Loose Material Filling in the Loading Trough Profile of the Belt Conveyor

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Abstract. The paper presents a mathematical expression of the sizes of the transverse and longitudinal cross-section surfaces and of the volume of the loose material spread on the surface of the conveyor belt before the transverse partition of the belt conveyor, inclination angle of which exceeds the limit transport angle permitted for the belt conveyor of a classic design. Volume and geometric shape of the lose material; transported in the trough (two-roller bench) loading profile; are impacted by the mechanical characteristics of the transported material, width of the conveyor belt, inclination angle of the side rollers, height of the transverse ribs and especially inclination angle of the conveyor. The maximal cross-section surface of the lose material filling at the conveyor with a smooth belt can be (for conveyor belts modified based on the shape of the trough) expressed as the sum of the cap cross-section surface and the surface of the bottom part of the belt filling. The paper describes the jacket curve of the of the cap cross-section using a parabola equation, and the surface curve of the bottom part of the belt filling using a line equation. The size of the cross-section surface of the belt filling along the longitudinal plane of the conveyor belt is defined as the difference between the inclination angle of the conveyor and the discharge angle of the transported material.

1. Introduction
Due to their technical, operation as well as economic benefits, belt conveyors have been widely used for industrial purposes. Conveyors with a pulling as well as loadbearing mechanism in the form of an endless loop of the conveyor belt [1] represent transport means from the category of fluently operating devices, designated for moving lose, semiliquid as well as piece materials to a distance of up to thousand meters.

The cross-section size of the conveyor belt filling $S [m^2]$ depends on the shape of the loading profile (flat or trough roller bench), loading width of the belt $b [m]$ and dynamic discharge angle $\psi_d [deg]$ of the transported material [2]. For a flat loading profile of a conveyor belt of a horizontally installed belt conveyor (i.e., when the transport inclination angle $\beta = 0$ deg), total surface $S [m^2]$ of the belt filling cross-section of the transported material can be determined using formula [2, 3]. When the transported material is loaded on the inclined part of the belt ($\beta > 0$), the reduction of a part of cross-section $S_1$ is determined by inclination coefficient $k [-]$ [2].

When the conveyor inclination angle $\beta$ equals to the dynamic discharge angle of the transported material $\psi_d$, upper cross-section $S_1$ of the belt filling is cancelled and only lower cross-section $S_2$ can be
used for the transport. This definition, which is included in technical standard [2], specifies that the limit angle, when there is no transported material on the flat loading profile of the conveyor belt anymore, acquires value \( \beta_{\text{max}} = \varphi_d \).

![Figure 1](image_url)

**Figure 1.** Conveyor belt a) grooved, b) with separated protrusions, c) profile

In real life, it is required; for example, due to a reduced built-up area by the conveyor, reduced length of the enclosed loop of the conveyor belt, etc.; that the lose or small-piece materials on the surface of the given conveyor belt are transported under the highest possible inclination angle of the conveyor. From among several methods [4, 5] of how to ensure, under a transport angle that exceeds the limit angle of a smooth conveyor belt \( \beta_{m} \, [\text{deg}] \) of a belt conveyor of a standard design, an effective transport of the grains of the transported material, a conveyor belt with transverse ribs is used, Figure 2.

### 2. Source of the explored topic

Various industrial fields require an increased inclination angle of the belt conveyor transport [4], or the use of belt conveyors of special designs [6-9]. The permitted inclination angle of the transport by belt conveyors of a standard design [2, 10] is particularly determined by the friction coefficient between the contact surface of the material grains (incapable of rotation) and the surface of the given conveyor belt. Material grains that are capable of rotation (grains of a spherical or cylindrical shape) must be prevented from rolling along the surface under any angle of the given inclined conveyor belt. For horizontally carried conveyor belts, we also need to prevent rotation of the spherical grains, which can occur due to the effects of the forces along the contact surface of the grains with the conveyor belt and the inertia forces. In order to increase the permitted angle of the belt conveyor transport [5], we need to:

- a) increase the friction coefficient along the work surface of the conveyor belt [11, 12],
- b) structurally modify the surface of the conveyor belt [13, 14], making sure that movement of the transported material grains along the belt is prevented (against the transport direction for the uphill transport and in the transport direction for downhill transport) [4],
- c) increase the pressure of the transported material to the conveyor belt [6, 15, 16].

