TECHNICAL GUIDELINES
FOR
ELITE TRAIL ORIENTEERING

Timed control at the ETOC 2018 Slovakia

IOF Trail Orienteering Commission

2023

BACKGROUND AND PURPOSE OF THIS DOCUMENT

“Quality” is a key element in all orienteering events. The key factors when targeting high quality competition in elite international Trail orienteering (TrailO) are good terrain, good maps, good design of courses and arrangements and good controlling and advising.

This document, issued by the IOF Trail Orienteering Commission, advises on each of these quality factors and presents the IOF interpretations of the Trail Orienteering Rules and established best practices.

These guidelines replace all previous issues of planning guidelines. They apply to all IOF events in trail orienteering for PreO, TempO and Relay formats. They are also recommended as a basis for any TrailO event on national and even local levels.

Trail orienteering continues to evolve, and the IOF Trail Orienteering (IOF TOC) Commission may issue updates to this document from time to time.

PREFACE

This is a revision of the Guidelines after more than 8 years. Since 2014 the discipline of TrailO has evolved considerably. Quality, precision, and detail requirements for an event need more description and definition than ever before to help organizers creating quality events.

Also, in the last 3-4 years the discipline has reached a good level of maturity, with consensus in many event organizing and competing aspects, including somewhat abstract concepts like what type of course setting is preferable. A good example is that map reading skills have become the key technique when solving TrailO tasks. This revision reflects this development and the new ideas in a modern way and the Trail Orienteering commission hopes that it will be of service in supporting elite level trail orienteering for planners and competitors.

EDITORS AND ASSISTING EXPERTS

The work to create/update this document has been huge and the results are outstanding. The Trail Orienteering commission wants to express our best thanks to the editors:

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1. INTRODUCTION

Trail orienteering (TrailO) is one of the four recognized disciplines of international orienteering. Developed from the core discipline of foot orienteering, it is a form of the sport in which physical performance has been eliminated to allow participation by competitors with mobility impairments, including those requiring the use of wheelchairs. Trail orienteering competition at all levels demands skills of map reading, terrain interpretation, problem solving and decision making.

The appeal of trail orienteering has extended to able-bodied orienteers over a wide range of experience, including world champion foot orienteers. Today all kinds of competitors are attracted by the technical challenge of TrailO and enabling the participation of mobility-challenged competitors is a required element of every competition.

TrailO competitions are open to all-comers, irrespective of age, gender, or physical ability, in which those mobility-challenged can compete with the able-bodied on equal terms. The TrailO 'Physically Challenged' (P) class is reserved for those eligibly classifiable athletes with mobility impairments certified by IOF Medical Personnel.

There are two formats of individual trail orienteering. In the PreO (Precision orienteering) format the main course controls are untimed but supplemented by one or more timed controls in which the speed of decision-making is measured. In PreO the timed controls are used only as tie-breakers.

The TempO format consists only of timed controls. In TempO a time penalty is given for each wrong answer, which is added to the time taken on the timed controls. The total time including penalties then makes up the result list.

There is also a format for team competition, the Relay, where a team competes in a course that includes a PreO part (main course type controls) and one or more TempO stations.

1.1 Essentials of Trail Orienteering

In TrailO the control sites, with a number of marker flags at each site, are out of bounds to the competitors. The flags are viewed from permitted access routes (trails), usually tracks and paths, sometimes with wheelchair-friendly deviations off-path, the limits of which are marked in the terrain.

The competitors are required at each control location to determine whether the feature at the centre of the circle on the map and defined in the control description is marked by a flag in the terrain. If this is so, then a letter code is recorded. If not so, with no flag matching the centre of the circle and the control description, a Zero answer is recorded.

Since there are no codes on the flags, as in FootO, the flags are identified in sequence from left to right from a viewing point as Alpha (A) through to Echo (E) (or Foxtrot (F) for timed stations). This viewing point, called the decision point, is a position on the competition path from which all flags are visible and correctly identified.

An alternative form of problem in PreO competition is simply to identify whether there is a flag at the described and marked site or not; the answer is either A or Zero.
The decision is recorded in PreO either by electronic means (by IOF-licensed electronic punching systems) or on a control card with six boxes for each control (A to E and Zero) marked by a pin punch placed a short distance along the course from the decision point or carried by the competitor.

In solving control problems, the competitors have to demonstrate advanced understanding of the relationship between map and terrain. The only permitted technical aid is a compass.

Further introductory articles are *available* on the trail orienteering document page on the IOF web site https://orienteering.sport/ in the TrailO tab.

1.2 Trail and Foot Orienteering Compared

There is widespread agreement, both within the trail orienteering discipline and elsewhere in the sport that trail orienteering should follow the same practices as foot orienteering, *as far as is sensible and practicable*. Ideally, this means the same mapping, the same control feature selections and the same descriptions, as well as all the procedures for organising a competition and taking part in it.

However, this ideal cannot be fully met, because of the following three significant differences between the disciplines:

- trail orienteers do not enter the terrain.
- the use of multiple flags at a control in trail orienteering.
- the greatly extended time for decision making at each trail orienteering control, which allows more information to be extracted from the more detailed and more accurate map, allowing more attention to be given to the exact placement of the control flag.

These differences produce constraints but also opportunities for trail orienteering to evolve beyond its starting point in foot orienteering.

Whilst trail orienteering undergoes natural and worthwhile evolution, those responsible for its development are conscious that it should retain the same ethos as foot orienteering, so that **as many as possible of the features of the sport that foot orienteers find attractive, are replicated in trail orienteering**.

1.3 The Purpose of these Guidelines

The basis of any successful trail orienteering competition is skilled course and control setting. Planning high quality TrailO courses, that are demanding and fair, is particularly difficult and may be underestimated by those who have not taken part in international TrailO competitions at IOF level.

It is especially important that all tasks at TrailO controls have a clear and unambiguous answer. This can be achieved by careful analysis of the map and terrain. The course setter

should never forget that the view to the flags must be equal to competitors regardless of whether they are standing or sitting in a wheelchair.

These guidelines are mainly intended to provide advice and technical guidance when preparing TrailO competitions at IOF level. However, the guidelines are very useful at all levels of TrailO events, and all course setters are encouraged to continue reading.

Throughout this document there will be several comments regarding how to locate the flags with precision. The aim is to help the organizer to be precise, not to demand the same level of precision by the competitors when solving the problems.

1.4 Relationship with the Rules

These guidelines supplement the IOF Competition Rules for Trail Orienteering Events.

Differences of interpretation between the guidelines and rules are not intended. Should such a difference occur, the Rules must always take precedence.

2. TERRAIN REQUIREMENTS for TRAILO

There are two extremely important terrain requirements for trail orienteering. The following questions must be considered.

2.1 Is the terrain suitable for Trail Orienteering?

The best TrailO terrain, well visible from the tracks and permitted areas, has complex ground and contour detail which demand advanced skills of map interpretation. If rock, water and vegetation features are present, there may be opportunities for adding variety to the course planning.

Man-made features can play some role in TrailO but are generally of secondary value, the best competition being based upon natural detail.

Trying to figure out from an existing FootO map, at 1:15000 or 1:10000 scale, whether the terrain is suitable for TrailO, is usually quite difficult. This is because TrailO mapping is typically done at 1:4000 scale, requiring detail not shown on the FootO map.

The IOF sprint map at 1:4000 or 1:3000 is much more useful but, even so, the terrain ***must*** be visited to make sure there are enough terrain features to support the competition and that they can be represented on a map with suitable accuracy.

If the terrain has suitable TrailO features, it is necessary to assess the quality of the existing map and due to the precision requirements of TrailO, usually it will be necessary to review the map.

2.2 Can a wheelchair competitor get round the course?

This requirement is often the most difficult to meet at IOF level events, which require a demanding level of terrain but also good accessibility for wheelchairs.

The IOF Rules for international trail orienteering events state:

“The terrain must be chosen so that the least mobile competitors, the person confined to and propelling a low fixed wheelchair and the person who walks slowly and with difficulty, can negotiate the course within the maximum time limit, using official assistance where provided.”

There is also useful guidance in Appendix 1 – Principles of Course Planning for Trail Orienteering – attached to the Rules.

The **wheelchair competitors need firm surfaces and enough space to turn around**. This is important on narrower tracks as competitors will often need to sight a problem from different positions before deciding at the decision point.

The firmness of the surface must be carefully considered, particularly in softer ground that may become difficult in wet conditions. It may be necessary for sections of the tracks to be repaired for the competition or have temporary surfaces installed.

The gradients on the course may be critical. Appendix 1 of the IOF TrailO Rules gives information about the limits to gradients for unassisted progress. Care should be taken concerning downhill slopes in wet conditions.

It is highly recommended that organisers seek on-site advice from those with practical knowledge of negotiating surfaces and slopes with wheelchairs. It is important to focus on all path irregularities even if at first glance they do not appear to be a problem, like shallow drainage channels which can be difficult to pass for wheelchairs.

Difficult sections will need physical assistance from helpers provided by the Organiser.

If the above two questions about terrain quality and wheelchair access can be satisfactorily answered, then an IOF TrailO event is possible.

3. MAPPING for TRAILO

Maps for international trail orienteering are based on foot orienteering mapping specifications. The design of the TrailO map usually follows one the following methods:

- Surveying and drawing a new map using ISSprOM for TrailO competitions is the preferable option due to the detail and precision requirements of TrailO maps.
- Modification of an existing sprint orienteering map, with a careful revision especially around the control positions

- Finally, an existing foot orienteering map could be used as the starting point, but this must be done with extra care reviewing all map elements, their positions, and the distance between them due to the several misadjustments produced by the scale enlargement. When enlarging the map, ISOM symbols should be enlarged to the size of symbols at 1:10000 scale. That is, 50% enlargement from 1:15000 symbol size, no enlargement from 1:10000 maps.

As stated above, trail orienteering maps are preferably prepared in the ISSprOM2019 format, but ISOM17-2 is also acceptable with an additional resize of the symbols (see below).

The preparation and correction of TrailO mapping is closely integrated with the planning process and is, therefore, included in detail in this document.

Since competitors in trail orienteering are forbidden to leave the tracks, paths and marked areas, there are some consequences for trail orienteering mapping. The competition area is that adjacent to the trails, generally within 100-150m, occasionally more when good visibility and contrast permits the placement of flags at longer distances.

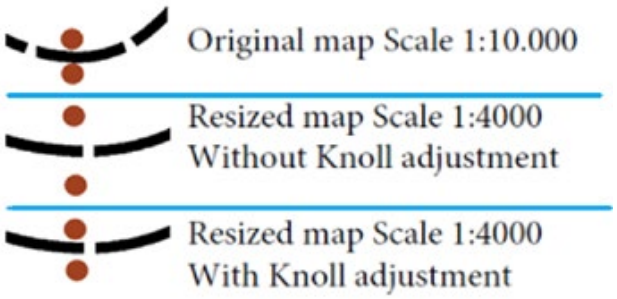
Concentrating on this greatly reduced area, compared with foot orienteering competition, requires much more detailed terrain representation. This is achieved by means of an enlarged map scale.

Map specifications for international trail orienteering:

- ISSPROM2019 map specification with 1:4000 or 1:3000 scale. This is the preferred option and the only one valid for WTOC and RTOC.
- ISOM17-2 map specification, scale enlarged to 1:4000 or 1:3000 scale, with printed symbol dimensions the same as for 1:10,000 scale maps (i.e. at 150% of conventional 1:15000 foot orienteering map symbols). This option is available for World Ranking Events and other national or local competitions.

Mappers modifying an existing FootO map for TrailO purposes need to reassure themselves that the final symbol dimensions are as in the above guideline. It is not unknown for maps to have some or all their symbol sizes non-standard.
A good starting point is to check the diameter of a dot knoll. Currently this is 0.75 mm.

In re-scaling from 1:10000 to 1:4000 (or 1:3000) care needs to be taken with symbols drawn close together on the 10000 map. It is possible that, for legibility to meet the minimum distances between objects, the distance between such features is greater on the map than in the terrain. The increased paper distance on the larger scale map allows displacements at the smaller scale to be corrected. The diagram illustrates this.



