



International Specification for Sprint Orienteering Maps (ISSOM)

Final draft



**IOF Map Commission
2003**

Version date: 28 February 2003

FOREWORD

The Map Commission within the International Orienteering Federation is responsible for all matters related to orienteering maps, such as map standardisation, development, education and quality assurance. It is a body under the IOF Council. The ISSOM project started in 2001, as a result of the Leibniz Convention.

The sprint discipline was in 2001 included in the World Orienteering Championships programme, and the Map Commission is responsible for establishing a map standard for sprint orienteering. The ISSOM project is a "fast track", low budget standardisation effort compared to the ordinary ISOM (the International Specification for Orienteering Maps) standardisation work. Our previous project was the ISOM2000 project, an update of ISOM, with special emphasis on the use of digital technology. The Commission spent about 3 years on the ISOM2000 project, being able to form a working group, a reference group, produce 7 offset testprints, etc.

Sprint orienteering is something new. We have had park maps previously, but sprint events can take place in forests, in urban areas and even in mixed environments. To establish a mapping standard for this new discipline is much more complicated than for traditional orienteering in the forest. So, what we publish now is just a final draft. We are waiting for feedback, and we want to collect experiences at WOC2003.

The structure of this document is based on ISOM2000. In some places we have followed the logical order of ISOM2000, so some of the numbers are not in ascending order. We have tried to distinguish between the semantics of a feature and its graphics implementation. For instance, minor watercourse (307) in the ISOM2000 has been kept in the ISSOM, but the graphics implementation of 307.1 in the ISSOM is the same as the graphics implementation for 306 in the ISOM2000. The semantics are the same, but the graphics implementation is different (and in this case, the graphics implementation is the same as for a feature with different semantics in the ISOM2000).

This file is a final draft, and we do not plan to make big changes in it in the next few months, but minor corrections may occur. The corrections will be listed on the MC website and the PDF file will be updated (check the date). You can download an OCAD template file which is based on this final draft. For additional information you can visit this website:

<http://www.swisshiking.ch/gloor/iof/>

Budapest, 28 February 2003

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1 INTRODUCTION

In the last few years, Sprint Orienteering has become popular - especially in urban areas. The integration of Sprint Orienteering into the World Orienteering Championship (WOC) program will push this development and gives the entire Orienteering movement a great chance to get increased public awareness.

According to the International Orienteering Federation's (IOF)'s specified format for Sprint Orienteering the event could take place anywhere, in forests, parks, urban or mixed areas. However, the challenge will be to determine a common approach to the interpretation of urban areas. In many countries, the development of Sprint Orienteering is still at an experimental stage. So far only a few countries have established national Sprint Orienteering championships.

The use of urban areas as a stage for Orienteering events implies major challenges from a cartographical point of view.

- The urban terrain differs completely from the "classical" forest terrain. The amount of detail in the centre of old towns is much higher than in a forest.
- Many restrictions have to be considered in urban areas, such as areas with forbidden access or areas with traffic.
- Urban areas are mostly paved and permit very high running speed. Therefore the legibility of competition maps is very important.
- The short course lengths (2.5 to 4.0 km) permit the use of large scales within a range of 1:2 000 - 1:5 000.

2 CONTENT OF SPRINT ORIENTEERING MAPS

"A map with few well chosen features will give a much better map, than a map cluttered with many insignificant features". (Eduard Imhof)

In order to obey this principle we have to ask which features in urban areas are significant for the competitors. Those that are important for navigation and those that will reduce the runnability?

Waste baskets, parking meters and light poles certainly do not fall into this category. They have a very small aspect (less than to 50 cm). A single seat bench (2.00 m × 0.50 m) does not represent a significant obstacle either. However, these features might serve orientation or navigation especially in areas where there are no other features. Seat benches would probably clutter a map without significant advantages to the runners.

Nevertheless, the dimension of a single seat bench is probably a useful limit for representing a feature on a Sprint Orienteering Map.

In urban areas passages, gaps in walls, fences and hedges and other openings are very important to the runners. The competitors try to take short cuts to win the race, even if they have to jump down a 4 m high retaining wall for example. Small openings must be clearly represented on a map. From a cartographical point of view, an exaggeration of 2 or 3 times the original size of a feature is acceptable. Hence, a minimum content dimension of approximately 2 m could be posted, which should not lead to overcrowded maps.

The following features **should not be** mapped, because they fall under the minimum content dimension of 2 × 2 m:

Lamp poste, telephone poles, junction boxes of cable television and telephone, benches, manholes, small sport fixtures, parking meters, trash cans, fire-hydrants, very small trees and bushes, traffic signs, individual posts, flag poles, ticket machines, traffic lights, street signs.

3 SCALE AND CONTOUR INTERVAL

3.1.1 Scale and contour interval

Both scales, 1:4 000 or 1:5 000 can be used. Scale 1:4 000 is recommended for old urban areas, e.g. in Southern Europe. 1:5 000 scale is suitable for most new urban, mixed and forest areas. The contour interval value should be either 2 or 2.5 m for both 1:4 000 and 1:5 000.

Arguments for scale are shown in Appendix.

3.1.2 Format of the map

The map format should not exceed a format much larger than DIN A4, never DIN A3. The space for labels may not exceed 200 cm².

Arguments for the map format are shown in Appendix.

3.1.3 Colour Concept

The 7-color concept of ISOM 2000 will be adopted for Sprint Orienteering maps as well. Thus, the colour combinations of black, brown, yellow, blue, green, grey are possible, and for overprint purple.

4 PRINCIPLES

4.1 Characteristics of Sprint Orienteering

Sprint Orienteering is an individual sport, built on high speed running in any environment. The winning time should not exceed 12-15 minutes.

The major challenge of Sprint Orienteering, from a cartographical point of view, is that it can also take place in urban areas. The following constraints have to be taken into consideration:

- ◆ Complex building constructions with passages, underpasses, canopies, etc.
- ◆ Areas with forbidden access (e.g. private areas) and their (impassable) surrounding walls and fences.
- ◆ Other human activities in urban areas like traffic, pedestrian zones, spectators, skaters, etc.

These factors and the very short running distances give this discipline an extreme challenge; the runners must orienteer and navigate at high speed, running in a very complex environment.

