



International Specification for Sprint Orienteering Maps (ISSOM)

Final draft 2004



**IOF Map Commission
2004**

Version date: 24 April 2004

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 WOC2004.

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, small earth wall (108) in the ISOM2000 has been kept in the ISSOM, but the graphics implementation of 108.1 in the ISSOM is the same as the graphics implementation for 107 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).

Budapest, 24 April 2004

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1 INTRODUCTION

Sprint Orienteering differs from the longer established forms of foot orienteering in that sprint events can be staged in park and urban areas, as well as in forested terrain. The use of park and urban areas has a significant advantage; it brings the sport into the midst of people and offers opportunities for increasing public and media awareness of orienteering, in accordance with the objectives of the Leibnitz Convention. The use of urban areas presents new challenges for the mappers. The international specification for orienteering maps (ISOM) contains symbols for man-made features which form a base for representing an urban area. However, they need revision and extension in order to provide the clear and unambiguous interpretation of urban terrain required for fair competition in sprint orienteering.

There are a number of reasons why the mapping of urban areas requires a modified approach compared to that used for the depiction of the 'classic' forested terrain. These include:

- The level of detail in urban areas, particularly in the centre of old towns, is often much greater than in a forest;
- Many more restrictions affecting route choice have to be considered in urban areas, such as areas and boundaries with forbidden access;
- 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 1:4000 - 1:5000.

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 identify which features in urban areas are significant for the runners; those that are important for navigation and those that will reduce the runnability. Waste baskets, fire-hydrants, parking meters, individual posts light poles, etc certainly do not fall into this category. They have a very small aspect. A single bench seat does not represent a significant obstacle either and these objects could clutter a map without significant advantages to the runners. However, these features might serve orientation or navigation especially in areas where there are no other features.

In urban areas, passages, gaps in walls, fences and hedges and other openings are very important. From a cartographical point 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 set, which should not lead to overcrowded maps.

Runners tend to take every legitimate opportunity to take a short cut to save time, even if this means jumping down a dangerously high retaining wall, however inadvisable this might be. Therefore passable openings and boundaries forbidden to cross must be clearly represented on a map.

Generally object smaller than 2 x 2 m shall not be mapped unless they are very prominent.

3 BASIC ELEMENTS

3.1 Scale and contour interval

Both scales, 1:4 000 or 1:5 000 may be used. Scale 1:4 000 is suitable 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 2.5m for both 1:4 000 and 1:5 000.

Arguments for the choice of scale are shown in the Appendix.

3.2 Format of the map

The map format should not exceed DIN A4.

Arguments for the map format are shown in the Appendix.

3.3 Colour Concept

The 7-color concept of ISOM2000 will also be adopted for Sprint Orienteering maps. 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 terrain, forested, open, park, urban, or any combination of these. The winning time should not exceed 12 -15 minutes.

The major challenge of Sprint Orienteering, from a mapping 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 (forbidden to pass) surrounding walls and fences.
- Other human activities in urban areas like spectators 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 non-urban areas like forests. Areas with forbidden access, walls or fences which cannot be crossed, 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 an 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 a 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 accurately as possible and to draw a legible map.

The course planner is responsible for planning 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, whilst others are not able to pass it, due to 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.

4.3 Restrictions to the competition area for Sprint Orienteering

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

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

4.3.2 Safety

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

The organiser should consider the following measures:

- Halting of traffic (closing of roads)
- Restricting traffic (controlled by policemen)
- Separate competitors from pedestrians and spectators by the use of a cordon (tapes) or barriers in crowded areas.

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

4.4 Restriction for course setting

The course setter should not encourage unfair actions from 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, (e.g. impassable walls and fences), then they have to be marked in the terrain.

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 widths have the same quality as printing with spot colours and the durability and the water resistance of the paper and colours is good enough.

Legibility depends on the correct choice of colours and paper.

