STRUCTURAL MECHANICAL CHARACTERISTICS OF ORIENTED STRAND BOARDS

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ABSTRACT

The oriented strand board (OSB) is a relatively modern type of engineered wood product used broadly in construction industry and the furniture production. An essential structural parameter of the OSB plate is the orientation of the layering strands (flakes) in the 3-D space XYZ, which pre-determines significant diversity in the directional strength of the final material. A structural model of a 3-layered OSB is presented and the parameters of the morphological structure are analyzed. Optimal limits of the principal morphology criteria ratios are established and optimized dimensions of the flakes are recommended. An empirical equation for calculating the bending strength of the manufactured composite plates is derived. In conclusion, an average value of the principal ratio $R_E = E_b^{\shortparallel} / E_b^{\perp} = \sigma_b^{\shortparallel} / \sigma_0^{\perp} = 2{,}25$ is suggested, that could be used in the OSB production.

Key words: wood composite plates, oriented strand board (OSB), load capacity, principal criteria ratios, morphological structure

INTRODUCTION

Composite oriented strand boards are also known under the name of OSB (*Oriented Structural Boards*)-type boards and are a relatively new product of woodworking industry intended for structural use. This structural composite combines in a best way the properties of solid wood and the technological capacities for obtaining a large-format product made of small-size wood raw material with high physicomechanical indices. On a world scale, the production of OSB-type boards increases with great intensity due to their technical-economic and environmental advantage as a structural material in construction and interior.

It is necessary to note, however, that systematic investigations with respect to the structural-morphological structure of OSB are still missing. That is why, a subject of this investigation is to make a theoretic structural model of OSB-type boards and, on the basis of geometrical-analytical analysis of their morphological structure and strain-strength characteristic to propose optimal models for determination of the variation limits of the criteria ratios of strand size and the degree of contact between the strands by glue layers.

1. THEORETIC PREREQUISITES

The oriented strand board (OSB) is a structural composite material built of adhesively connected wood strands. Pursuant to BDS EN 300, the strands in the outer layers are parallel to the longitudinal axis of the boards It is allowed as a variant that the strands in the middle layer, respectively intermediate layers, are located chaotically or are oriented perpendicularly to the strands of the inner layers.

The main building elements of the OSB-type boards are flat large-size strands. Most often, their shape is parallelepipedal, with dimensions in length above 50 mm, in width – 10 to 20 mm and in thickness – less than 0,8 mm. The wood fibres in their prevailing part are parallel to longitudinal axes of the strands.

Upon examining the structure of the composite in the XYZ co-ordinate system, the elementary layers of strands can be presented as parallel to the XY plane with longitudinal orientation of the strands along the X-axis. At the same time, the thickness of the elementary layers is equal to the strand thickness δ, and their total thickness forms the board thickness $h_в = \sum\delta$. A diagram of a three-layer OSB-type board with equal layer thickness, i.e. $h_l = h_m = 1/3\ h_в$ is presented in Fig. 1. Macroporous space with pore (intermediate spaces) size d is formed between the front and longitudinal edges of the strands. The thicknesses of the glue layers, δ_L, are not presented on the diagram because of their very small value.

Of interest for the theory and practice is the arrangement of the strands in the layers, i.e. in the planes parallel to the XY co-ordinate system. In principle, during the formation of the wood mat the strands of the front layers are stratified (positioned) with their flat sides parallel one above the other, with their longitudinal axes being oriented parallel to the board length, i.e. the X-axis. Because of the imperfection of the methods and the orientating devices related to them, part of the strands (about 15%) remain unoriented, i.e. with an orientation angle $\alpha \neq 0°$. Most often, $\alpha \leq 15°$.

Main influence on the structural and strength-strain characteristic of the OSB-type boards is exercised by the morphological characteristic of the strands (shape and size), the directions of loading with respect to the longitudinal axes of orientation of the strands in the face and intermediate layers of the boards, the degree of contact on glue layer between the strands, the thickness of the glue layer, the strength indices of the wood and the binding agent and the degree of compression.

