INFLUENCE OF A CORNER AND DISTANCES BETWEEN WORKING BODIES ON PRODUCTIVITY BARS MIXER OF CONTINUOUS ACTION

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INTRODUCTION

Construction of buildings, highways, bridges, manufacture of building products in any measure is connected to process of hashing of a mix. Quality of objects and products, their durability, cost, durability depends on quality of preparation of a mix. Quality of a mix depends as on physicomechanical properties of components of a mix, accuracy of batching, and from the device of the mixer and duration of hashing. The problem of an intensification of process of hashing of a mix consists in development of methods and devices which promotes uniformity of a mix, reduction of quantity{amount} of binding substance, increase of productivity, reduction of cost of construction.

With the purpose of an intensification of mix preparation process at Technical University of Moldova are developed a lot of mixers with bars working body [1, 2]. Mixers will consist of working bodies as bars, located radial on rotating to a shaft fig. 1.

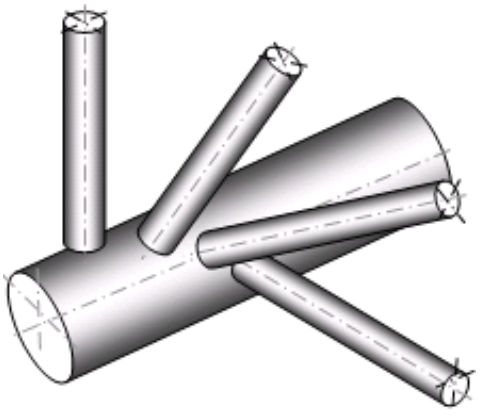

Figure1. The type of working body bar of the mix.

During the roller rotation the mix grasp shuffled bodies, rise up and at the same time shuffle along the trunk. The material that has been in front of the working body is divided on the flows. The part of the material pass through the shuffled bodies but another big part pass along the mix and continue to be divided on the flows by the others shuffled bodies. So happen the division of the material in the flows and after that their joining. During the repeated passing of shuffled bodies take place the division and joining of the mixture components and at the same time their deallocation along the trunk.

Analyzing publications in the field of preparation of various mixtures and manufacturing of building products, and also experience of experts major factors influencing on productivity of mixers have been determine:

- frequency of rotation of a shaft with working bodies;
- geometrical parameters of the mix;
- coefficient of filling of the mix;
- the sizes of particles of the mixture;
- humidity of the mixture, etc.

In work are presented the results of research of influence of geometrical parameters of the mix on its productivity.

1. CONDITIONS OF RESEARCH

As a facts for researching have taken the distances between working corners but not early investigated corners fig. 2.

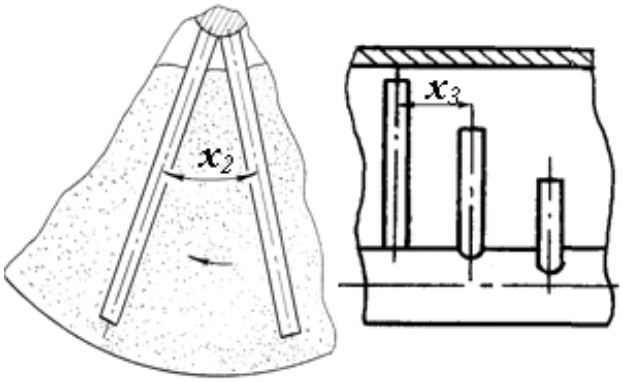

Figure 2. The investigated facts corner x_1 and distance x_2 between working bodies.

With the purpose of reduction of time and expenses for carrying out of research has been used the method of planning of experiment [3] and two factorial *D* – optimal plan table 1.

Considering various designs of mixers of continuous action have been accepted the variation of factors:

– a corner between working bodies
$\tilde{x}_1 = 45 \pm 30^{o}$;

– distance between bars $\tilde{x}_2 = 15 \pm 10$, мм.

Table 1. D – optimal plan for two factors.

№ test	α	S
1	+	+
2	+	-
3	-	-
4	-	+
5	+	0
6	-	0
7	0	+
8	0	-
9	0	0

Constant factors were:
– frequency of rotation of a shaft with working bodies *n = 120* rotation/min;
– factor of filling of the mix *k = 0,4*.

As a working mix has been used river sand in the size of particles up to 1 mm and by humidity of 2 %. Researches were spent in the mix with internal diameter of a drum - 206 mm, diameter of the points - 8 mm, and length - 83 mm.
Productivity of the mixer was measured by means of a glass flask with a margin ± 0,005 dm^3.

2. RESULTS OF RESEARCH

Concerning the plan were carried out 9 experiments. Each experiment has been put at the corresponding size and the distance between the working bodies. There were taken 3 measurements for each investigated factor.
The results of the realized experiment are presented in table 2.

The handling of the experiment results realized on *D* – the optimal plan for two factors permits to discover the regress equalization for the productivity estimation of the mix as polinom in the second level:

$$P = b_0 + b_1 \cdot x_1 + b_2 \cdot x_2 + b_{11} \cdot x_1^2 + b_{22} \cdot x_2^2 + b_{12} \cdot x_1 \cdot x_2 \qquad (1)$$

where: P – the productivity of the mix, m^3/h;

b_0 – free factor;

b_1 and b_2 – numerical factors x_1 and x_2

b_{11} and b_{22} – numerical factors x_1^2 and x_2^2

b_{12} – numerical factors at product $x_1 x_2$.