To improve the legibility one should use the highest screen frequency for dot screens that is available and technically feasible (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	1. yellow
Brown	471	2. green
Yellow	136	3. grey
Blue	299	4. brown
Green	361	5. blue
Grey	428	6. black
Violet	Purple	7. purple

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 ISOM2000 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

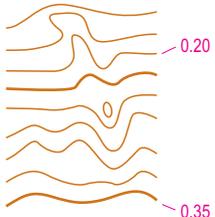
Colour	PMS number
Black	black
Brown	471
Yellow	136
Blue	299
Green	361
Grey	428
Purple	purple (magenta)

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. The smallest bend in a contour is 0.4 mm from centre to centre of the lines.

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. Where an index contour coincides with an area of much detail, it may be shown with a normal contour line.

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 may be drawn on the lower side of a contour line, e.g. along the line of a reentrant or in a depression. 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.

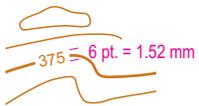
Colour: brown.



105 Contour value

Contour values may be included to aid assessment of large height differences. The figures shall 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.

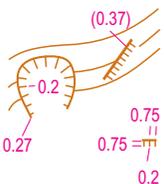
Colour: brown.



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).

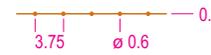
Colour: brown.



7

108.1 Small earth wall

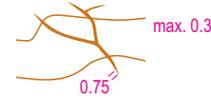
A small distinct earth wall, usually man made. The minimum height is 0.5 m. Due to the large scale, earth walls should be represented with the symbols contour line (101), form line (103) or earth bank (106).
Colour: brown.



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 end of the line is pointed. Minimum depth is 1 m. Minimum length is 3 mm on the map.

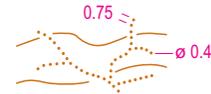
Colour: brown.



110 Small erosion gully

A small erosion gully or trench. 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 height of the knoll should be a minimum of 1 m from the surrounding ground.

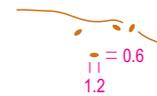
Colour: brown.



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 should be a minimum of 1 m from the surrounding ground. Knolls larger than this must be shown by contours. The symbol may not be drawn in free form or such that two elongated knoll symbols overlap. The symbol may not touch a contour line.

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 should be 2 m. The minimum depth from the surrounding ground should be 1 m. Location is at the centre of gravity of the symbol, which is orientated to north.

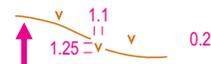
Colour: brown.



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 shall be 1 m. Location is at the centre of gravity of the symbol, which is orientated to north.

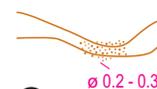
Colour: brown.



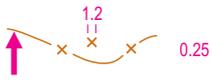
117 Broken ground

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.



8



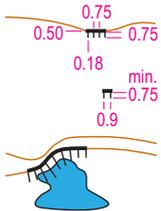
118 Prominent landform feature

This symbol can be used for a prominent small landform feature. The definition of the symbol must be given in the map legend.
Colour: brown.

Removed symbols compared with ISOM2000

- ♦ 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 small earth wall (108.1).
- ♦ Knoll (111): covered by symbol contour line (101).
- ♦ Depression (114): covered by symbol contour line (101) and slope line (104).

6.2 ROCK AND BOULDERS



201 Impassable cliff (forbidden to pass)

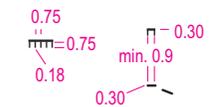
An impassable cliff, quarry or earth bank (see 106). Tags are drawn downwards, showing its full extent from the top line to the foot. For vertical rock faces the tags may be omitted if space is short, e.g. narrow passages between cliffs (the passage should be drawn with a width of at least 0.3 mm). The tags may extend over an area symbol representing detail immediately below the rock face. When a rock face drops straight into water making it impossible to pass under the cliff along the water's edge, the bank line is omitted or the tags should clearly extend over the bank line. 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.**



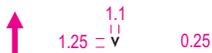
202 Gigantic boulder or rock pillar

A gigantic boulder, rock pillar or massive cliff must be represented in plane shape without tags.
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. Minimum height is 1 m. For passable rock faces shown without tags the end of the line may be rounded to improve legibility.
Colour: black.