A number of authors (Štofko 1960, Rackwitz 1963, Klauditz 1967, Brinkmann 1979, Küne & Niemz 1980, Druet 1988, Behta 1994 and Yosifov 1989, 2010 и 2011) propose simplified structural models of composite boards made of oriented and unoriented strands. The cross-section of the model boards resembles most often a brick wall built of symmetrically or asymmetrically located strands of equal size with parallelepipedal shape. Taking into account the advantages of the geometrical analysis, a diagram of a simplified model structure of an oriented strand three-layer board (Fig. 1) is proposed in the present investigation. It is characterised by laminar structure of elementary layers made up of parallelepipedal strands with equal size, lying on their flat side. In the 3D space XYZ, the strands in the face layers with their longitudinal axes are oriented parallel to the Y-axis, and in the middle layer the orientation of the strands is at a right angle to the face layers.

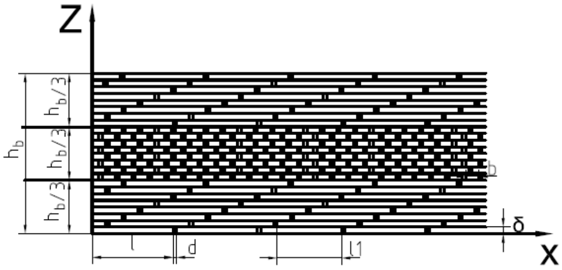

Figure 1: Schematic diagram of a cross-section of an oriented strand three-layer board (OSB) with thickness h_b

2. GRAPHIC ANALYSIS OF THE MODEL STRUCTURE

It is expedient to analyse the model structure of the oriented strand board by means of graphic presentation of the arrangement of the strands in two elementary layers in 3D space. In view of the above, The cross-sections of the model OSB-type board along XZ, YZ and XY are presented in Fig. 2 and Fig. 3. The characteristic overlapping between the strands along the length ℓ_1 and the width b_1 are shown. The positioning of the strands are presented in the figures both in the case of orientation of the strands with their longitudinal axes parallel to the X co-ordinate (pos. 1) and along their widths – parallel to the Y co-ordinate (pos. 1'). The overlapping of the strands along the length and width at an angle $\alpha = 15°$ are shown in positions 2 and 2' respectively for the face layers and the middle layer. By means of the overlapping between the strands, the possible ways of contact between them both on glued and on unglued sections are expressed. From technological point of view, it is important to know not only the specific area of the wood strands (S_p), but also the areas of contact on a glue layer (S_{cg}).

The total area of the strands with adopted basic shape of a parallelepiped in 1 m^2 of the board area will be:

$$S_p = 2n_s\left(b.\ell + \ell.\delta + b.\delta\right).10^{-6}\text{, m}^2/\text{m}^2 \qquad \textbf{(1)}$$

where: ℓ, b and δ are the mean linear dimensions of the strands, in mm;

n_s – the number of strands, in pc./m^2.

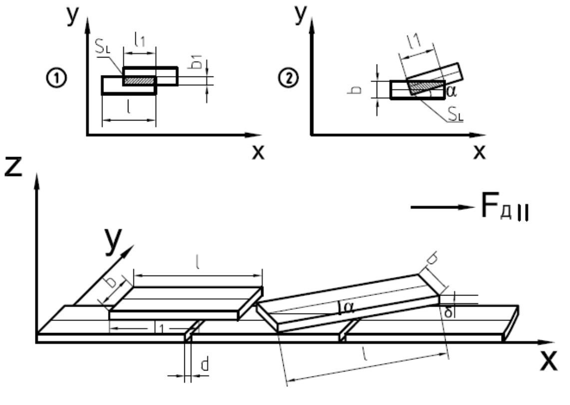

Figure 2: Schematic diagram for orientation of wood strands along their longitudinal (main) axis: 1) parallel overlapping along the X-axis; 2) arbitrary overlapping with an angle α

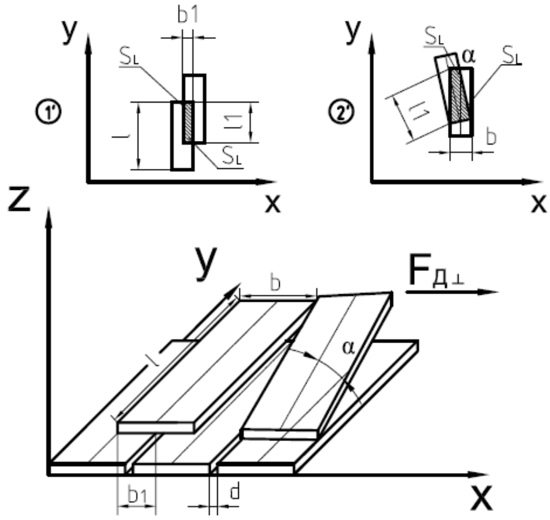

Figure 3. Schematic diagram for orientation of wood strands along their transverse (additional) axis: 1) parallel overlapping along the Y-axis; 2) arbitrary overlapping with an angle α

