

Effect of roof structure reconstruction on interior environment formation in stalls

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Abstract: A reconstruction design of outdated but most often used shed structures of K-96 series, type T-27 or T 1/U, in Slovakia is presented. The real "behaviour" of the reference group of reconstructed buildings in the operating conditions was investigated. The civil – engineering aspects in relation was investigated. The civil – engineering aspects in relation to possible occurrence of mould were evaluated. The occurrence of all-area condensation and mould in the lower ceiling part was not detected for the buildings were the natural slotted ventilation operation in the right way. On the other hand, the natural shaft ventilation has shown the local or all-area occurrence of moulds in the lower ceiling part of roof structure in spite of intensive maintenance.

Key words: reconstruction, surface condensation, natural ventilation.

INTRODUCTION

Large amount of double-row stabling buildings for dairy cow tie-stall housing and milking were built up in Slovakia up to the end of the 60th. Most of these buildings need to be reconstructed at present. The market mechanism brings these buildings, which are morally obsolete at present, to the position of non-conforming buildings from the financial point of view. The financial pressure on operators of these buildings forces them to reconstruct these buildings in order to increase the productivity of labour. The system change from the tie-stall into the free stall allows decreasing the number of cattle keepers by half, while maintaining the basic motion activities of that stabled cattle.

Individual designing phases of new buildings include namely the operation - arrangement part, the technological part and the construction - structural part. In such case the construction - structural design may be adapted to the operation – arrangement design and the technological design. At the same time the shape design can be done in such way that it will accept the designing principles of natural ventilation and establishment of micro-climate conditions.

In case of reconstruction the situation is different. Because the building, which needs to be reconstructed, already exists, the construction investigation and the construction – structural design have a priority over the operation – arrangement design and the technological design. When assessing the building whether it is suitable for reconstruction, mostly the construction - structural aspects represent such serious limitations in addition to financial possibilities of the operator that those limitations become the primary indicator.

Materials and Methods

To analyse the construction - structural and shape design of stalls, the buildings, which are the most common in our conditions, have been selected, namely buildings of K-96 series, designated as T-27 or T 1/U types. Solutions for reconstruction with implementation of mobile mechanization (lines for feeding, bedding, manure removal) are presented, while the shape design observes the designing principles of natural ventilation in stalls. The reference group made of ten buildings is specified in detail within the framework of the research project No. 1/4407/97-M-27 designated as "Technical and Technological Rationalization of Production and Processing of Selected Agricultural Products". The farm selection criterion was a long-term, above-average utility rate with high assessment of quality of milked milk.

The suitability of the applied ventilation system was assessed on the basis of occurrence of mould and the rate of building ceiling surface damage, because occurrence of the mould is an indicator of occurrence of the surface condensation.

Results and Discussion

Construction – structural and shape designs (fig.1) are worked out in order to assist

potential operators in selection of the most suitable type of reconstruction for their specific conditions.

The table 1 (according to fig.1) presents the result of assessment of the reference group of buildings after reconstructions. It is evident from the submitted table that the ventilation system operation method in the alternative 2a or alternative 1,2 can be clearly recommended. In case of lack of funds the alternative 2 is only acceptable as a transition (first) phase of reconstruction, while the objective is execution of the second phase – alternative 2a - in the future. Operation under conditions of the alternative 2 should take as short as possible otherwise the gradual deterioration and significant shortening of the life of the external wall will occur.

