

### **MODERN TECHNOLOGIES AND PRODUCT DEVELOPMENT STRATEGY IN ROADS MAINTENANCE TERMS**

**Abstract:** Every person is a participant of road traffic whether is a pedestrian or a driver and every one care about safe and easy movement in every season of year. Such requirements established by the users of roads and roadsides are being met by the use of new technologies and their appropriate management. During the winter maintenance of roads, snow fences are being used to prevent blowing snow on a road surface or at least to limit the amount of blown snow. In order to achieve this effect, snow fences made of wood were applied in the past, but during the development of technology and the emergence of new technological solutions, the former technology was changed by the replacement of wood by plastic material in the construction of snow fences. Comparing these two technologies shows the benefits of the technologies development and how its appropriate management influences in a positive way not only on road users, but also on lowering the snow fences production cost. It is obvious that every technology may have some deficiencies, but the task of persons responsible for a given technology is its observation and implementation of improvements.

**Key words:** snow fence, modern technologies, technology management, quality.

#### **5.1. Introduction**

From the beginning it is important to explain what technology is, so that, it is the way of processing natural resources into products (usable goods), and also the science concerning creating products from starting materials. Technology may be divided into few types, depending on the criterion adopted. The first criterion concerns the type of an obtained product, so it is e.g. paper technology, machine construction technology.

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The second criterion is what type of material is processed, e.g. wood technology, steel technology. A method which was used in the process is the third criterion, e.g. mechanical technology, chemical technology.

The next issue which is worth mentioning is technology management. This type of management involves learning and implementing new, more efficient and cost-effective technologies and creating innovations due to better integration of the research and development area with marketing system, establishing and clarifying the specialization (production program), application of progress in production analysis strategy, conducting own research of production process organization, striving to improve own product or services, enhancing their quality and the reduction of costs (BORKOWSKI S. 2012).

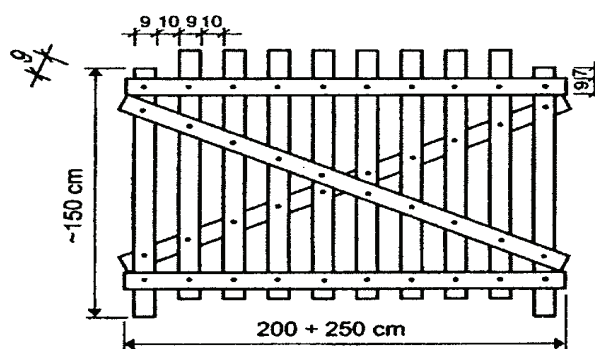
Every enterprise, regardless whether it represents the production or services market, should strive to manage technologies to improve their market performance and become more competitive both on domestic and international market. This article will be focused on snow fences technology, which shall ensure greater safety on roads during the winter season, and reduce the cost of maintaining the roads in the same time.

Every participant of road traffic have seen snow fences produced of black netting, but nobody was wondering what technology was previously used for production such screens. The aim of this article will be to show the former and contemporary technology their advantages and disadvantages, and showing in tree diagram how the technology may be improved.

## **5.2. Types of snow fences technology by taking into account the materials used**

A first technology was wooden fences technology. Contemporarily there are some regions of Poland where the use of such technology can be noticed, but most of the regions change the technology on the newer one, i.e. using the plastic material nettings.

The wooden fences technology involves setting up a wooden fence spans along the line of the road. Such hurdles are made of wooden planks, or short wooden boards and slabs with thickness of  $12 \div 18$  mm, planks with the width of 9 cm, attached with 10 cm interstices. The dimensions of such a span shall be 1.5 m (height) and  $2 \div 2,5$  m (length). A fence frame consists of two bollards and two struts, braced by two glancing struts. The entire surface is filled with boards attached to the frame in such a way that free spaces formed between them should constitute of 35%- 45% of the whole fence surface. The whole construction is nailed (Fig. 5.1).