204 Rocky pit

A rocky pit, hole or mineshaft which may constitute a danger to the runner. Location is at the centre of gravity of the symbol, which is orientated to north.
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 generally not be used in urban areas. The centre of gravity of the symbol marks the opening.
Colour: black.

Controls may not be placed inside caves!



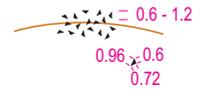
206 Boulder

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 be 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 ISOM2000

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

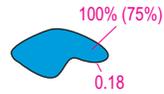
6.3 WATER AND MARSH



0.25

303 Waterhole

A water-filled pit or an area which is too small to be shown to scale. Location is the centre of the symbol, which is orientated to north.
Colour: blue.



100% (75%)

0.18

304.1 Impassable body of water (forbidden to pass)

An area of deep water such as a sea, lake, pond, river or fountain 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. The minimum dimension is 1 mm².

Colour: blue 100% or 75% (min. 60 lines/cm), black.

It is forbidden to pass an impassable body of water!

Competitors violating this rule will be disqualified.



30%

0.18

305.1 Passable body of water

An area of shallow water such as a pond, river or fountain that can be passed. The body of water must be less than 0.5 m deep and runnable. If the body of water is not runnable it must be represented with the symbol impassable body of water (304.1).

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



0.20

306 Passable small watercourse

A crossable watercourse (including a major drainage ditch) less than 2 m wide.
Colour: blue.

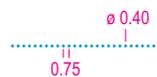


0.20

0.37 1.87

307 Minor watercourse

A natural or man-made minor watercourse which may contain water only intermittently.
Colour: blue.

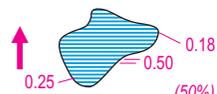


ø 0.40

0.75

308 Narrow marsh

A marsh or trickle which is too narrow to be shown with symbol 310.
Colour: blue.



0.25

0.18

0.50

(50%)

309 Impassable marsh (forbidden to pass)

A marsh which is impassable or which may constitute a danger to the runner.
Colour: blue, black.

It is forbidden to pass an impassable marsh!

Competitors violating this rule will be disqualified.



0.30

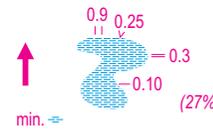
(33%)

0.10

min. 0.5

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.



min.

0.9 0.25

0.3

0.10

(27%)

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.



1.2

0.25

312 Small fountain or well

Small well or fountain, which is at least 1 m high or at least 1 m in diameter.
Colour: blue.



1.2

0.25

313 Spring

The source of a stream with a distinct outflow. This symbol should generally not be used in urban areas. Location is at the centre of gravity of the symbol, which is oriented to open downstream.
Colour: blue.



1.2

0.25

314 Prominent water feature

A small water feature which is very significant or prominent. The definition of the symbol must always be given in the map legend.
Colour: blue.

Removed symbols compared with ISOM2000

Due to the larger scale, the following symbols of ISOM2000 must be represented with new symbols:

- ◆ Lake (301): must be represented with the symbol impassable body of water (304.1) or passable body of water (305.1).
- ◆ Pond (302): must be represented with the symbol impassable body of water (304.1) or passable body of water (305.1).
- ◆ Uncrossable river (304): must be represented with the symbol impassable body of water (304.1).
- ◆ Crossable watercourse (305): must be represented with the symbol passable body of water (305.1).

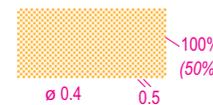
6.4 VEGETATION



100%

401 Open land

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



100%

(50%)

ø 0.4

0.5

402 Open land with scattered trees

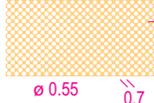
An area of meadows with scattered trees or bushes, with grass or similar ground cover offering very good runnability. Individual trees (418, 419) may be added.
Colour: yellow (20 lines/cm).

403 Rough open land
 Areas of heath or moorland, felled areas, newly planted areas (trees lower than ca. 1 m) or other generally open land with rough ground vegetation, i.e. heather or tall grass. This symbol 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).