However, urban areas affect route choices much more than in non-urban areas like forests. Areas with forbidden access, impassable walls or fences, heavy traffic, railways etc. will reduce the variety of route choices dramatically, compared to orienteering in forests or open spaces. There, runners can decide whether they will choose a short route with worse runnability or a longer route with good runnability. Between these two variants, many other variants exist. Moreover, to lose a few seconds due to unexpected hindrance will not count too much on the winning time in long and middle distance races. However, in Sprint Orienteering, unexpected bad runnability (e.g. crowded areas) or obstacles will affect

the running time to much greater extent. They might even determine victory or defeat. It is the responsibility of the surveyor and the cartographer to represent the area of competition as precisely as possible and to draw a legible map. The course planner has the principal responsibility to plan a fair course.

4.2 Features represented as impassable shall be forbidden to pass

Map symbols can just represent classes of features. It is not possible to represent every feature in its real dimensions. For example, impassable walls can have a range of 2 m up to 10 m height. However, some competitors could try to pass a 2 m wall, some are not able to pass it, due differing ability. To make competitions fair to all competitors, it must be declared, that competitors shall not pass features that are represented as impassable. Competitors who do not obey this rule, will be disqualified. This restriction also makes sense, because walls and fences are mainly constructed to fulfil the function of an enclosure.

4.3 Restrictions of the course area for Sprint Orienteering

4.3.1 No controls may be put underground or inside buildings (indoors)

Due to lack of representation possibilities in maps for multi-level features, Sprint Orienteering may not take place underground (e.g. cellars, underground buildings) or inside buildings (indoor). The main "running" level should primarily be represented on a map. However, underground passages (e.g. lighted tunnels, underpasses) or overpasses (e.g. bridges), which are important for the runners must be represented on the map.

4.3.2 All reasonable measures must be considered to prevent accidents with other human activities in urban areas such as traffic, pedestrians, spectators, etc.

The organiser is responsible for the runner's safety and for the safety of other people in the area of the Sprint Orienteering Event. They should take every precaution to prevent accidents. The organiser has to consider the following measures:

- ♦ Halting of traffic (close roads)
- ♦ Restrict traffic (controlled by policeman)
- ♦ Separate competitors, pedestrians and spectators by the use of a cordon (tape) in crowded areas.

If such measures are not possible, the chosen area is not suitable for Sprint Orienteering.

4.4 Restriction for course setting

The course setter should not provoke or invite unfair actions of the competitors. Course setters should consider all possible route choices. They have to try to avoid unfair and dangerous actions by the runners, such as crossing areas with forbidden access, impassable walls and fences or jumping down high walls.

If it is unavoidable to set legs that cross or skirt areas with forbidden access, impassable walls and fences, they have to have to be marked in the terrain. In addition, these features have to be marked with purple crosses on the map.

5 PRINTING

A sprint orienteering map must be printed on good, possibly water resistant paper (weight 80-120 g/m²). Spot colour printing is recommended for IOF events. Other printing methods may be used, if colours and line width have the same quality as printing with spot colours.

Legibility depends on the correct choice of colours.

To increase the legibility we may use as high screen frequency for dot screen as it is technically available (60 lines/cm is the minimum).

5.1 Spot colour printing

Spot colour printing uses pure colour inks. Each spot colour ink is made by mixing a number of stock inks in specific proportions to produce the desired colour. The colours specified for use for orienteering maps are defined by the Pantone Matching System (PMS).

The map may be in up to 6 colours (excluding overprinting).

The following recommendations for spot colours are intended to standardize maps as much as possible:

Colour	PMS number	The appearance of colours is dependent on the printing order. In spot colour printing, order should always be:
Black	Process black	
Brown	471	1. yellow
Yellow	136	2. green
Blue	299	3. grey
Green	361	4. brown
Grey	428	5. blue
Violet	Purple	6. black
		7. purple

3.5.2. Four colour printing

Four-colour printing is the traditional way of printing most colour work, maps have been one of the main exceptions due to the fine line requirements. The four colour printing method uses the three basic colours of the subtractive colour model: cyan, magenta and yellow. In theory a mix of 100% of cyan, magenta and yellow produces black colour, but in reality it will be more of a dark brown. Therefore black is normally printed as a separate colour. After these four colours the model is often referred to as CMYK.

Although four-colour printing requires fewer and standardized inks, the main advantage of using this process is that it allows the inclusion of colour photographs and full colour advertisements at no extra cost. The use of digital techniques to produce four colour separations has now made it possible to make high quality orienteering maps using four colour printing. This is not the suggested method of printing orienteering maps, it is an alternative. This method will only be acceptable when line quality, legibility and colour appearance are of the same quality as the traditional spot colour printed map.

However, the mapmaker has to take into consideration the limitations and potential errors of this method. The reproduction of very thin lines (contours) requires special attention.

See ISOM 2000 3.5.2 for more details, but take into consideration that this is not the suggested method of printing for IOF events.



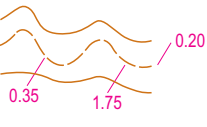

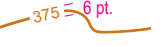
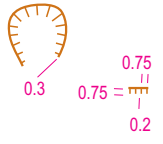
6 DEFINITION OF SYMBOLS

Note: dimensions are specified in mm at the scale of 1:4000/1:5000.
All drawings are at 1:4000/1:5000 scale.

- < gap or infill between two lines
- line thickness
- distance from centre to centre or length of line
- ∅ diameter
- ↑ symbol orientated to north

Colour	PMS number
Black	black
Brown	471
Yellow	136
Blue	299
Green	361
Grey	428
Purple	purple (magenta)

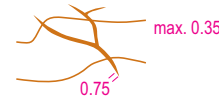
6.1 LAND FORMS

- 101 Contour**
A line joining points of equal height. The standard vertical interval between contours is 2 or 2.5 m.
Colour: brown.
- 
- 102 Index contour**
Every fifth contour shall be drawn with a thicker line. This is an aid to the quick assessment of height difference and the overall shape of the terrain surface.
Colour: brown.
- 
- 103 Form line**
An intermediate contour line. Form lines are used where more information can be given about the shape of the ground. They are used only where representation is not possible with ordinary contours. Only one form line may be used between neighbouring contours.
Colour: brown.
- 
- 104 Slope line**
Slope lines are only used where it is necessary to clarify the direction of slope e.g. along the line of a re-entrant or in a depression.
Colour: brown.
- 
- 105 Contour value**
Contour values may be included to aid assessment of large height differences. The figures should be orientated so that the top of the figure is on the higher side of the contour. They are inserted in the index contours in positions where other detail is not obscured.
Colour: brown.
- 
- 106 Earth bank**
A steep earth bank is an abrupt change in ground level which can be clearly distinguished from its surroundings, e.g. gravel or sand pits, roads and railway cuttings or embankments. The tags should show the full extent of the slope, but may be omitted if two banks are close together. Impassable banks must be drawn with the symbol impassable cliff (201).
Colour: brown.
- 



