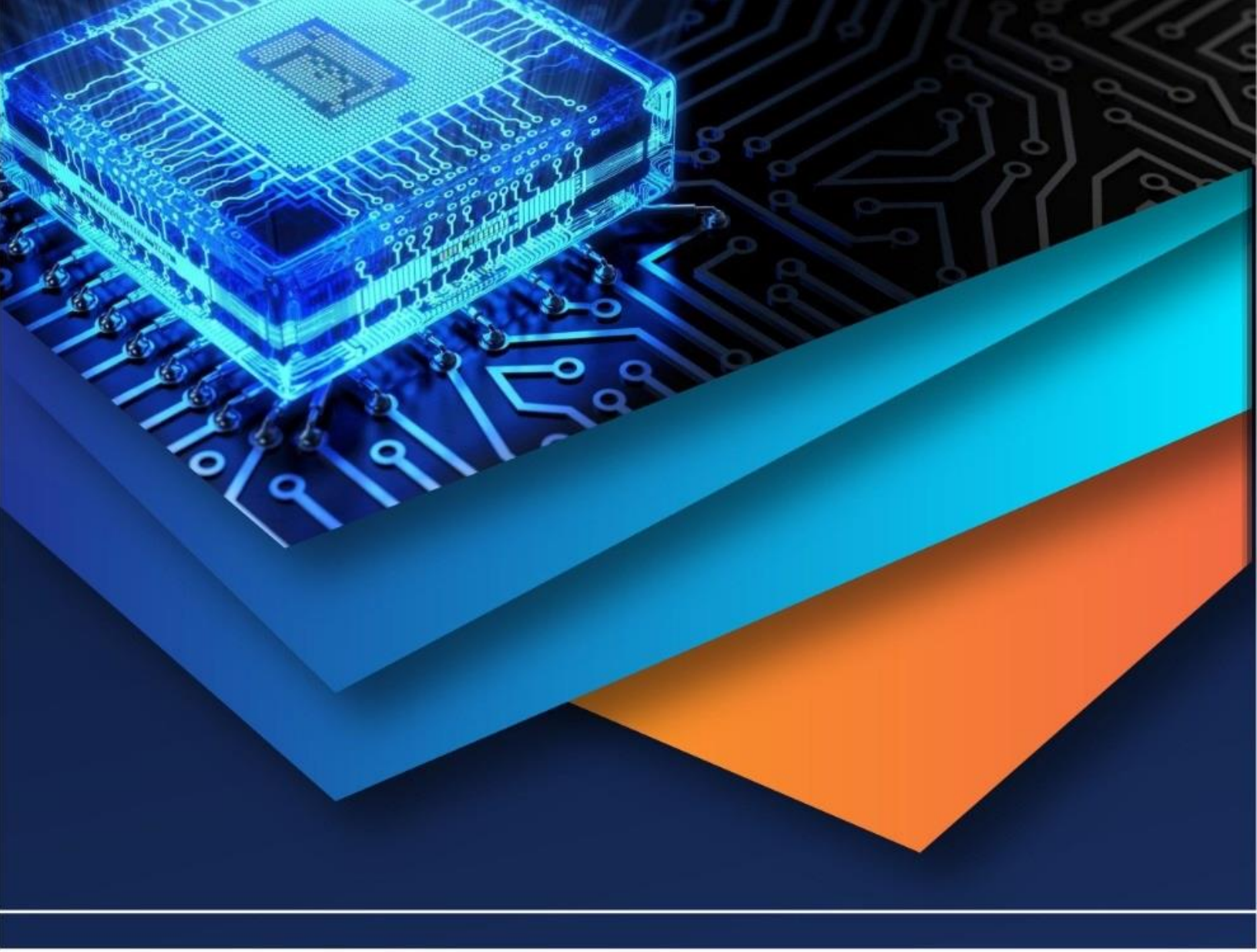

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