50%

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).

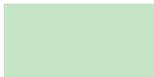


70% (36%)
 ø 0.55 0.7

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.

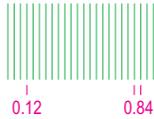


406 Forest: slow running
 An area with dense trees (low visibility) which reduces running to ca. 60-80% of normal speed.
 Colour: green 30% (min. 60 lines/cm).



30%

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.



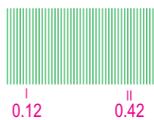
(14%)
 0.12 0.84

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



60%

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.



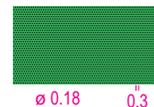
(29%)
 0.12 0.42

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%.



min. 0.25

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 violating this rule will be disqualified.



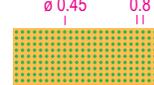
0.3
 ø 0.18 0.3

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.



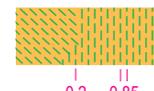
1.5 0.4

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



ø 0.45 0.8

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.



1.3 0.6
 0.2 0.85

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.



0.07

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).



ø 0.2 0.8

416 Distinct vegetation boundary
 A distinct forest edge or very distinct vegetation boundary within the forest. For indistinct boundaries, the area edges are shown only by the change in colour and/or dot screen.
 Colour: black.



ø 0.25
 0.6

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



1.2 = ○ 0.25

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



ø 0.75



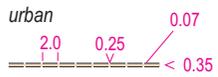
420 Prominent vegetation features

A special vegetation feature. The definition of the symbol must always be given in the map legend.
Colour: green.

Removed symbols compared with ISOM2000

- ◆ Distinct vegetation boundary (417): this is not a symbol.

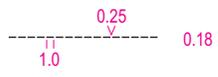
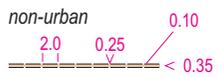
6.5 MAN-MADE FEATURES



506.1 Unpaved footpath or track

An unpaved footpath or rough vehicle track is a way for passing mainly by foot, without a smooth, hard surface. The density of the brown fill-in shall be the same as the density chosen for paved area (529.1).

To improve the legibility of this symbol in non-urban parts of the map, the line width shall, in the non-urban parts of the map, be increased from 0.07 mm to 0.10 mm, and the brown fill-in shall, in the non-urban parts of the map, be drawn darker, so that if (x)% brown is used in urban parts of the map, (x+10)% brown shall be used in the non-urban parts of the map.
Colour: black, brown 15-30% (min. 60 lines/cm).



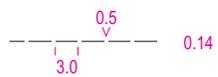
507 Small unpaved footpath or track

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



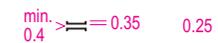
508 Less distinct small path

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



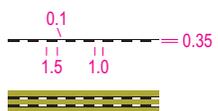
509 Narrow ride

A distinct ride is a linear break in the forest (usually in a plantation), which does not have a distinct path along it. Where there is a path along a ride, the symbol small unpaved footpath or track (506.1) shall be used. Not to be used in urban areas.
Colour: black.



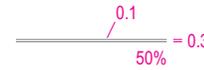
512.1 Footbridge

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



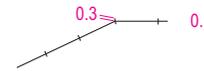
515.1 Railway

A railway is a permanent track laid with rails on which locomotives, carriages or wagons can travel. If it is forbidden to pass or run along the railroad, the forbidden area around the railway must be represented with symbol area with forbidden access (528.1).
Colour: black.



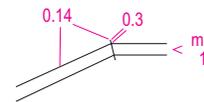
515.2 Tramway

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%.



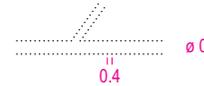
516 Power line, cableway or skilift

Power line, cableway or skilift. The bars indicate the exact location of the pylons.
Colour: black.



517 Major power line

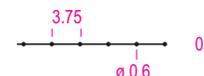
Major power lines should be drawn with a double line. The gap between the lines may indicate the extent of the powerline. Very large carrying masts, mostly complex poles, must be represented in plane shape. In this case, the cable lines can be left out (the map shows only the pylons).
Colour: black.



