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## Laboratory tests of operational durability and energy – efficiency of conveyor belts

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# Laboratory tests of operational durability and energy – efficiency of conveyor belts

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**Abstract.** The paper presents the results of laboratory tests into the resistance of conveyor belts to simulated wear-related defects such as punctures and longitudinal cuts. Puncture and cut resistance of a conveyor belt have a significant influence on how long the belt can be operated without repairs and the related downtime, and as a result they allow increased operational safety of conveyor belts. The paper also presents a test method and the test results of indentation rolling resistance, which allows evaluating energy-efficiency of conveyor belts. The results here presented confirm that the test rigs and test methods developed at the Wroclaw University of Science and Technology are useful in evaluating the energy-efficiency of conveyor belts and their resistance to simulated wear-related damage.

## 1. Introduction

Belts operated on conveyors are subjected to a variety of loads which lead to damage [1, 2, 3]. They undergo wear in a process which depends on the type of conveyor, its length, the material transported and the working site. Laboratory tests of a conveyor belt's operational durability require determining a number of its properties, such as tensile strength, longitudinal and transverse elongation strength, delamination strength, shear strength, flammability, and resistance to low temperature, as well as rubber cover tensile strength, abrasion resistance, aging resistance, etc. The methods for measuring the above mentioned properties are standardized. However, a number of methods for testing belt puncture and cut resistance, as well as indentation rolling resistance have not yet been described in the form of standards. In most cases, belts are removed from a conveyor due to worn rubber cover and defects caused by punctures and cuts. Therefore, the resistance of belts to punctures and longitudinal cuts is an important criterion in the evaluation of their operational durability. Regardless of their strength parameters, belts operated in underground mining industry should additionally meet safety requirements related to fire and explosion hazards. For this reason, belts are subjected to special flammability tests [4].

Due to rising electricity prices and ecological expectations, low operating costs of conveyors are becoming a concern. These costs may be lowered by decreasing the values of indentation rolling resistances. These resistances are in turn mostly affected by the dynamic properties of the belt's pulley side cover [5, 6].

This paper presents conveyor belt tests performed with the use of test methods devised at Laboratorium Transportu Tasmowego (Belt Conveying Laboratory, further BCL), Wroclaw University of Science and Technology. BCL was established in the 1980s and is currently a leading laboratory dedicated to research into conveyor belts, with a reputation both in Poland and abroad. In 2006, the laboratory was awarded Research Laboratory Accreditation Certificate No. AB 710 from Polish Center



for Accreditation. It is also certified to conduct tests and issue expert opinions related to the admission, by Higher Mining Office, of conveyor belts for use in underground mining operations. The laboratory also has a 30-year experience in research on conveyor belts, splices, rubber materials, textile fabrics, rubber mixtures and plastics.

## 2. Laboratory Tests

Standards do not regulate the methodology of laboratory tests for determining belt puncture resistance, belt cut resistance or indentation rolling resistance. For this reason, the tests were based on methods developed at Belt Conveying Laboratory as part of research projects [7] and a doctoral dissertation [5].

### 2.1. The test object

Tests of belt resistance to wear-related damage such as punctures and longitudinal cuts were performed on two conveyor belts having nominal tensile strength of 1250 kN/m. The belts have the following symbols: 1250/2 5+3 and 1250/2 5T+3. They are textile belts with two textile plies in the core. The carrying covers and the pulley covers have identical thicknesses in both belts – 5 mm and 3 mm, respectively. Total belt thickness is also provided: ca. 18÷19 mm. The belts differ only in the design of the carrying cover. The T symbol in the belt designated as 1250/2 5T+3 stands for reinforcement added perpendicular to the belt axis. The reinforcement is in the form of steel wires 1 mm in diameter, spaced ca. 25 mm from each other and ca. 1.5÷2.0 mm from the belt core. The belts were chosen for tests in order to demonstrate the influence of the design of the carrying cover, i.e. of the presence of lateral reinforcement, on belt resistance to punctures and longitudinal cuts. The tested belts are used for material transportation in open-cast mining. They may be also used in underground mining, provided they meet additional flammability requirements.