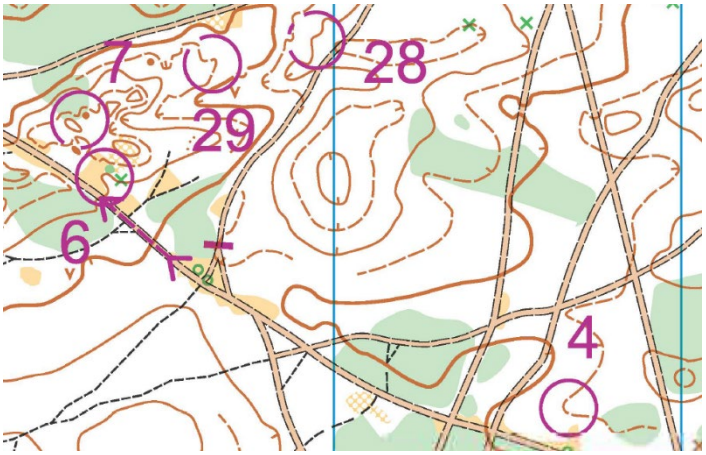
The need for extra precision in fixing features on a TrailO map applies particularly for features used in sighting lines.

The contour and form lines should give a clear indication of the gradient and shape of the terrain. A contour interval of 2.5m is recommended but may be reduced for flatter terrain. The height of a contour line may be adjusted by up to 25% to improve the representation of a feature, provided relative height differences between closely adjacent features are maintained. If further representation is required, to indicate a definite change in gradient, for example, a form line may be used. The form line is not a specific intermediate contour and may be at any height between contours. Only one form line may be used between adjacent contours (ISSprOM 2019-2).

The map must fairly represent the terrain **as seen** from the trails and permitted access areas and, *in exceptional circumstances, non-visible features may be omitted*, if their inclusion would otherwise unacceptably distort the distances to and between visible features on the map (for example a small non-visible marsh between 2 visible boulders that would make it necessary to draw the boulders more distant from each other than they really are).

The concept of runnability cannot apply in trail orienteering, but there is a close correlation between runnability and the nature of the vegetation affecting visibility in the terrain. The criteria for the vegetation should be the same as in FootO maps.

The precision with which a control flag is placed in trail orienteering may be to 1m or less. At a map scale of 1:4000 this is positioning the centre of the control circle to 0.25mm. This precision can be achieved with modern printing technology, provided the control circles are integral to the map. Therefore, the control circles and courses shall be integrated into the map prior to printing.



An advantage of using ISSprOM symbols in trail orienteering (the example here is from WTOC 2018 in Latvia) is that the tracks and large paths are similarly marked. This allows the competitors to be instructed that, unless marked as no-go on the map and/or on the ground, all the brown routes may be used – **and no other path.**
However, with very short-range features the out-of-scale width of the path symbol, a minimum of 3m on the ground, might give problems. In this example, one path is forbidden, and there is one "one-way" section.

If, in a particular competition, small paths form part of the course, two options are possible:

- Change the small path symbol (ISSprOM 506 or 507) to the Unpaved footpath or track symbol (ISSprOM 505). This is the preferred option.

- State in the pre-race information and bulletin that at some point it is allowed to use the black path according to signs and markings in the terrain, showing a sample of the map.

But it is important to remember that these paths should always be feasible for wheel-chair users.

3.1 Tips on modifying Forest Orienteering maps

It is possible to survey and draw a new map specially for a TrailO competition and this is the natural inclination of most mappers. But this may not always be best in terms of time, effort, and cost.

If the TrailO competition terrain is only a small fraction of the total mapped area, it is possible to modify an existing map around the control sites. The existing map may have benefited from the increased precision of laser contouring, in which case the contour adjustment and other changes to the map in the vicinity of the sites should be made without difficulty. If the existing map is older and less perfect in terms of contouring, there may be an understandable inclination by the mapper to 'start from scratch' with a new map. The harsh economic reality of trail orienteering competition often demands the most cost-effective method of producing the required high-quality map.

The compromises in using a FootO map for TrailO mapping are not just about contouring. Other features can be involved. The FootO mapper may be concerned when the requested changes conflict with the standard adopted across the whole map. For example, if the smallest boulder mapped is 1.5 m high because there are so many in the terrain, the mapper may be reluctant about specially mapping 1.0 m boulders at TrailO control sites. The solution is to persuade the mapper that this requirement is for a one-off special version of the map for this competition only, and the map file can be archived after the competition.

And, as it was said before, great care needs to be taken when rescaling with symbols drawn close together on the FootO map.

It is recommended to use only new maps or maps fully reviewed and adjusted for TrailO competition's needs.

MAPS IN THIS DOCUMENT:
The map segments in the following pages are for illustrative purposes and are modified extracts from competition maps and solution sheets. The latter show individual flag positions and a decision point.

4. POSITION-FIXING TECHNIQUES

Trail orienteering is all about position-fixing: position-fixing on the map and position-fixing in the terrain. There are several position-fixing techniques in elite trail orienteering. Some of these are well-established classic orienteering techniques used in FootO and should be the main techniques required from the competitors to solve the controls. The others are

secondary techniques that can be used to have a rough location of the control zone but should not be required to be used to precisely define the control.

4.1 Position at a mapped feature (Classic)

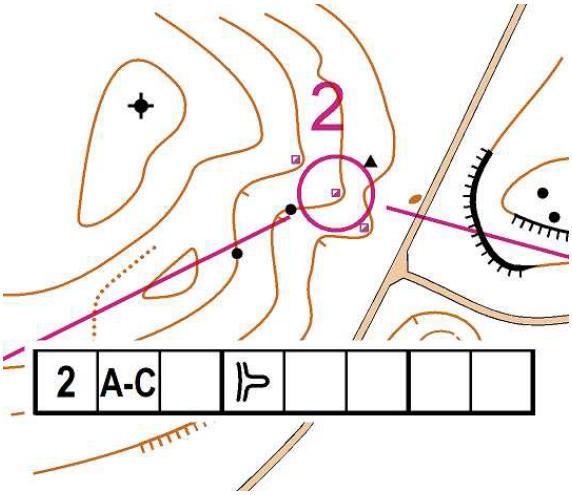
This is the basic form of precision-fixing of a control position at or next to a mapped feature, which can be identified in the terrain. At advanced level, identification may be more difficult due to complexity and variability of the features, in that some are mapped and some are not.

Example: A map reading exercise, that demands careful map reading for the competitor to identify the several cliffs around the control zone. The elevation of the zone as well as the visibility restricted by the forest poses additional difficulties.

The task for this kind of problem is to locate the correct feature, not to specify the exact location of the flag on the feature. This is an example from ETOC 2018, Slovakia

4.2 Position by contouring (Classic)

This is an advanced form of precision position-fixing which requires skill and practice. It is the tracing across the ground of a contour or form line from a selected reference point on the map. The reference point may be a feature at the same height as the contour or it may be between features at different heights. To position by contouring with accuracy needs a good sense of horizontal level in structured and sloping terrain.



Example: In this case the contour line passes through the nearby boulder which, once identified, is a good reference point for tracing the contour across the ground. All three flags are on the spur, but the contour traced through the boulder, with the correct flag being slightly higher up on the spur as indicated by the centre of the circle.

4.3 Secondary Techniques

There are also other techniques that can be used by the competitors but these **should not be the only possible techniques to solve a task**, as they do not provide interesting orienteering challenges. These techniques can be used as auxiliary, rough estimation of the control zone, etc.

4.3.1. Position by sighting lines

This is a form of precision fixing which can be very accurate with close references, but very dangerous as the distance increases, so it is not recommended to be the only technique to solve any problem. The technique is to identify two or more reference points on the map that line up with a feature on the map. The references used for sighting lines must be clearly visible in the terrain and close to the control and/or to the viewer. Locating these 'leading marks' in the terrain and sighting along the line(s) between them leads to the feature. This may be the control point at the centre of the circle or another feature.

The use of this technique demands a map with every point feature and other clear references precisely georeferenced, and this is almost impossible due to the need to move the features in the map to meet readability demands of the cartographic norms. As with the following secondary techniques, it is recommended to use them as support to solve the controls, but not as the final technique used to achieve a clear answer.

Example: The spur system lying across the control circle was stepped so that there were two separated spurs within the circle, giving the control description 'E spur, NW part'. This is a good example on how to use sighting lines as a secondary technique. The task can be solved by map reading, but probably the distance makes it a bit difficult to identify the contour lines precisely- So, the boulders acting as leading marks can be used to help identify the centre of the circle, which had a flag.

As a distractor an incorrect flag also had leading mark boulders.

Sighting lines that do not lead directly to a mapped feature can also be useful when they pass to one side of the feature. This can help with identification of the feature, aided by estimating the distance by which the line 'misses' the feature and transferring this distance to the terrain.

The planner has to consider the different solving techniques used in TrailO and make sure that all lead to the same answer.

4.3.2 Position by distance estimation

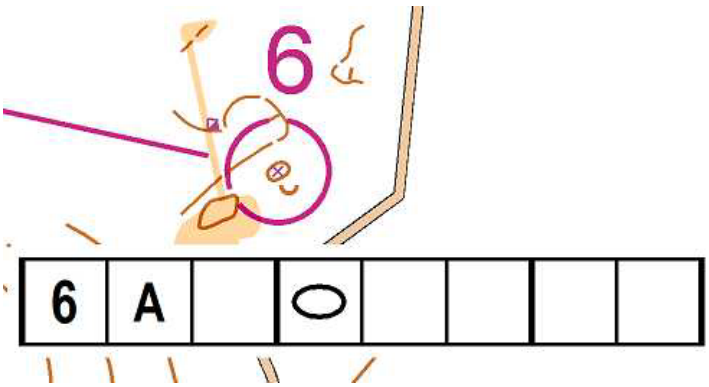
a) Into the terrain (range)

The estimation of distance off the tracks into the terrain can be used in control problems to distinguish between features sufficiently separated in range. It is not a precision technique.

As with the other secondary techniques, distance estimation can be used as an auxiliary aid to solve the controls, not as the main technique. Even so, the following should be observed:

- Distance in range into the terrain estimated by competitors should not be required to an accuracy better than 25%.

This figure includes any map error. For problems where range estimation can be helpful, the map should be accurate to better than 10%.



Example: In this map sample, redrawn from the WTOC2018 map, the solution was Zero as there was no flag on the right hill. The point could be solved by map reading, but since the hill was hard to distinguish in the terrain, distance estimation from the path could help the competitor to give the right answer, as the only flag was much further away from the observation path.

Estimation of distance from the observer (range) should be used with caution across 'dead ground'. This is ground which falls out of sight for part of the distance.

b) Across the terrain

Estimation of small distances across the field of view in the terrain can sometimes be achieved by using the control markers as measuring aids. The control flags have 30cm squares and are usually suspended from a stake/pole/rod of 1m height.

Estimation of larger distances across the field of view at a particular range can be assisted if there are features on the map at that range.

4.3.3 Position by compass bearing

Using the compass to transfer a direction from the map to the terrain can result in an unacceptable margin of error. It can be used by the competitors to roughly define the general zone of the control. It can also be used to discard some flags or elements in the terrain and then use other classic techniques.

4.4 Use of position-fixing problems in Planning

Whilst all the above position-fixing techniques are available to planners of elite competition, in areas of classic orienteering terrain it is expected that the 'classic' techniques of contour and feature recognition will predominate, as these provide the most interesting and demanding orienteering problems.

In areas with limited detailed classic terrain TrailO competition can still be planned, demanding the use of secondary techniques, but not at Elite level.

4.4.1 More ways than one to the solution

It is important for planners to note that competitors will consider several different (possibly all) fixing techniques in solving a control and these must lead to the same answer.

When a control problem is designed, there can be an intended best method of solution. It may be that, of several alternative methods of solution, others have **equal or close merit**. It is important that the second or any other method of solution that is a valid way of arriving at the answer is checked for consistency with the intended method.

It is not realistic to expect maps in which every feature is perfectly represented in exactly its correct position with respect to all the other features. However, **the main features which could be used for valid solutions of each problem must be correctly related to each other**.