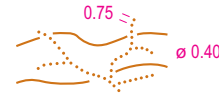
108.1 Small earth wall

A small distinct earth wall, usually man made. The minimum height is 0.5 m. Due to the large scale, generally earth walls shall be represented with the symbol contour line (101) or form line (103).
Colour: brown.



109 Erosion gully or trench

An erosion gully or trench which is too small to be represented with the symbol earth bank (106), contour line (101) or form line (103) will be represented by a single line. The line width reflects the size of the gully. The minimum depth is 1 m.
Colour: brown.



110 Small erosion gully

A small erosion gully or trench. The minimum depth is 0.5 m.
Colour: brown.



112 Small knoll

A small obvious mound or rocky knoll which cannot be drawn to scale with a contour line (101) or form line (103). The minimum diameter should be 2 m. The height of the knoll shall be a minimum of 1 m from the surrounding ground.
Colour: brown.



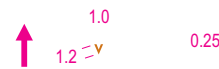
113 Elongated knoll

A small obvious elongated knoll which cannot be drawn to scale with a contour line (101) or form line (103). The maximum length should be 6 m and the maximum width 2 m. The height of the knoll shall be a minimum of 1 m from the surrounding ground.
Colour: brown.



115 Small depression

A small shallow natural depression or hollow which cannot be represented by the symbol contour line (101) or form line (103) is represented by a semicircle. The minimum diameter shall be 2 m. The minimum depth from the surrounding ground shall be 1 m.
Colour: brown.



116 Pit or hole

A pit or hole with distinct steep sides which cannot be represented to scale with the symbol earth bank (106). The minimum diameter shall be 2 m. The minimum depth from the surrounding ground should be 1 m.
Colour: brown.



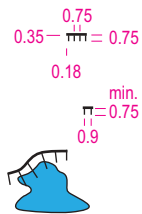
117 Broken ground

An area of pits or knolls, which is too intricate to be represented in detail. The density of randomly placed dots may vary according to the detail on the ground.
Colour: brown.

Removed symbols compared with ISOM 2000

- ♦ Earth wall (107): due to the larger scale, it must be represented with symbol contour line (101) index contour (102) or form line (103), earth bank (106) or earth wall (108.1).
- ♦ Knoll (111): covered by symbol contour line (101).
- ♦ Depression (114): covered by symbol contour line (101) and slope line (104).
- ♦ Special land form feature (118): due to the larger scale, it can be covered by the remaining land form feature (101-117).

6.2 ROCK AND BOULDERS



201 Impassable cliff (forbidden to pass)

An impassable cliff, quarry or earth bank (see 106). Tags are drawn downwards, showing its full extent from the top line to the foot. For vertical rock faces the tags may be omitted if space is short, e.g. narrow passages between cliffs. The minimum height is at least 2.0 m.

Colour: black.

It is forbidden to pass an impassable cliff!

Competitors violating this rule will be disqualified.



202 Gigantic boulder or rock pillar

A gigantic boulder, rock pillar or massive cliff must be represented in plane shape without tags. The minimum height is 1 m.

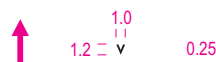
Colour: black.



203 Passable rock face

A small vertical rock face may be shown without tags. If the direction of fall of the rock face is not apparent from the contours or to improve legibility, short tags should be drawn in the direction of the fall. The minimum height is 1 m.

Colour: black.



204 Rocky pit

A rocky pit, hole or mineshaft which may constitute a danger to the runner.

Colour: black.



205 Cave

A cave is represented by the same symbol as a rocky pit. In this case the symbol should be orientated to point up the slope as indicated opposite. This symbol should not be used in urban areas.

Colour: black.

Controls may not be placed inside caves!



206 Boulder

A small distinct boulder. The minimum height is 1 m. Every boulder marked on the map shall be immediately identifiable on the ground.

Colour: black.



207 Large boulder

A particularly large and distinct boulder. Gigantic boulders must be represented in plane shape with symbol gigantic boulder or rock pillar (202).

Colour: black.



208 Boulder field

An area which is covered with so many blocks of stone that they cannot be marked individually is represented with randomly orientated solid triangles. The runnability is reduced and is indicated by the density of the triangles. A minimum of two triangles must be used.

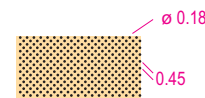
Colour: black.



210 Stony ground

An area of stony or rocky ground which reduces runnability. The dots shall be randomly distributed with density according to the amount of rock. A minimum of three dots shall be used.

Colour: black.



211 Open sandy ground

An area of soft sandy ground or gravel with no vegetation which reduces runnability. Where an area of sandy ground is open and has good runnability, it is represented with symbol open land (401), open land with scattered trees (402) or paved area (529).

Colour: black 12.5% (22 lines/cm) and yellow 50% (see 403).



212 Bare rock

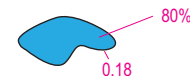
An area of runnable rock without earth or vegetation is represented. An area of rock covered with grass, moss or other low vegetation must be represented with symbol open land (401/402/403/404).

Colour: black 20% (min. 60 lines/cm) or grey.

Removed symbols compared with ISOM 2000

- ♦ Boulder cluster (209): due to the larger scale, it must be represented with symbol boulder (206).

6.3 WATER AND MARSH



304.1 Impassable waterbody (forbidden to pass)

An area of deep water such as a sea, lake, pond, river, fountain etc. which may constitute a danger to the runner or has forbidden access. The dark blue color and the surrounding black bank line indicates that the feature cannot or may not be passed.

Colour: blue 80% (min. 60 lines/cm), black.

It is forbidden to pass an impassable waterbody!