The area of contact between the strands is mainly on their flat sides in the XY plane and depends on the values of the overlapping along their length ℓ_1 and width b_1, and also on the overlapping angle α, which is seen from the diagrams in figures 2 and 3. So, for the face layers of the three-layer OSB, the area of contact S_c can be expressed as a sum of the areas of overlapping of regularly oriented strands (angle $\alpha \approx 0°$), which are most often rectangular, and of the cross strands (angle $\alpha \leq 15°$) with a shape of rhombuses. Then:

$$S_c = \sum^{n_1} b_{1i}.\ell_{1i} + \sum^{n_2} b_{1j}.\ell_{1j} / \sin\alpha\text{, m}^2/\text{m}^2 \qquad \textbf{(2)}$$

where n_1 and n_2 are respectively the number of regularly oriented strands (85%) and of cross strands (15%).

For mean values of the dimensions of the overlapping b_1 and ℓ_1, equation (2) takes the form:

$$S_c \approx 0.85nb_1\ell_1 + nb_1^2 = nb_1(0.85\ell_1 + b_1).10^{-6}\text{, m}^2/\text{m}^2 \qquad (3)$$

During the formation of the wood mat, i.e. during the positioning of the strands in the XY plane, technological macroporous surfaces are formed between their longitudinal and transverse sides. The pore width d is most often 0.4 to 1 mm. The area of the macroporous surface can be approximately determined from the expression:

$$S_{pore} = n\left[2d.0.85.(\ell_1 + b_1) + 4b_1 d\right].10^{-6} = 2dn(0.85\ell_1 + 2.85b_1).10^{-6}, \text{ m}^2/\text{m}^2 \quad \textbf{(4)}$$

Therefore, the total area ($S_c + S_{pore}$) in 1 m^2 of the cross-section parallel to the XY plane will be:

$$S_{xy} = S_c + S_{pore} = n\left[0.85b_1\ell_1 + b_1^2 + 1.7d\ell_1 + 5.7db_1\right].10^{-6}, \text{ m}^2/\text{m}^2 \quad \textbf{(5)}$$

To simplify the expression (5), the following assumptions may be adopted with an accuracy sufficient for the practice:

$\ell_1 = \ell - 2d$ and $b_1 = b - 2d$, mm **(6)**

where d is the width of the linear macropores ($d_{cp} = 0.6$ mm), i.e.:

$\ell_1 = \ell - 1,2$ and $b_1 = b - 1,2$, mm **(7)**

Moreover, according to literature data (Rackwitz 1963, Drouet 1988 and Potashev 1978) the following relationship has been established:

$\ell \perp \kappa_b.b$, mm **(8)**

where $\kappa_b \perp 5\text{-}8$ is a coefficient of width proportion.

Then, at $b = b_{cp} = 12$ mm and $\ell = 6b = 72$ mm.

$S_c = n.766.10^{-6}$, m^2/m^2; $S_{pore} = n.109.10^{-6}$, m^2/m^2 and $S_{xy} = 875.n.10^{-6}$, m^2/m^2 **(9)**

The number of strands in 1 m^2 of the board cross-section parallel to XY, at the above mean values of the linear parameters, is 1305.

During the formation of the wood mat, two alternative contacts between the strands are possible – on glued or on unglued sections. According to Potashev 1978, Yosifov 1989, 2010 and Behta 1994, the degree of contact on glue layer between the strands is a very important structural index of the composite boards, which depends both on the amount of binding agent per unit of area and on the uniformity of its distribution on the surface of the strands. In this connection, the use of dry (powdered) binding agent during the production of OSB-type boards leads to better technological solutions for increase of the uniformity of its distribution. To determine the degree of contact on glue layer P_L, the following expression can be used:

$P_L = (S_{cg}/S_c).100\%$, **(10)**

where S_{cg} is the specific area of contact between the strands on glue layer, m^2/m^2.