Indentation rolling resistance was tested on two steel-cord belts of the same type: ST 2000 8+8, used for material transportation in underground mines. They are slow-burning belts. Total belt thickness is ca. 22.7÷23.1 mm. The carrying and pulley covers have identical thicknesses of ca. 8.6÷8.8 mm. The belts differ only in the composition of the rubber compound used in the pulley cover. The belts have the following designations:

- belt No. 1 has its pulley cover fabricated of standard slow-burning compound, typically used in underground mines;
- belt No. 2 has its pulley cover fabricated of slow-burning compound which is, in addition to belt No. 1, energy-efficient.

Belts 1 and 2 were selected for tests in order to demonstrate how various rubber compounds in the pulley cover influence the values of indentation rolling resistance. The conveyor belt having lower indentation rolling resistances will at the same time prove more energy-efficient in comparison to a belt with higher indentation rolling resistances.

### 2.2. Belt puncture resistance test method

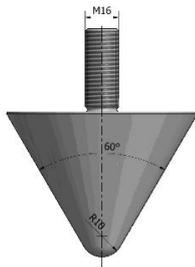
Belt puncture resistance tests are performed on a purpose-design test rig [8]. The method for measuring conveyor belt puncture resistance consists in subjecting the belt to impacts of a punch having increasing energy. The punch causes defects which are then measured. After each impact, the position of the belt sample is changed. The belt sample, depending on its strength and thickness, as well as on the design of the carrying cover, is subjected to only several or even more than twenty impacts. The test is considered complete if the belt is perforated or if impact energy reaches ca. 2060 J. This value corresponds to an energy of a 70 kg punch dropped on the belt from the height of 3.0 m. Impact energy  $E$  (J) is determined from relationship (1):

$$E = m \cdot g \cdot h \quad (1)$$

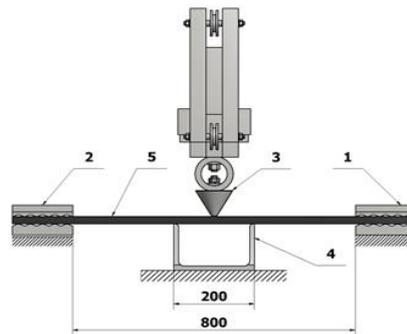
where:

$m$  – mass of the punch (kg),  
 $g$  – acceleration of gravity ( $\text{m/s}^2$ ),  
 $h$  – punch drop height (m).

Punch mass can be adjusted and is typically 50 kg. If greater impact energy is required, it may be increased to 70 kg. The punch has a cone-shaped head. The cone has a point angle =  $60^\circ$  and a nose radius  $R = 10$  mm (figure. 1). Fixed supports are located axially to the punch, at a distance of 200 mm from each other (figure. 2).



**Figure 1.** Punch shape.



**Figure 2.** Sample support scheme: 1 – fixed gripping jaw, 2 – movable gripping jaw, 3 – punch, 4 – support, 5 – belt.

After a series of impacts with a known energy  $E$ , the carrying cover is removed from the belt. In the next step, defects are identified and described. Belt core defect lengths  $L$  are subsequently measured. When a steel cord belt is hit by a punch with low energy, the cover frequently remains intact, while the steel cords are likely to peel off the core rubber and the length of this peeled fragment is then measured. Identification of the defects in the belt is followed by plotting graphs representing a relationship between impact energy  $E$  and defect length  $L$ . The graphs serve to read the following energy values:

- critical  $E_k$ , which results in first defects penetrating to the belt core;
- puncture  $E_p$ , which results in perforating the belt;
- mean  $E_m$ , which results in belt defects reaching a particular size.

The value of mean impact value  $E_m$  is determined from the area below the  $E=f(L)$  curve. By integrating equation  $E=f(L)$  in the range of selected defect lengths and by dividing the area below the curve by the value of  $L$ , the mean impact energy  $E_m$  equation can be given the following form (2):

$$E_m = \frac{\int_0^L f(L)dL}{L} \quad (2)$$

In the tests, the assumed value of  $L = 60$  [mm], since this is the damage length most frequently encountered in belt conveyor operation [9].