An increase of the friction (cohesive, adhesive) force of the transported material in relation to the surface of the conveyor belt is usually implemented by increasing the roughness (friction) of the surface or the operation layer of the conveyor belt [17]. Higher values of the friction coefficient can be achieved by:

- a1) applying an additional compact layer of particles on the conveyor belt operation surface after the assembly of the conveyor belt [18], or
- a2) by adding abrasive particles to the rubber cover layer when manufacturing the belt by vulcanization.

- b) grooving and indenting the belt operation surface, see Figure 1a, when vulcanizing the cover rubber surface of the conveyor belt.
c) vulcanization [19] of protrusions (separated Figure 1b or profile Figure 1c) onto the belt operation surface.

Prevention of undesirable movement of the transported piece materials as well as lose material grains (capable as well as incapable of rotation); along the surface of the conveyor belts of conveyors that operate with a transport incline angle [20] that exceeds the limit angle [21, 22]; is usually ensured by implementing transverse partitions [23] (Figure 2a) with a regular span along the entire length of the endless loop of the conveyor belt.

![Figure 2. Conveyor belt a) with transverse partitions, b) with partitions ad side bellows](image)

When transporting lose materials on belt conveyors under the transport angle $\beta = 90 \text{ deg}$, conveyor belts furnished (by the means of hot as well as cold vulcanization or mechanically) by partitions and side bellows [24] (Figure 2b) are used. Side bellows prevent the transported grains from falling off over the side edges or the conveyor belt and significantly increase transport performance $Q \left[ t \cdot h^{-1} \right]$ by putting a larger volume of the lose material $V \left[ m^3 \right]$ to the area between the two mutually adjacent partitions.

3. Methodology of research

3.1. Transverse cross-section of the conveyor belt filling

The maximal cross-section surface of the lose material filling $S \left[ m^2 \right]$ at the conveyor with a smooth belt [2] can be (for conveyor belts modified based on the shape of a trough) [25] expressed as the sum of the cap cross-section surface $S_1 \left[ m^2 \right]$ (3) and the surface of the bottom part $S_2 \left[ m^2 \right]$ (4) of the belt filling [3]. Canonical shape of the parabola [5] with its axis in axis $y$, see Figure 3a, and vertex $V$ in the distance of $h_{\text{max}} \left[ m \right]$ from the beginning $0$ of the coordinate system can be recorded using formula (1).

$$x^2 = -2 \cdot p \cdot y_{(x)} + h_{\text{max}} \left[ m^2 \right]$$

(1)

The value of parameter $p \left[ m \right]$ and height of the parabola $h_{\text{max}}$ can be determined; if we know point $A_1$ of the intersection of the parabola with axis $x$ and tangent $t$ to the parabola, which passes through point $A_1$; by graphic procedure (Figure 3a) [5], and it can be expressed using formula (2).

$$p = \frac{b_1 \cdot \tan(\psi_a)}{2} \left[ m \right], \quad h_{\text{max}} = \frac{b_1 \cdot \tan(\psi_a)}{4} \left[ m \right]$$

(2)

Surface of the transverse cross-section cap $S_1 \left[ m^2 \right]$ (see Table 1) of the transported material, see Figure 3b, along plane $xy$ can be expressed using formula (3).

$$S_1 = \frac{b_1^2 \cdot \tan(\psi_a)}{6} = \int_{-b/2}^{b/2} y_{(x)} \cdot dx = 2 \cdot \int_{-b/2}^{b/2} y_{(x)} \cdot dx = 2 \cdot \int_{-b/2}^{b/2} \frac{x^2}{2 \cdot p} \cdot dx$$

