# Orienteering moves indoor

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**Abstract.**The paper gives an introduction to existing maps used for orienteering in indoor environments. It also discusses techniques that are distinctive for indoor maps in general and for indoor maps of multiple floors in particular. This is a challenge both for the map maker and the orienteers. The cartography on normal orienteering maps are based on international standards developed by the International Orienteering Federation. There are no standards for indoor maps so far. However, the design of the maps should build on the same philosophy.

**Keywords:** Orienteering, indoor map

## 1. Introduction

Today there is a trend that many sports are moving into indoor environments. An important reason for this is to avoid unstable and unequal weather conditions for the athletes. However, better facilities and a better experience for the spectators also play a role.

Orienteering is maybe considered as one of the most typical outdoor sports that exist. Orienteering maps over large wilderness areas have usually formed the basis for orienteering competitions. However, some years ago the sprint distance was introduced in orienteering. This moved orienteering out from the woods, and a new standard for sprint maps were established (International Specification for Sprint Orienteering maps (ISSOM), 2005).

Orienteering is based on one crucial facility; the map. Consequently, facilities for orienteering can be established in many different areas, as long as a map can be made and the area is accessible for sport activities. One

more “exotic” branch within orienteering is when the event is moved indoor!

Indoor orienteering opens for new possibilities and new challenges both when it comes to the competition and to the making of the map. For example will indoor orienteering in a multi-storey building extend the sport into 3 dimensions, and the navigation in 3 dimensions based on 2 dimensional maps might be quite a challenge.

Indoor orienteering is not a new invention. There are sporadic examples on indoor orienteering competitions arranged in different locations. Zentai (2009) shows an example on indoor micro orienteering where a gym is the arena and different equipment forms the obstacles in the track. In this example the map scale is set to 1:100. A similar example is shown at Web:Lasnamäe (2007) where an indoor athletic stadium is the arena and the map scale is 1:500. An even more exotic orienteering map can be found Web: Plaza de Toros (2013). This is a 1:250 map for a micro-sprint at Plaza de Toros de Villena – an arena for bullfighting.

All these examples are categorized as micro-orienteering and are on the most extreme edge of indoor orienteering. Another, and maybe even more challenging kind of indoor orienteering is when an ordinary building is used as arena, especially when this “arena” consists of several floors. In Web:osprint (2008) the arena consists of five different floors in a 1:500 map over the building. Accessible areas have a white colour and the different floors have about the same horizontal delimitation. However, when it comes to Web:Kuusalu_Keskool (2011) the different floors have an uneven location in the horizontal plane and it is difficult to know for example where the second floor is located.

## 2. The third dimension

The handling and presentation of several floors is maybe the most challenging problem for indoor navigation. Usually maps of the different floors are drawn side by side. In that case it is important to indicate how the horizontal positions of the different floors are related to each other. Figure 1 shows an example from one of the campuses at the Norwegian University of Science and Technology (NTNU) where vertical reference points are included in the map.