### 2.3. Belt cut resistance test method

Tests of belt resistance to cuts consists in determining the value of force  $F$  required to cut the belt (figure. 3) with the use of a special cutting element. The element is 6 mm in thickness, with the thickness of the cutting point reduced to 4 mm. The belt sample is positioned in the gripping jaw of a testing

machine (figure. 4) and then, using actuators and a fixed cutting element, it is cut with the speed of 600 mm/s. After the belt is completely cut, a graph is plotted, which represents cutting force in the function of time  $F=f(t)$ . This graph serves to calculate belt resistance to cutting [7].



**Figure 3.** Belt sample after the test.



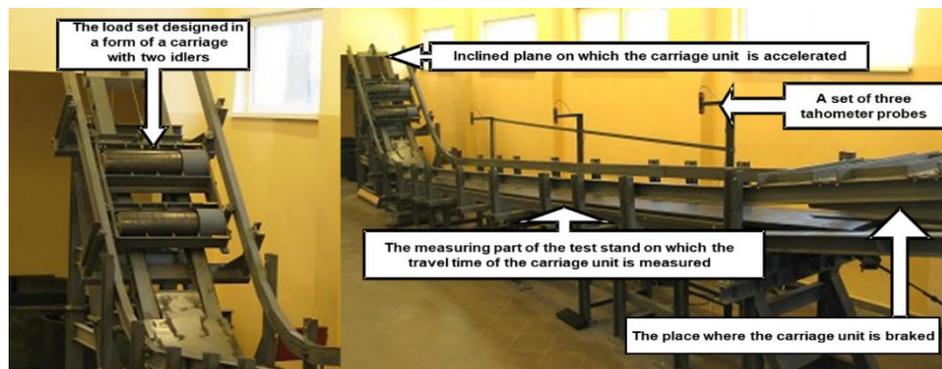
**Figure 4.** The ZP40 testing machine together with the cutting element.

If covers become delaminated during the cutting process, which is manifested in the graph as increased force, such graph fragments are not considered when calculating mean cutting force  $F_m$ . Mean value of cutting force corresponds to belt cutting resistance.

#### 2.4. Method for testing indentation rolling resistance

Belt indentation rolling resistances account for 50-60% of the total resistances to motion in long level belt conveyors used in lignite and copper ore mines as well as in power plants. Experiments performed to date have demonstrated that changing the parameters of the rubber compound used in the pulley cover and modifying the belt design may reduce rolling resistances and also lower the energy consumption in the conveyor drive mechanism by more than ten percent [5, 10-13].

Works at the CBL resulted in developing new test rigs and methods for measuring the resistance of idler rolling on the conveyor belt. figure. 5 shows the test rig whose design is based on an inclined plane. The plane holds a conveyor belt (pulley cover side up) with a carriage rolling on the belt, exerting a load on it. The carriage moves on two standard idlers whose rotational resistances were measured prior to tests. By using equations describing the movement of a carriage on a plane and by measuring the parameters of this movement (deceleration), it is possible to determine the resistance of the belt moving on idlers, also referred to as indentation rolling resistance. The test requires a belt segment approximately 7.5 m in length and 0.5 m in width.



**Figure 5.** The measuring rig for rolling resistance tests using the inclined plane method.

The rolling resistances are measured according to the following principle: the load set designed in a form of a carriage comprising two idlers, having mass  $m$ , radius  $r$  and moment of inertia  $I_r$ , is accelerated to speed  $v$  on the conveyor belt positioned on stiff background with the pulley cover side up. As it rolls on the belt, the carriage gradually loses speed. By measuring the distance traveled  $S$  and the time  $t$  required to travel this distance, it is possible to calculate deceleration  $a$  of the load set.

Unit indentation rolling resistance  $W_e$  measured on the rig according to the above principle, as shown in figure. 5, is calculated from relationship (3):

$$W_e = \left( m + \frac{2I_r}{r^2} \right) \cdot a - 2W_k - W_p \quad (3)$$

where:

$W_p = m \cdot g \cdot \sin\beta$  – carriage lift resistance (N),

$\alpha$  – measured carriage deceleration ( $\text{m/s}^2$ ).