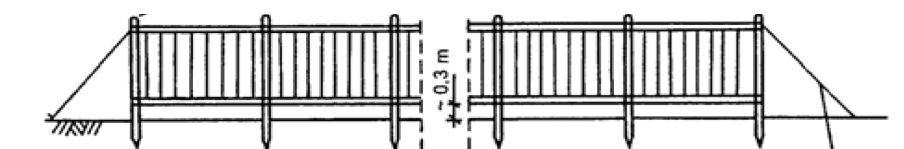
**Fig. 5.1. The construction of wooden snow fence span.**

Source: <http://www.mzdw.pl/files/przetarg/ogolne-specyfikacje-techniczne-d-10.10.01a.pdf>

Setting a cover by using such a type of materials involves the following steps:

- drawing a line of setting the fence,
- demarcation of the places of hammering the pillars,
- making holes for pillars,
- placing the pillars in the holes and finishing them off by using the hammer,

- hanging the fences to the pillars at the height of  $20 \div 30$  cm above the ground by using the wire or cord with regard to the windward side,
- attaching each span on the pillars by the use cord,
- setting up the transverse and longitudinal guy- wires on the extreme and intermediate pillars as the last step of setting up the whole cover, demonstrated by Fig. 5.2.



**Fig. 5.2. An example of setting up the covering of wooden fences.**

Source: <http://www.mzdw.pl/files/przetarg/ogolne-specyfikacje-techniczne-d-10.10.01a.pdf>

Removing the cover of wooden fences consists of:

- dismantling the covering (removal of fences and bars),
- sorting removed components in separate stacks:
  - completely able to be used in the next season,
  - requiring the repair
  - completely worn out
- repair of damaged components,
- disposal of waste material
- keeping materials for use in the next winter season.

The technology of setting up snow fences of the knotted polyethylene netting consists of attaching the netting on formerly prepared wooden pillars. The material of netting is characterized by the high coefficient of thermal expansion, therefore it is recommended to install it at the positive temperatures, which shall ensure better subsequent netting tension in the freezing temperature conditions (BORKOWSKI S., KLIMECKA-TATAR D. 2012).

The covers made of plastic materials are installed in spans of the length equal to a netting on a roll, which gives an ability to create spans

with a length of up to 25 meters without the use of seams that could weaken the cover strength.

The covers are attached by the use of hemp rope stretched on wooden pillars additionally tying the netting in four places for each pillar. The nettings used for the snow fences are available in two colors: orange and black (Fig. 5.3). The mesh of netting has irregular shapes which ensure greater wind turbulence and helps in stemming snow.



*Fig. 5.3. Polyethylene netting examples.*

Source: <http://www.zlotystok.com.pl/zstpp.html>

Setting up covers made of plastic material consists of following actions:

- demarcation of the covering fitting line,
- demarcation of the places of hammering the pillars,
- making holes for pillars,
- placing the pillars in the holes and finishing them off by using the hammer,
- attaching the cord for hanging the netting and anchoring its ends at a distance of 1.6m from the extreme pillars,
- unrolling the netting along the segment,
- hanging the netting on the formerly prepared cord, fixing the netting on the first post using clamp nails (protection from moving the netting up),
- straining the netting,

- fixing the netting on the rest of posts as the last step of installation, what in the effect provides the protection made of plastics shown in the Fig. 5.4.



***Fig. 5.4. The example of the snow cover made of PE netting.***

*Source: own study*

### **5.3. Comparison of technology of snow covers**

Technologies management relies on looking for better and more profitable solutions concerning production and services. In the case of installing snow fences better solution is using the netting made of plastics instead of wooden fence.

In a particular enterprise, a person who is responsible for choosing the technologies adequate to the possibilities of the company and to its equipment is also responsible for choosing them to the market needs. Choice of a given technology consists of not only tangible but also intangible assets. Juxtaposition of few factors in a data table shows how different these two methods are, and how the technique of its implementation has changed due to the technological progress. Some of the factors are presented in the data Table 5.1.

As shown in the data Table 5.1 it can be noticed that due to the application of netting made of plastics, costs will lower because expenses of the transport to the place of installation and to the warehouse are

reduced. The costs of storage also decrease because the lower area is needed.

Netting covers are more resistant to the weather conditions because their construction is more elastic what means longer durability while rough winds and also resistance to the rain. Wooden covers are less resistant to the weather conditions what can be noticed due to the green coating known as moss, induced by the constant moisture of wood. Such moss on the wood surface leads to the later corrosion of post components and also decreases esthetical values of such cover.

