

International Specification for Mountain Bike Orienteering Maps

1 INTRODUCTION

Orienteering is a worldwide sport. A common approach to the interpretation and drawing of orienteering maps is essential for fair competition and for the future growth of the sport.

It is the aim of the International Specification for Orienteering Maps (ISOM) to provide a map specification which can accommodate the many different types of terrain around the world and the many ways of doing orienteering. These specifications should be read in conjunction with the rules for International Orienteering Federation (IOF) orienteering events. For IOF events deviations are permissible only with the sanction of the IOF Map Committee (IOF MC). For other events such sanction must be given by the national federation. In addition, there are supplementary specifications for other orienteering disciplines on the basis of the specification for foot orienteering maps.

Maps for mountain bike orienteering are based on the specifications for foot-orienteering maps. However in order to meet the specific requirements put on the map by the nature of mountain bike orienteering, certain deviations and additions to the foot-orienteering map specification are needed. These special rules and symbols are described in this chapter.

2 GENERAL REQUIREMENTS

2.1 Orienteering and the map

Mountain bike orienteering is a sport in which the orienteer completes a course of control points in the shortest possible time, aided only by map, compass and bike. As in all forms of sport, it is necessary to ensure that the conditions of competition are the same for all competitors. The more accurate the map, the better this can be done, and the greater the opportunity for the course planner to set a good and fair course.

From the competitors' point of view, an accurate and legible map is a reliable guide for choice of route, and it enables them to navigate along a route chosen to suit their navigational skill and physical ability. However, skill in route choice loses all meaning if the map is not a true picture of the ground—if it is inaccurate, out-of-date or of poor legibility.

The path and track network shows where the going and navigation is easiest. A detailed classification of the degrees of hindrance or good going helps the competitor to make the right decisions. Orienteering is first of all to navigate by map reading. An accurate map is therefore necessary for a good and effective route choice. In the ideal case no competitor should gain an advantage or suffer a disadvantage because of faults on the map.

The aim of the course planner is a course where the deciding factor in the results will be navigational skill. This can be achieved only if the map is sufficiently accurate, complete and reliable, and is also clear and legible under competition conditions. The better the map the course planner has, the greater the chance he has of setting good, fair courses, whether for the elite or for the novice.

For the mapper, the task is knowing which features to map and how to represent them. A continuing involvement in the sport is important for a basic understanding of the requirements for the orienteering map: its content, the need for accuracy, the level of detail and above all the need for legibility.

2.2 Content

Mountain bike orienteering is a sport in which the bike-orienteer uses the map to navigate a track and path network in order to visit a number of control points. The competitor must always stay on the track and paths and is not allowed to cycle freely in the terrain. This rule is important for the requirements of the map.

Mountain bike orienteering takes place on the track and path network and involves as a basic element complex route choice problems, including the estimating of height differences. It is obvious that the map must concentrate on clearly depicting these features. The map must also be legible when cycling at high speed. This means that the map should omit a large number of details in "free" terrain in order to exaggerate the track and path network and to simplify the presentation of the shape of the ground. Only details that impact a) route choice and b) navigation and positioning, need be shown on the map.

A mountain bike orienteering map is a detailed topographic map. The map must contain the features which are obvious on the ground to a competitor at speed. It must show every feature which could influence map reading or route choice.

The map must show the features which are obvious on the ground and which are of value from the point of view of map reading. An attempt must be made when surveying to maintain the clarity and legibility of the map, i.e. the minimum dimensions designed for normal sight must not be forgotten when choosing the degree of generalization.

The map must contain magnetic north lines and may additionally contain some place names and peripheral text to help the competitor to orientate the map to north. This text should be written from west to east. Text within the map should be placed to avoid obscuring important features and the style of lettering should be simple.

The sides of the map should be parallel to the magnetic north lines. Arrowheads may be used to show magnetic north.

In order to accomplish fairness in route choice, additional symbols need to be introduced. These symbols describe the quality and width of the tracks and paths.

2.3 Accuracy

The general rule should be that competitors shall not perceive any inaccuracy in the map. The accuracy of the map as a whole depends upon the accuracy of measurement (position, height and shape) and the accuracy of drawing.

2.4 Generalization and legibility

Those features which are most essential for the runner in competition must be selected and presented on the orienteering map. To achieve this, in such a way that the map is legible and easy to interpret, cartographic generalization must be employed. There are two phases of generalization—selective generalization and graphic generalization.