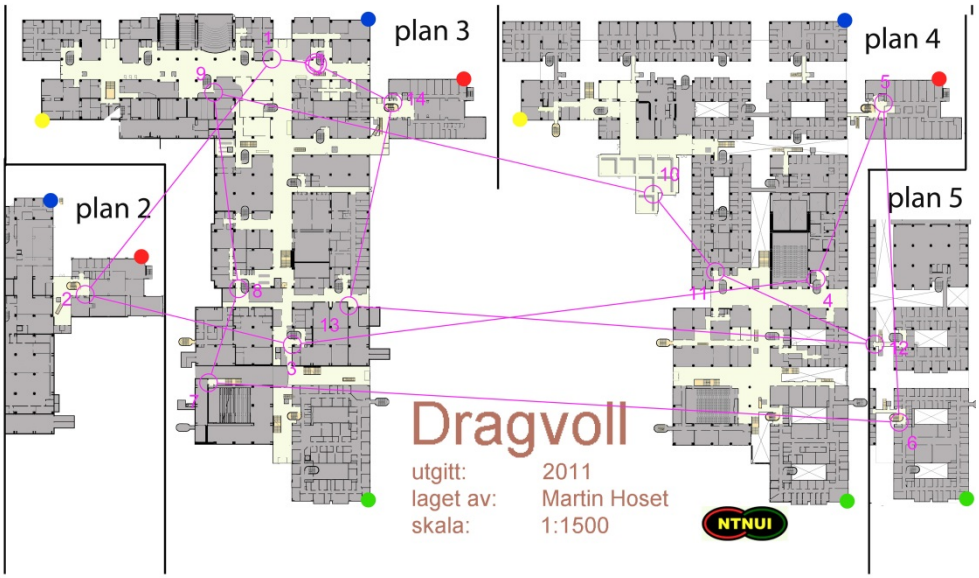


**Figure 1.** Map over NTNU Dragvoll. Map made by Martin Hoset.

The coloured circles in the corners of the floor maps are used as horizontal reference. Circles of colours have identical horizontal coordinates. However, even with these references it is a challenge to do a "mental movement" between different floors when time is a factor. Web:osprint_1 (2013) solves this by using the same colour for the same stairs on different floors (Figure 2). The stairs will then act as horizontal reference points and link the floors together visually as well as in "the real world".

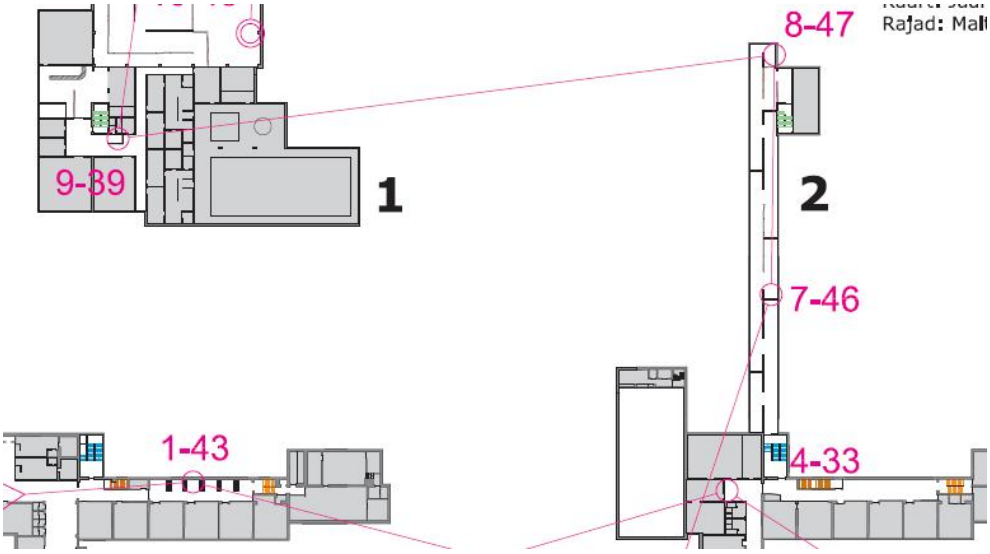


**Figure 2.** Coloured stairs used as horizontal reference. Map made by Jaan Tarmak.

Some of the orienteering community in Estonia seems to be particularly active within indoor orienteering. They have experimented with different methods for visualizing one- or two ways connection between floors. This can be studied in Web:osprint (2009) (V-letters used as arrows), Web:osprint_1 (2010) (ISSOM passage symbols), Web:osprint_2 (2010) (arrowheads), Web:osprint_3 (2010) (Colour codes: blue –up (towards the sky), green – down (towards the grass)), Web:osprint (2011) (arrows). Since these constrains are made by the course setters it will be a part of the course rather than elements in the map itself.

In a normal orienteering course the connections between control points are drawn as lines. This method is also commonly used in "multi-floor" orienteering maps as for example in Figure 1 and Figure 2. However, for an orienteer this makes a visual mismatch. When he/she sees a long connection line between control points he/she expects a long distance. This is not necessarily the case when moving between floors.