It is the responsibility of the planner to check that:

- If there is more than one valid way to solve a control problem, all must give the same answer.

The competitor, when considering various methods of solution to a control problem, may not be aware that there is an intended best solution and will think about using all the methods. But they do not have equal importance in identifying the exact centre of the control circle in the terrain.

The most accurate position fixing is associated with those features on the map which in themselves, or combined with the description, lead to a precise point. These are the point features, the small features mapped to scale and precise parts of larger features. Examples are boulder (with direction description), knoll and fence corner.

Also with potential for precise position fixing is the use of contouring. If the contour can be located in position and height by reference to mapped features, then it may be traced with confidence. If not, or if there is some difficulty in viewing the terrain, the traced contour may be subject to error. According to the current map specifications (ISSprOM2019-2) it is possible for a contour to shift ±25% in height to better show features in the terrain and course setters have to pay attention that, even with laserscan mapping, the relative height difference between neighbouring features must be represented on the map as accurately as possible, but absolute height accuracy is of less importance.

Although potentially very accurate, position fixing by sighting lines can pose several problems. For example, when viewing across a pair of boulders as leading marks, allowance must be made for viewing to the side. The technique can also be sensitive to the need to slightly move the elements on the map to fit them according to the minimum distance between point elements. If the point to be identified is beyond the leading marks (extrapolation), then error in mapped position of the leading marks is increased. If the point is between the leading marks (interpolation), any such error is reduced.

A common difficulty with sighting lines is when there are too many! In areas such as parkland with many individually marked trees or urban spaces with many buildings there may be very many sighting line possibilities and it is likely they will not all agree.
The sighting lines have most merit when they intersect each other or cross a linear feature at an angle at or close to 90 degrees. Those that intersect at a shallow angle are most susceptible to error.

A more complex way to use the sighting line is when the line does not cross the control position but is to one side. The skill then required is to estimate the offset on the map and judge the equivalent distance in the terrain. This is a very imprecise technique, especially as the distance from the competitor increases, and should be used with caution.

Compass bearing is inherently less precise for position fixing than the above techniques. If used to select which of several identical features, it can lead indirectly to a very precise position. However, it should never be used by itself to fix a position.

Distance estimation across the direction of view can be reliably done if the range is not great and/or there are visual clues for size. Least accurate is using distance estimation in range. However, this technique can again be useful in distinguishing between features at different ranges.

Elite competitors will consider all techniques in solving a control problem and, particularly if they do not all agree with each other, give priority to those likely to have resulted in the most precise and accurate answer. And, as stated before, **position at a mapped feature and by contouring, the classic map reading techniques, are the main techniques that should be used**.

5. CONTROL SPECIFICATION

The key to all trail orienteering competition is accurately locating in the terrain the centre of the circle on the map, as described in the control description.

Planners need to take care that they do not demand too high a precision from the competitors. Whilst planners and mappers can fix the centre of a circle to better than 0.1mm (by enlarging the map on the screen), competitors should not be required to judge better than 1mm on the map. Hence the new Zero Tolerance Guidance that planners must consider.

Since current mapping technology results in the circles on the maps being precisely located, the following IOF definitions apply:

- The control position is defined by the centre of the circle on the map together with the control description.
- The control description shall correctly describe the control position.
- If more than one description can be used for the control, the one which offers the most precise position shall normally be preferred.

As currently stated by the IOF Rules, **the control circles on the map are 6.0 mm in diameter**. The circles are broken where essential detail would otherwise be obscured. They are also broken where adjacent control circles overlap.

If control sites are close together in very detailed areas and the above procedures give unacceptably fragmented course markings, then 4.0 mm diameter circles may be exceptionally used in the congested areas on the map. The pre-event details shall inform if this is so.

The centres of the control circles should be placed on the map with the best accuracy available, typically to 0.1mm.

It is very important to remember that Zero Tolerance only applies to the subjective interpretation of the competitor. The planner/organizer must place the flags as precisely as possible and define the control description carefully. The Zero Tolerance is only for competitors, not for organizers.

5.1 Control Selection

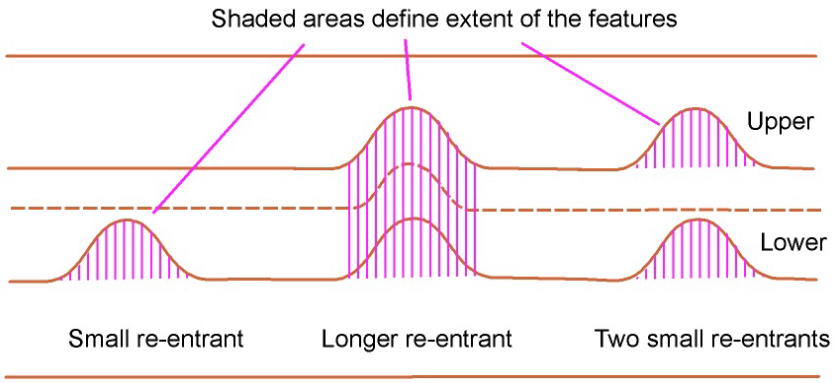
At elite level the controls need to be both varied and of high quality. In general, this means the use of detailed terrain features primarily of landform and rock, but also water and vegetation, as used in classic foot orienteering. Man-made features, such as buildings and fences, tend to be less acceptable for PreO, but may be used sparingly to add variety to the overall courses. For TempO competitions, man-made features can be equally valid for high level competitions.

In principle, controls may be placed on, or in association with, any feature marked on the map, subject to certain constraints:

- Given adequate visibility into the terrain, the controls may be set in accordance with accepted orienteering convention on any feature marked on the map, provided the centre of the circle can be determined by use of position-fixing techniques and the control feature can be correctly described.
- Adequate visibility refers to being able to sight the area with the relevant flags from the decision point and any other necessary viewing points. Special care has to be taken for users of low-level wheelchairs so that the control can be solved.

Accepted orienteering convention refers to procedures for selecting controls in trail orienteering, which are mostly derived from traditional foot orienteering convention, but with some differences. Where these conventions affect control position selection, it is necessary to understand the reasoning behind them.

The most important convention concerns contour line features, such as re-entrants and spurs. Where these are represented by a single contour the map cannot show the full extent of the feature, so the convention is that the control is restricted to being within the curve of the contour. However, if the feature is represented on the map by more than one contour or form line, then there is better indication of its extent, so the area acceptable for control selection is significantly increased. These concepts are shown in the diagrams:



Note that the two curved contours in the middle diagram, if without a form line, may represent two separate features, upper and lower in Column C of the description, as in the right diagram.

An important difference between FootO and TrailO practices, which needs to be understood, concerns linear features. Linear features that do not have a bend or corner to define position cannot be used in FootO; they could be used in TrailO, but only if other close-by features allow precise location of a point on the linear feature. See example in later section: 'Examples of flag position and description'. However, such problems are not recommended to be used at elite level, because higher quality problems are usually available. The same can be applied to area features.

A further important difference between the two disciplines is that, when selecting from a group of similar features (say, boulders), TrailO planners are not restricted to the middle boulder or, for example, the northernmost boulder. If it is possible for others in the group to be precisely located by reference to other features, the description 'boulder' is acceptable.

5.2 Control Description

Reference: International Specification for Control Descriptions, IOF 2018.

In all TrailO events, IOF Control Descriptions must be used. The conventions used for IOF events are as given below.

The control descriptions used in IOF trail orienteering are the same as those for foot orienteering, as given in the reference. In particular, compound descriptions for the position of the control (Column G), which require more than one symbol are not permitted in current practice. Therefore, the position of the control flag is described by a single symbol (or none) in Column G.

Since the development of accurate circle printing has made redundant the earlier practice of the description needing to be unique, it follows that the control description may correctly apply to more than one flag.

Using precision position fixing, the control point, with or without a flag, is determined without the need for any modified interpretation of the description. The convention for a direction description (such as NW part), where more than one flag fits the description, that the flag furthermost in that direction is the correct one does NOT apply in IOF TrailO competition.

Difficulties can arise with describing control positions with respect to contour features (particularly re-entrants and spurs) where the contour lines, as discussed above, do not represent the limits of the feature, although they may appear to do so on the map. The following procedure should be observed:

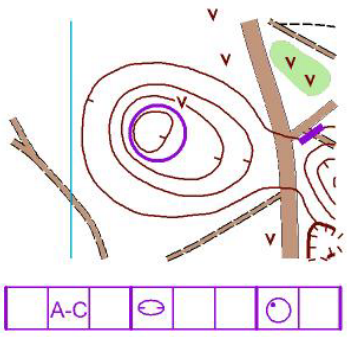
- The description should take note of the visible extent of the feature in the terrain as well as its representation within the circle on the map.

This may be seen in the following examples:

If the terrain shows, as the map suggests, a continuous single re-entrant, with no steps in the slope, extending across more than one contour line, although only one is within the circle, the correct description is ‘re-entrant, lower part’.

The direction description ‘eastern part’ does not apply in this example because the control is on the centre line of the re-entrant.

Nonetheless, this type of control should not be used, according to current practice, as the flag could not be clearly fixed using nearby features.



In this example of a very large and deep depression the control point is in the SE part of the ring contour within the circle. However, taking note of the full extent of the feature on the map and in the terrain, the correct description is ‘Large depression, NW part’.

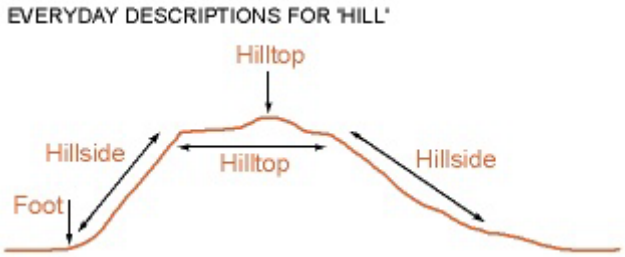
Similar convention applies to hills with several contour rings.

Examples such as these, in which the feature extends well outside the circle and modifies the description, need a common-sense approach by the planner and event advisor.

5.2.1 The Position of the flag (Column G description)

The placing of flags and the description of their positions has developed into a precise set of terms, which needs careful understanding to avoid confusion with the general, less precise, use in everyday English.

In particular, the differences between the everyday descriptions of hill features and orienteering terms could lead to confusion:



- In everyday English usage the 'side' of a hill is commonly understood to be all of the slope between top and bottom.

- Additionally, a description also cannot be used in situations where it has two meanings. For example, the 'top' of a hill in everyday English can mean both the uppermost area of the hill and its highest point. The term 'top' is best avoided for hills in elite orienteering.

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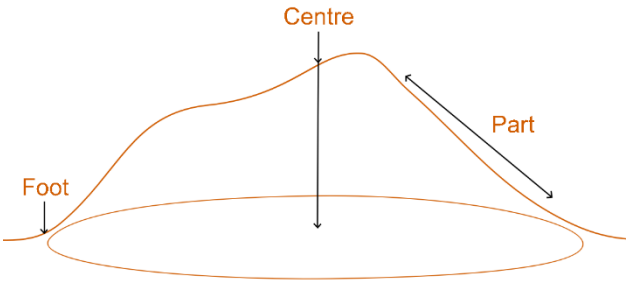


- The diagram on the left shows how the descriptions on column G should be interpreted. The only orienteering description which agrees with everyday use is **foot**. Elsewhere on the hill the description **part** is used (except for no Column G description, which refers to the centre of the hill).

5.3 Definition of Descriptions *used* in Column G

(**Blank/None**) – used for the middle of the feature. In case of hills (depressions) with multiple contours, it refers to the middle of the top (bottom) contour. Additionally for rock faces, it means the middle of the foot.

SIDE – Used for features that rise up sharply from the ground (such as building, boulder, stone wall). The flag is positioned as close to the side of the feature as can be achieved.

FOOT – Used for the edges of features that rise less steeply from the ground (such as hill, knoll, spur). The flag is positioned, as best as can be judged, at the junction of the slope of the feature and the surrounding terrain.

EDGE – used for the edges of features at ground level (such as marsh, clearing) and those below ground level (such as depression). If the edge of a feature cannot be precisely fixed, the use of 'part' is preferred.