The specific area of contact between the strands on glue layer is determined by the formula:

$S_{cg} = S_L(1-\Pi_s)$, m^2/m^2, **(11)**

where: S_L is the glued specific area of the strands, m^2/m^2,

Π_s – the relative areal porosity of the boards.

$$S_L = \frac{q_s.S_p}{\rho_L^o.\delta_L}, \text{ m}^2/\text{m}^2, \quad \textbf{(12)}$$

where: q_s is the relative consumption of binding agent, g/m^2;

ρ_L^o –the density of the binding agent (for the synthetic resins UFR (urea-formaldehyde resin) and PFR (phenol-formaldehyde resin), ρ_L is 1200 to 1300 kg/m^3) (after Ryabinovich 1977);

δ_L – the glue layer thickness – 0,01 to 0.,05 mm (Potashev 1978).

It has been established (Krames 1988) that during the production of composite boards q_s varies within 15 to 30 g/m^2, but for the oriented strand boards the resin consumption is considerably lower: (10–20 g/m^2) at percentage of dry resin 4 % to

7 %. In case of use of powdered glues, which is often practiced in the OSB technology, the specific consumption of binding agent is reduced to 2–4 g/m^2. To calculate q_s, the following formula is used:

$$q_s = \rho_w^{o}.\delta.P_L.10^{-2},\ g/m^2 \qquad \textbf{(13)}$$

The relative areal porosity is determined by the equation:

$$\Pi_s = (S_{pore}/S_{xy}).100,\ \% \qquad \textbf{(14)}$$

At mean values of S_{pore} = 0.142 m^2/m^2 and S_{xy} = 1,00 m^2/m^2, we obtain:

$$\Pi_s = 14{,}2\% \qquad \textbf{(15)}$$

The total area of the wood strands in m^2 of the cross-section of the board, according to formula (1), is S_p = 1,19 m^2/m^2.

Then, at q_s = 16 g/m^2 and δ_L = 0,03 mm, we obtain:

$$S_L = 0.507\ m^2/m^2 \text{ and } S_{cg} = 0.435\ m^2/m^2 \qquad \textbf{(16)}$$

In this case:

$$P_L = (0.435 / 0.766).100 = 56.79 \approx 56.8,\ \% \qquad \textbf{(17)}$$

3. OPTIMISED DIMENSIONS OF WOOD STRANDS FOR OSB

The wood strands are the main structural elements of the composite OSB-type boards. According to the above adopted theoretic structural model (see Fig. 1), they have parallelepipedal shape with a dominating dimension in length, and the arrangement of the wood fibres is mostly parallel to their longitudinal axes. The geometrical parameters of the strands are technologically guaranteed during their production by means of cutting from small round timber. Essentially, the individual strands have anisotropic structure corresponding to the tree species they are obtained from (it is recommendable that the tree species are of hard or soft wood). The shape and size of the strands play an important role for the strain-strength characteristic of OSB composites and determine to a great extent the resistance of the structural elements manufactured from them to various loads in operating conditions.

To determine the optimised dimensions of the wood strands, in principle, the diagram of the cross-section of the model OSB-type board given in Fig. 1 is used. According to Rackwitz 1963, if the theoretic model is conditionally subjected to tensile load with a force F_x parallel to the X-axis, then tensile stress parallel to the wood fibres, σ_w^{II}, and on glue layers between the strands – shearing stress, τ_L, emerge in the wood strands. From the diagram in Fig. 4 is seen that the breaking tensile force on the glue layers, F_L, grows in direct ratio to the increase of the overlapping length of the strands, ℓ_1, i.e. with the increase of the area of gluing ($S_L = b.\ell_1$) at equal widths of the strands. The tensile force F_x'' depends on the tensile strength of the wood parallel to the wood fibres, σ_w^{II}, and on the cross-section if the strands, i.e. $F_x'' = \sigma_w^{II}.b.\delta$ = const. Then, for the point of crossing of forces, the equality $F_x'' = F_L$ is obtained, i.e.:

$$\sigma_w^{II}.b.\delta = \tau_L.b.\ell_1,\ N/mm^2 \qquad \textbf{(18)}$$

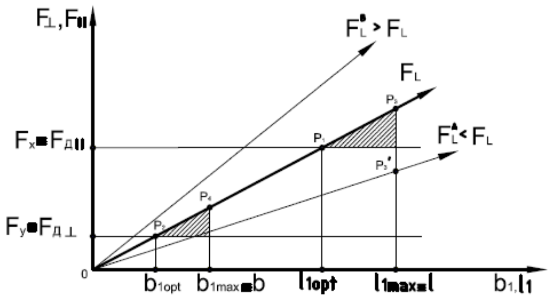

Figure:4 Diagram for determination of the optimal overlapping of the strands in length (ℓ_{1opt}) and width (b_{1opt})

