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Security methods for livestock buildings including assessment aspects

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Abstract. The problem of security methods affects a large proportion of intrusion and hold-up alarm systems (I&HAS). In a time of increasing property crime, it is highly important for the security methods of livestock buildings to be able to achieve efficiency, reliability and faultlessness. In case it is proposed to place detectors, it is essential to determine the position of the detectors, the types of the detectors, but also to guarantee their capability of detection for use in livestock production buildings. The security proposals, which have been conducted, examine both the normal security methods in livestock production as well as cost and long-term financial expenses (investment in the communicator, private security guards etc.). These security proposals are important both from an informative perspective and also because of the possibility of using individual proposals in securing livestock production in practice. The aim was to compare the two kinds of security methods for a livestock building object. The compared values become the acquisition costs of security system.

Key words: security risks, sabotage, intrusion and hold-up alarm systems, glass break detector.

INTRODUCTION

Intrusion and hold-up alarm systems serve primarily for the protection of buildings against unlawful conduct of third parties, and can be used as monitoring and control systems. Therefore, they are primarily a tool for ensuring a state of security. They operate in the material realm (physical protection of property, life and health) and in the emotional realm (providing a feeling of peace, safety and certain security). As a result, it is important for them not to malfunction and to be sufficiently resistant to attack.

The procedure for the design of the placement of detectors in livestock buildings is a very relevant part that precedes the actual installation of the entire electrical security system, and it a part of the overall design of the security alarm and emergency systems (hereinafter SAES). This usually regards the part of security process which determines where individual detectors will be located. The process that we selected when designing the SAES will decide on how difficult the installation will be, and the price of the final system.

MATERIALS AND METHODS

Nowadays, several methods are used that provide a sufficient level of the building's security (Staff & Honey, 1999; Uhlář, 2005; Křeček, 2006). However, only two methods comply with the applicable standards related to ČSN EN 50 131. These are the method of perimeter procedure and the procedure using nodal points.

The perimeter procedure is a frequently-used procedure in the process of securing a building. Detectors are installed around the perimeter of the building, thereby almost perfectly securing the building which cannot be entered without triggering an alarm. The closer to the centre of the building a detector is located, the less important it is for the correctness of the operation of the system – see Fig. 1.

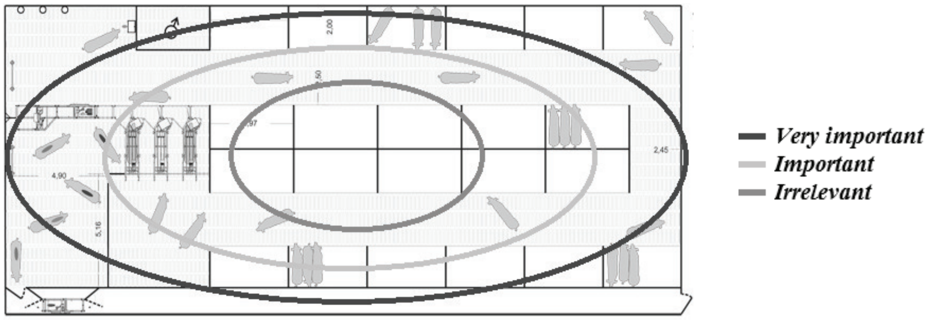

Figure 1. Floor plan showing the perimeter security procedure.

The procedure using nodal points is very different from the perimeter procedure. Here, the security of the perimeter of the building is not dealt with, but the most frequently used places, and places with the greatest probability of disturbing the building are selected and then secured – see Fig. 2. During this procedure, it is necessary to be experienced and have a certain amount of imagination, as the security design becomes complicated in determining the nodal points. Like with the perimeter procedure, three degrees of security priorities are also defined for this method, but herein this priority is defined for every room (by points) and not for the perimeter.

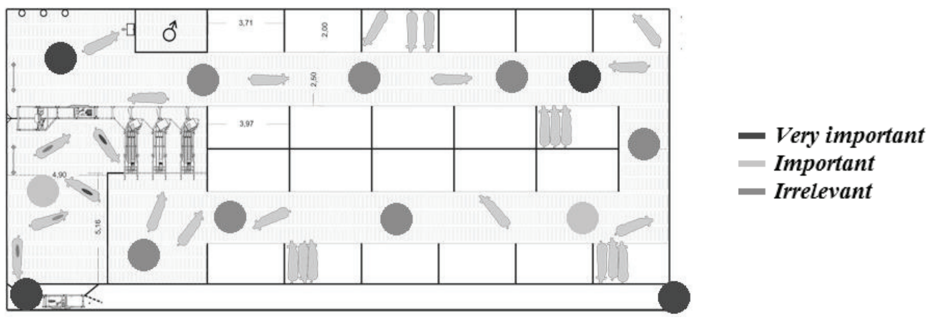

Figure 2. Floor plan showing the nodal points.

Nodal points are most often located in entrance areas and in all of the locations where the movement of an attacker is expected most probably. This mainly involves corridors, staircases to other floors, rooms that can be entered, etc.

Compared to the standard security of family homes, the security of buildings for livestock production is a complicated matter. This is due to the movement of animals, which can cause false alarms in the building. However, it is possible to use various specific detectors that allow for even such complicated spaces to be guarded.

The first alternative is to deploy infrared barriers and microwave barriers (Petruzzellis, 1993; Capel, 1999; Uhlář, 2005; Křeček, 2006). Although this alternative is efficient and effective, it is also costly, and it is relatively difficult to find a location where they can be placed in order to be usable.