PART – used for any part of an area or linear feature which is not the centre or the edge or an end.

TOP – used for features where the normal flag position is at the base of the feature, e.g. rock face, where the top is at the mid-length of the feature.

BETWEEN – used for the mid-point of the shortest distance between the edges of two features.

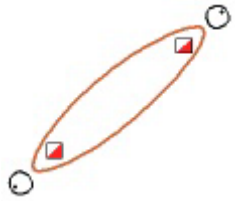
UPPER/LOWER – used for the upper and lower parts of the feature as existing in the terrain.

END – used to indicate the distinctive end of a linear feature. The orientation of the symbol, in one of the eight compass directions, indicates in plain view the orientation of the linear feature and its end.

CORNER (Inside & outside) – used for a sharp change of direction of a linear feature or the edge of an area feature. The angle enclosed by the directions each side of the corner is between 45° and 135°. The orientation of the symbol indicates the direction of the corner in plain view.

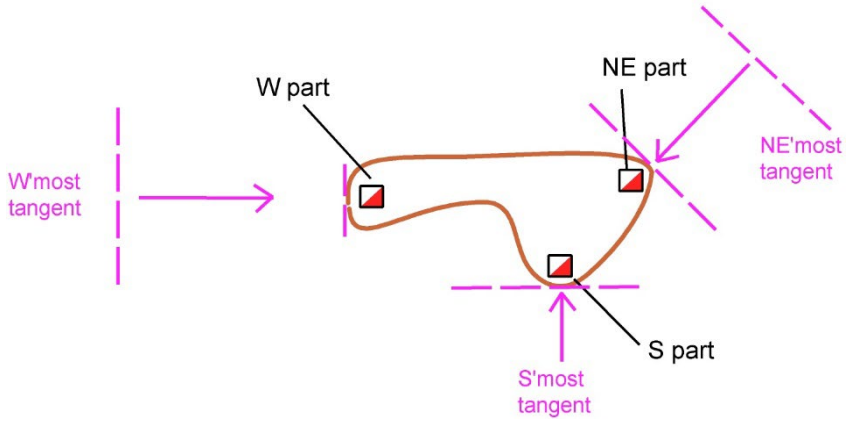
TIP - used for a very sharp change of direction of a linear feature or the edge of an area feature. The angle enclosed by the directions each side of the corner is less than 45°. The orientation of the symbol indicates the direction of the tip in plain view. The flag is placed outside the tip, as the symbol itself indicates

BEARING – there are 8 permissible positions based on compass bearing: N, NE, E, SE, S, SW, W, NW.



With some features, such as the elongated hill shown in the diagram, not all eight compass directions can be used to describe 'part'. In this example only the NE and SW directions can be clearly identified.

With more irregularly shaped features the direction may be identified by the 'tangent' or 'approaching front' method. This is bringing a line, set at 90 degrees to the required direction, towards the feature. The point at which first contact is made is the furthermost in that direction.



This awkwardly shaped hill shows the tangent method in use, giving three good direction descriptions for part. The other five directions, in this example, are less satisfactory and best not used.

The description "Bend"– used for a smooth change of direction of a linear feature. Bend has been moved from G column to F column in the IOF Control descriptions 2018.

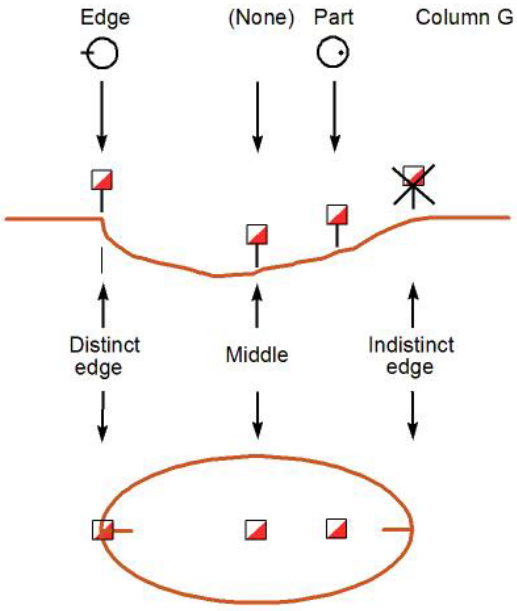
More complete definitions of these descriptions are given in the International Specification for Control Descriptions, IOF 2018.

Use of these descriptions is illustrated in the following section and plan view diagrams.

5.4 Examples of Flag Position and Description

In the diagrams the sections are W to E, looking N. The plan views are conventional, with N at the top of the page. The flags indicate permitted control positions – for a Zero control the flag would be absent.

Depression



If there is no description in Column G, the control flag is placed in the centre of the depression. Note that the lowest part is not necessarily the centre.

If the description is **part**, the control flag is placed sufficiently removed from the centre and the edge so as not to be confused with them, and such that its direction can be distinguished from adjacent directions.

If there is a distinct edge, the control flag may be so placed and described as **edge.** Again, its direction must be clearly distinguishable from adjacent directions.

Pit

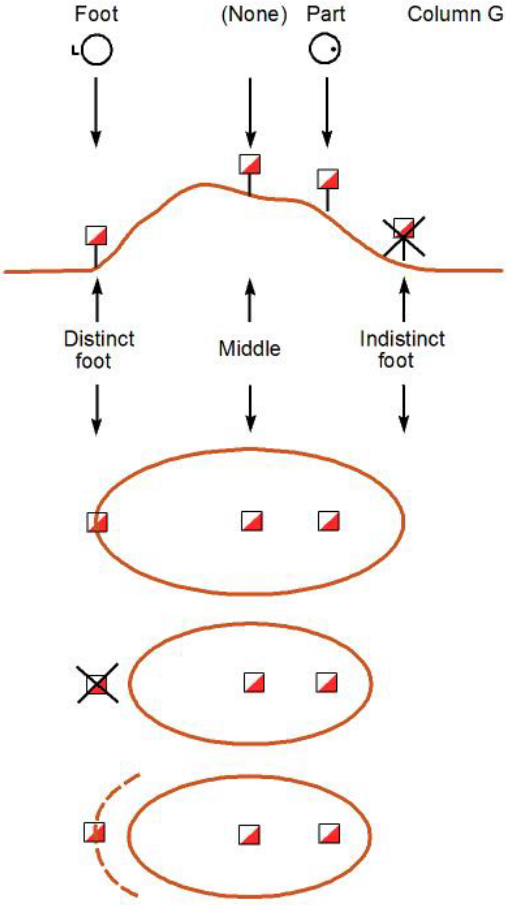
The same arrangements apply as for ‘depression’ above. Pits, having steeper sides than depressions, are more likely to have clear edges. For small pits, control flag positions are the centre and edge. For large pits the ‘part’ description may be used.

Erosion gully

A wide erosion gully can have a section across its width similar to that for a large pit and control flags may be placed across the gully in similar manner. A narrow gully, as with a narrow re-entrant (see below), has flag positions only along its centre line. However, flags may also be placed along its edge, if distinct.

Since gullies have longitudinal dimension, it is necessary to fix the control flag positions by reference to other features. Also, as gullies run down slopes, descriptions ‘upper part’ and ‘lower part’ may apply, in similar manner to re-entrants.

Hill



If there is no description in Column G, the control flag is placed at the centre of the hill. Note that the highest point is not necessarily at the centre. The description ‘top’ is not used.

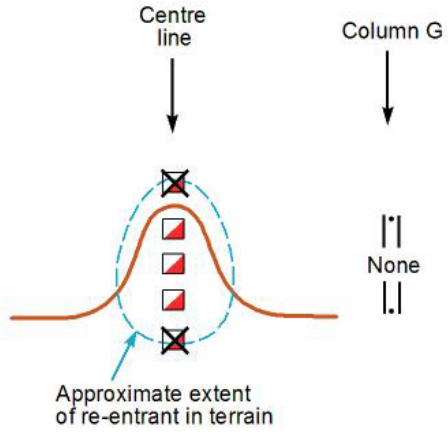
If the description is part, the flag is placed sufficiently distant from the centre and the foot so as not to be confused with them, and also such that its direction is clear.

If the contour marks a distinct foot, the control point may be placed there and described as foot, with direction indication.

If the contour ring does not represent the base of the hill (as in the two lower plan views), a distinct foot may be some distance away and cannot be used as a control, unless a form line is added. The description is then either ‘Hill, foot’ or ‘Spur, foot, depending on how the form line is drawn.

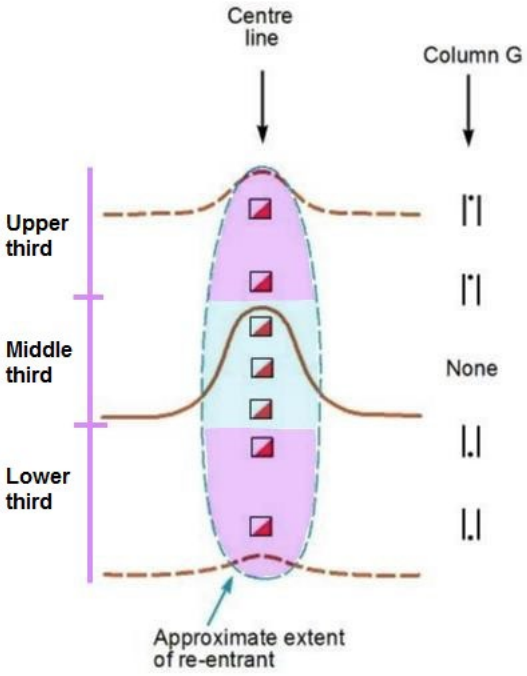
Re-entrant

The diagram shows a narrow re-entrant shown by a single contour line. Without any indication on the map of the extent of the re-entrant in the terrain, other than just this single contour, the convention is that the defined area of the re-entrant is within the curve of the contour.



Control positions may only be set within this defined area. In this case the midpoint along the centre line passing through the re-entrant is described as 'Re-entrant'. Control positions along the centre line above this point (upper half) are described as 'Re-entrant, upper part' and positions along the centre line below this point (lower half) are described as 'Re-entrant, lower part'.

However, if the re-entrant in the terrain extends well beyond the limits of the contour line, these descriptions of the control positions within the defined area of the contour may not agree with those of the feature in the terrain.



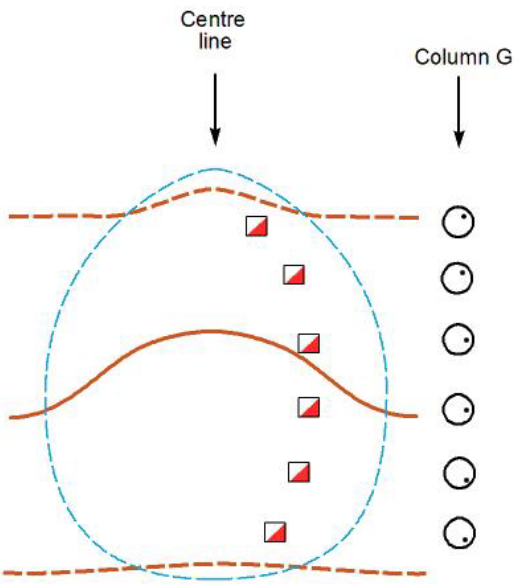
In such cases it is necessary for the extent of the re-entrant to be more fully shown on the map with more than one contour line or form lines. This allows its defined area to be greatly increased and most of its extent may be used for control positions and described appropriately.

As shown in the second diagram the centre line passing through the complete feature in the terrain is split into three parts. The centre of the circle may be placed within the upper third and described as 're-entrant, upper part', within the middle part and described by 're-entrant' and within the lower part and described by 're-entrant, lower part'. The correct flag must still be placed in the centre of the circle. This 'rule of thirds' applies only to features extending over several contour/form lines (re-entrants, spurs, …)

The descriptions match the appearance of the feature in the terrain, not just that part within the control circle. The control description may correctly apply to more than one flag and the control point is located by reference to the contour/form lines and/or other features.