(3)

Surface of the bottom part of the transverse cross-section cap $S_2 \left[ m^2 \right]$ (see Table 1) of the transported material filling, see Figure 3b, can be expressed using formula (4). Distance $z_{(x)} \left[ m \right]$ of the distribution of the material transported on the conveyor belt along plane $yz$, i.e., in the direction of axis $z$, can be
expressed pursuant to Figure 3b formula (5).

\[ S_2 = \frac{b_1^2 \cdot \tan(\lambda)}{4} = 2 \cdot \int_0^{b_1/2} x \cdot \tan(\lambda) \cdot dx [m^2] \]  

(4)

\[ z_{(x)} \left( \frac{y_{(x)}}{\tan(\beta - \delta_0)} \right) = \frac{y_{(x)}}{\tan(\beta - \delta_0)} + \left( h_2 - x \cdot \tan(\lambda) \right) \cdot \tan(\lambda) = \frac{h_{\max} - \frac{x^2}{2 \cdot p} + \left( \frac{b_1}{2} - x \right) \cdot \tan(\lambda)}{\tan(\beta - \delta_0)} [m] \]  

(5)

where \( y_{(x)} [m] \) is the height of the lose material layer on the conveyor belt along plane \( xy \) [4] within the interval of distances \( 0 \) to \( b_1/2 \) on axis \( x \).

3.2. Longitudinal cross-section of the lose material filling before the partition

The size of the longitudinal cross-section \( S_{1yz(x)} [m^2] \) of the transported material, see Figure 3b, can be, for the selected width of the conveyor belt \( B \) and inclination angle \( \beta \) of the conveyor, expressed by formula (6), see Table 2 through Table 4. The size of the longitudinal cross-section \( S_{2yz(x)} [m^2] \) of the transported material, see Figure 3b, can be, for the selected width of the conveyor belt \( B \) and inclination angle \( \beta \) of the conveyor, expressed by formula (7), see Table 2 through Table 4 (Figure 5).

| \( B \) | \( \beta \) | \( S_1 \) | \( S_2 \) | \( S_{1y} \) | \( S_{2y} \) | \( V \) |
|---|---|---|---|---|---|---|
| 0.4 | 30 | 45.95 | 77.21 | 123.17 | 502.74 | 291.31 | 123.17 | 16671.23 | 49653.73 | 1884.01 |
| 0.5 | 30 | 76.51 | 128.56 | 205.07 | 502.74 | 375.88 | 203.88 | 13268.28 | 27756.47 | 4047.36 |
| 0.65 | 20 | 136.87 | 229.98 | 366.85 | 502.74 | 408.49 | 203.88 | 23735.71 | 49653.73 | 9684.09 |

\[ S_{1yz(x)} = \frac{1}{2} \cdot y_{(x)} \cdot z_{1y(x)} = \frac{1}{2} \left( y_{(x)} + \frac{b_1}{2} \cdot \tan(\lambda) \right) \cdot \frac{y_{(x)} + \frac{b_1}{2} \cdot \tan(\lambda)}{\tan(\beta - \delta_0)} = \left[ \frac{h_{\max} - \frac{x^2}{2 \cdot p} + \left( \frac{b_1}{2} - x \right) \cdot \tan(\lambda)}{2 \cdot \tan(\beta - \delta_0)} \right]^2 \]  

(6)

\[ S_{2yz(x)} = \frac{1}{2} \cdot y_{(x)} \cdot z_{2y(x)} = \frac{1}{2} \left( h_2 - x \cdot \tan(\lambda) \right) \cdot \frac{h_2 - x \cdot \tan(\lambda)}{\tan(\beta - \delta_0)} = \left[ \frac{\left( \frac{b_1}{2} - x \right) \cdot \tan(\lambda)}{2 \cdot \tan(\beta - \delta_0)} \right]^2 \]  

