CONSIDERATIONS REGARDING TO DURABILITY OF BELTS CONVEYOR INSTALLATIONS

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Abstract: The paper treated the defects of the transport belts and causes that generate them. Transport belt are presented with textile inserts and steel cables, the causes which influencing durability belts as a cause-effect diagram and weight to remedy defects time in relation to the total time as a Pareto diagram.

Keywords: belt, conveyor, durability, defect, transport

1. GENERAL ASPECTS

Belt conveyors have attained a dominant position in transporting bulk materials due to a number of inherent advantages like the economy, safety operation and reliability, while ensuring a continuous transport.

Among parts of conveyor, belt is the most stressed during operation, but also the most expensive, its value representing over 35 % of the total conveyor installations. Life of the belt conveyor according internal experimental data and data from countries with tradition in this field is valued at about 8÷10 years. In under this functioning period, belt durability is valued at only 2÷4 years, the duration her life is influenced by the quality of the execution, the rubber resistance from the carrying face and rolling, on the effect of scraping produced by material abrasiveness and contact of belt conveyor with fixed and moving conveyor elements, the operating conditions but mainly for preventive maintenance and repair of defects that occur during operation.

2. CONSTRUCTIVE TYPES OF MINING BELT CONVEYOR [1],[3]

Mining conveyor belts are classified into two types depending on belt carcass:

- with textile insertion;
- with steel cable insertion.

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2.1. Belts with textile insertion

As part of transport installations, the belt is the element, which accumulates two main functions:

- organ load carrier;
- organ traction.

The constructive type of conveyor belts are subject to the requirements imposed on them in operation including: the nature and temperature of the conveyed material, conditions and work climate (dry or humid), transport length, the angle of inclination of the route, etc.

In relation to these requirements was made over time a variety of types of belts. Textile inserts a normal belt (fig. 1) consists of woven carcass (i.e. the textile inserts) with rubber interlayers from 0,5÷1,0 mm, the rubber cover-faces(supporting and rolling) and rubber edges.

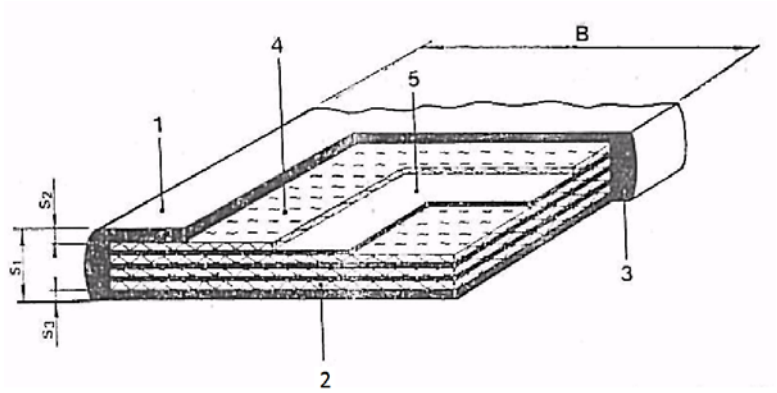

Fig. 1. Parts of textile insertion conveyor belts:
1-carrying rubber face; 2-rolling rubber face; 3-rubber edge; 4-insertion;
5-intermediate rubber (linking inserts); S_1-belt thickness;
S_2-supporting face of the belt thickness; S_3-rolling face belt thickness; B-belt width;

2.2. Belts with steel cable insertion

Belts with steel cable insertion are widespread in many countries and primarily in mining, construction materials industry, thermoelectric power stations and metallurgy of iron. In our country works, such belts in open-pit mining and at the same time as increasing transportation length and concentration of production in several coal face are found more accentuated their penetration in underground mining. Today, it is not designed to modern open-pit mining, high capacity without transport system reliable in operation and the only satisfying these goals are belt conveyor with iron cable insertion. Their continued spread is favored in the future and that world wide almost continuous increase distance between fields of raw materials and location of pickup or consumption thereof. Such belts are produced today already resistant 6000÷6500 N/mm. Their elasticity good property, to be flexible and their elongation

very small coefficient (0,1÷0,15 %) permit the making of single unit transport with a single drive mechanism and stretching which provides significant cost reduction and high efficiency.

The structure of a rubber belt inserts of steel cables is represented in figure 2.