Another alternative is the use of dual detectors, or detectors with PET immunity. Dual detectors combine the properties of PIR (passive infra-red) detectors and usually one representative from active space detectors (Petruzzellis, 1993; Capel, 1999; Uhlář, 2005; Křeček, 2006). This alternative is acceptable, but in view of the fact that the detector may set off an alarm anyway when animals are untethered, it is gradually being waived. The alarm is caused by the movement of accumulated heat and its movement, which in principle works with the surrounding spaces in the same way as it does for heat exchangers (Šeďová et al., 2013; Neuberger et al., 2014).

Thus, the only alternative for securing indoor spaces is the use of detectors with PET immunity. If these detectors are correctly selected and installed, they are able to accept the movements of animals whilst reliably detecting a human being. This is due to certain immunity to movement that occurs below a certain height level. These movements can also be limited by certain weight ranges that the detector can ignore up to a defined height level (Petruzzellis, 1993; Capel, 1999; Uhlář, 2005; Křeček, 2006).

In order to compare the design of security via the perimeter procedure and the nodal points procedure, a building for stabling pigs at a pig farm near Jablonné nad Orlicí was selected. This is a classical smaller stable with several partition walls (Syrový et al., 2008). The wall is located in the centre of the building and it separates individual pens (See Fig. 3), and the exit is also separated from the building via a long corridor.

Figure 3. Pig pens.

The security for the given building was designed according to the perimeter procedure (Fig. 1). The overall costs for the purchased material are shown in the following Table I.

Table 1. Price calculation of the system resolved by the perimeter procedure

	pcs	Price per item (EUR)	Total price (EUR)
Detector of opening	26	1.86	48.29
Glass break detector	2	17.82	35.64
PIR detector with PET immunity	7	21.39	149.75
MainUnit +Keyboard	1	167.46	167.46
Zone expander	1	46.39	46.39
GSM communicator	1	189.25	189.25
Cost of installation (approx)	45	12	540
Total			1176.79
Total without GSM communicator and MainUnit			820.07

Detectors of opening were designed for each pen and passage through the building. The glass break detectors were designed for the front of the building, as it has a glass surface. PIR detectors with PET immunity were designed for both sides of the passage serving as the entrance to building, and for both sides of both aisles with pens.

The security for the given building was designed according to the procedure using nodal points (Fig. 2). The overall costs for the purchased material are shown in Table II.

Table 2. Price calculation for the system resolved using nodal points

	pcs	Price per item (EUR)	Total price (EUR)
Detector of opening	3	1.86	5.57
Glass break detector	1	17.82	17.82
PIR detector with PET immunity	4	21.39	85.57
MainUnit +Keyboard	1	167.46	167.46
Zone expander	0	46.39	0.00
GSM communicator	1	189.25	189.25
Cost of installation (approx)	20	12	240
Total			705.68
Total without GSM communicator and MainUnit			348.96

With regard to nodal points, is was first necessary to mark the areas in the floor plan of the building where security is very important, followed by the areas that are important, and, finally, the areas that are unimportant in order for the system to operate correctly. The placement of nodal points follows the estimation of the designer, and is therefore not applicable for everyone who installs such a system. The floor plan marked in this way is shown in Fig. 2.

The following nodal points were marked as **very important: the access corridor** (from both sides) and the **top aisle between the pens** (from both sides). These were selected due to the most probable entry by an intruder. The following nodal points were marked as **important**: the **bottom aisle between the pens**. The **remaining spaces** were selected as **unimportant**.

RESULTS AND DISCUSSION

If we disregard the repeated costs for both security designs (MainUnit + keyboard and GSM communicator) and subtract them from the resulting comparison, the resulting price difference between individual designs is 471.11 EUR – see Table 3.

Table 3. Comparison of the price of the system designed with the perimeter procedure and nodal points

	Price (EUR)	Price (%)
Perimeter procedure	820.07	100
Nodal points	348.96	42.55
Difference	471.11	57.45

Using nodal points will save approx. 62% of the acquisition costs while the resulting degree of security will not be decreased. The long-term costs are the same for both proposals. Estimated useful lives of the systems are tens of years. Although the method of nodal points does not give great variability of settings, it saves on the cost of the system.

The correct determination of nodal points in the building can decrease the costs for securing the building whilst maintaining the degree of security. Therefore, it is important not to refrain from this method, in particular in livestock production, where it is reasonable due to the efficiency of the security design, the fact that it can be assembled by on one's own or the resulting savings.

As stated in 'Security Systems & Intruder Alarms' (Capel, 1999), the security design is one of the most important parts of the entire installation. This can minimize false alarms and lower the costs of acquiring the system. The same is stated in 'Security: A Guide to Security System Design and Equipment Selection and Installation' (Cumming, 1994), and that is why the author recommends primarily using the nodal points procedure.

CONCLUSIONS

Correct installation is one of the essential factors that can directly affect the security and functionality of the security system. It is necessary that the companies providing the installation of security systems always follow the manuals for the given system and pay attention to the correct installation procedure according to the relevant standards. If the installation company does not follow the manuals and standards, then no equipment installed by them will meet the parameters of security systems and it is not suitable to use them.

In livestock production, the use of the perimeter procedure is not financially feasible. It is always important to concentrate on the building that needs to be secured, and not to proceed, with regard to all structures, in a manner that overdoes the security. Maximum security is not necessary for pig breeding, and it is important to focus rather on the development on new types of protection, specifically for livestock production.

In terms of the security design, financial calculations clearly showed that the perimeter procedure for small and simple installations can increase costs by up to 62% compared to the nodal point procedure – and the nodal point method does not decrease the quality of security. The perimeter procedure may be able to perfectly secure a building, but this procedure is costly and increases the number of false alarms. Therefore, the question is whether or not to use the perimeter method.

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