Competitors violating this rule will be disqualified.

305.1 Passable waterbody

An area of shallow water such as a pond, river, fountain etc. that can be passed. The waterbody must be runnable. If the waterbody is not runnable it must be represented with the symbol impassable waterbody (304.1). The pale blue color and the surrounding blue line indicates that waterbody can be passed (less than 0.5 m deep, and runnable).

Colour: blue 30% (min. 60 lines/cm), blue.



307.1 Minor watercourse

A natural or man-made minor watercourse which is too small to represent with the symbol passable waterbody (305.1).

Colour: blue.



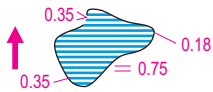
309 Impassable marsh (forbidden to pass)

A marsh which is impassable or which may constitute a danger to the runner. A black line surrounds and indicates that the feature cannot or may not be passed.

Colour: blue, black.

It is forbidden to pass an impassable marsh!

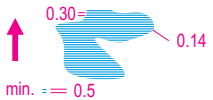
Competitors violating this rule will be disqualified.



310 Marsh

A passable marsh, usually with a distinct edge. The symbol shall be combined with vegetation symbols to show runnability and openness.

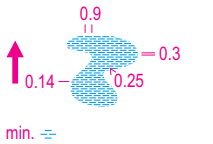
Colour: blue.



311 Indistinct marsh

An indistinct or seasonal marsh or area of gradual transition from marsh to firm ground, which is passable. The edge is generally indistinct and the vegetation similar to that of the surrounding ground. The symbol shall be combined with vegetation symbols to show runnability and openness.

Colour: blue.



312 Small fountain or well

Small well or fountain, which is at least 1 m high, at least 1 m in diameter and has an open waterbody.

Colour: blue.



313 Spring

The source of a stream with a distinct outflow. This symbol shall not be used in urban areas.

Colour: blue.



Removed symbols compared with ISOM 2000

Due to the larger scale, the following symbols of ISOM 2000 must be represented with new symbols:

- ◆ Lake (301): must be represented with the symbol impassable waterbody (304.1) or passable waterbody (305.1).
- ◆ Pond (302): must be represented with symbol the impassable waterbody (304.1) or passable waterbody (305.1).

- ◆ Waterhole (303): must be represented with the symbol impassable waterbody (304.1) or passable waterbody (305.1).
- ◆ Uncrossable river (304): must be represented with the symbol impassable waterbody (304.1).
- ◆ Crossable watercourse (305): must be represented with the symbol passable waterbody (305.1).
- ◆ Crossable small watercourse (306): must be represented with the symbol passable waterbody (305.1) or minor watercourse (307.1).
- ◆ Narrow marsh (308): must be represented with the symbol marsh (310).
- ◆ Special water feature (314): must be covered by the remaining water features (304.1-313).

6.4 VEGETATION

401 Open land

An area of cultivated land, lawn, field, meadow, grassland, etc. without trees, offering good runnability.

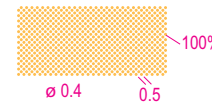
Colour: yellow.



402 Open land with scattered trees

An area of meadows with scattered trees or bushes, with grass or similar ground cover offering good runnability. Individual trees (418, 419) may be added.

Colour: yellow (20 lines/cm).



403 Rough open land

An area of heath, moorland, felled areas, newly planted areas (trees lower than ca. 1 m) or other generally open land with rough ground vegetation, heather or tall grass. Symbol rough open land may be combined with symbols undergrowth: slow running (407) and undergrowth: difficult to run (409) to show reduced runnability.

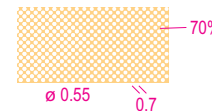
Colour: yellow 50% (min. 60 lines/cm).



404 Rough open land with scattered trees

Where there are scattered trees in rough open land, areas of white (or green) should appear in the tone. Individual trees (418, 419) may be added.

Colour: yellow 70% (min. 60 lines/cm), white 48.5% (14.3 lines/cm).



405 Forest: easy running

An area of typical open runnable forest for the particular type of terrain. If no part of the forest is runnable then no white should appear on the map.

Colour: white.

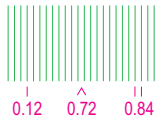


406 Forest: slow running

An area with dense trees (low visibility) which reduces running to ca. 60-80% of normal speed.

Colour: green 30% (min. 60 lines/cm).





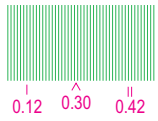
407 Undergrowth: slow running

An area of dense undergrowth but otherwise good visibility (brambles, heather, low bushes, cut branches, etc.) which reduces running to ca. 60-80% of normal speed. This symbol may not be combined with the symbol forest: slow running (406) or forest: difficult to run (408).
Colour: green.



408 Forest: difficult to run

An area with dense trees or thicket (low visibility) which reduce running to ca. 20-60% of normal speed.
Colour: green 60% (min. 60 lines/cm).



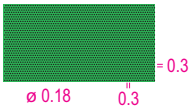
409 Undergrowth: difficult to run

An area of dense undergrowth but otherwise good visibility (brambles, heather, low bushes, cut branches, etc.) which reduces running to ca. 20-60% of normal speed. This symbol may not be combined with the symbol forest: slow running 406 or forest: difficult to run 408.
Colour: green.



410 Vegetation, very difficult to run

An area of dense vegetation (trees or undergrowth) which is barely passable. Running reduced 1-20% of normal speed.
Colour: green 100%.



421 Impassable vegetation (forbidden to pass)

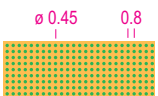
An area of dense vegetation (trees or undergrowth) which is impassable or which may constitute a danger to the runner.
Colour: green 100%, black 28%.

**It is forbidden to pass impassable vegetation!
Competitors which violating this rule will be disqualified.**



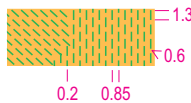
411 Forest runnable in one direction

When an area of forest provides good running in one direction but less good in others, white stripes are left in the screen symbol to show the direction with good runnability.
Colour: green, white.



412 Orchard

Land planted with fruit trees or bushes. The dot lines may be orientated to represent the direction of planting.
Colour: green, yellow.



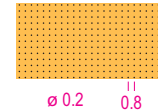
413 Orchard, one direction (e.g. Vineyard)

Land planted with fruit trees or bushes, with a distinct direction of planting which reduces the runnability. The green lines shall be orientated to show the direction of planting.
Colour: green, yellow.