(7)
4. Results

4.1. Volume of the lose material batch on the conveyor belt

The volume of the lose material $V_{(i)}$ [$m^3$] spread on the conveyor belt with a width of $B$ before the transverse partition; provided the height of the transverse partition is at least $h_{max} + h_2$ [$m$] (where $h_2 = tan(\lambda) \cdot b/2$) see Figure 4a.; can be, for inclination angle $\beta$ of the belt conveyor, expressed by formula (8).

$$V_{(i)} = \int_{-h/2}^{h/2} \frac{1}{2} \cdot y_{(i)} \cdot z_{(i)} \cdot dx = 2 \int_{0}^{h/2} \frac{1}{2} \cdot y_{(i)} \cdot z_{(i)} \cdot dx = 2 \int_{0}^{h/2} S_{yz(i)} \cdot dx =$$

$$= 2 \int_{0}^{h/2} \left[ h_{max} - \frac{x^2}{2 \cdot P} + \left( \frac{b}{2} - x \right) \cdot tan(\lambda) \right]^2 \cdot \frac{1}{2 \cdot tan(\beta - \delta)} \cdot dx \tag{8}$$

Figure 4. The volume of the transported material for a partition height a) $\geq h_{max} + h_2$, b) $> h_3 \leq h_{max} + h_2$, c) $< h_3$

| $i$ | $\beta$ deg | 1   | 2   | 3   | 4   |
|----|-------------|-----|-----|-----|-----|
| $B$ mm |       | 400 |     |     |     |
| $z_{(i)}$ mm | 434.85 | 210.66 | 132.81 | 91.38 |
| $S_{1yz(i)}$ cm$^2$ | 16671.23 | 8076.45 | 5091.52 | 3503.26 |
| $S_{2yz(i)}$ cm$^2$ | 7969.26 | 3860.74 | 2433.87 | 1674.65 |
| $V_{1(i)}$ cm$^3$ | 246.67 | 119.50 | 75.34 | 51.84 |
| $V_{0(i)}$ cm$^3$ | 1884.01 $^{*1}$ | 912.72 | 575.39 | 395.9 |

Table 2. Longitudinal cross-section and lose material volume for $B = 0.4$ m for $\beta = 30$–60 deg

| $i$ | $\beta$ deg | 1   | 2   | 3   | 4   |
|----|-------------|-----|-----|-----|-----|
| $B$ mm |       | 500 |     |     |     |
| $z_{(i)}$ mm | 561.10 | 271.83 | 171.36 | 117.91 |
| $S_{1yz(i)}$ cm$^2$ | 27756.47 | 13446.74 | 8477.03 | 5832.7 |
| $S_{2yz(i)}$ cm$^2$ | 13268.28 | 6427.88 | 4052.23 | 2788.17 |
| $V_{1(i)}$ cm$^3$ | 529.90 | 256.72 | 161.84 | 111.35 |
| $V_{0(i)}$ cm$^3$ | 4047.36 | 1960.79 | 1236.11 | 850.52 |

Table 3. Longitudinal cross-section and lose material volume for $B = 0.5$ m for $\beta = 30$–60 deg
Table 4. Longitudinal cross-section and transported material volume for B = 0.65 m for \( \beta = 30\text{°} - 60 \text{°} \)

| \( \beta \) deg | 1  | 2  | 3  | 4  |
|-----------------|----|----|----|----|
| \( B \) mm      |   |    |    |    |
| \( z(x) \) mm   | 750.47 | 363.57 | 229.20 | 157.70 |
| \( S_{x(yi)} \) cm\(^2\) | 49653.73 | 24054.97 | 15164.61 | 10434.15 |
| \( V_{ii0} \) cm\(^3\) | 1267.90 | 614.25 | 387.24 | 266.44 |
| \( V_{ii0} \) cm\(^3\) | 9684.09 | 4691.50 | 2957.59 | 2034.98 |

When the height of the transverse partition installed on the conveyor belt reaches \( h_3 \) [m] (which is lower than \( h_{\text{max}} + h_2 \), but higher than \( h_2 \), see Figure 4b), the volume of the given lose material \( V_3 \) [m\(^3\)] spread on the conveyor belt with a width of \( B \) before the transverse partition with a height of \( h_3 \) [m], can be expressed by formula (10).