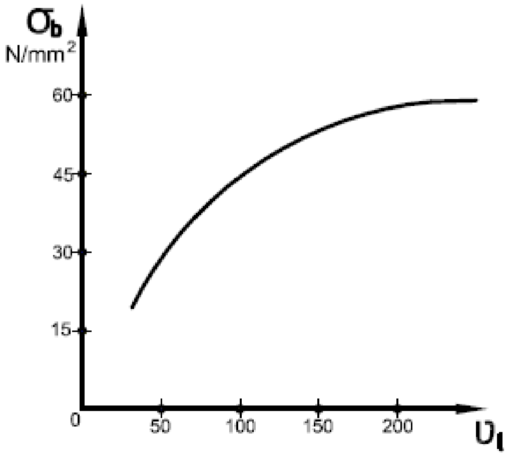

Figure 5: Effect of slenderness of wood strands ($\nu = \ell/\delta$) on the bending strength of composite boards (according to data of Klauditz, Drouet, Dimeski, etc.)

At $\ell_1 > \delta.\sigma_w^{II} / \tau_L$, the possible destruction is on the wood, and at $\ell_1 < \delta.\sigma_w^{II} / \tau_L$ – on glue layers. Hence the conclusion that the increase of the overlapping length on glue layer leads to an increase of the gluing area, i.e. to an increase of the shearing strength on glue layer. At the same time, the overlapping lengths depend on strand lengths, the degree of orientation and the number of breaks. Most generally, $\ell_1 = k.\ell$, where $k \leq 1$. The most favourable case is $\ell_1 = \ell$.

As very significant structural parameter, Klauditz 1963 introduces the index "*degree of slenderness of strands*" (ν_L). It is determined from the ratio:

$$\nu_L = \ell / \delta = C.\sigma_w^{II} / \tau_L, \qquad \textbf{(19)}$$

where $C = \ell / k$ is a coefficient of proportionality.

It has been established (Stofko 1960, Küne 1980) that the degree of slenderness of the strands in the structural OSB-type boards exercises strong influence on their tensile strength in the direction of orientation of the longitudinal axes of the strands. This regularity also applies to a great extent in case of loading of boards transversely to their longitudinal axis (Fig. 5). From the diagram in the figure is seen that the increase of the strand slenderness leads to an increase of the bending strength of the boards, which is very intensive to $\nu_L = 120$. High value for the slenderness can be guaranteed in case of optimised dimensions of strands for OSB: length 60 to 90 mm and thickness 0.5 to 0.7 mm.

In this connection, the strand length is a determining morphological index for the oriented strand boards. Proceeding from the established relationships for the strain-strength characteristic of composite boards (Kollmann 1967, Ashkenazi 1966, Potashev 1978) in the determination of the optimised value of the strand length, the following inequality shall be taken into consideration:

$$\ell \geq 1{,}6\delta.\sigma_{bend} / \sigma_p, \text{ mm}, \qquad \textbf{(20)}$$

where: σ_{or} is the bending strength of the composite boards, N/mm^2;

σ_p – the transverse tensile strength of the composite boards, N/mm^2.

The unidirectional orientation (e.g. along the X-axis) of the strands during the formation of the wood mat by means of an orientating device is with an accuracy of up to 85 %. As shown in Figures 2 and 3, the orientation of part of the strands is with an angle α different from 0° and most often $\alpha < 15°$. For the unoriented strands ($\alpha \neq 0°$), the overlapping length ℓ_1 and the gluing area S_L are smaller than that for the oriented ones and can be determined from the ratios:

$$\ell_1 = b_1 \cdot \left(\frac{1 + \cos\alpha}{\sin\alpha} \right) \text{ and } S_L = \frac{b_1^2}{\sin\alpha}, \qquad \textbf{(21)}$$

where: $\ell_1 \leq \ell$ and $b_1 \leq b$ are the values of the overlapping between the strands in length and width, being able to adopt with an accuracy sufficient for the practice $\ell_1 = \ell/2$ and $b_1 = b/2$;

α – angle of orientation of the longitudinal axis of the strands with respect to the X-axis, it is adopted that $\alpha = 0° – 15°$.