Narrow re-entrants approximate to linear features and as indicated; control positions are down the centre line. It is necessary, when viewing in the terrain a re-entrant which is indicated on the map with more than one contour/form line, to determine whether the re-entrant is a single continuous feature or is stepped to give two or more separate re-entrants along the same line.

A **wide re-entrant** is an area feature and controls may be positioned off the centre line and given a direction description. The diagram shows control positions in the NE, E and SE parts of the re-entrant. Other positions in the NW, W and SW parts are also possible (and along the centre line).



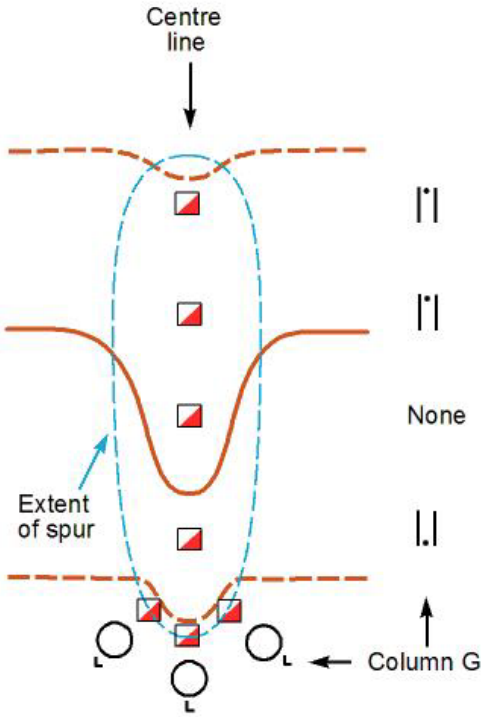
Any control position so described is permitted provided the flag is clearly within the defined extent of the re-entrant and sufficiently separated from the centre line to avoid confusion with centre line descriptions.

Again, selection of the correct flag among more than one with the same description is by reference to the contour line and/or other features.

Spur

Similar criteria apply to spurs as for re-entrants.

The diagram shows a continuous narrow spur depicted by a single contour line and two form lines. The extent of the spur in the terrain is shown by the broken blue line. The lower form line is at the foot of the spur in the terrain. The whole extent of the spur may be used for control positions, provided the form lines are on the map.



On a narrow spur the permitted control positions are down the centre line.

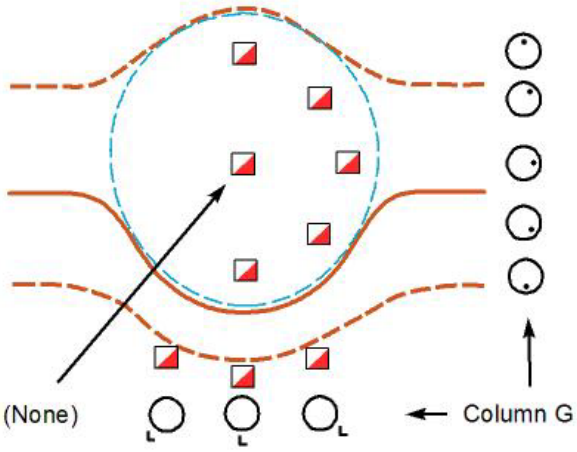
The foot of a spur refers to its furthest extension down the terrain and a number of control positions around the foot are permitted, as in the diagram.
For wide spurs the same principles apply as for wide re-entrants and controls may be positioned off the centre line and given a direction description.

Since the control description may apply to more than one flag, the control point is located by reference to the contour line and/or other features.

Terrace

A terrace is an area of flat ground in sloping terrain. A common form arises from the excavation of material from the slope and bringing it forward to make a flat area for charcoal burning or other purposes.

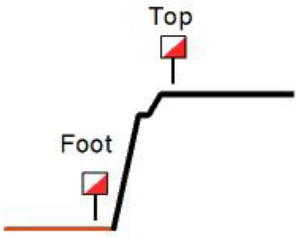
The diagram shows this form, which can be regarded as a flat-topped wide spur. The whole extent of the flat top, termed terrace, may be used for control positions, provided the upper form line is on the map. The lower form line shows the foot of the feature, and this is referred to as spur foot.



The diagram shows control flag positions in the N, NE, E, SE and S parts of the terrace. Other flag positions are possible. These have direction descriptions. The centre flag has no description.

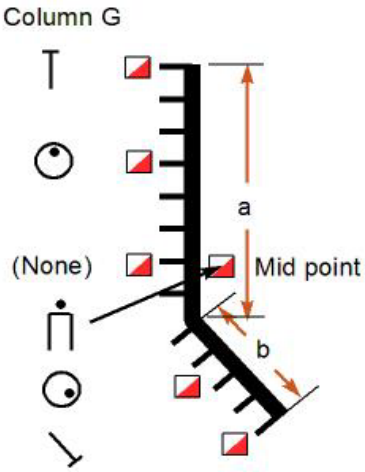
The control flags at the foot of the spur are positioned at the foot in the terrain. This is separate from the contour line in this example, which marks the edge of the flat area further up the slope. If used for a control, the foot must be marked with a form line.

Rock face



Flags at the foot of a cliff /rock face are placed as close to the foot cliff as possible.

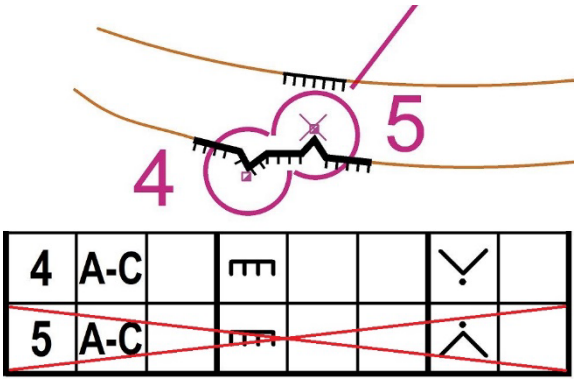
Tip: Flags which have to be positioned a short distance from the rock face, or any other feature, may have their stakes tilted towards the feature.



The flag with no Column G description is placed at the mid-length foot. The length of the rock face includes bends and steps, if mapped. The length of the rock face in the diagram is (a + b). Minor steps and offsets, which are not mapped, are not included.

Flags may be positioned at other places along the rock face foot and described as ‘corner’ or ‘part’. When using the description part, it is only allowed to use descriptions that match the direction of the cliff ends, in this example North part or Southeast part. All other part descriptions will lead to confusion and should not be used. Also, ‘end’ may be used, provided the map shows the whole length of the rock face, with the same direction restrictions.

A flag may be positioned at the rock face top at mid-length and described by the ‘top’ symbol; it is not necessarily at the highest point.



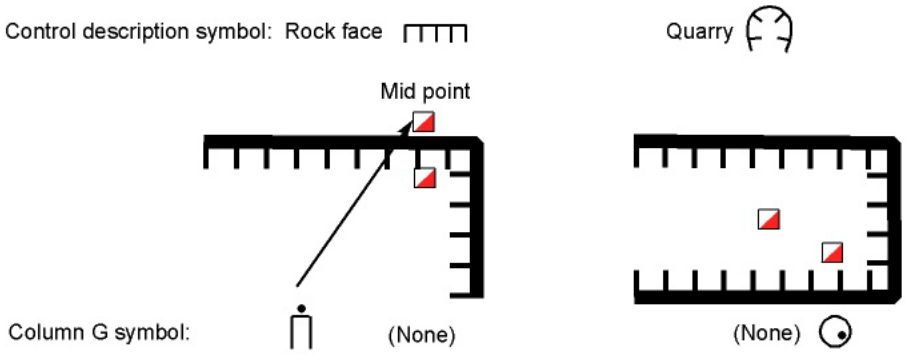
Note that, under current rules, no other flags are permitted along the top of the rock face, because double descriptions would be needed to identify them. This includes using descriptions like “corner” if they point to the upper part, as represented in the figure to the right. In this figure, control 4 is a valid one, as the corner description points to the foot of the cliff, but control 5 is not a valid one, as the control description points to the top of the cliff.

Quarry

A rock face, conventionally mapped, is a linear feature. A rock face that is not straight but has convex form, such as that in the previous diagram, remains a linear feature. However, if the form is concave and sufficiently extended, it can become an area feature.

This is shown in the two diagrams. That on the left is still a linear rock face and offers flag placements similar to the previous example. The diagram on the right shows the rock face enclosing an area, now termed quarry.

Flag positions additional to those marked are possible.



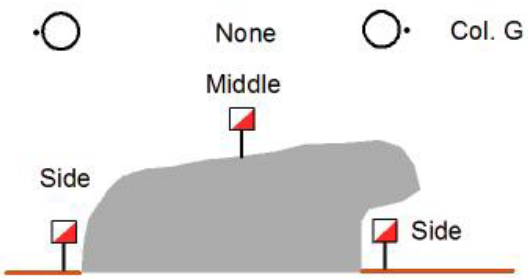
Earth banks

Also known as steep slopes, earth banks which have a well-defined foot and top, together with well-defined ends can be treated the same as rock face and quarry above.

Boulder

Control flags placed around the boulder are positioned as close to the base of the boulder as possible and given a direction description.

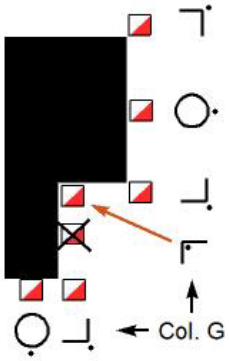
Flags are normally placed around a boulder but may be positioned on the boulder. A flag placed on a boulder in the middle position has no Column G description. For very large boulders the description 'part' may be used.



If the upper part of a boulder, above flag height, projects further than its base, the projecting part is ignored for 'side' controls.

Building

Control flags may be placed round the foot of a building at the mid-length of a projecting side (i.e. that which is furthest in a given direction) or at outside and inside corners. The descriptions are 'side' and 'corner'.



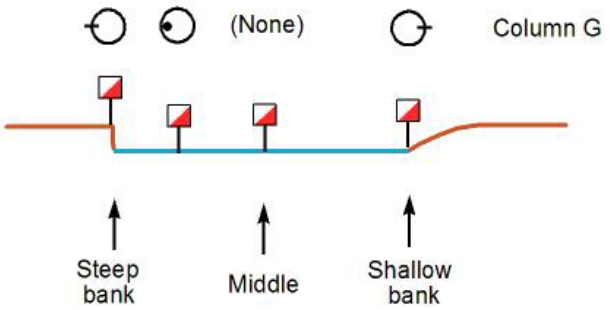
In the diagram the two faces of the building forming the inset cannot be described and therefore cannot be used, apart from the inner corner.

Where an upper part of a building projects further than its foot, the projecting part is ignored (as with boulder).

Watercourse

If Column G is blank, the control flag position is in the centre of the watercourse.

If the watercourse is wide, other flag positions within the watercourse are possible and the description 'part' in a given direction applies (similarly to wide re-entrants).



Control positions at the water edge are also possible. If the bank is at a shallow angle, the flag may be placed exactly at the water edge. If the bank is vertical so that the flag cannot be placed at the water edge, it may be placed at the top of the bank, as close as possible to the edge.

An advantage of using the top of a steep bank is that this flag position and description does not change if the water level rises and falls significantly.

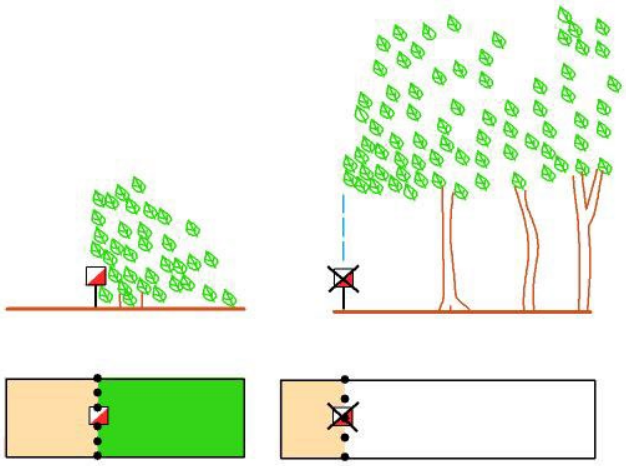
Since a watercourse has linear dimension, unless at a precisely positioned irregularity, the flag positions have to be determined by reference to other features (See also **Linear features**)

Vegetation boundary

Care needs to be taken with vegetation boundaries. A distinct vegetation boundary, such as a forest edge adjacent to open land or an obvious change within the forest from broadleaf to coniferous trees, is mapped, according to IOF practice, in aerial plan view. The boundary at ground level is located directly under the edge or meeting of the canopy vegetation.