The rolling resistance tests were performed with the following parameters:

$m = 163$  kg – mass of the load carriage with two idlers (adjustable),

$r = 97$  mm – idler radius (idlers of various radii possible),

$W_k = 4.38$  N – rotational resistance of a single idler,

$I_r = 0.173$   $\text{kg} \cdot \text{m}^2$  – moment of inertia of the idler,

$g = 9.81$   $\text{m/s}^2$  – gravitational acceleration,

$\beta = 4.98^\circ$  – angle of inclination in the measuring section of the test rig.

The time required for idlers to travel a certain distance along the belt is measured with the use of three tachometer probes. In order to increase the accuracy of measurement, the frame of the idler carriage was fitted with 3 markers. Each of the probes records the travel time for each marker. According to the selected measurement procedure, the test is repeated a number of times and the result is provided as a mean value. Each measurement provides 9 results of time in the function of distance traveled by the idlers. The results are approximated with equation (4):

$$s = \frac{a \cdot t^2}{2} + v_o \cdot t + s_0 \quad (4)$$

and deceleration  $\alpha$  is calculated.

Rolling resistance tests are always performed in a particular temperature. Belt conditioning is performed in such a way that belt temperature is stabilized equal to ambient temperature. The belts are seasoned in an unrolled position, on a flat surface.

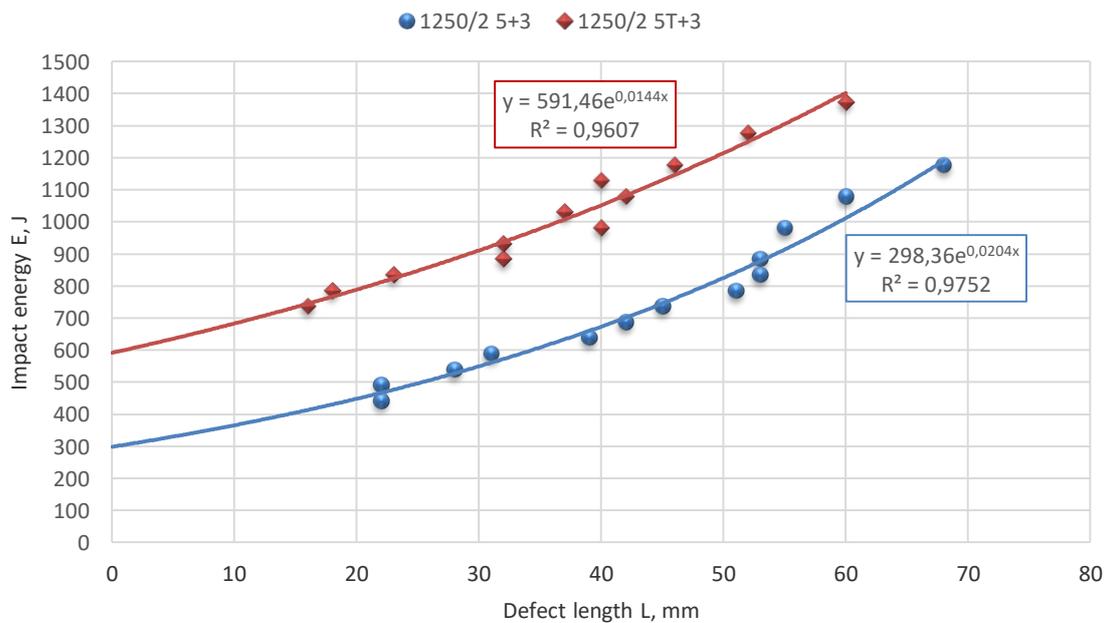
### 3. Test results

The tests of belt puncture resistance were performed on a belt sample 1300 mm in length and 500 mm in thickness. The mass of the punch used in the tests was 50 kg. Belt 1250/2 5+3 was subjected to 14 impacts and belt 1250/2 5T+3 was subjected to 16 impacts. The resulting damage in the belts is provided in table 1.