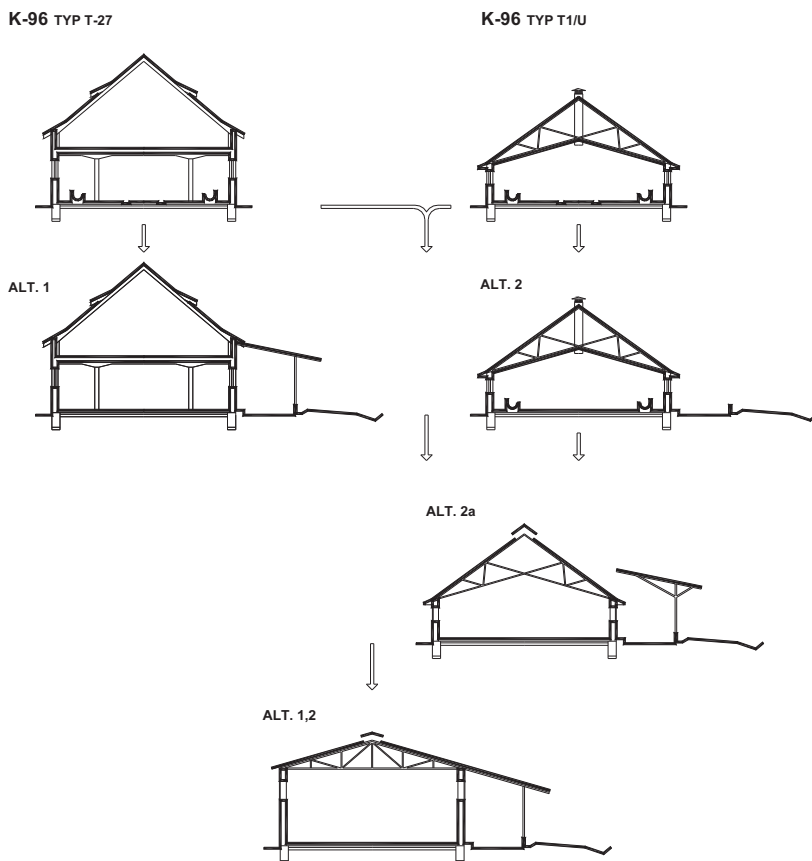


Figure 1. Reconstruction of standard stall buildings, T-27 and T/U types

Although the conditions for growth and propagation of individual vegetative pests differ, the general principle is valid saying that these pests get active if the temperature has risen a few degrees above zero and the balance humidity keeps above 18 per cent for a longer period of time. So this is also the reason why it is the best to eliminate the alternative 2 totally.

Table 1.

Assessment of suitability of stall structures under study for reconstructing and microclimate solution			
Result of construction investigation of stall structures, T-27 and T 1/U types, before reconstruction	Kind of reconstruction	Building plan	Occurrence of surface condensation and mould after reconstruction
Sound load-bearing structure	Alternative 1	Extension: feeding line	Yes, small local extent
	Alternative 2*)	1st phase of reconstruction, outdoor feeding at good weather conditions	Yes, full-area extent
	Alternative 2a	2nd phase of reconstruction – roofed feeding line, removal of ceiling surface, slotted ventilation	No
Defective roof structure	Alternative 1,2	removal of ceiling - roof structure increase of vertical clearance of external wall erection of compact ceiling - roof structure (original building + extension)	No

On the basis of studying the mentioned reconstruction works it is possible to recommend especially the solutions of alt. 2a or 1,2 from the point of view of interaction of the internal environment quality and the civil engineering design of a stall. The slotted ventilation with the continuous uncovered slot (the covered slot in areas with above-average rain-falls) has to be preferred to the shaft ventilation for dairy cows. We can classify such buildings as colder stalls, but when sufficient bedding is provided this indicator does not affect the quality or the quantity of milked milk at a more significant rate, even during the winter season.

CONCLUSIONS AND FUTURE WORK

The solution for reconstructions of the most common stalls, but morally obsolete at present, namely buildings of K-96 series, designated as T-27 or T 1/U types, was worked out for conditions of Slovakia. The real "behaviour" of the reference group of reconstructed buildings under operating conditions was investigated. The civil – engineering aspects in relation to possible occurrence of the full-area surface condensation and occurrence of mould were assessed. Occurrence of the full-area condensation and mould on the ceiling surface was not detected in the buildings, in which the natural slotted ventilation was operated in the correct way. On the other hand, the natural shaft ventilation has shown the local or the full-area occurrence of mould on the ceiling surface of the ceiling – roof structure in spite of the maintenance has been executed in the increased rate.

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Докладът е рецензиран.