Figure 5. Volume of the lose material for \( B = 0.4\text{°} - 0.65 \text{ m} \) for \( \beta = 30\text{°} - 60 \text{°} \)

Pursuant to formula (9) and Figure 4b, we can express height \( h_4 \) [m] and length \( b_2 \) [m] of the parabolic surface along plane \( xy \), which is higher than the transverse partition with a height of \( h_3 \). The loss of the transported material (i.e., volume \( V_2 \) [m\(^3\)], Figure 4b); which falls over the upper edge of the partition due to an insufficient height of the partition \( h_3 \) from the original volume of \( V_{i0} \) (see Figure 4a) of the transported material (8); can be expressed by expression \( V_2 \) [m\(^3\)], which is specified in formula (10).

Table 5. Volume of the transported material \( V_2 \) [m\(^3\)] for \( h_3 \) [m] and \( \beta = 30\text{°} - 60 \text{°} \) at \( B = 0.4 \text{ m} \)

| \( B \) mm | \( \beta \) deg | \( h_3 \) mm | 55 | 60 | 65 | 70 | 75 |
|-----------|----------------|-------------|----|----|----|----|----|
| 400       | 30             | 198.10      | 102.85\(^*2\) | 42.19 | 10.43 | 0.33 |
|           | 40             | 95.97       | 49.82 | 20.44 | 5.05 | 0.16 |
|           | 50             | 60.50       | 31.41 | 12.88 | 3.19 | 0.10 |
|           | 60             | 41.63       | 21.61 | 8.87  | 2.19 | 0.07 |

\(^*2\) see Figure 4b, \( V_{i0} - V_2 = 1884.01 - 102.85 = 1781.16 \text{ cm}^3 \)

Volume of the lose material \( V_2 \), falling over the upper edge of the partition with a height of \( h_3 \), for the given width of the conveyor belt \( B \) and inclination angle of the conveyor belt is showed in Table 5 through Table 7.

When the height of the transverse partition installed on the conveyor belt reaches \( h_3 \) [m] (which is lower than \( h_2 \), see Figure 4c), the volume of the given lose material \( V_5 \) [m\(^3\)] spread on the conveyor belt with a width of \( B \) before the transverse partition with a height of \( h_3 \) [m], can be expressed by formula (12).
Table 6. Volume of the transported material $V_2 [\text{m}^3]$ for $h_3 [\text{m}]$ and $\beta = 30^\circ-60^\circ$ at $B = 0.5 \text{ m}$

| B [mm] | $\beta$ [deg] | $h_3$ [mm] | 70 | 75 | 80 | 85 | 90 | 95 |
|--------|---------------|--------------|----|----|----|----|----|----|
| 500    | $\gamma$     |              | 463.33 | 288.37 | 160.52 | 74.59 | 24.56 | 3.16 |
| 40     | $\delta$     |              | 224.47 | 139.70 | 77.77 | 36.13 | 11.90 | 1.53 |
| 50     | $\zeta$      |              | 141.51 | 88.07 | 49.02 | 22.78 | 7.50 | 1.00 |
| 60     | $\eta$       |              | 97.37 | 60.60 | 33.73 | 15.67 | 5.16 | 0.66 |