414 Distinct cultivation boundary

The boundary of cultivated land when not shown with other symbols (fence, wall, path, etc.) is represented with a black line. A permanent boundary between different types of cultivated land is also represented with this symbol.
Colour: black.



415 Cultivated land

Cultivated land which is seasonally out-of-bounds due to growing crops may be shown with a black dot screen.
Colour: yellow, black 5% (12.5 lines/cm).



416 Distinct vegetation boundary

A distinct forest edge or very distinct vegetation boundary within the forest.
Colour: black.



417 Indistinct vegetation boundary

Indistinct boundaries between areas of green, yellow or white are shown without a line. The edge of the area is shown only by the change in colour or dot screen.



418 Large tree

A single large tree, with a trunk of at least 0.5 m diameter.
Colour: green.



419 Bush or tree

A bush or a tree with a trunk less than 0.5 m diameter.
Colour: green.



420 Special vegetation features

A special vegetation feature in the forest. The definition must be given in the legend.
Colour: green.

6.5 MAN-MADE FEATURES



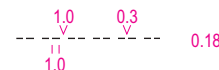
506.1 Unpaved footpath

An unpaved footpath is a way for passing mainly by foot, without any pavement.
Colour: black, brown 15% (min. 60 lines/cm).



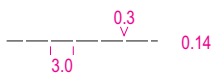
507 Unpaved footpath in the forest

An unpaved footpath or track. Not to be used in urban areas.
Colour: black.



508 Less distinct small path

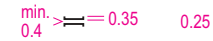
A less distinct path or forestry extraction track.
Colour: black.



509 Narrow ride

A distinct ride is a linear break in the forest (usually in plantation), which does not have a distinct path along it. Where there is a path along a ride, the symbol unpaved footpath in forest (507) shall be used.

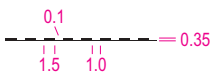
Colour: black.



512.1 Footbridge

A bridge is a structure spanning and permitting passage over a river, chasm, road or the like.

Colour: black.



515.1 Railroad (forbidden to pass)

A railroad is a permanent road laid with rails on which locomotive and cars are run.

Colour: black.

It is forbidden to pass or run along a railroad!
Competitors violating this rule will be disqualified.

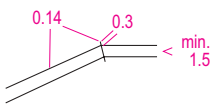


515.2 Tramway

A tramway is a public vehicle running regularly along certain streets, usually on rails. The rails are plane to the ground level. The track can be passed by a competitor.

Tramways are generally not represented. However, if they serve navigation or orientation, they can be represented.

Colour: black 50%.

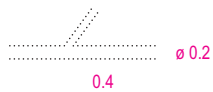


517 Major power line

A power line is a line for conducting electric power. The carrying masts, mostly complex poles, must be represented in plane shape.

Wires of the powerline will generally be not represented. However, if they serve navigation or orientation, they can be represented.

Colour: black.

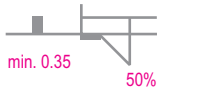


518.1 Underpass or tunnel

An underpass or a tunnel is a passage running underneath the ground, especially a passage for pedestrians or vehicles, crossing under a railroad or road, etc.

Colour: black.

Controls may not be set into underpasses or tunnels etc.!
However, if underpasses or tunnels etc. must be used in competition, they must be emphasized with the symbol 708 overprint!



519.1 Passable wall

A passable wall is a construction made of stones, concrete etc., which can be passed. If such a wall is higher than 2.0 m, it must be represented with the symbol impassable wall (521.1). Wide walls must be drawn in plane shape.

Colour: black 50%.

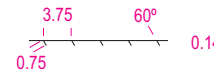


521.1 Impassable wall (forbidden to pass)

An impassable wall or a retaining wall is a wall, which fulfil the function of an enclosure or solid fence. It may not be passed, due to forbidden access or because it may constitute a danger to the competitors, due to its height. Wider impassable walls must be drawn in plane shape and represented with the symbol building (526.1).

Colour: black.

It is forbidden to pass an impassable wall!
Competitors violating this rule will be disqualified.

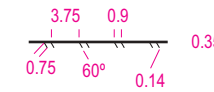


522 Passable fence or railing

A passable fence is a barrier enclosing or bordering a field, yard, etc., usually made of posts and wire or wood. It is used to prevent entrance or to confine or mark a boundary. A railing is a fence-like barrier composed of one or more horizontal rails supported by widely spaced upright poles, usually it can be slipped through.

If a passable fence is higher than 2.0 m it must be represented with the symbol impassable fence (524).

Colour: black.

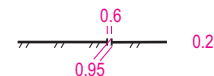


524 Impassable fence or railing (forbidden to pass)

An impassable fence or railing, which may not be passed, due to forbidden access or because it may constitute a danger to the competitors, due to its height.

Colour: black.

It is forbidden to pass an impassable fence or railing!
Competitors violating this rule will be disqualified.

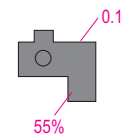


525 Crossing point

A crossing point is a gap or an opening in a fence, railing or wall, which can easily be passed by a competitor.

Small gaps or an openings which can not easily passed by competitors, may not be represented on the map and must be closed during the competition.

Colour: black.

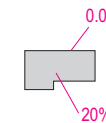


526.1 Building

A building is a relatively permanent construction having a roof.

Buildings on areas with forbidden access (527.1) may just be represented in a simplified manner.

Colour: black, black 55%.

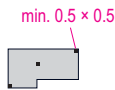


526.2 Canopy

A canopy is a building construction (with a roof), which is supported by pillars, poles or walls, such as passages, gangways, courts, bus stops, gas stations or garages etc. At least one side of the building is without a closed front.

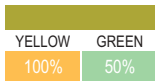
Small passable parts of buildings which can not be easily passed by competitors, may not be represented on the map and must be closed during the competition.

Colour: black, black 20%.



526.3 Pillar

A pillar is an upright shaft or structure, of stone, brick or other material, relatively slender in proportion to its height and any shape in section, used as a building support. Pillars smaller than 2.0 m × 2.0 m are generally not represented. Columns of pillars and pillars along buildings are not represented. However, if they are important for navigation and orientation, they can be represented. Pillars must be represented, if a building is fully supported by them. Colour: black.