**Table 5.1 Comparison of different types of technology used in implementation of snow protection netting**

Type of technology Factor	Plastics	Wooden
durability	more than 8 seasons	6-8 seasons
level of implementation	easy	easy
transport demandings	VAN	VAN + trailer
possibility of corrosion	high	high
estethic of appearance	Available colors: black and orange	After some time green coating, noticeable spots of wood decay, noticeable loss due to the mechanical injuries
Construction of cover	elastic	rigid
Resistance to the Feather conditions	high	low
Recycling possibility	yes	no
Costs of storage	low (low storage area)	high (huge storage area)

*Source: own study*

Due to the appliance of mesh in irregular shape of PE netting cover there is a bigger air circulation which causes better snow stopping.

In covers with wooden components slots have regular shapes and pass higher amounts of snow.

Unfortunately, every technology, considered to be the best is not perfect. It should be controlled and the quality level should be tested. Such actions can help in constant improving of quality and liquidate places or activities causing loss. Every technology should seek to the constant improvement.

#### **5.4. Quality assessment of new technology and the proposition of improvement**

In order to establish why snow fences, with the appliance of plastics netting, although being a new technology, are not perfect and what is this cause, there was used quality analysis tool known as Ishikawa diagram. This method indicates occurred problems and the place of their occurrence. All factors and causes are determined on the basis of specially qualified people's observations. During so called 'brainstorm' the causes of some phenomena occurrence are determined. All causes of the occurrence of the incompatibility are grouped into few main groups and shown in so-called "herringbone diagram" (i.e. Ishikawa diagram) in Fig. 5.5.

It allows us to identify the most important sections generating loss and introducing preventing actions or total elimination of particular problems.

In order to improve the technology of snow fences installation with the appliance of plastic netting, some actions, which are shown in details in a tree diagram shown in Fig. 5.6, may be introduced.

Fig 5.6 clearly states which actions are the best to improve the technology. Most of these actions will not be generating additional costs such as commending for a good work, nice atmosphere in the installation group, montage referring to the instructions etc. Such actions will contribute to the lowering of technological costs. From the figure mentioned earlier, it can be read that activities which will generate costs