Table 2. Mixer productivity.

Nr. exp.	Corner between working bodies x_1, grad	Distance between bars x_2, мм	Productivity, m^3/h				S_{ui}^2
			P_1	P_2	P_3	P_{med}	
1	75	25	0,141	0,143	0,148	0,144	0,000013
2	75	5	0,52	0,56	0,57	0,55	0,0007
3	15	5	1,24	0,9	1,13	1,09	0,0301
4	15	25	0,12	0,14	0,16	0,14	0,0004
5	75	15	0,243	0,259	0,269	0,257	0,000172
6	15	15	0,219	0,23	0,226	0,225	3,1E-05
7	45	25	0,041	0,042	0,055	0,046	0,000061
8	45	5	0,56	0,42	0,67	0,55	0,0157
9	45	15	0,187	0,183	0,191	0,187	0,000016

By results of experiences and carrying out the regressive analysis have been received a polynom:

$$P = 0,1297 - 0,084 \cdot X_1 - 0,31 \cdot X_2 + \\ +0,14 \cdot X_1^2 + 0,197 \cdot X_2^2 + 0,136 \cdot X_1 \cdot X_2 \qquad (2)$$

Check of conformity of the received model to process of hashing of a mixture was spent with use of criterion Fisher:

$$F = \frac{0,15829}{0,005244} = 3,01875 < F_{tab} = 3,16$$

For: $\alpha = 0,05$, $f_1 = 3$, $f_2 = 18$.

As settlement value of criterion *F* less tabulated, it is possible to draw a conclusion, that this equation adequately describes studied process. The greatest influence on productivity renders a distance between points x_2 and square-law effect x_2. For revealing influence of each factor separately on productivity have been constructed graphic dependences $Y = f(x_i)$ fig. 3 Graphic dependence influence of each factor is constructed with a condition of a finding of other factor at a zero level.

With increase in a corner between points from 15° up to 45° productivity decreases. The further increase in a corner from 45° up to 75° productivity starts to increase. Significant there was a square-law effect at x_1. With increase in distance between bars productivity decreases, that explain the reduction of a zone of influence bars on mixing material. For revealing influence of interaction of factors on productivity it has been constructed nomogram fig. 4.

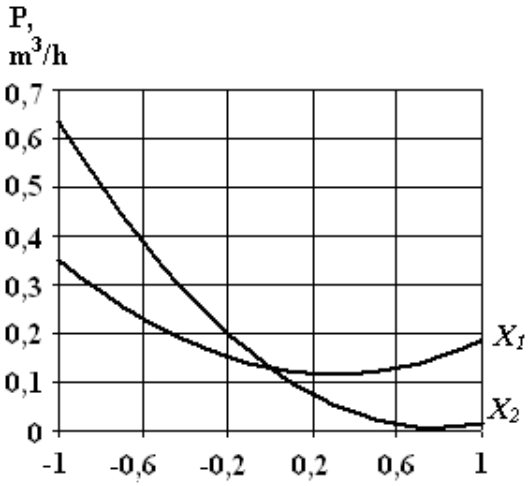

Figure 3. The influence of the corner x_1 and the distance x_2 between the working bodies on the mix productivity

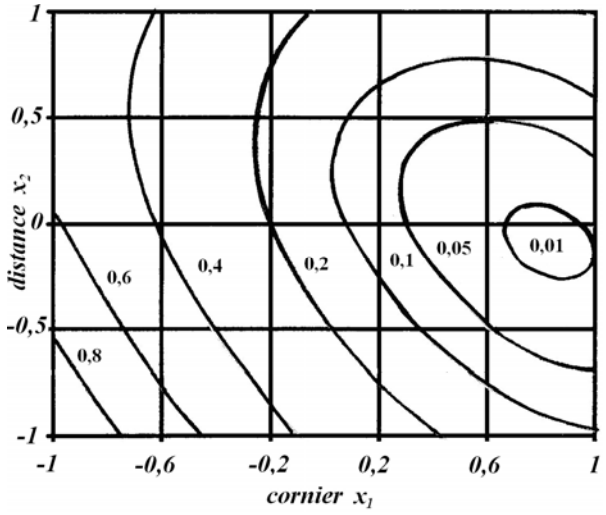

Figure 4. The depending of productivity in м^3/hour from corner x_1 and distance x_2 between working bodies

The high productivity can be received or at small corners and small distances between working bodies, or at the same distance but with big corners. The increasing of the distance between the bars leads to decreasing of the productivity of the corners significance.

Dynamics of influence of studied factors on productivity of the mix bar is practically identical with influence of the same factors on resistance to hashing. However, it is necessary to note, that on preliminary skilled data in zones of the greatest productivity and the least resistance deterioration of a mix was observed.

3. CONCLUSIONS

1. The mathematical model of influence of a corner x_1 and distances x_2 between working bodies of the amalgamator which adequately describes process of hashing of a mix is received.

2. The received model can be used for definition of the maximal values of productivity depending on change of investigated factors.

3. The problem of increase in productivity should be investigated together with resistance to hashing and quality of a mix

References

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Recommended for publication: 19.10.2011