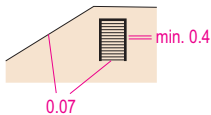
527.1 Area with forbidden access (forbidden to pass)

An area with forbidden access such as a private area, a flower bed, a railway area etc. No feature shall be represented in this area, except prominent features such as railways, large buildings, or large trees. Colour: yellow 100%, green 50%.

It is forbidden to pass an area with forbidden access!
Competitor violating this rule will be disqualified.

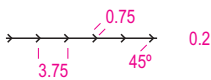
529 Paved area

A paved area is an area with a firm level surfaces such as asphalt, hard gravel, tiles, concrete or the like. Distinct differences in the pavement can be represented with the symbol step or edge of pavement (529.1), if they are important for navigation and orientation. Colour: brown 15% (min. 60 lines/cm).



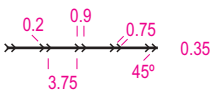
529.1 Step or edge of pavement

A step or an edge of a pavement. Steps of a stairway must be represented in generalized manner, borders of a sidewalk are generally not represented. However, if they serves navigation or orientation, they can be represented. Colour: black.



533 Passable pipeline

A pipeline (gas, water, oil, etc.) above ground level which can be passed over or under. Colour: black.



534 Impassable pipeline (forbidden to pass)

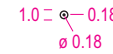
A pipeline (gas, water, oil, etc.) above ground level which cannot be passed over or under. Colour: black.

It is forbidden to pass an impassable pipeline!
Competitors violating this rule will be disqualified.



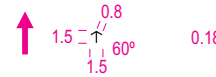
536.1 Small tower

A small tower. Large towers must be represented in plane shape with the symbol building (526.1). Colour: black.



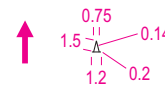
537 Cairn, memorial or boundary stone

Cairn, memorial or boundary stone more than 0.5 m high. Colour: black.



538 Fodder rack

A fodder rack, which is free standing or attached on to a tree. Colour: black.



541 Monument, memorial or statue

A monument or a statue is a three-dimensional work of art. Very large monuments, memorials or statues must be drawn to scale with the symbol building (526.1). Small monuments could be represented with the symbol cairn, memorial or boundary stone (537). Colour: black.



540 Special feature

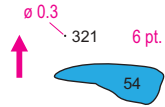
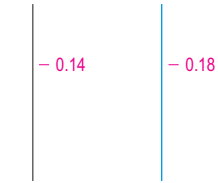
Special man-made feature. The definition of the symbol must be given in the legend. Colour: black.

Removed symbols compared with ISOM 2000

- Due to the larger scale, the following symbols of ISOM 2000 must be represented with new symbols:
- ♦ Motorway (501), major road (502), minor road (503), road (504) and vehicle track (505): must be represented with symbol paved area (529) and the symbol distinct paved area boundary (529.1).
 - ♦ Visible path junction (510) and indistinct junction (511): due to the larger scale, it has been removed.
 - ♦ Crossing point with bridge (513) must be represented with symbol footbridge (512.1).
 - ♦ Crossing point without bridge (514) must be represented by omitting the symbol paved area (529).
 - ♦ Power line (516) must be represented with symbol major power line (517).
 - ♦ Stone wall (519) must be represented with symbol passable wall (519.1).
 - ♦ Ruined stone wall (520) must be represented with symbol passable wall (519.1).
 - ♦ High stone wall (521) must be represented with symbol impassable wall (521.1).
 - ♦ Ruined fence (523) must be represented with symbol fence or railing (522).
 - ♦ Ruin (530) must be represented with symbol passable wall (519.1).
 - ♦ Firing Range (531) has been removed.
 - ♦ Grave (532) must be represented with symbol special man made feature (540).
 - ♦ High tower (535) must be represented with the symbol building (526) or tower (536.1).

6.6 TECHNICAL SYMBOLS

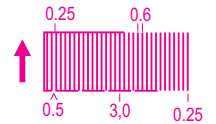
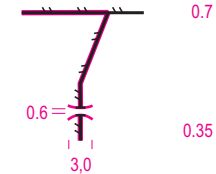
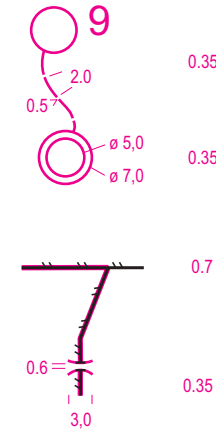
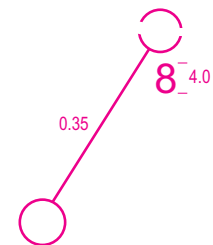
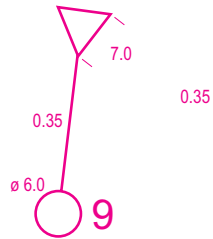
- 601 Magnetic north line**
Magnetic north lines are lines placed on the map pointing to magnetic north. Their spacing on the map should be 30 mm which represents 150 m on the ground at the scale of 1:5 000 or 37.5 mm which represents 150 m on the ground at the scale of 1:4 000. North lines may be broken where they obscure small features such as boulders, knolls, cliffs, stream junctions, path ends, etc. In areas with very few water features, blue lines may be used.
Colour: black (blue).
- 602 Registration marks**
At least three registration marks must be placed within the frame of a map in a non-symmetrical position. In addition, a colour check should also be possible.
Colour: all printed colours.
- 603 Spot height**
Spot heights are used for the rough assessment of height differences. The height is given to the nearest metre. The figures are orientated to the north. Water levels are given without the dot.
Colour: black.



6.7 OVERPRINTING SYMBOLS

Courses should be overprinted at least for elite classes. For other classes they can be drawn by hand.
The size of overprinting symbols is given for both 1:4 000 and 1:5 000 maps.

- 701 Start**
The start or map issue point (if not at the start) is shown by an equilateral triangle which points in the direction of the first control. The centre of the triangle shows the precise position of the start point.
Colour: purple.
- 702 Control point**
The control points are shown with circles. The centre of the circle shows the precise position of the feature. Sections of circles should be omitted to leave important detail showing.
Colour: purple.
- 703 Control number**
The number of the control is placed close to the control point circle in such a way that it does not obscure important detail. The numbers are orientated to north.
Colour: purple.
- 704 Line**
Where controls are to be visited in order, the start, control points and finish are joined together by straight lines. Sections of lines should be omitted to leave important detail showing.
Colour: purple.