If the objective of the control is to establish the correct location of the flag on the boundary, then the use of such a vegetation boundary in elite trail orienteering is not recommended because of difficulties in fixing the line of the vegetation boundary on the ground, particularly with the high canopies of mature trees. Even if the canopy is low (as in the left part of the example), it may not be possible for sufficient sighting possibilities along and across the boundary to fix the control position precisely. However, if the problem is to distinguish between different boundaries or between obvious spots on the boundaries (corners for instance), then the problem can be considered.

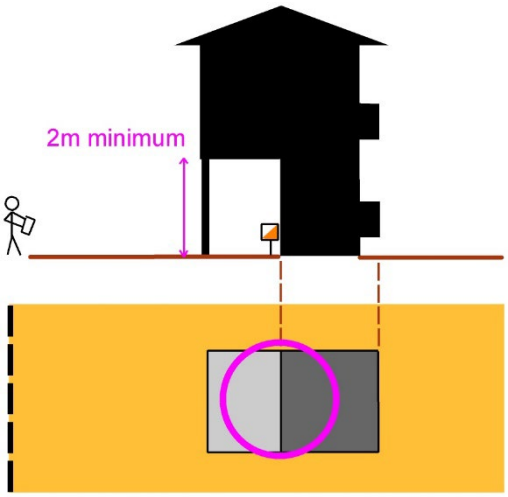
Note that, for the terrain within the trees to be mapped runnable white, the clearance under the canopy should be 2m or more.



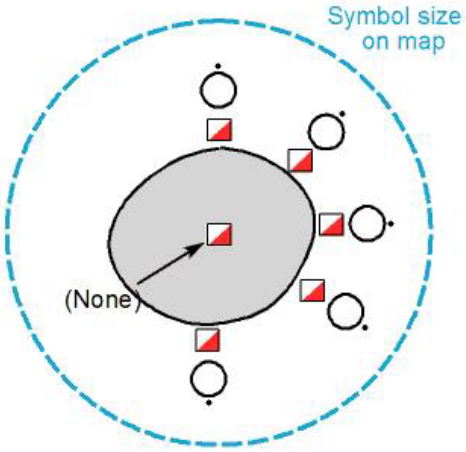
Overhangs

Similarly to runnable forest the clearance underneath building overhangs should be 2m or more in order to be mapped with the grey symbol. The mapped footprint should represent the main structure. Here the balconies have been included but should not feature in flag placement. The canopy too high shall not be mapped and sloping walls are mapped according to the situation on the building ground (according to the ISSprOM Guidelines for complex urban structures).

Roof projections, unless very large or close to ground level, should be ignored.



Point features



These are 'small' features where the size of the symbol on the map represents a greater area than the actual dimension of the feature in the terrain. Examples are boulders, knolls, small depressions/pits and minimum sized features like small building. Note that even the small distinct boulder symbol (ISSprOM symbol 206) is equivalent to a diameter of 3 m on the ground.

Where there is no Column G description, the control flag is at the centre of the feature.

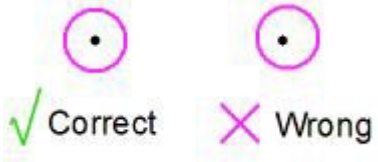
Otherwise, the flags are positioned round the feature, as partly illustrated in the diagram, using direction descriptions as follows:

- Boulder - 'side'
- Knoll - 'foot'
- Small Depression, Pit - 'edge'

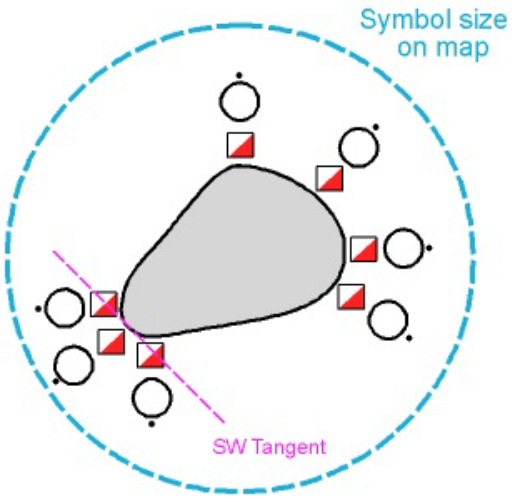
For all large non-vegetation point features, the description 'part' can also be used.

Since the map symbol is larger than the feature, positioning the centre of the circle on the control position cannot be precise. The convention in TrailO is that, **with point features, the circle is centred on the feature symbol** and not offset in the direction of a flag on the side or edge of the feature.

Here is an example with a Boulder NE side control:



Irregular point features



Irregularly shaped point features sometimes offer micro positioning of flags with different direction descriptions. Here is a permissible example of a suitably aligned boulder, with closely positioned but differently described flags on its SW side:

With the current Zero Tolerance, it is not allowed for Zero problems where, for example, the description is SW part, and the flag is on W part. Similarly, a problem with 3 flags (at W, SW, and S part) and asking the competitor to decide which one is the right 'part' should be avoided for a TrailO control.

Individual trees

Distinctive trees, in open land or in the forest, may be mapped with a point symbol (usually green circle). In this case the symbol (ISSprOM symbol Prominent large tree 417 and Prominent bush or small tree 418) represents the trunk of the tree. The flag placements are at the side of the trunk. The flags are placed as close to the trunk of the tree as possible.

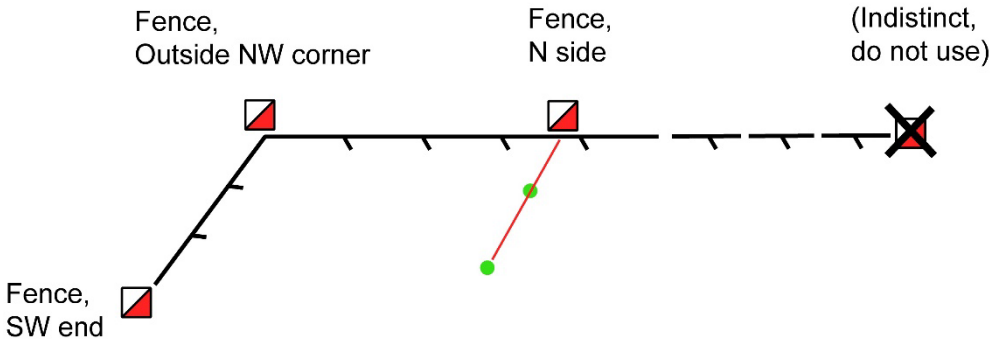
Single trees in open land and mapped only by the extent of their canopy are shown as area features and cannot be used in this way unless re-mapped as point symbols.

If the canopy extends below flag height the tree should be mapped as a vegetation feature (large canopy trees, symbols 406, 408, 410) or using the symbol Prominent bush or small tree 418. The flag will be placed around the canopy using the control description “Thicket”.

In the occasional cases where the trunk of the tree is not vertical, the position of the flag is as close as possible to the trunk at flag height, 1m. These trees should not be used for “between” problems.

Linear Features

In foot orienteering, linear features can only be used for flag placement if the feature has a clearly identifiable end or change of direction. In trail orienteering, position fixing from nearby features may allow other parts of the linear feature to be used.



Note that a fence corner is a precise position and self-defining but a fence bend is an extended linear feature, which may be compact enough to be used in FootO, but requires additional description in TrailO: e.g. ‘fence’, ‘bend’, ‘side’. As “Bend” is in column F, it is possible to describe the problem as Fence, Bend (or Junction or Crossing), N-side.

Linear not-to-scale features

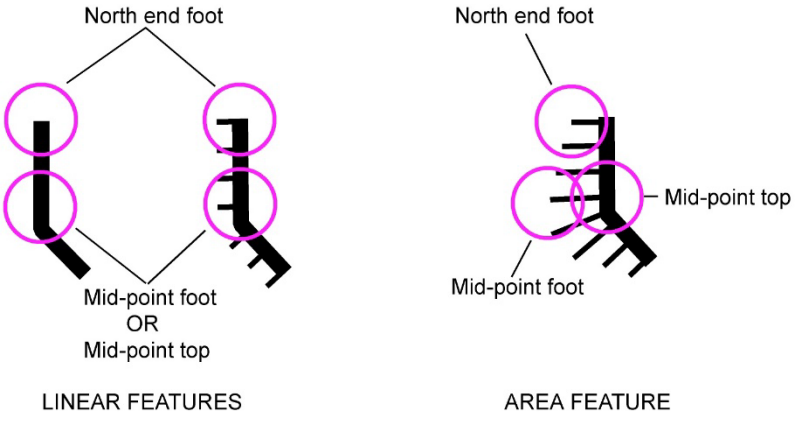
Straightforward examples are paths, streams, ditches, small erosion gullies, etc where the symbol on the map is wider than the feature in the terrain.

In all of these the control circle is positioned on the centre line of the symbol, and not displaced in the direction of the flag, if positioned to the side (e.g. path) or to the edge (e.g. stream).

More complicated are rock faces and earth banks, which require special attention.

A rock face may be represented on the map by a single black line or a black line with conventional tags to show the direction of the face. The conventional tags are ignored (even though they may equate to the actual extent of the rock face in plain view) and the control circle is centred on the black line.

Sometimes a large rock face has considerable lateral extent and is represented by a thick baseline with extended tags. It is then considered an area feature and the control circles are placed in actual map position.



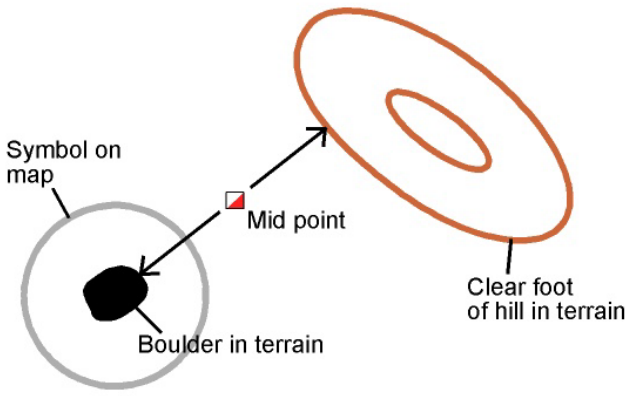
The same procedures apply to earth bank symbols with tags.

Between

The 'between' description refers to the midpoint of the shortest imaginary line joining the 'edges' of two features (not the centres).

Flag Position

When setting 'between' problems using contour line and/or form line features, it is important to check that the contours and form lines on the map have been drawn to represent the actual edge or foot of the features. If necessary, form lines must be added to define the edge/foot.



In the case of point features whose map symbols are larger than the objects they are depicting, such as boulders, trees, bushes and knolls, the actual edges of the features in the terrain are used in defining the separating distance. The case of the prominent bush or small tree symbol 418 requires more consideration. If the symbol in the map represents a tree, the midpoint should be

calculated from the trunk of the tree, as with symbol 417 Prominent large tree. On the other hand, if symbol 418 represents a bush, the midpoint should be calculated from the edge of the bush in the terrain.

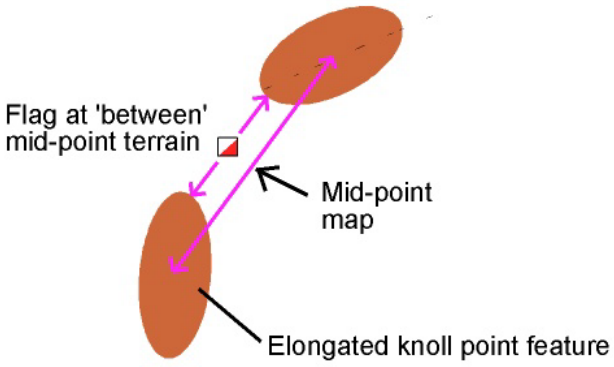
In the example, 'Between the boulder and hill', the diagram shows the correct position for the flag in the terrain.