For the cross strands, the format criteria ratio ν_f, which is derived from the equations (22), applies:

$$\nu_f = \ell_1 / b_1 \text{ or } \nu_f = \ell / b \qquad \textbf{(22)}$$

For the practice, 4 to 8 can be recommended as optimal values of ν_f, which corresponds to strand width 7 mm to 22 mm, but it is expedient to adopt 10 mm to 15 mm as optimised widths.

It should be noted that the derived relationships for the morphological characteristics of the strands only apply to the face layers of three-layer OSB. For the middle layer, in which the orientation of the longitudinal axes of the strands is perpendicular to the X-axis, the breaking tensile force $F_x^{\perp}$ has an action transverse to their wood fibres. It has been proven that (Enchev 1984) the breaking tensile stress transversely to the wood fibres, $\tau_w^{\perp}$, is tenfold smaller than the longitudinal τ_w^{II}. Therefore, the three-layer structure of the boards contributes to reduction of the differences between their strength indices.

The diagram in Fig. 4 expresses the equality of the breaking tensile strength transversely to the wood fibres of the strands ($F_x^{\perp}$) and the shearing force of the glue layer (F_L) or $F_x^{\perp} = F_L$, i.e.:

$$\sigma_w^{\perp}.\ell_1.\delta = \tau_L.b_1.\ell_1, \qquad \textbf{(23)}$$

At $\ell_1 = 1/2\ell$ and $b_1 = 1/2b$, the following equation can be adopted with an accuracy sufficient for the practice:

$$\sigma_w^{\perp}.\delta = 1/2.\tau_L.b \qquad \textbf{(24)}$$

The width ratio ν_b can be formulated from equation (24) or

$$\nu_b = b / \delta = 4\sigma_w^{\perp}/\tau_L \qquad \textbf{(25)}$$

The optimised dimensions of the strands in thickness at an optimal width ratio 16 to 24 are: width – 10 mm to 15 mm and thickness 0,5 mm to 0,7 mm.

It can be summarised from the relationships derived that the dimensions of the strands for the OSB-type boards must conform to following requirements for mean values of the criteria ratios: degree of slenderness $\nu_L = 120$; format ratio $\nu_f = 6$; width ratio $\nu_b = 20$. At these criteria ratios, the mean optimised dimensions of the strands for OSB are in the ratio of δ:b:ℓ = 1:20:120, and the actual strand dimensions are respectively $\delta = 0.6\pm0{,}2$ mm; $b = 12\pm3$ mm; $\ell = 72\pm10$ mm.

4. EFFECT OF MACRO-STRUCTURE OF OSB ON THEIR STRAIN-STRENGTH CHARACTERISTIC

The composite OSB-type boards belong to the materials with strongly expressed anisotropic mechanical properties, which is due to, on the one hand, the anisotropic properties of wood as a source material for wood strands and, on the other hand, the effect of the technological factors, such as degree of contact of the strands on glue layers, degree of compression, morphology and angle of orientation of strands and macrostructural indices of the boards. In this connection, the strain-strength indices of the OSB-type boards can be determined, making use of the theory of elasticity of anisotropic materials. On the basis of the tensorial formula of Ashkenazi of 1996, Potashev 1978 has derived an equality for the strain-strength indices of wood, which, with certain approximation, also applies to the OSB-type composites:

$$\sigma_w^{II}/E_w^{II} = \tau_{wд}^{\perp}/E_w^{\perp} \qquad \textbf{(26)}$$

where E_w^{II} and $E_w^{\perp}$ are the moduli of elasticity of wood, respectively along and across the wood fibres.

On the basis of experimental investigations, Kieser & Ufermann 1979 determine a criteria ratio R_E for the strain-strength characteristic of OSB composites in bending:

$$R_E = E_B^{II}/E_B^{\perp} = \sigma_B^{II}/\sigma_B^{\perp} = 1{,}5\text{-}3{,}0 \qquad \textbf{(27)}$$

For calculations in the practice, a mean value for $R_E = 2.25$ can be adopted.