Selective generalization is the decision as to which details and features should be presented on the map. Two important considerations contribute to this decision—the importance of the feature from the runners' point of view and its influence on the legibility of the map. These two considerations will sometimes be incompatible, but the demand for legibility must never be relaxed in order to present an excess of small details and features on the map. Therefore it will be necessary at the survey stage to adopt minimum sizes for many types of detail. However, consistency is one of the most important qualities of the orienteering map.

Graphic generalization can greatly affect the clarity of the map. Simplification, displacement and exaggeration are used to this end.

3 MAP SPECIFICATION FOR MOUNTAIN BIKE ORIENTEERING

3.1 Scale

The scale for a MTBO map is smaller than foot-o maps. Organisers are encouraged to use maps drawn specifically for MTBO at an appropriate scale which will normally be 1:10 000, 1:15 000 or 1:20 000.

Maps at 1:10 000 may be produced for sprint distance competitions.

1:15 000 and 1:20 000 scales are suitable for relay, middle and long distance events. The dimension of the symbols are the same in every scale.

For practical reasons a map should not be larger than is necessary for the orienteering competition. Maps larger than A3 should be avoided.

3.2 Contour interval

The contour interval for mountain bike orienteering maps is 5 m. In very hilly terrain an interval of 10 m, a flat terrain an interval of 2.5 m may be used. Note: The same interval must be used all over the map!

3.3 Printing and reproduction

Even though new printing methods, like digital offset, colour copying etc. is developing rapidly, traditional offset is still superior in quality when printing detailed maps. For IOF events such as World Championships and World Cup this is the recommended method. However, if alternative methods produces maps with the same quality as traditional spot colour offset printing, they will be accepted.

For smaller competitions, maps are likely to be reproduced in relatively small quantities and for this the new and cheaper printing methods are well suited.

4 EXPLANATION OF SYMBOLS (MTBO)

Definitions of map features and specifications for the drawing of symbols are given in the following sections.

The dimension of the symbols are the same in every scale.

Symbols are classified into 7 categories:

Land forms	(brown)
Rock and boulders	(black+grey)
Water and marsh	(blue)
Vegetation	(green+yellow)
Man-made features	(black)
Technical symbols	(black+blue)
Course symbols	(purple)

Note: dimensions are specified in mm at the real map scale.

All drawings are in double scale for clarity only.

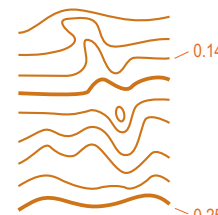
<	gap or infill between two lines
—	line thickness
—	distance from centre to centre or length of line
⊘	diameter
↑	symbol orientated to north

4.1 Land forms

The shape of land is shown by means of contours. This is complemented in black by the symbols for rock and cliffs. Orienteering terrain is normally best represented with a 5 m contour interval.

In order to maintain legibility of the map with scales down to 1:20 000, when cycling at high speed the contour lines may be more generalised in comparison to foot-o maps

The relative height difference between neighbouring features must be represented on the map as accurately as possible. Absolute height accuracy is of less importance. It is permissible to alter the height of a contour slightly if this will improve the representation of a feature. This deviation should not exceed 25% of the contour interval and attention must be paid to neighbouring features.



101 Contour

A line joining points of equal height. The standard vertical interval between contours is 5 metres. The smallest bend in a contour is 0.25 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.



104 Slope line

Slope lines may be drawn on the lower side of a contour line, e.g. along the line of a re-entrant or in a depression. They are used only where it is necessary to clarify the direction of slope.

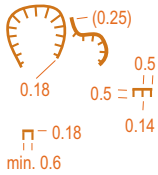
Colour: brown.



105 Contour value

Contour values may be included to aid assessment of large height differences. They are inserted in the index contours in positions where other detail is not obscured. The figures should be orientated so that the top of the figure is on the higher side of the contour.

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, road 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 should be drawn with symbol 201 (impassable cliff). The line width of very high earth banks may be 0.25 mm. Colour: brown.



109 Erosion gully

An erosion gully or trench which is too small to be shown by symbol 106 is shown by a single line. The line width reflects the size of the gully. Minimum depth 1 m. The end of the line is pointed. Colour: brown.



111 Knoll

Knolls are shown with contour lines. A prominent knoll falling between contour lines may still be represented by a contour line if the deviation from the actual contour level is less than 25%. Colour: brown.



114 Depression

Depressions are shown with contour lines and slope lines. Prominent depressions falling between contour lines may be represented by a contour line if the deviation from the actual contour level is less than 25%. Colour: brown.