Circle Position

Marking the position of the centre of the circle on the map depends on whether the features are to scale or not.

For mapped-to-scale features the control circle on the map is simply positioned at its correct location in the terrain. For two point features the circle is positioned at the midpoint between the centres of the mapped points (but see the variation below). For combinations of point and to scale features (as in the example) the circle is centred between the centre of the point feature and the edge of the mapped-to-scale feature.

Variation. It is possible, with angled point features such as the elongated knolls in the diagram, for the mid-point and the actual position of the flag in the terrain to be different. In such cases, practical sense should prevail, and the circle should be centred on the flag position.



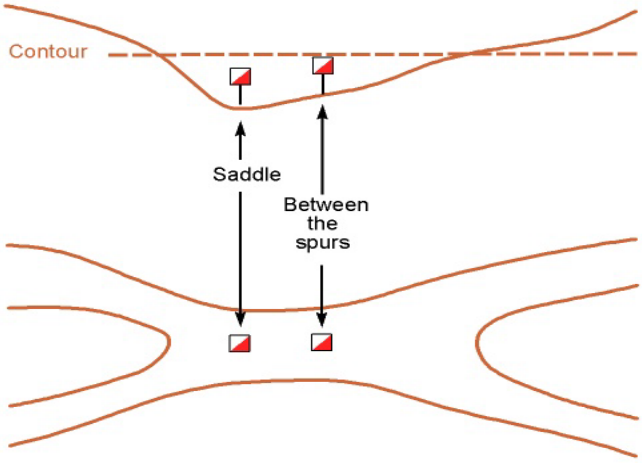
Use of other positions along the line requiring two Column G symbols (such as 'Between, NE part') must not be used.
For good control setting it is necessary to set limits on the separation of 'between' features and how they are described:

- Only features within or partly within the circle shall be used for setting problems using the 'between' description.

- The Column C direction description should identify which pair of features of several within the control circle form the 'between' pair (considering each pair as a distinct element).

Despite everything that has been said, the circle position in the map should be centered as exactly as possible at the correct flag position. If the use of the above recommendations makes this impossible, the problem should be reviewed.

Saddle



Care needs to be exercised with ‘saddle’ (also known as ‘col’), which is the lowest point on a ridge between spurs. The lowest point is not necessarily midway between the contours.

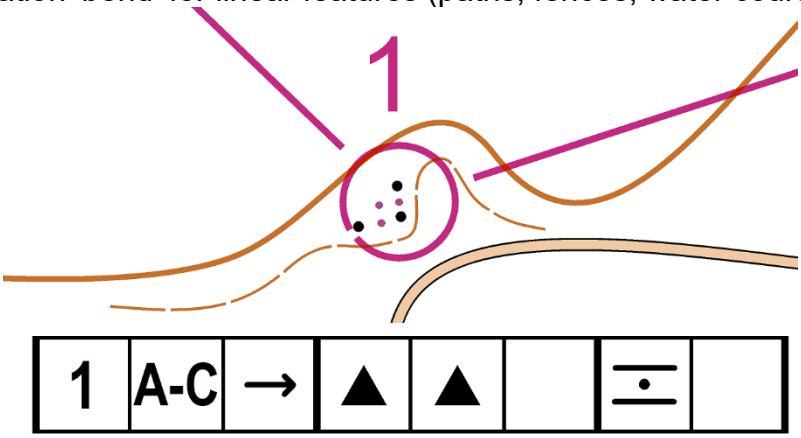
A saddle control may not be of sufficient difficulty for elite competition (unless one of many in a complex area) as the lowest point can be easy to determine. Between the contours may offer a better problem.

About Column C

Column C indicates which of the features pointed out by Column D within the control circle is the one relevant to the control. But, as was said before, **the feature must always be clearly identified as the one in the centre of the circle**.

In the case of many features, if the use of “the one in middle” is not enough to identify the feature, the competitors should look for the feature in the centre of the circle.

When Column D and Column E show elements that should be combined to identify the right spot for the flag (between, crossing, junctions) the Column C indicates which between point, which crossing, etc. should be considered among the ones within the circle. This is true also for the indication ‘bend’ for linear features (paths, fences, water courses, etc.).



These recommendations are illustrated in this example of a multiple ‘between’ control. In the example the 3 possible between spots are identified (marked with purple dots) and the control description points to the East spot with the centre of the circle also in that position.

5.5 Changes introduced by 2018 Rules on Control Descriptions

Trench

This new symbol refers to a rocky or artificial trench. The same conventions that apply to gullies can be applied to trenches. Bear in mind that due to the nature of this element, special care must be taken to assure flag visibility in all conditions.

Out-of-bounds area

This area symbol is usually used to represent flower beds, and other special sensitive zones in parks. It requires the same treatment as other area elements, though flags should not be placed inside the area.

Bend

Used for a smooth change of direction of a linear feature. Bend has been moved from G column to F column in the IOF Control descriptions 2018.

5.6 Descriptions – Good Practice

In general, descriptions should not be more detailed than is necessary for the viewing of the problem from the decision point.

It is possible for some controls to have more than one valid description. Where one description is preferred, it should be used, but the others are acceptable and do not invalidate the control.

It is also reasonable practice to allow some variation in descriptions, where this does not critically affect the identification of the correct flag. The essentials of good trail orienteering are skilful map reading and terrain interpretation, and not over-precision in control description.

Where misdescription of a control in competition is thought to be critical in the solution of a problem, this can be tested by the complaints and protest procedures. But, particularly, for features mapped to scale:

- A control flag which is correctly placed in accordance with the centre of the circle on the map, but wrongly described, must NOT result in a Zero answer

For point features, the absence of a flag at the described position can give a valid Zero answer if it complies with the Zero Tolerance.

6. TrailO Controls and Timed Stations

This section will focus on the main elements of TrailO events, that is, a control point and a timed station. To analyse how these elements are used in the different disciplines, please refer to the discipline section.

6.1 PreO Control

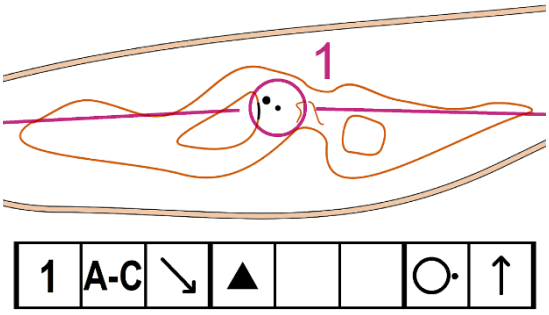
A PreO control is composed of several elements:

- The Decision point mark.
- Several flags (1 to 5) that are labelled from the decision point and from left to right as A, B, C, etc.
- A delimitation angle, normally tapes, indicating which of the visible flags from the decision point should be considered for the current control point (if needed).
- The punching mechanism.
- And of course, the circle in the competition map for the control and its control description.

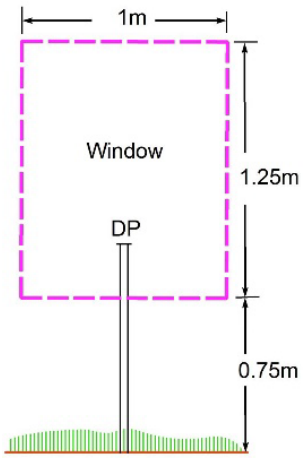
6.1.1 Decision Point

The *decision point* is a position in the competition path from which all flags are visible. It is also the place where the flags can be labelled A, B, etc. from left to right in the viewing field. From any other point flags can swap places and produce incorrect names. The decision point is marked with a prominent stake in the path to be readily visible and is identified with the number of the control.

The decision point is not marked on the competition map. If there is any doubt about its general location, the direction of view from the decision point towards the control may be given in Column H of the control description. In the example on the right, it is not clear on the map if the Decision Point for control 1 is on the north or the south path. Column H solves this question showing that the control is seen from the south.



In the interests of wheelchair users, the decision point should be located on an easily accessible place for wheelchairs - not in a steep section of the path or on a totally broken surface, for example.



It is required to allow for several competitors, including wheelchair users, to be at the decision point at the same time. All must have reasonably equal opportunity to view the flags and the terrain, whether in a wheelchair or standing erect.

It is also required for the marker flags and decision point to be so positioned that a movement by the observer 0.5m either side of the decision point does not change the kite order.

These requirements lead to a viewing window rather than a viewing point of the dimensions given in the diagram.

To accommodate two wheelchair competitors at the decision point at the same time, the conditions required for visibility of the flags and absence of parallax altering the flag sequence should also apply 2m back from the decision point stake.
The decision point is mandatory for every control in major events (WTOC, RTOC), WRE and other international level events.

Decision points and associated punches should proceed in a logical, numerical order along the physical route from the start towards the finish, regardless of whether controls are to be solved in order or not ('free order'). This is a much better strategy than to order the controls as they appear on the competition map. Occasionally, at a very late stage in the planning process, some vegetation growth or other reason may lead to better decision point positioning out of order and not reflected on the map; but this should be the exception, not the norm.

6.1.2 Flags

The flags, along with circle on the map defining the control, are the key elements of a control task. In elite TrailO it is essential to plan fair and challenging controls.

A fair control is the one where there is enough information available to solve it and, if the competitor has fully understood the map, matched it correctly to the terrain and correctly analysed the relations between the different objects in the terrain, then the answer of the control should be clear and offer no valid doubts. And of course, all possible ways to solve the control should lead to the same answer.

A challenging control can be of very different types, like those in micro relief terrain where is hard to interpret the contour and form lines, those with many point elements, those with some features hidden by vegetation, and many more. In the appendix 1 some examples of challenging controls are given.

It is permitted for flags visible from more than one control decision point to be part of the problems set at those decision points, unless excluded by tapes laid in the terrain.

Planning a control with several flags very close to each other, without clear features to decide which one is correct, is not a fair tactic to increase the control difficulty and should not be used.

A-type Controls

It is now common practice in elite competition to have the single flag problem (answer A or Zero), identified in Column B of the description with just the single letter ‘A’. This adds some dynamism to the course, and variety on the type of control-solving tactics.

The early use of the single ‘A’ control had only one flag visible from the decision point. Current practice allows more than one flag to be visible.

Competitors are required to identify the circled and described feature in the terrain and decide whether there is a flag in the correct position or not, without being excessively distracted by other flags that might be visible from the decision point.

Note that, with ‘A’ controls, it is not necessary to lay tapes in the terrain. Tapes are only needed with A-B, A-C, etc. controls in the presence of other visible flags, so that the flags for the control being analysed can be identified in the sequence A, B, C, etc.

To maintain quality of course setting with ‘A’ controls it is necessary to limit the number of flags and the degree to which they can interfere with each other, and the following procedures are recommended:

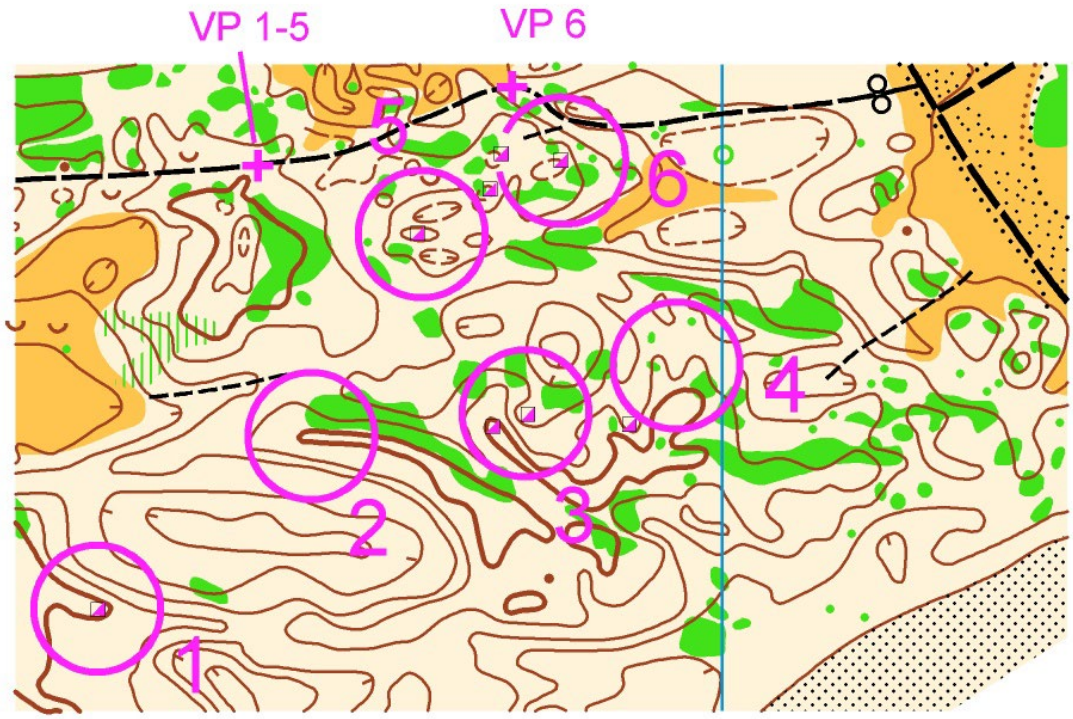
- For each ‘A’ control there is only one flag, which is either correctly placed at the feature (A) or incorrectly placed (Z) according to Zero Tolerance.