The structure of the oriented strand board predetermines essential differences in their resistance against breaking loads in different directions of the co-ordinate system XYZ. This ensues from the anisotropic structure of wood strands, technologies applied for formation of the wood mat and hot pressing. Under operating conditions, the dominating load of the OSB-type boards is in the direction of the X-axis, but, irrespective of this, it is expedient to also guarantee a certain level of their strength indices in the direction of the Y- and Z-axes. In Y direction, the above condition can be satisfied by means of three-layer structure of boards from the middle layer perpendicular to the face layers. Thus, at a tensile load along the Y-axis of the model board, the following equalities can be adopted:

a) for the face layers:

$$\sigma_y^{||} = \sigma_w^{\perp} = F_y^{||} / b_1.\delta.\eta_s, \text{ N/mm}^2 \quad \textbf{(28)}$$

b) for the middle layer:

$$\sigma_y^{\perp} = \sigma_w^{||} = F_y^{\perp} / \ell_1.\delta.\eta_s, \text{ N/mm}^2 \quad \textbf{(29)}$$

c) in case of shear on glue layer:

$$\tau_y = \sigma_L = F_L / b_1.\ell_1.\eta_k, \text{ N/mm}^2 \quad \textbf{(30)}$$

where η_c – number of contacts on glue layer.

It can be concluded from the above equalities that, due to the orientation of the strands from the middle layer parallel to the Y-axis, their tensile strength in this direction is higher than that of the face ones ($\sigma_w^{||} > \sigma_w^{\perp}$). Therefore, the three-layer structure of the OSB-type boards is completely expedient with a view to increasing the level of their stability in bending in transverse direction.

The shearing stress on glue layer, (τ_y), between the strands along the Y-axis does not differ from that along the X-axis.

In case of tensile load in the direction of the Z-axis, i.e. perpendicular to the plane XY of the board, the following equality is valid:

$$\sigma_z^{||} = \sigma_p = F_z / S_L, \text{ N/mm}^2 \quad \textbf{(31)}$$

where: $\sigma_z^{||}$ is the tensile strength along the Z-axis, i.e. perpendicular to the plane of the board, N/mm^2;

σ_p – the transverse tensile strength, N/mm^2.

Under operating conditions, the main load on the oriented strand boards is bending across their width ($E_B^{||}$). That is why, the modulus of elasticity in bending $E_B^{||}$ is a very important structural index of this material. A functional dependence of the modulus of elasticity on the bending strength of composite boards, which is only valid in principle for OSB-type boards, has been experimentally established (Yosifov 1989, 2010). In the practice, the following empirical formula can be successfully used for the oriented strand boards:

$$\sigma_b = \sigma_w.k_c.k_L.k_p.k_\varphi.k_t, \text{ N/mm}^2 \quad \textbf{(32)}$$

where: $k_c = \rho_b^o/\rho_w^o$ – the coefficient taking into account the compression of the wood strands (k_c = 1.1–1.2);

$k_L = P_L/100$ – a coefficient taking into account the degree of contact on glue layer (k_L = 0,60–0,65);

$k_p = V_{pore}/V_в$ – a coefficient taking into account the volumetric porosity of the composite (k_p = 0,88–0,93);

$k_\varphi = \varphi/100$ – a coefficient taking into account the degree of orientation of the strands (k_φ = 0,85–0,90);

k_t – a coefficient taking into account the degree of other technological factors (k_t = 0,95–1,05).

CONCLUSIONS

- The main structural feature of the OSB-type boards is the orientation of the longitudinal axes of the strands, as main structural elements, in the 3D space XYZ, which predetermines essential differences in the resistance of the boards to breaking loads in the different axes of the co-ordinate system.

- A model structure of a three-layer oriented strand board has been presented and graphic analysis of the parameters of their morphological characteristic has been made.
- The optimal limits of variation of the morphological criteria ratios – degree of slenderness, width and format ratios, have been established.
- The optimised dimensions of the wood strands, which guarantee the set strain-strength indices of the OSB-type boards for structural purposes, have been proposed.
- An empirical formula for determination of the bending strength of the OSB-type boards depending on the strength of the source wood and the effect of the technological factors – degree of compression of the wood strands, degree of contact on glue layer, volume porosity, degree of strand orientation, has been derived.
- A mean value of the criteria ratio R_E = 2,25, which can be successfully used in calculations in practice, has been proposed.

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