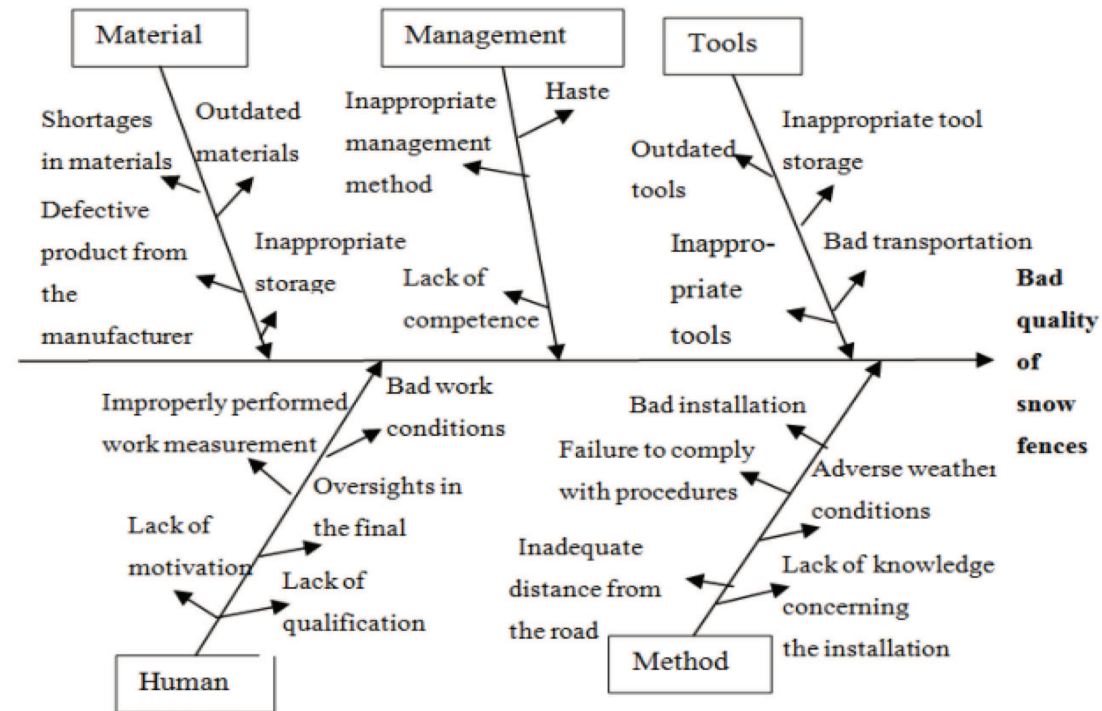
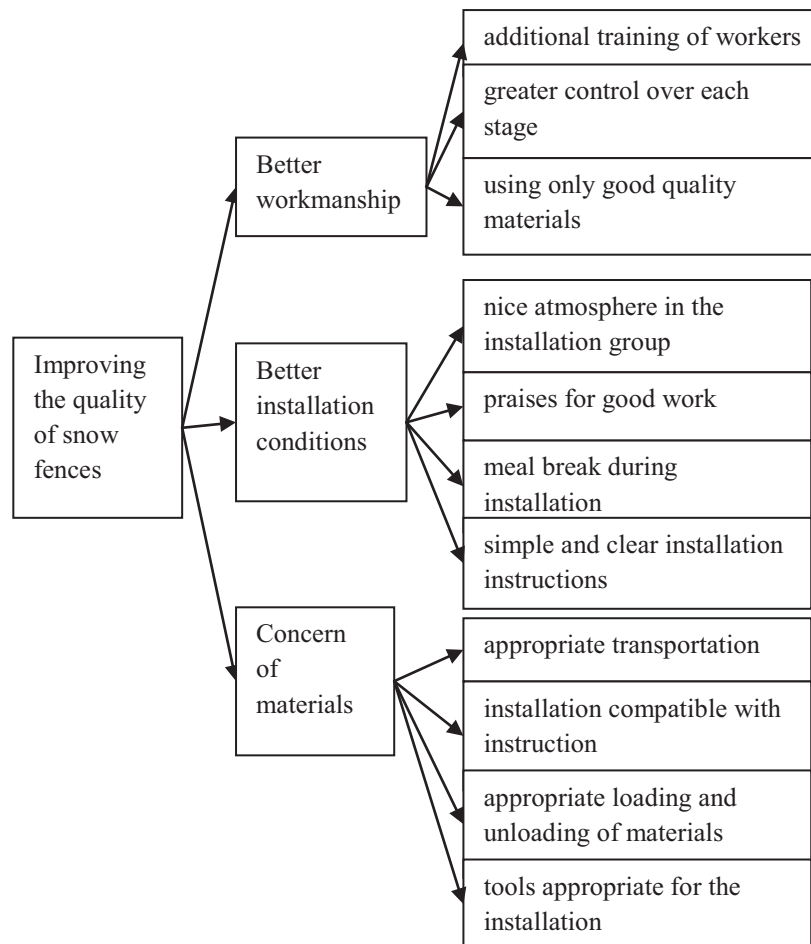


Fig. 5.5. Ishikawa Diagram.

Source: own study based on results of research



**Fig. 5.6 Tree diagram to improve the quality of snow covers.**

*Source: own study*

e.g. trainings for employees, breaks for meals during the installation, increasing controls, still occur (GOLEC M. 2013). But these are operations by which costs will change into profits after some time.

## 5.5. Summary

Technology management is not as simple as it may seem, because it demands a huge knowledge on a given topic- so the topic of production and services. A person responsible for such type of management must demonstrate a good knowledge about used technologies and about technological innovations showing up in the market (BORKOWSKI S., TUCKOVA Z. 2011). Every enterprise fights in the current market for keeping its market position or for making it better. It is only possible because of good technological management. Because of perfect activities they can lower costs of their products and gain larger groups of customers.

In road engineering what matters is not only lowering the costs allocated in the snow covers- what is also important- but also the security of road users and comfort of their travel. Due to use of snow covers made of plastics such security is increased. It is because lower amount of snow which are blown into the lane of the road what leads to avoiding creation of snowdrifts, which sometimes make it hard to drive during the winter season. It also ensures better visibility during snow storms because some amount of snow is stopped in the covers; the strength of the wind is also lowered. Such covers have also impact on the decreasing of maintaining costs during the winter season because the lower amount of snow is blown into the roads which results in avoiding use of heavy machinery to remove the snow or to struggle with the slippery of the road.

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