705 Marked route
A marked route is shown on the map with a dashed line.
Colour: purple.

706 Finish
The finish is shown by two concentric circles.
Colour: purple.

707 Uncrossable boundary
A boundary which it is not permitted to cross.
Colour: purple.

708 Crossing point
A crossing point through or over a wall or fence, or across a road or railway or through a tunnel or an out-of-bounds area is drawn on the map with two lines curving outwards. If necessary the symbol can be drawn according to the plane shape (under-passes).
Colour: purple.

709 Out-of-bounds area
An out-of-bounds area is shown with vertical stripes. A bounding line may be drawn if there is no natural boundary, as follows:
- a solid line indicates that the boundary is marked continuously (tapes, etc.) on the ground,
- a dashed line indicates intermittent marking on the ground,
- no line indicates no marking on the ground.
Colour: purple.

710 Dangerous area
An area presenting danger to the competitor is shown with cross-hatched diagonal lines.
Colour: purple.

711 Forbidden route
A route which is out-of-bounds is shown with crosses.
Colour: purple.

712 First aid post
The location of a first aid post.
Colour: purple.

713 Refreshment point
The location of a refreshment point which is not at a control.
Colour: purple.

APPENDIX

7 Arguments for the choice of scale 1:4 000 or 1:5 000

In cartography, the following factors are important in choosing the scale:

- ◆ Relationship between the required area (see 7.1) and a handy map format (see 7.2);
- ◆ Minimum optical minimum dimension (resolution of the human eye), (see 7.3);
- ◆ Minimum content dimension (the minimum size of features, which substantially serve orientation and navigation, (see Map Content);
- ◆ Accuracy of the mapping and precision of the printing process.

7.1 Size of area required for Sprint Orienteering

The winning time for an International Sprint Orienteering Event should not exceed 12-15 min. The corresponding running distances are between 2.5 km and 4.0 km. Therefore a maximum area of 3.0 km² is needed (see Fig. 1). In order to offer the spectators an attractive Sprint Orienteering event, the course could have loops or crossing legs. Therefore, in most cases an area of 0.5 km² to 1.0 km² is sufficient.

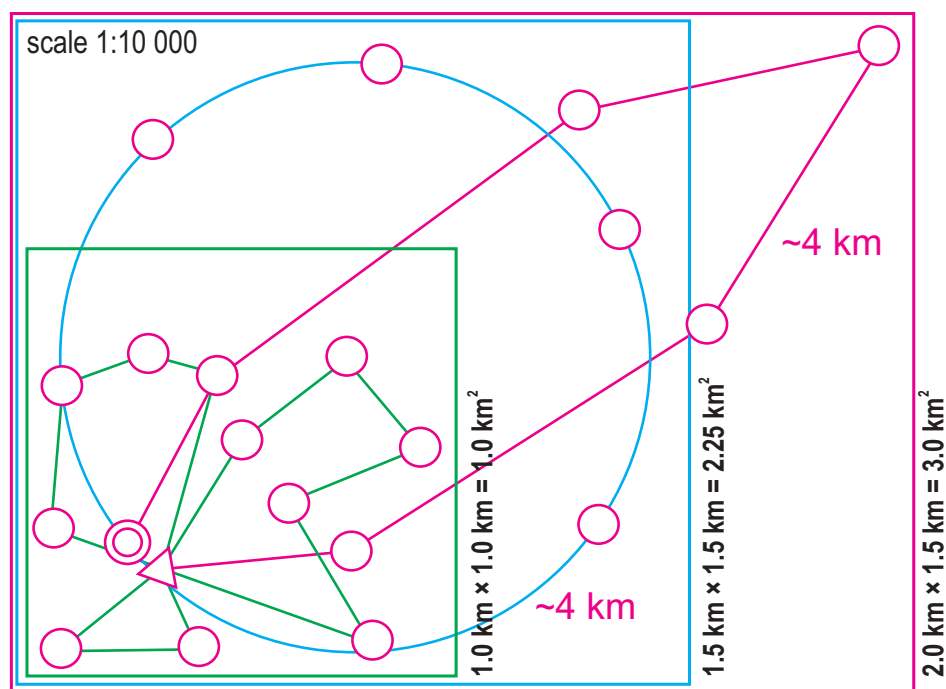


Fig. 1: Maximum area for a Sprint Orienteering of 4 km length.

7.2 Format of the map

7.2.1 Map folding

A map format should not be too large, because otherwise the competitor will have to fold it too many times. Already a DIN A4-format means you will have to fold a map once or twice. Thus, a map format larger than A4 should be avoided. In any case, the map should not be larger than DIN A3. The A4 format is handy and therefore reasonable for Sprint Orienteering.

7.2.2 Advertising and Sponsor labels

A map should not be cluttered with advertising or sponsor labels for the period of the competition. Too many labels lead to very large maps and avert the concentration of the runners. Therefore, maps without any advertising or sponsor labels should be given to the runners during the competition. After the competition, the maps can be collected and replaced with maps with advertising and sponsor labels, to fulfil the demands of the advertising and sponsor companies.

7.2.3 Essential Map Information

Only very important map information like scale, contour interval, date of mapping, map title, indication of magnetic north, as well as a description of the controls (clue sheet) may be put on a map. The space for labels should not exceed 200 cm². Hence, the following cutouts are left for the area of a Sprint Orienteering:

$$\text{DIN A4 (21x30) minus map inscription (6 x 30 cm)} = 450 \text{ cm}^2$$

$$\text{DIN A3 (41x30) minus map inscription (6 x 30 cm)} = 1050 \text{ cm}^2$$

The optimal scale for Sprint Orienteering depends on two constraints: the "required area for Sprint Orienteering"; and "the coverage of DIN formats". The required area for Sprint Orienteering is between 0.5 km² and 1 km² (see 7.1). The map format should not be much larger than A4, so cutout of 450 cm² is necessary for the area (see 7.2). A scale of 1:3 000 and larger would lead to large formats rapidly. Hence, the recommended scale should be 1:4 000 or 1:5 000 (see table 1).