4.2 Rock and boulders

Rock is a special category of land form. Rocks and boulders are not likely to affect route choice, but where prominent they can serve as valuable features for navigation and positioning. The maps may show these features when they are visible to the competitor.



201 Impassable cliff

An impassable cliff, quarry or earth bank (see 106) is shown with a 0.35 mm line and downward tags 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. Colour: black.



202 Rock pillars/cliffs

In the case of unusual features such as rock pillars or massive cliffs or gigantic boulders, the rocks shall be shown in plan shape without tags. Colour: black.



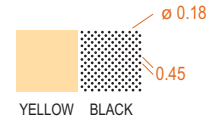
206 Boulder

A distinct boulder (minimum height 1 m). Every boulder marked on the map should be immediately identifiable on the ground. Colour: black.



210 Boulder fields / Stony ground

An area which is covered with so many blocks of stone that they cannot be marked individually. Stony or rocky ground which affects going should be shown on the map. The dots should be randomly distributed with density according to the amount of rock. A minimum of three dots should be used. Colour: black.



211 Open sandy ground

An area of soft sandy ground or gravel with no vegetation and where running is slow. Where an area of sandy ground is open but running is good, it is shown as open land (401/402). Colour: black 12.5% (22 lines/cm) and yellow 50% (see 403).



212 Bare rock

A runnable area of rock without earth or vegetation is shown as bare rock. An area of rock covered with grass, moss or other low vegetation is shown as open land (401/402). Colour: black 30% (60 lines/cm) or grey.

4.3 Water and marsh

Besides navigation and positioning, this group is important to the competitor as it facilitates the interpretation of height in maps with complex contouring. In dry areas the features listed in this section may only contain water in some seasons.



301 Lake

Large areas of water are shown with dot screen. Small areas of water should be shown with full colour. A black bank line indicates that the feature cannot be crossed. For large lakes using 50% blue fill, a 100% blue bank line (0.25 mm) used in place of the black bank line. Colour: blue, blue (50%).



304 Uncrossable river

An uncrossable river or canal is drawn with blue bank lines. Colour: blue, blue 50%.



305 Crossable watercourse

A crossable watercourse, minimum 2 m wide. The width of watercourses over 5 m wide should be shown to scale. Colour: blue.



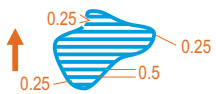
306 Crossable small watercourse

A crossable watercourse (including a major drainage ditch) less than 2 m wide. For better legibility a ditch in a marsh should be drawn as a crossable watercourse (305). Colour: blue.

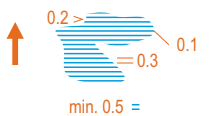
307 Minor water channel
 A natural or man-made minor water channel which may contain water only intermittently.
 Colour: blue.



309 Uncrossable marsh
 A marsh which is uncrossable or dangerous for the runner. A black line surrounds the symbol.
 Colour: blue, black.



310 Marsh
 A crossable marsh, usually with a distinct edge. The symbol should be combined with vegetation symbols to show runnability and openness. Where a small marsh area should be combined with either 403/404 it is permitted to use 401/402 to improve legibility.
 Colour: blue.



314 Special water feature
 A special small water feature. The definition of the symbol must always be given in the map legend.
 Colour: blue.



4.4 Vegetation

The representation of vegetation is of importance to the competitor only for navigational purposes, not for route choices. If for example the forest is dense on one side of the path and sparse on the other, this presents navigation and positioning information. It is not necessary to grade the forest for "speed" purposes unlike maps for foot-orienteeing, only for visibility. In order to meet the demands for highest possible legibility, the 30% green colour used for 406 Forest slow running has been judged optimal. It should also be noted that the symbols 414 and 416 (cultivation boundaries) should be omitted since they may cause confusion with some of the symbols used for tracks and paths.

COLOUR

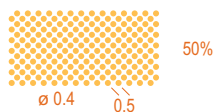
The basic principle is as follows:

- **white** represents runnable forest,
- **yellow** represents open areas divided into several categories,
- **green** represents the density of the forest and undergrowth according to its runnability and is divided into two categories.

401 Open land
 Cultivated land, fields, meadows, grassland, etc. without trees, offering easy running. If yellow coloured areas becomes dominant, a screen (75%) instead of full yellow may be used.
 Colour: yellow.