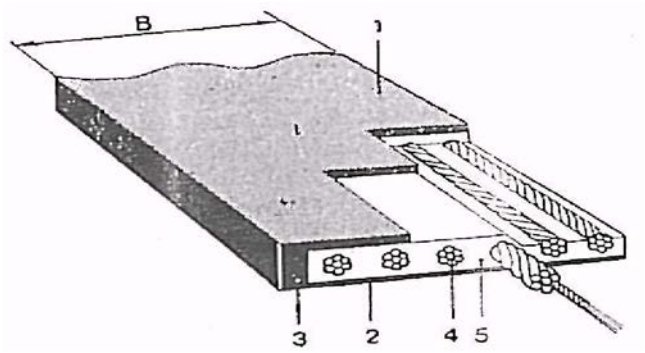

Fig. 2. The structure of transport belt with steel cable insertion:
1-carrying rubber face; 2-rolling rubber face; 3-rubber edge; 4-steel cables;
5-rubber layer linking cables; B-belt width;

3. CAUSES DEFECTS CONVEYOR BELTS

It is know that during use and even not using their, the transport belts lose some functional qualities due to physics wear process in which the transport belts. Physical wear that lose some of functional properties and operational due both to their productive use and the action factors of nature, it can divide in two distinct groups:

a. Dynamic wear

Occurs as a result of their exploitation above the durability limit and is caused by a lot of factors such as: mechanical, thermal and chemical. Transport belts in action mechanical factors change their constructive dimensions (thickness and width). Sudden temperature variations causes the rubber cracks and fissures, deformation belts and the action of chemical factors long time leads structural modifications of their rubber coating.

b. Static physical wear

Static physical wear transport belts are characterized by aging of rubber and fatigue being favored by the bad weather and physical and chemical agents in the atmosphere, their action being particularly pronounced in the case of improper storage and duration.

To identity all the causes and factors that define it constructed the cause-effect diagram (Ishikawa diagram) for transport belt durability (fig. 3) [2].

Transported material, influence the durability transport belt by: sharp form and hardness of the material and the material fixed to the circumference of drums which determine break the longitudinal belt. Also, accidental fall or fall piece of work load, break the local belt.

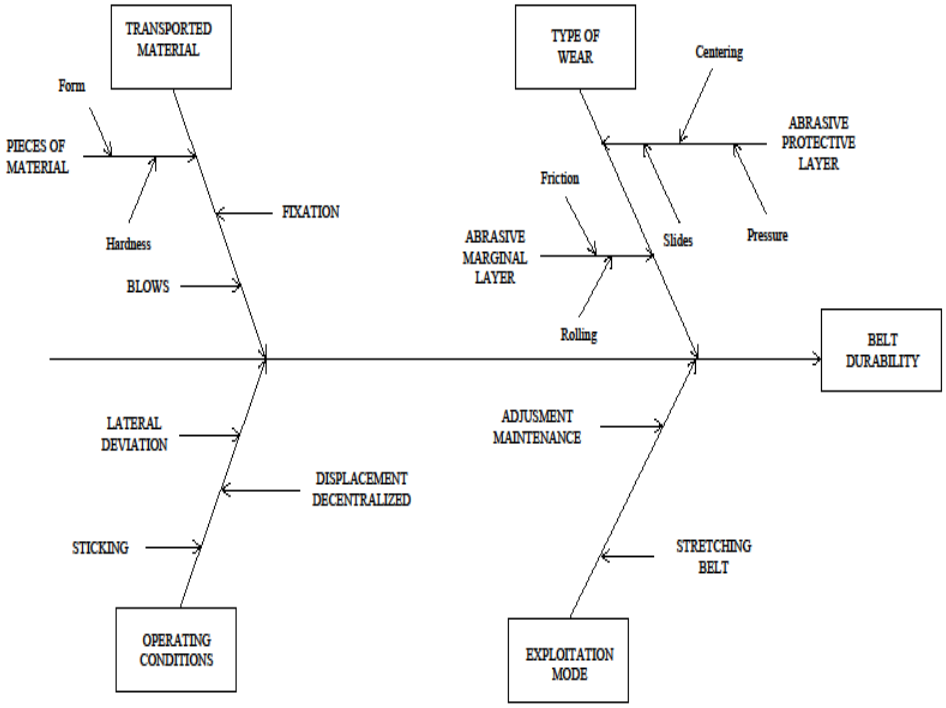

Fig. 3. Cause-effect diagram to identify belt durability

Transport belts wear greatly influence their durability is distinguished in specially the abrasion wear of the protective layer and marginal.

Abrasive wear of the rubber protective layer on the superior surface is due to: pressure column material at the loading print; pressing the border edges to center of the material on the belt surface; total or partial sliding belt on drums motor; type scraper for cleaning and the sides of guidance material.

Abrasion wear of the rubber layer marginal is due to friction to the metal parts of the frame and rolling on the centering deflector rollers.

Operating conditions influence the durability belt due to: lateral deviation belt during operation; belt decentration displacement, forming convex and concave arcs to curvature of the route points the transition zone from trough to flat form and to step supports roller. Also, sticking of rollers favors breaking of the belt.