Another, more innovative way of handling navigation on several floors is presented in Nossum (2011). This uses a new approach were the areas for moving around is visualized in a map inspired by the network-oriented map used by underground railways.

In Nossum et al. (2012) different floors are given unique colours codes. This might help in a generalized representation where several floors are projected into the same horizontal projection. However, this concept can be categorized as thematic maps and is based on too much generalization when it comes to navigational purposes.

3D extension of orienteering also introduces new and challenging possibilities for an orienteering course. When navigating between the controls, orienteers often have to select between two or more possible routes in the horizontal plane. In a multi-floor orienteering course it is even possible to choose between routs on different levels. Figure 1 gives an example on the "vertical challenge". When moving between the 4th and 5th control it is necessary to select a route via another floor even when those two controls are located on the same floor.

## 3. Cartography

A significant challenge in orienteering is the use of different terrain and landscape types, both on national level and, in particular, between different countries. However, even if the areas for competition may have quite different characteristics, it is desirable to keep the setting for the competitions as equal as possible. To meet these objectives the International Orienteering Federation has agreed on several standards for orienteering maps. The most significant in this connection are *International Specification for Orienteering Maps* (ISOM) and *International Specification for Sprint Orienteering Maps* (ISSOM). These specifications use colours to distinguish between different areas. As a general rule accessible areas are represented by light colours while darker areas indicate less or no access.

When it comes to maps over indoor environments no specifications exist. For indoor maps in general there are fewer conventions on how a map shall appear. However, most indoor maps indicate public areas with a lighter colour than less accessible areas. This is in accordance with the results we will get if we apply the philosophy used in ISSOM for indoor environments. Since a building is represented by a grey colour in ISSOM it is natural to let some of the building remain grey when moving indoor. Most of the recorded examples use grey for rooms that are inaccessible, outlined by black or darker grey.

Yellow usually indicates open areas in an orienteering map (ISOM and ISSOM). The map in Figure 1 makes use of this. The open area in the map over Plaza de Toros de Villena (Web: Plaza de Toros, 2013) is also coloured in two nuances of yellow. However, to avoid that the course information

drowns in the background it is important to avoid too high saturation value or too dark shadings.

Symbolization of the vertical connections in a multi-floor arena is a distinct cartographic challenge. As mentioned earlier it is important to emphasize the vertical connections between the floors. One solution may be to make more distinct symbols for stairs in a building, and make a separation between stairs with different horizontal positions. Figure 2 uses colours for the horizontal separation. Giving unique numbers to the same stairs at different floors is another possible solution.

All orienteering maps are a generalized picture of the real situation. Scale is of course an important factor when different generalization parameters are set. A typical indoor map has a scale in the range 1:500 – 1:1000. For larger building complexes it might even be 1:1500, and for micro-indoor orienteering the range are from 1:100 to 1:500. Large scale open for maps showing quite small details. It is however important to avoid details that are superfluous for the orienteer. Details inside inaccessible areas in the building need to be strongly de-emphasized, or even totally removed.

Figure 3 shows some maps Jaan Tarmak has made over Tallinna Spordihall. The three maps are dated (from top) 2007, 2009 and 2012 and show development in the generalization. From 2007 to 2009 the saturated background colours disappear together with all the marking on the floor. In addition are the tennis and basket areas marked as inaccessible, and most of the details disappear in those. In 2012 the individual seats on the tribune are replaced by a more general symbol and indications of different rooms are removed from the inaccessible area beside the running track (grey area). All these simplifications are made to reduce the amount of insignificant information for the participants.