402 Open land with scattered trees
 Meadows with scattered trees or bushes, with grass or similar ground cover offering easy running. Areas smaller than 10 mm² at the maps scale are shown as open land (401). Individual trees may be added (418, 419, 420). If yellow coloured areas becomes dominant, a screen (75%) instead of full yellow may be used.
 Colour: yellow (20 lines/cm).



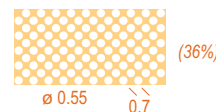
403 Rough open land

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 403 may be combined with symbols 407 and 409 to show reduced runnability.
 Colour: yellow 50% (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. Such an area may be generalised by using a regular pattern of large white dots in the yellow screen. Areas smaller than 16 mm² in the maps scale are shown as rough open land (403). Individual trees may be added (418, 419, 420).
 Colour: yellow 70% (60 lines/cm), white 48.5% (14.3 lines/cm).



405 Forest: easy running

Typically 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 and difficult to run

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



408 Forest: very difficult to run, impassable

An area of dense vegetation (trees or undergrowth) which is barely passable.
 Colour: green 60% (60 lines/cm).



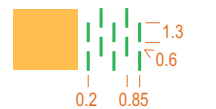
412 Orchard

Land planted with fruit trees or bushes. The dot lines may be orientated to show the direction of planting. If yellow coloured areas becomes dominant, a screen (75%) instead of full yellow may be used.
 Colour: yellow and green 25% (12.5 lines/cm).



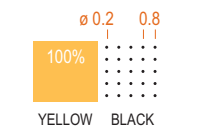
413 Vineyard

The green lines may be orientated to show the direction of planting. If yellow coloured areas becomes dominant, a screen (75%) instead of full yellow may be used.
 Colour: yellow and green.



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 100%, black 5% (12.5 lines/cm).



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, 419, 420 Special vegetation features

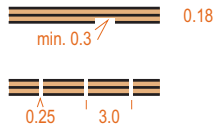
Symbols 418, 419 and 420 can be used for special small vegetation features. The definition of the symbol must be given in each case in the map legend.
 Colour: green.



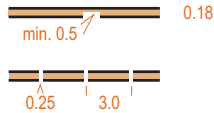
4.5 Man-made features

The track and path network provides information fundamental to the competitor. Other man-made features are also important both for map reading and as control points.

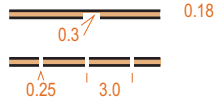
501 Motorway
A road with two carriageways. The width of the symbol should be drawn to scale but not smaller than the minimum width. The space between the black lines must be filled with brown (50%). A road under construction may be shown with broken lines. Colour: black and brown 50% (60 lines/cm).



502 Major road
Road wider than 5m. The width of the symbol should be drawn to scale but not smaller than the minimum width. The space between the black lines must be filled with brown (50%). A road under construction may be shown with broken lines. Colour: black and brown 50% (60 lines/cm).



503 Minor road
Road 3-5 m wide. The space between the black lines must be filled with brown (50%). A road under construction may be shown with broken lines. Colour: black and brown 50% (60 lines/cm).



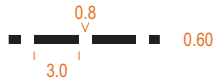
811 Track: easy riding
A track with stabilised surface at least 1.5 m wide. Forest road or well maintained track with no obstacles. Colour: black.



812 Path: easy riding
Well maintained path narrower than 1.5 m. Smooth, clean path with no erosion or obstacles. Colour: black.



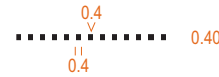
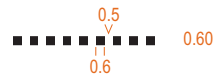
813 Track: slow riding
A track at least 1.5 m wide, with ruts, grassy, wet, muddy or sandy. Possibility of rocky surfaces. Pedalling is more difficult, riding is slowed. Colour: black.



814 Path: slow riding
Path narrower than 1.5 m, through difficult terrain, with rocky or banked surface. Other characteristics as in 813. Colour: black.



815 Track: difficult to ride
A track at least 1.5 m wide, with obstacles such as roots or rocky steps. Many obstacles, stones, rocks, erosion, mud, landslides or sand. Very slow or impossible riding. Could necessitate to carry bike. Colour: black.



816 Path: difficult to ride

Path narrower than 1.5 m, through very difficult terrain. Mountain paths with many obstacles. Other characteristics as in 815. Colour: black.



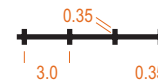
510 Visible path junction

When a junction or intersection of paths or tracks is visible, the dashes of the symbols are joined at the junction. Colour: black.



511 Indistinct junction

When a junction or intersection of paths or tracks is not clear, the dashes of the symbols are not joined. Colour: black.