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 for instance a railroad or road.
Colour: black.

If underpasses or tunnels etc. must be used in competition, they must be emphasized with the symbol 708 overprint!



519 Passable stone wall

A stone wall or stone faced bank. This symbol shall be used only in non-urban areas. If such a wall is higher than 2 m, it must be represented with the symbol impassable wall (521.1).
Colour: black.



519.1 Passable wall

A passable wall is a construction made of stone, brick, concrete etc., which can be passed. This symbol is suitable for urban areas. 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 barrier. It shall 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.

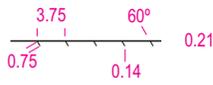
**It is forbidden to pass an impassable wall!
Competitors violating this rule will be disqualified.**

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.



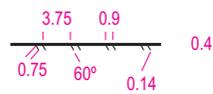
524 Impassable fence or railing (forbidden to pass)

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

Colour: black.

It is forbidden to pass an impassable fence or railing!

Competitors violating this rule will be disqualified.

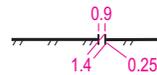


525 Crossing point

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 be passed by competitors, shall not be represented on the map and must be closed during the competition.

Colour: black.

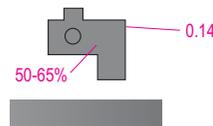


526.1 Building

A building is a relatively permanent construction having a roof.

Buildings within areas with forbidden access (527.1) may just be represented in a simplified manner. An area totally contained within a building shall be mapped as being a part of the building.

Colour: black, black 50-65%.

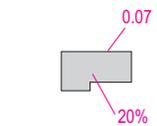


526.2 Canopy

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

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

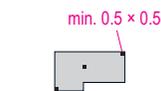
Colour: black, black 20%.



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.

Colour: black.



527.1 Area with forbidden access (forbidden to pass)

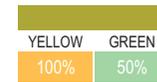
An area with forbidden access such as a private area, a flower bed, a railway area etc. No feature shall be represented in this area, except very prominent features such as railways, large buildings, or very large trees.

Areas with forbidden access totally contained within buildings shall be mapped as being a part of the building.

Colour: yellow 100%, green 50%.

It is forbidden to pass an area with forbidden access!

Competitor violating this rule will be disqualified.

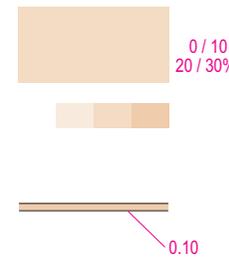


529 Paved area

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 paved areas (529.1), if they are important for navigation and orientation.

Where a paved footpath or track goes through a non-urban part of the map, the brown fill-in shall be drawn darker, so that if (x)% brown is used in urban parts of the map, (x+10)% brown shall be used in the non-urban parts of the map, and the thickness of the black outline of the symbol (529.1) shall be increased from 0.07 to 0.10 mm.

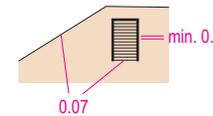
Colour: brown 0 / 10 / 20 / 30% (min. 60 lines/cm).



529.1 Step or edge of paved areas

A step or an edge of a pavement. Steps of a stairway must be represented in generalized manner. Borders of pavements are generally not represented. However, if they may help 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.



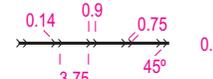
534 Impassable pipeline (forbidden to pass)

A pipeline (gas, water, oil, etc.) above ground level which cannot be passed over or under. It shall not be passed, due to forbidden access or because it may constitute a danger to the competitor because of its height.

Colour: black.

It is forbidden to pass an impassable pipeline!

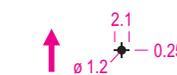
Competitors violating this rule will be disqualified.



535 High tower

A high tower or large pylon, standing above the level of the surrounding area. Very large towers must be represented in plane shape with the building symbol (526.1). Location is at the centre of gravity of the symbol, which is orientated to north.