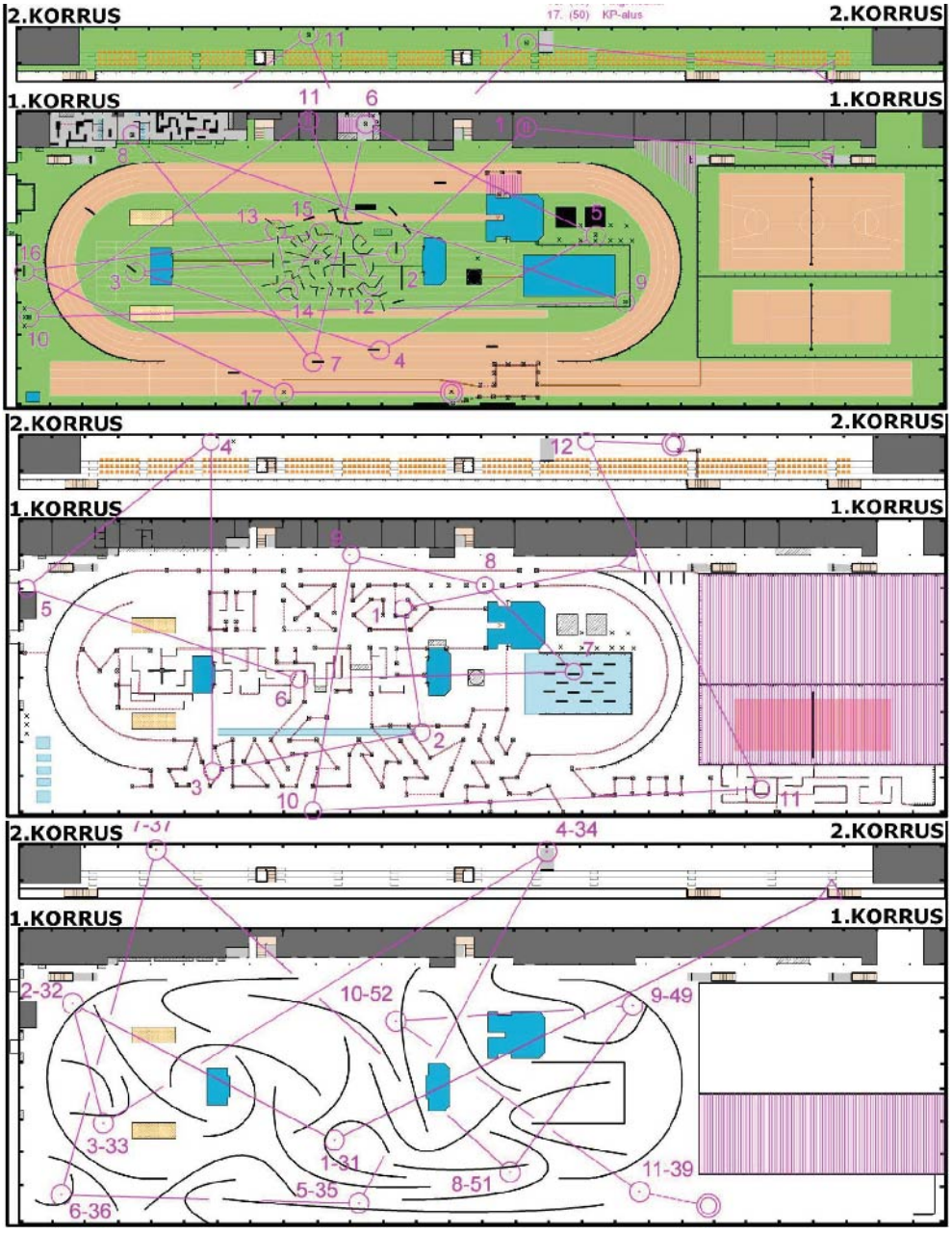


**Figure 3.** Three maps of Tallinna Spordihall showing various grades of generalization. Maps made by Jaan Tamrak.

## 4. Conclusions

Indoor orienteering opens for new and interesting aspects within the sport and may be a valuable contribution as a new training scenario for orienteers. Increasing activity in the field will also open for more advanced competitions. The activity will of course be hampered by the lack of available "arenas". However, the access to buildings that in principle is designated for sport activities might be a good option. Other large building complex with a public purpose might be another.

The map is of course a crucial component in this connection. Today there are no international standard for indoor orienteering maps. The cartography for existing indoor maps is however based on the same philosophy as for conventional orienteering map. Standards for how the map should be designed may help in further development of these activities. These standards should keep a particular focus on how to represent the vertical connection between floors in buildings.

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