**Table 1.** Results of belt puncture resistance tests.

| Punch drop height $h$ (m) | Impact energy $E$ (J) | Defect size on the belt $L$ (mm) |             |
|---------------------------|-----------------------|----------------------------------|-------------|
|                           |                       | 1250/2 5+3                       | 1250/2 5T+3 |
| 0.8                       | 392.4                 | 0                                | 0           |
| 0.9                       | 441.5                 | 22                               |             |
| 1.0                       | 490.5                 | 22                               | 0           |
| 1.1                       | 539.6                 | 28                               |             |
| 1.2                       | 588.6                 | 31                               | 0           |
| 1.3                       | 637.7                 | 39                               |             |
| 1.4                       | 686.7                 | 42                               | 0           |
| 1.5                       | 735.8                 | 45                               | 16          |
| 1.6                       | 784.8                 | 51                               | 18          |
| 1.7                       | 833.9                 | 53                               | 23          |
| 1.8                       | 882.9                 | 53                               | 32          |
| 1.9                       | 932.0                 |                                  | 32          |
| 2.0                       | 981.0                 | 55                               | 40          |
| 2.1                       | 1030.1                |                                  | 37          |
| 2.2                       | 1079.1                | 60                               | 42          |
| 2.3                       | 1128.2                |                                  | 40          |
| 2.4                       | 1177.2                | 68                               | 46          |
| 2.6                       | 1275.3                |                                  | 52          |
| 2.8                       | 1373.4                |                                  | 60          |

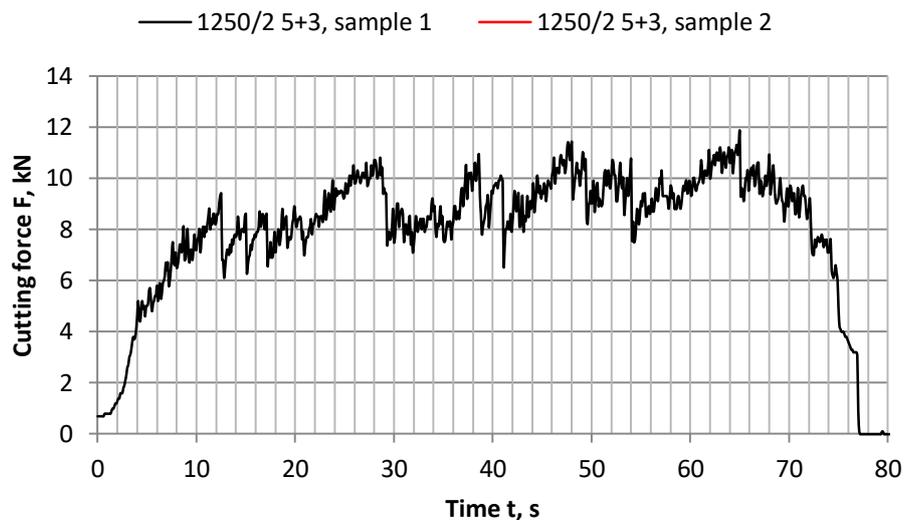
Based on the measured defect lengths, a graph was plotted which represents the relationship between defect length  $L$  as a function of impact energy  $E$  (figure 6).



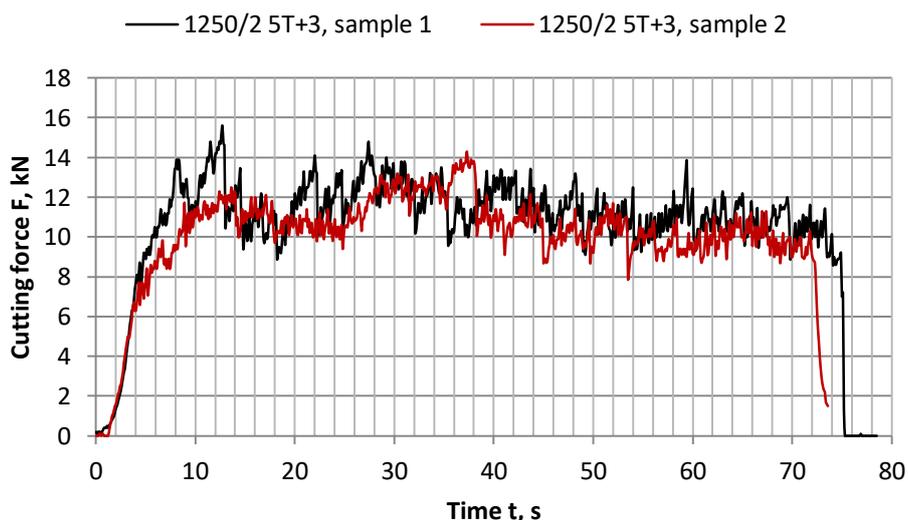
**Figure 6.** Defect length  $L$  vs impact energy  $E$ .