Table 1: An optimal scale depends on the required area for a Sprint Orienteering and DIN formats.

Required area for a Sprint Orienteering		0.25 km ²	0.5 km ²	0.75 km ²	1.0 km ²	1.25 km ²	1.5 km ²
	A4 = 450 cm ²	A3 = 1050 cm ²					
1:2000	0.18 km ²	0.65 km ²	A3	A3	A2	> A2	> A2
1:2500	0.42 km ²	0.95 km ²	A4	A3	A2	A2	> A2
1:3000	0.28 km ²	0.72 km ²	A4	A4	A3	A3	A2
1:4000	0.40 km ²	1.68 km ²	A4	A4	A4	A4	A3
1:5000	1.1 km ²	2.62 km ²	A4	A4	A4	A4	A3

7.3 Minimum optical minimum for Sprint Orienteering maps

The human eye recognizes fine lines of approximately 0.04 mm under good lighting conditions. Orienteering maps should be readable at high running speeds and under bad lighting conditions as well. Therefore, the minimum optical dimensions for Orienteering maps must be set higher than the resolving power of the eye permits. In addition, it is not meaningful to provoke the refinement of the map features to the limit of the visible and printable:

- ♦ Important features must be clearly and rapidly recognizable and not just noticeably;
- ♦ Form differences must be clearly recognizable;
- ♦ Weak lighting and bright print colours reduce the contrast;
- ♦ Best reproduction and printing-technologies are not always available or can be uneconomic.

Therefore, the minimum optical dimensions for Sprint Orienteering maps, presented in table 2, must be kept strictly. The proposed minimum dimensions for line widths and symbols, depend on experiences of topographic maps and Orienteering maps (see ISOM 2000).

Table 2: Optical minimum dimension for symbols of Sprint Orienteering maps

	Scale	1:5000	1:4000	1:3000	1:2500	1:2000
	Size in reality					
Map symbol	mm	m	m	m	m	m
Solid line	0.10	0.5	0.4	0.3	0.3	0.2
Gap between two fine lines	0.25	1.9	1.0	0.8	0.6	0.5
Squares	0.30	1.5	1.2	0.9	0.8	0.6
Circles	0.30	1.5	1.2	0.9	0.8	0.6
Dots	0.15	0.8	0.6	0.5	0.4	0.3
Triangles	1.00	5.0	4.0	3.0	2.5	2.0
Dotted lines	0.10	0.5	0.4	0.3	0.3	0.2
	mm ²	m ²	m ²	m ²	m ²	m ²
Colour mosaics	1.00	25	16	9	6.25	4

Table 3: Content minimum dimension for features of Sprint Orienteering maps

Content minimum dimension	1:5000	1:4000	1:3000	1:2500	1:2000
	mm	mm	mm	mm	mm
1 m	0.2	0.25	0.3	0.4	0.5
2 m	0.4	0.5	0.7	0.8	1.0
3 m	0.6	0.8	1.0	1.2	1.5

The content minimum dimension of 2 m × 2m (see map content) could be represented in scale up to 1:5 000 with 0.4 mm and in scale 1:4 000 with 0.5 mm. These dimensions are above the optical minimum dimension for a square and a circle (0.3 mm). Gaps of 1.875 m are represented in scale 1:5 000 m with a gap of 0.25 mm. However, the refinement of urban areas will probably exhaust the limit of visibility and print-techniques in scale 1:5 000, if the best reproduction and printing-technologies are not available.

7.4 Conclusion

So far scales 1:5 000 dominates in Orienteering maps in urban areas. Despite maps in scale 1:5 000, maps have been published in scales 1:3 000, 1:2 500, 1:2'000.

In urban areas, with their numerous crossings, house corners and other outstanding features, a quick calibration of the so called "distance feeling" is much easier than in a dense forest. Therefore, a restriction of the scales to a common scale is probably not so important as it is for orienteering in the forest. Nevertheless, it would be desirable to have a general scale for Sprint Orienteering maps.

Due to the size for of area required for Sprint Orienteering, the preferred map format (not much larger than DIN A4) as well as the optical and content minimum dimensions, Sprint Orienteering maps could be produced in scale 1:5 000 with the greatest possible area cutout. However, it is not meaningful to provoke the refinement of the map features to the border of the visible and printable, therefore a scale of 1:4000 is probably optimal.

7.5 Contour interval

Good selection of the contour interval is very important. The contour interval depends on the type of terrain, the scale and the line width. In general, the smallest possible contour interval is selected, as it leads to a more accurate and more detailed reproduction of the shape and generates a more three-dimensional image. On the other hand, the smaller the contour interval, the more crowded and difficult the map is to read. Thus, it is necessary to consider the advantages and disadvantages carefully with respect to one another. The contour line values should be simple numbers, easily added and easily divisible. They should also produce simple numerical values when grouped in fours or fives (index contour lines) or when halved or quartered (intermediate form lines), etc.

We can approach the question of the most suitable interval from two directions: either by calculation, where certain limits of slope angles are assumed, or derived empirically. Unfortunately, empirical experiences are often missing. Therefore, we have to approach the most suitable scale by calculation.

Table 4: Contour interval depends on the type of terrain and scale, according to Imhof (1965)

Scale	Maximum slope angle				Flat terrain	Hilly terrain
	a=5°	a=10°	a=15°	a=20°	a=5-10°	a=10-20°
	m	m	m	m	m	m
1:2'000	0.27	0.53	0.81	1.10	0.5	1.0
1:2'500	0.32	0.64	0.97	1.31	0.5	1.0
1:3'000	0.36	0.73	1.11	1.51	1.0	1.5
1:4'000	0.45	0.91	1.38	1.88	1.0	2.0
1:5'000	0.53	1.08	1.63	2.22	1.0	2.0
1:10'000	0.88	1.78	2.70	3.67	2.0	2.5
1:15'000	1.17	2.36	3.59	4.87	2.5	5.0

In case of doubt, it is better to round off the interval value and, in level terrain, to introduce intermediate contours freely, rather than overload a whole map through a contour interval which is too small.

According to the calculations in table 4 for scale 1:4 000 and 1:5 000 the recommended contour interval value for flat terrain (max. slope angle of 5-10%) is 1 m, for hilly terrain (max. slope angle of 10-20%) is 2 m.