Table 7. Volume of the transported material $V_2 [\text{m}^3]$ for $h_3 [\text{m}]$ and $\beta = 30^\circ-60^\circ$ at $B = 0.65 \text{ m}$

| B [mm] | $\beta$ [deg] | $h_3$ [mm] | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
|--------|---------------|--------------|----|----|----|----|----|----|----|----|
| 650    | $\alpha$     |              | 1012.74 | 706.92 | 464.45 | 280.24 | 148.69 | 63.48 | 17.29 | 0.98 |
| 40     | $\beta$      |              | 490.65 | 342.47 | 225.00 | 135.77 | 72.03 | 30.75 | 8.38 | 0.48 |
| 50     | $\gamma$     |              | 309.31 | 215.90 | 141.85 | 85.59 | 45.41 | 19.39 | 5.28 | 0.30 |
| 60     | $\delta$     |              | 212.83 | 148.55 | 97.60 | 58.90 | 31.24 | 13.34 | 3.63 | 0.21 |

\[
h_q = h_{max} + h_2 - h_3, \quad b_2 = \sqrt{8 \cdot p \cdot h_q} [\text{m}]
\]  

\[
V_3 = V_{o1} - V_2 = V_{o1} - 2 \cdot \int_0^{b_2/2} S_{yz(x)} \cdot dx = V_{o1} - 2 \cdot \int_0^{b_2/2} \left( h_q - \frac{x^2}{2 \cdot p} \right)^2 \cdot \frac{1}{2 \cdot \tan(\beta - \delta_0)} \cdot dx [\text{m}^3]
\]

Pursuant to Figure 4c, we can express height $h_q [\text{m}]$ and length $b_2 [\text{m}]$ of the parabola along plane $xy$, which is higher than the transverse partition with height of $h_5$, using formula (11). The loss of the transported material (i.e., volume $V_3 [\text{m}^3]$, Figure 4c), which falls over the upper edge of the partition due to an insufficient height of the partition $h_5$ from the original volume of $V_{o1}$ (see Figure 4a) of the transported material (8); can be expressed by formula (12).

Table 8. Volume of the transported material $V_{4i} [\text{m}^3]$ for $h_5 [\text{m}]$ and $\beta = 30^\circ-60^\circ$ at $B = 0.4 \text{ m}$

| B [mm] | $\beta$ [deg] | $h_5$ [mm] | 25 | 30 | 35 | 40 | 45 |
|--------|---------------|--------------|----|----|----|----|----|
| 400    | $\gamma$     |              | 971.77/168.19 | 913.55/96.69 | 802.54/48.05 | 655.69/18.76 | 491.81/4.53 |
| 40     | $\delta$     |              | 470.78/81.48 | 442.57/46.84 | 388.79/23.28 | 317.65/9.09 | 238.27/2.20 |
| 50     | $\zeta$      |              | 296.78/51.37 | 279.00/29.53 | 245.10/14.67 | 200.25/5.73 | 150.21/1.38 |
| 60     | $\eta$       |              | 204.21/35.34 | 191.97/20.32 | 168.64/10.10 | 137.79/3.94 | 103.35/0.95 |

*See Figure 4c, $V_{o1} - (V_{41} + 2 \cdot V_{42}) = 1884.01 - 693.22 = 1190.79 \text{ cm}^3$

Figure 6. a) overfalling volume $V_{4i} [\text{m}^3]$, b) distribution $z(x) [\text{mm}]$ and volume $V_{o1} [\text{m}^3]$ of the lose material

\[
h_6 = h_{max} + h_2 - h_3, \quad b_3 = \sqrt{8 \cdot p \cdot h_6} [\text{m}]
\]
Figure 6a shows the surfaces of the transverse cross-section \( (S_{41xy}(a) \ a \ S_{42xy}(a)) \), longitudinal cross-section \( (S_{41yz}(a) \ a \ S_{42yz}(a)) \), and volumes \( (V_{41} \ a \ V_{42}) \) of the lose material that falls over the transverse partition with a height of \( h_5 \) in relation to increasing inclination angle \( \beta \) of the conveyor belt. (Figure 7)