The graph served to determine the value of critical energy  $E_k$ . This is the energy level which must be exceeded to cause damage in the belt. The graph equations served to calculate mean impact energy  $E_m$ . The results are presented in table 4. As indicated in figure 6, the size of the defect is not in linear dependence on impact energy. The reason for this phenomenon is in the textile core of the belt: its design causes the defects to propagate in the belt both lengthwise and crosswise.

The tests of belt resistance to longitudinal cuts were performed with the use of two samples collected from each belt type. The samples were 1300 mm in length and 300 mm in thickness. The test results are presented in the form of cutting force vs time graphs (figure 7, figure 8). figure 7 shows the results of belt cut resistance for belt 1250/2 5+3, and figure 8 – for belt 1250/2 5T+3.



**Figure 7.** Changes of cutting force in time for belt 1250/2 5+3.



**Figure 8.** Changes of cutting force in time for belt 1250/2 5T+3.

The shape of the cutting curve does not indicate the delamination of the covers from the belt core. Such delamination is manifested in the graph as a surge of force value. The resulting peak in the graph

has a value significantly different from other values. If a peak is found, it is ignored in the calculations of mean cutting force. table 4 includes mean cutting forces for individual samples as well as each belt's resistance to longitudinal cuts.

The results of indentation rolling resistance for belt ST 2000 8+8 No 1 are provided in table 2 and for belt ST 2000 8+8 No 2 – in table 3. The tests were performed at a temperature of 28 °C. The load set exerted a unit force of 1.6 kN on the belt. The tables include times  $t$  required for the carriage to travel distance  $s$  along the belt. The tested belts were subjected to seven measurements. Originally, carriage travel times were measured with the use of two tachometer probes: Tacho 1 and Tacho 2. However, because the idler set traveling along the belt produces phenomena of non-linear character, an additional third probe (Tacho 3) was introduced in the middle of the belt length. Using this method, travel times of the idler set were measured in nine points. These measurements allowed more accuracy to the  $s = f(t)$  equation.

**Table 2.** Test results for belt ST 2000 8+8 No 1.

| Rolling distance of the carriage on the belt $s$ (m) |   | Probe Tacho 1 |        |        | Probe Tacho 2 |        |        | Probe Tacho 3 |        |        |
|------------------------------------------------------|---|---------------|--------|--------|---------------|--------|--------|---------------|--------|--------|
|                                                      |   | 0             | 0.273  | 0.769  | 2.186         | 2.459  | 2.955  | 4.390         | 4.663  | 5.159  |
| Travel time of the carriage on the belt $t$ (s)      | 1 | 0             | 0.0860 | 0.2436 | 0.7463        | 0.8561 | 1.0625 | 1.7904        | 1.9632 | 2.3272 |
|                                                      | 2 | 0             | 0.0865 | 0.2452 | 0.7529        | 0.8634 | 1.0720 | 1.8123        | 1.9880 | 2.3647 |
|                                                      | 3 | 0             | 0.0860 | 0.2435 | 0.7459        | 0.8559 | 1.0611 | 1.7881        | 1.9601 | 2.3250 |
|                                                      | 4 | 0             | 0.0863 | 0.2441 | 0.7508        | 0.8610 | 1.0679 | 1.8044        | 1.9812 | 2.3525 |
|                                                      | 5 | 0             | 0.0860 | 0.2427 | 0.7442        | 0.8536 | 1.0581 | 1.7816        | 1.9527 | 2.3134 |
|                                                      | 6 | 0             | 0.0862 | 0.2441 | 0.7499        | 0.8602 | 1.0664 | 1.8011        | 1.9757 | 2.3463 |
|                                                      | 7 | 0             | 0.0859 | 0.2423 | 0.7442        | 0.8533 | 1.0578 | 1.7824        | 1.9539 | 2.3127 |