Colour: black.

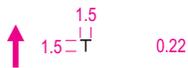


6.6 TECHNICAL SYMBOLS

536 Small tower

An obvious platform or seat, or small tower. Location is at the centre of gravity of the symbol, which is orientated to north.

Colour: black.

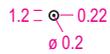


0.22

537 Cairn, memorial, small monument or boundary stone

Cairn, memorial, small monument or boundary stone more than 0.5 m high. Large monuments must be represented in plane shape with the building symbol (526.1).

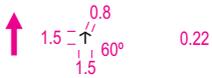
Colour: black.



538 Fodder rack

A fodder rack, which is free standing or attached to a tree. Location is at the centre of gravity of the symbol, which is orientated to north.

Colour: black.



0.22

539 Prominent man-made feature

A prominent man-made feature. The definition of the symbol must always be given in the map legend.

Colour: black.

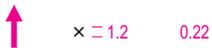


0.22

540 Prominent man-made feature

A prominent man-made feature. The definition of the symbol must always be given in the map legend.

Colour: black.



0.22

Removed symbols compared with ISOM2000

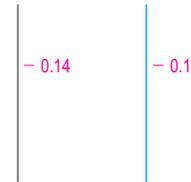
Due to the larger scale, the following symbols of ISOM2000 must be represented with new symbols:

- ♦ 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 step or edge of paved areas (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).
- ♦ Ruined stone wall (520) must be represented with symbol passable wall (519.1).
- ♦ Ruined fence (523) must be represented with symbol fence or railing (522).
- ♦ Settlement (527) has been removed. Settlements that are out of bounds must be represented with symbol area with forbidden access (528.1).
- ♦ 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).

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.

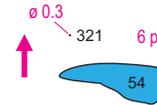


0.1

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.



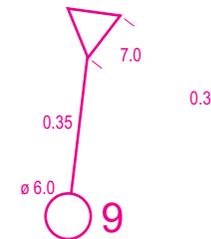
6.7 OVERPRINTING SYMBOLS

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.

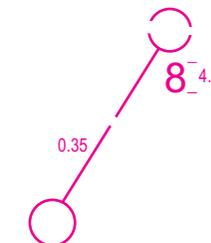


0.35

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.



0.35

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.

APPENDIX

7 Arguments for scale 1:4000 or 1:5000

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 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.

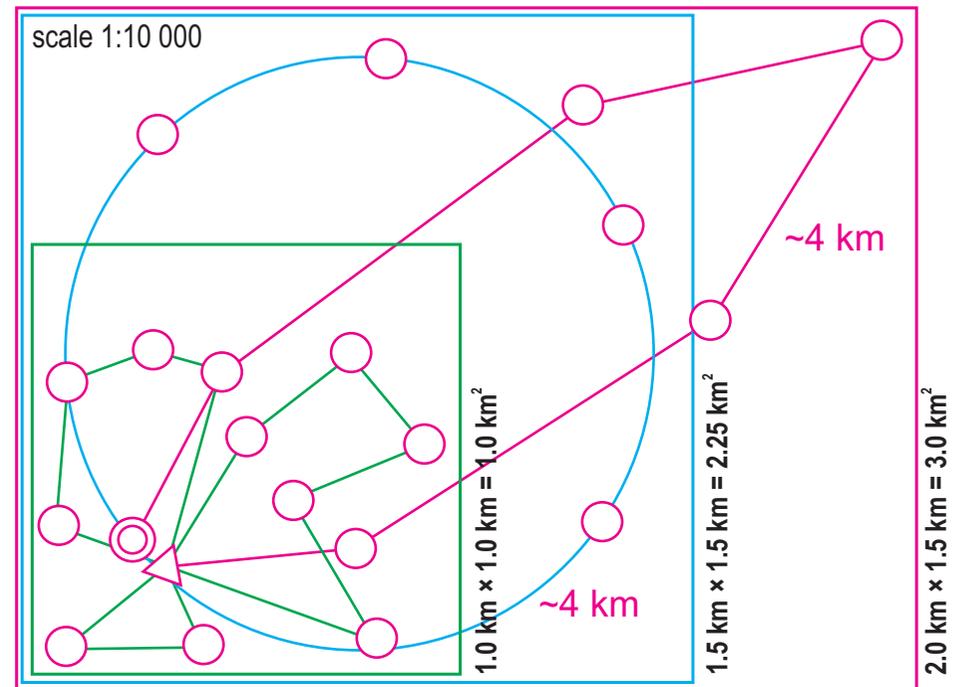
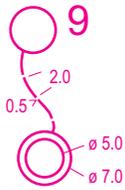
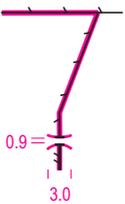