\[
V_5 = V_{(a)} - V_4 = V_{(a)} - V_{41} - V_{42} = V_{(a)} - 2 \cdot \int_0^{h_5} S_{41yz(a)} \cdot dx - 2 \cdot \int_0^{h_5} S_{42yz(a)} \cdot dx =
\]

\[
= V_{(a)} - 2 \cdot \int_0^{h_5} \left( h_b - \frac{x^2}{2 \cdot \tan(\beta - \delta)} \right) \cdot \frac{1}{2 \cdot \tan(\beta - \delta)} \cdot dx - 2 \cdot \int_0^{h_5} \left( h_b - \frac{x^2}{2 \cdot \tan(\beta - \delta)} \right) \cdot dx (12)
\]

![Figure 7. Loose material distribution on the surface of the conveyor belt before the transverse partition](image)

Volume of the lose material \( V_4 \), falling over the upper edge of the partition with a height of \( h_5 \), for the given width of the conveyor belt \( B = 0.4 \) m and inclination angle of the conveyor belt \( \beta \) is demonstrated by Table 8.

5. Conclusion

One of the several practical ways of transporting lose material grains on the surface of a conveyor belt, the inclination angle of which exceeds the limit angle of a classic design of belt conveyors, is to prevent the transported grain from moving. Grains are prevented from moving (against the direction of the transport for uphill transport and in the transport direction for downhill transport) by the implementation of transverse ribs, fastened to the surface of the conveyor belt.

The transverse cross-section of the belt filling increases with increasing transport capacity (volumetric or weight), i.e., with the material volume that needs to be transported by the given belt conveyor over a certain time. Increasing transverse cross-section surface of the belt filling results in an increasing length of the base area of the transported material, spread on the surface of the conveyor belt. The maximal length of the surface base of the transverse cross-section of the belt filling, which must not exceed the value of the so-called used loading width, results in the need to use a wider conveyor belt when the use of a flat profile of the conveyor belt and identical transport speed are required for transporting an increased volume of the given material. When it is possible to use a trough loading profile of the conveyor belt, the surface of the transverse cross-section of the belt filling can be increased (while the width of the conveyor belt remains the same) by selecting a bigger inclination angle of the side rollers (two- as well as three-roller bench) or by adjusting the length of the middle roller (three-roller bench).
The paper describes a mathematical method for determining the surface of the transverse as well as longitudinal cross-section and volume of the lose material spread on the surface of the conveyor belt before the transverse partition, provided we know mechanical characteristics of the transported lose material. Because of the limited space, the paper only states the values that apply to a trough loading profile (two-roller bench) of the conveyor belt, along which transverse partitions of the appropriate height are installed with a regular span. The height of the transverse partition can exceed the height of the given lose material layer in the middle of the conveyor belt in the transverse cross-section of the belt conveyor. Alternatively, the height of the transverse partition may not exceed the height of the given lose material layer in the middle of the conveyor belt in the transverse cross-section of the belt conveyor. The paper specifies formulas for both these variants. Using the formulas, you can calculate the surface of the cross-sections and volume of the lose material batches, spread before the transverse partition for the given inclination angle of the conveyor belt.

The experimental tests conducted in the Laboratory of Research and Testing were supposed to verify the measured maximal length of the spread of the lose material on the conveyor belt for the known inclination angle, with theoretical values, calculated pursuant to the above-stated mathematical formulas. The laboratory tests also included measurements of the batch volumes of two types of lose materials (dry sand and ground marble chips), which were caught by a transverse rib. The values were then compared with the corresponding, theoretically determined values.

Mathematical formulas that express the volume and distance of the lose material layer distribution along the length of the conveyor belt with a direct support and a conveyor belt with undulated side rails or without them can be found in [5]. The surface of the transverse as well as longitudinal cross-sections and the volume of the lose material spread on the surface of the conveyor belt (with a trough loading profile, three-roller bench) before the transverse partition can be determined pursuant to [4].

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