**Table 3.** Test results for belt ST 2000 8+8 No 2.

| Rolling distance of the carriage on the belt $s$ (m) |   | Probe Tacho 1 |        |        | Probe Tacho 2 |        |        | Probe Tacho 3 |        |        |
|------------------------------------------------------|---|---------------|--------|--------|---------------|--------|--------|---------------|--------|--------|
|                                                      |   | 0             | 0.273  | 0.769  | 2.186         | 2.459  | 2.955  | 4.390         | 4.663  | 5.159  |
| Travel time of the carriage on the belt $t$ (s)      | 1 | 0             | 0.0860 | 0.2427 | 0.7406        | 0.8488 | 1.0494 | 1.7475        | 1.9076 | 2.2351 |
|                                                      | 2 | 0             | 0.0863 | 0.2432 | 0.7401        | 0.8480 | 1.0489 | 1.7460        | 1.9060 | 2.2318 |
|                                                      | 3 | 0             | 0.0863 | 0.2443 | 0.7473        | 0.8560 | 1.0595 | 1.7695        | 1.9329 | 2.2682 |
|                                                      | 4 | 0             | 0.0859 | 0.2433 | 0.7422        | 0.8507 | 1.0520 | 1.7533        | 1.9138 | 2.2432 |
|                                                      | 5 | 0             | 0.0861 | 0.2447 | 0.7467        | 0.8558 | 1.0601 | 1.7704        | 1.9353 | 2.2742 |
|                                                      | 6 | 0             | 0.0859 | 0.2426 | 0.7400        | 0.8483 | 1.0488 | 1.7457        | 1.9057 | 2.2298 |
|                                                      | 7 | 0             | 0.0866 | 0.2451 | 0.7484        | 0.8577 | 1.0611 | 1.7723        | 1.9381 | 2.2780 |

The data provided in table 2 and in table 3 served to calculate the deceleration of the idler set and subsequently to calculate unit indentation rolling resistances. The results are presented in table 5.

#### 4. Discussion

Table 4 presents test results of the resistance to wear-related damage such as punctures and longitudinal cuts for 2-ply textile belts having strength equal to 1250 kN/m. The analyzed influence of the carrying cover's design, i.e. of the presence of lateral reinforcement, allows a conclusion that belt resistance to both punctures and longitudinal cuts increases.

Punctures in a belt with reinforced carrying cover (belt 1250/2 5T+3) are observed only after the critical energy  $E_k$  of 591 J is exceeded. The belt has then an almost twofold greater puncture strength in comparison to the belt without reinforced carrying cover (belt 1250/2 5+3 298 J). As a result, defects

penetrating to the belt core develop more quickly in belt 1250/2 5+3. Also, mean puncture energy  $E_m$  for belt 1250/2 5T+3 is approximately 60% higher than for belt 1250/2 5+3.

The resistance to longitudinal cuts of a belt without the reinforced cover is higher by ca. 28% than in the case of a belt without reinforced carrying cover. In some situations, an increase in belt resistance to longitudinal cuts by 28% may be sufficient for the belt operated on the conveyor to actually break off the stuck element which is responsible for cutting the belt.

**Table 4.** Test results of a 2-ply belt 1250/2 resistance to defects such as punctures and longitudinal cuts.

| Belt type   | Critical energy $E_k$ (J) | Mean energy $E_m$ (J) | Sample No. | Longitudinal cutting force $F$ (kN) | Mean longitudinal cutting force $F_m$ (kN) |
|-------------|---------------------------|-----------------------|------------|-------------------------------------|--------------------------------------------|
| 1250/2 5+3  | 298                       | 585                   | 1          | 9.0                                 | 8.5                                        |
|             |                           |                       | 2          | 8.0                                 |                                            |
| 1250/2 5T+3 | 591                       | 940                   | 1          | 11.4                                | 10.9                                       |
|             |                           |                       | 2          | 10.4                                |                                            |

Table 5 contains the deceleration values of the idler set, calculated from equation (4). Subsequently, unit indentation rolling resistance values for ST 2000 8+8 belts were calculated from equation (3).