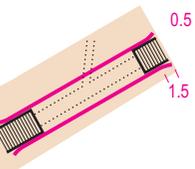
Fig. 1: Maximum area for a Sprint Orienteering of 4 km length.



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



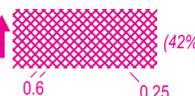
706 Finish
The finish is shown by two concentric circles.
0.35 Colour: purple.



707 Uncrossable boundary
A boundary which it is not permitted to cross. Uncrossable boundaries shall be mapped using the ordinary symbols: impassable wall (521.1), impassable fence or railing (524) or impassable pipeline (534). These symbols shall not be overprinted with uncrossable boundary (707). This symbol is to be used only for last minute updates to the competition area, as excessive use of purple for indicating barriers is unfortunate.
0.7 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.
0.35 Colour: purple.



708.1 Crossing section
A crossing section through or over a building, wall or fence, or across a road or railway or through a tunnel or an out-of-bounds area is drawn on the map as a linear object, according to the plane shape (underpasses).
0.5 Colour: purple.



709 Temporarily out-of-bounds area
Out of bounds areas are mapped with the symbol area with forbidden access (528.1). This symbol shall only be used for last minute updates to the competition map. A temporarily out-of-bounds area is shown with vertical stripes.
(42%) Colour: purple.



710 Dangerous area
An area presenting danger to the competitor is shown with cross-hatched diagonal lines.
(42%) Colour: purple.
It is forbidden to enter a dangerous area!
Competitor violating this rule will be disqualified.



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



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



714 Temporary constructions
Obvious temporary constructions like platforms for spectators and speaker should be represented in plane shape.
50% Colour: purple.
It is forbidden to enter a temporary construction!
Competitors violating this rule will be disqualified.

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 such as 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:

DIN A4 (21x30) minus map inscription (6 x 30 cm) = 450 cm²
 DIN A3 (41x30) minus map inscription (6 x 30 cm) = 1050 cm²

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	> A2
1:2500	0.42 km ²	0.95 km ²	A4	A3	A2	A2	> A2	> A2
1:3000	0.28 km ²	0.72 km ²	A4	A4	A3	A3	A2	A2
1:4000	0.40 km ²	1.68 km ²	A4	A4	A4	A4	A3	A3
1:5000	1.1 km ²	2.62 km ²	A4	A4	A4	A4	A3	A3

7.3 Minimum Optical dimension for Sprint Orienteering maps

The human eye recognises 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 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 recognisable and not just noticeable;
- ◆ Form differences must be clearly recognisable;
- ◆ 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 adhered to strictly. The proposed minimum dimensions for line widths and symbols, depend on the experiences of topographic maps and Orienteering maps (see ISOM2000).

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				
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 x 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 1:5000 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 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.

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.

7.5 Conclusion

So far the 1:5 000 scale dominates in Orienteering maps of urban areas. Maps have also been published at scales of 1:3000, 1:2500 and 1:2000. 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 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 of the 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. The presented specification for Sprint Orienteering maps is optimized for the scale 1:4000. If a deviation from this scale is necessary, the scale must be a scale simply and easily divisible (1:5000, 1:4000, 1:3000, 1, 2500, 1:2000) and the contour interval must be adapted accordingly.

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