During operation is very important to stretching the belt and adjustment and maintenance of the wiper belt and rollers along the route the belt and also the replacement of worn or deteriorated elements. Stretching the belt above normal resistance for to compensate the lack of adhesion between belt and drum drive, could break the belt in the joint areas or transversal break on limited portions or entire width. Consideration should be given to adjustment and maintenance of wiper belt. Correct resolution and high belt cleansing is necessary because the deposited material stratified

and separate during transport and the smallest granules, fine, get on exterior coating surface transport belt. If the material is transported wet or moisture content in the atmosphere is high, increases the water content of fine granules on the surface, they are plastic and adhere on exterior coating surface transport belt. Under the action scraper drum, over-running some material detaches and falls from the belt and remained in this layer is compressed between drums and belt reinforcing in fact adhere more to the transport belt. On drums and rollers in contact with the belt, the material caught it loses moisture content due to heat friction phenomenon appeared after. Movement due to flexible, elastic belt in the lower branch, the layer of dry material detach and falls under installation.

Examining the causes of the decrease durability, respectively availability conveyor belts result as the biggest influence has abrasive wear followed by of the transport material.

Analyzing the causes of failure, in general, they can be classified into three groups:

- technical defects in the subassembly studied, such as: design errors, execution and material characteristics;
- defects that occur during operation due to, for example: fatigue, aging, wear and corrosion;
- defects due to the human factor, for example: exploitation errors and negligence in maintenance actions.

Defects in the first two groups influence through technical measures while the third group is added to the technical possibilities, in the first place qualification degree operating personnel, maintenance and repair.

In the table 1 are selection and presented from a quantity of 6000 defects with interrupted exploitation at large equipment of the lignite quarries, defects which provoked an operational interruption more than 12 hours.

Table 1. **Defect causes and weight of remediation time from total time**

No	Defect cause	From total time %
1	Errors of exploitation and maintenance	34,7
2	Defects and breakages due to fatigue	16,1
3	Manufacturing defects and assembly	15,1
4	Design errors	9,0
5	Defects due materials	8,9
6	Defects suffered due to external factors foreign bodies (stones, worn pieces, etc.)	6,7
7	Misalignment, loss of adhesion, reduced physical and mechanical properties	6,3
8	Exceed of wearing limit	2,8

Based on data from table 1 can draw Pareto diagram shown in figure 4 [2].

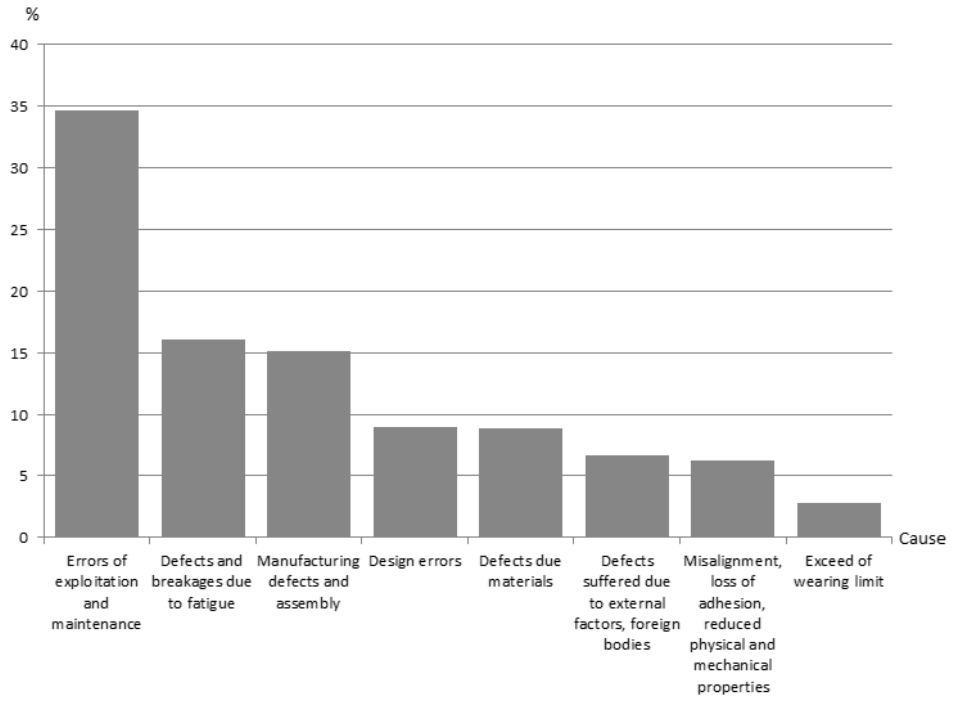

Fig. 4. Pareto diagram

4. CONCLUSIONS

Cost belt which represents between 35÷50 % of the conveyor and maintenance costs and relatively small during the life of its, lead the belt to represent the decisive factor in determining the application efficient of belt conveyors. Between the two types of carcasses in the open-pit mining is preferred both in our country and abroad belts inserts steel cables which now shows high strength and very low coefficient along. Analyzed the causes that influence durability in the form of a diagram "cause-effect", was found that most influence the belt has durability to abrasion and effects of material transported. Based on experimental data was presented in both tabular and Pareto diagram form weight to remedy defects duration of the total remediation from 6000 defects, considering only those that caused an interruption in operation longer than 12 hours, at highest percentage 34,7 % is due to exploitation and maintenance errors.

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