**Table 5.** Comparison of indentation rolling resistance test results for belts ST 2000 8+8 No 1 and 2.

| Pass No. | Carriage deceleration $a$ (m/s <sup>2</sup> ) |            | Unit indentation rolling resistances $W_e$ (N/m) |            |
|----------|-----------------------------------------------|------------|--------------------------------------------------|------------|
|          | Belt No. 1                                    | Belt No. 2 | Belt No. 1                                       | Belt No. 2 |
| 1        | 0.8942                                        | 0.8560     | 30.54                                            | 22.84      |
| 2        | 0.8898                                        | 0.8562     | 29.67                                            | 22.88      |
| 3        | 0.8956                                        | 0.8510     | 30.81                                            | 21.86      |
| 4        | 0.8928                                        | 0.8542     | 30.26                                            | 22.49      |
| 5        | 0.8964                                        | 0.8564     | 30.97                                            | 22.92      |
| 6        | 0.8926                                        | 0.8534     | 30.22                                            | 22.33      |
| 7        | 0.8962                                        | 0.8544     | 30.93                                            | 22.53      |

Seven measurements were performed for each belt. The obtained results of unit indentation rolling resistances have very high repeatability. The ST2000 8+8 belt designated as belt No. 1, with the pulley cover made of standard rubber compound commonly used in underground mines, has unit indentation rolling resistance equal to 30.5 N/m. Belt No. 2, with the pulley cover made of energy-efficient rubber compound, has unit indentation rolling resistance equal to 22.5 N/m. The rolling resistance in belt No. 2 is thus 26% lower than in belt No. 1. This figure translates directly into reduced power demand from the conveyor drive mechanism. A conveyor with belt No. 2 will require lower power in the drive mechanism. As a result, the electricity consumption in such a drive mechanism will also be lower. Consequently, the mine will face lower operating costs related to belt conveyors.

## 5. Conclusions

Increasing competition forces conveyor belt manufacturers to constantly search for improved solutions. Obviously, each improvement must be first subjected to appropriate tests and advantageously to tests which provide results in a relatively short time. a demand thus exists for developing and improving test methods and laboratories which are capable of quickly and precisely evaluate the quality and predicted

life of a product in particular operating conditions. In order to meet this demand, new test infrastructure is constructed.

The main focus of the research here presented was to investigate what influence belt design has on belt resistance to punctures and longitudinal cuts. This aspect is crucial for mining operations, in which belt conveyors constitute the most important means of transportation. Many conveyor belts operated in a mine become damaged, as the mined material is dropped on the belt. The analysis of the test results was performed on the basis of the measured impact energies – kinetic energy  $E_k$  and mean energy  $E_m$ . When analyzing the influence which the design of the carrying cover has on puncture resistance, a comparison was made between textile belts of the same type and nominal strengths. The tests demonstrated that the belt with reinforced carrying cover has a twice higher puncture resistance. This type of belt is also 28% more resistant to longitudinal cuts.

Another aim of this research was to investigate the influence of the rubber compound used in the pulley cover on indentation rolling resistance. The tests showed that it is possible to lower the rolling resistances by 26%. An appropriately selected rubber compound in the pulley cover may thus bring notable financial savings due to lower costs of conveyor transportation.

The tests of conveyor belt resistance to punctures, longitudinal cuts and rolling on idlers, as well as the analysis of their results, confirm that these phenomena are an important factor in determining the operational durability of conveyor belts. They are also of influence to the costs of transporting mined material on belt conveyors. Puncture and cut resistance of a conveyor belt have a significant influence on how long a belt can be operated without repairs and the related downtime, and as a result they allow increased operational safety of conveyor belts. The results here presented confirm that the test rigs and test methods developed at the Wrocław University of Science and Technology are useful in evaluating the energy-efficiency of conveyor belts and their resistance to simulated wear-related damage.

The Belt Conveying Laboratory located at the Faculty of Geoen지니어ing, Mining and Geology, WUST, employs over 30 methods for testing conveyor belts. This paper presents some of them, focusing in particular on the new test infrastructure in the laboratory. The new test rigs significantly increase the laboratory's research potential and allow meeting the demand from manufacturers and users of conveyor belts.

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