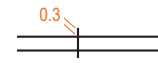
515 Railway

A railway or other kind of railed track (tramway, truckway, etc.). Colour: black.



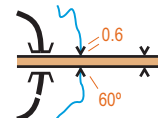
516 Power line

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



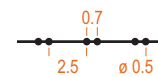
517 Major power line

Major power lines should be drawn with a double line. The gap between the lines may indicate the extent of the powerline. Colour: black.



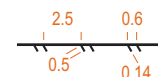
518 Tunnel

A way under roads, railways, etc. which may be used by the runner. This symbol is used whether or not the tunnel has a track leading to it. Colour: black.



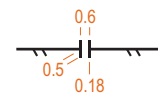
521 High stone wall

A stone wall higher than ca 1.5 m, not crossable to the average orienteer. Colour: black.



524 High fence

A boarded or wire fence higher than ca 1.5 m, not crossable to the average orienteer, eg. deer fence. Colour: black.



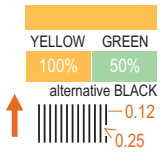
525 Crossing point

All ways through or over high fences or walls must be indicated. The symbol may also be used for a gate through or stile over a stone wall (519) or a fence (522) or a pipeline (534). Colour: black.



526 Building

A building is shown with its ground plan so far as the scale permits. Colour: black.



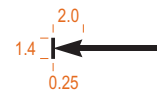
527 Settlement

Houses and gardens and other built up areas. Roads, buildings and other significant features within a settlement must be shown. If all buildings cannot be shown, an alternative symbol (black line screen) may be used.
Colour: green 50% (60 l/cm) and yellow 100% or alternatively black 32.5% (27 l/cm).



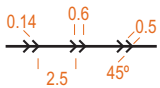
529 Paved area

An area of hard standing used for parking or other purposes.
Colour: black and brown 50% (60 lines/cm).



531 Firing range

A firing range is shown with a special symbol to indicate the need for caution. Associated buildings are individually marked.
Colour: black.



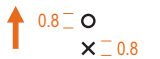
534 Uncrossable pipeline

A pipeline which cannot be crossed.
Colour: black.



535 High tower

A high tower or large pylon, standing above the level of the surrounding forest. Location is at the centre of gravity of the symbol.
Colour: black.



539, 540 Special man-made features

Special man-made features are shown with these symbols. The definition of the symbols must be given in each case in the map legend.
Colour: black.

4.6 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 20 mm which represents 300 m on the ground at the scale of 1:15 000. 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.



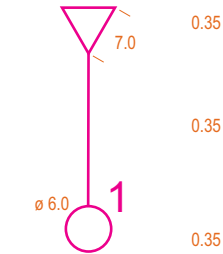
603 Spot height

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.

4.7 Overprinting symbols

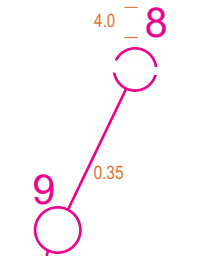
Note: dimensions are specified in mm at the real map scale

Courses should be overprinted at least for elite classes. For other classes they can be drawn by hand. The size of overprinting symbols is the same in every scales.



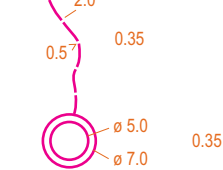
701 Start

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.



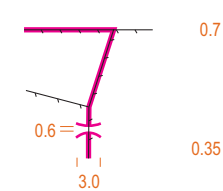
702 Control point

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.



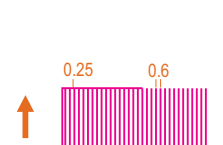
703 Control number

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.



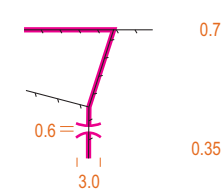
705 Marked route

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



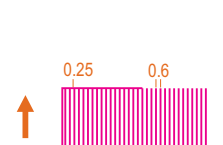
706 Finish

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



707 Uncrossable boundary

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



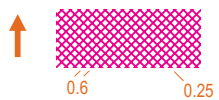
708 Crossing point

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.
Colour: purple.



709 Out-of-bounds area

An out-of-bounds area, is shown with vertical stripes. A bounding line may be drawn.
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.



714 Dangerous object across tracks or paths

These barriers must be highly visible on the map and should be overprinted in purple.

Crossable barrier is shown as a short dash. Uncrossable barrier or out of bounds are represented by a cross or series of crosses (711).

Colour: purple.