- It is permissible for markers from other ‘A’ or multi-flag (e.g. A-C) controls to be visible from the ‘A’ control decision point.

- For any ‘A’ control, flags other than the ‘A’ control flag may be positioned within the ‘A’ control circle but must not be on features similar to the control feature.

A set of ‘A’ controls grouped together, viewed from one or more decision points, is termed an **‘A’ Cluster**.

The principles of ‘A’ control setting are shown in the following example:



This example shows a cluster of 'A' controls (1-5) with an overlapping conventional control (6) nearby.

The area contains a total of 8 marker flags, one for each of the five 'A' controls and three for the conventional control.

All 5 'A' controls are viewed in this example from a common decision point (but separate decision points could be used, especially to separate the punching mechanism poles).

#1. 'A' control. Spur, upper part – marker flag correct (A)

#2. 'A' control. Spur, upper part – no flag (Z). The flag is on the spur to the east.

#3. 'A' control. Re-entrant – flag correct (A). Note that the Control 2 flag is close but on a clearly different feature.

#4. 'A' control. Re-entrant – no flag (Z). The flag is in the next re-entrant to the SW.

#5. 'A' control. Hill – Flag correct (A). The flags for Control 6 to the NE can be seen from the cluster decision point. They are on similar features but, since they are outside the Control 5 circle, they are not interfering. Had a Control 6 flag been placed on the east hill inside the Control 5 circle, it would interfere and not be acceptable. In this last case, perhaps the course setter should consider an A-B task instead of an A-control.

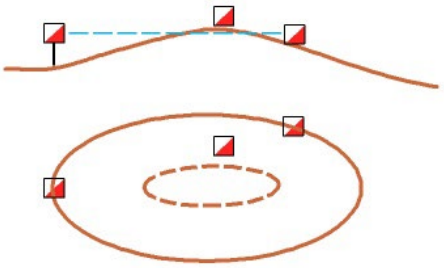
#6. 'A-D' control. Hill, NE foot. Flag A is the answer. Note that the Control 5 flag is visible from the Control 6 decision point and is then the 4th flag for that control. Alternatively, it could be taped off and the problem is then A-C.

All flags to have meaning

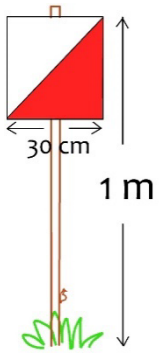
Do not add marker flags simply to increase numbers to reduce the chance of random selection being correct. At elite level flags which have no meaning are instantly rejected. Each flag used should be positioned so that it has some definite connection with the control position and description. The best incorrect flags are those which are right in several respects but wrong in one.

Caution should be exercised with 'A' flags that are well to the left of the main flag cluster. Such flags can lead to competitors identifying the correct flag but mistakenly labelling it. If a well-to-the-left flag is used, it is essential that it is an initial viable option with the correct description to give the flag legitimacy.

Control Flag height



It is important that flags are hung at the same height in a control cluster where the height of the ground is significant but difficult to judge – on the far side of a hill, for example, where the ground level is not visible but assessed from the flag height. The example shows that Flags A and C are at the same height and on the contour. Flag B is higher up the hill.

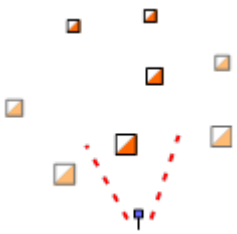


It is recommended that flags are hung with the top of the flag 1m above the ground. The flag is then useful for judging the height of features, particularly relevant for those features that have a threshold height for being mapped. All deviations from this should be stated in the bulletin or final details for any competition.

Flags can also be used for the estimation of small horizontal distances, using the apparent width of the flag as a guide. This does not change much, between 26 and 30cm, depending on the rotation of the flag,

For IOF competitions the organizer should use the same standard height equipment (or doubled kite at a distance) throughout the competition and announce that height to the competitors. This must be applied without exceptions at those controls were there is no full visibility of the flags (cane and kite) and the height of the flag could be used to infer the position of the flag.

6.1.3 Delimitation Angle



For those controls where flags from nearby controls are visible, this delimitation angle will define which of the visible flags should be considered for the current control.

It can be done with tape, forming an angle with the corner on the Decision point mark. The flags visible inside the angle are the ones that should be considered. For an "A" control a single line of tape pointing towards the control is sufficient.

This element is not needed if the only flags visible are those that should be considered for the corresponding control.

6.1.4 Punching Mechanism

The *recording point* (either a pin punch for marking a competitor's control card or electronic recorders) is sited a short distance from the decision point and placed so that it does not interfere with the decision-making process. The recording point, which may be on either side of the track, is to be readily visible, if necessary, by the addition of tapes, and numbered.

To improve fairness for wheelchair users, similarly to decision points, punching mechanisms and the main viewing points for solving control points should not be planned on steep or irregular sections of the path.

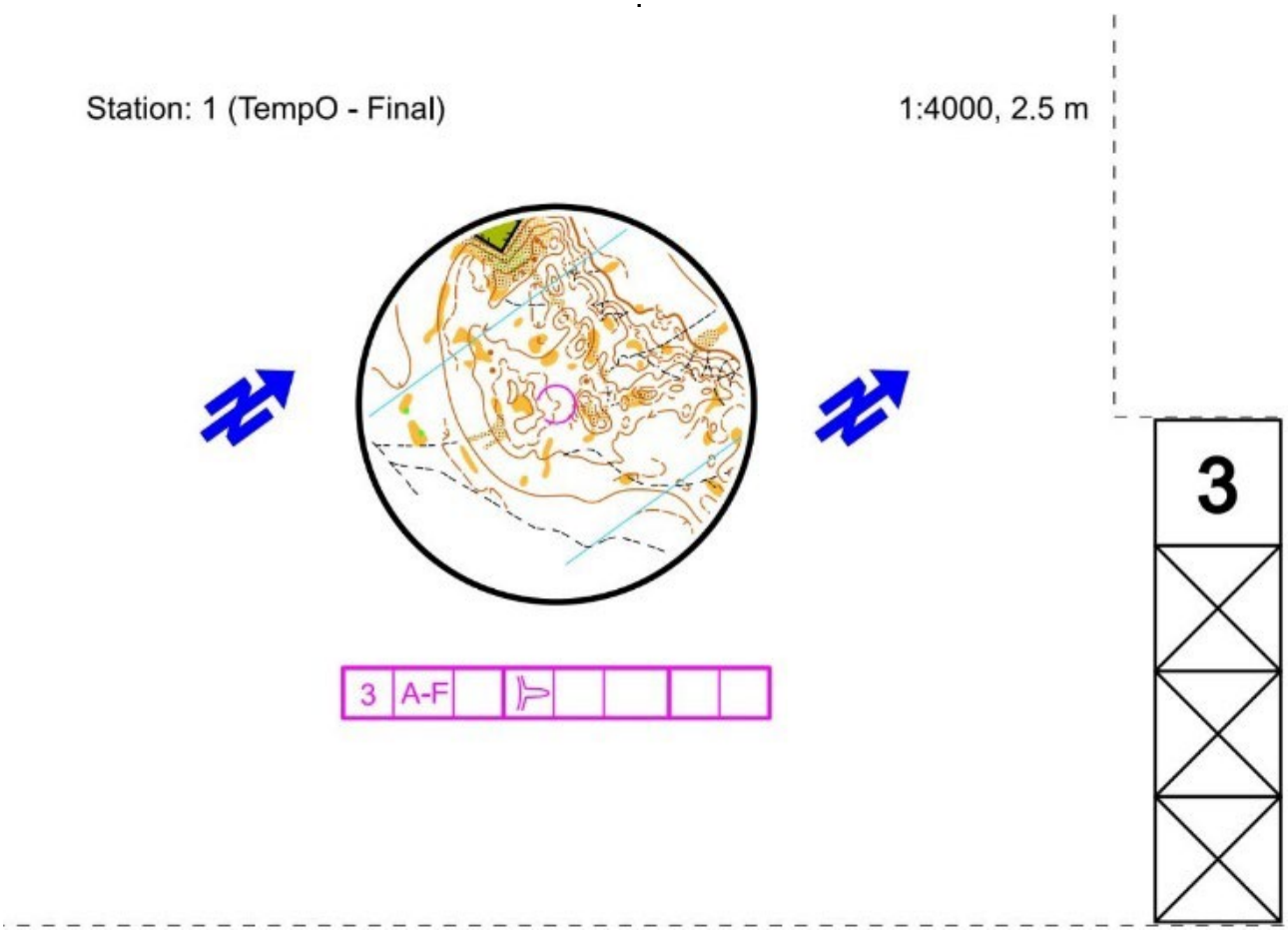
6.2 Timed Station

Timed stations are the core component of the TempO discipline and are also used in the Relay and as the tiebreaker for the PreO discipline. There are different configurations of a Timed station: TempO configuration and PreO configuration that will each be discussed later on this section.

6.2.1 Generalities of a Timed Station

For the timed station, the competitor stays seated in a fixed position. It is the most inclusive element of TrailO, as there is no advantage taken from the competitor physical condition. A timed station has six flags and several tasks (timed controls) to be solved with the same flags.

The timed control map is a small segment of the competition map at the same scale, attached to a stiff board not less than A5 in size. The segment has the control circle in the centre of the map and is oriented so that the direction of view to the flags is straight up the sheet. The following example is from ETOC 2018.



The competitor has a total time of *n x 30* seconds (*n* is the number of tasks in the station) in which to solve all the tasks in the station. For instance, with 5 tasks in the station, the competitor will have 150 seconds and can give the 5 answers at any moment during that time. The result of a station is the time taken to solve all tasks plus a 30 second penalty for each wrong answer.

When there are 1-2 tasks on a station, a warning is given when 10 seconds remains of the total available time for the station. When there are 3 or more tasks, a warning is given when 20 seconds remains of the total time for the station.

The default method of answering is vocalizing the answer using the International Code: Alpha, Bravo, Charlie, Delta, Echo, Foxtrot or Zero. The competitor can ask the marshals to use an alternative method by pointing to a letter board.

The timing starts at the sighting of the first map and stops when the answer is given for the final map.

To provide fair competition the tasks should be solvable by all competitors in the time allowed. The best outcome for a timed control test is that all competitors give the right answer but the more skilled do so more quickly.

The timed station tasks should be solvable by map reading skills, without the need of precision compass, bearing or distance estimations. Problems which are too difficult because of complexity or poor visibility result in guesswork, and this unfairly distorts the results. Most competitors will feel that the best tactic would be to guess the solution if they are taking a time close to the penalty time for a wrong answer.

Also, problems which are too easy and solved in less than 5 seconds by the fastest competitors can be subject to uncertainties in the timing procedure. The target time for the best competitors should be 5-10 seconds.

If the timed control flags are widespread across the field of view, it may be useful to place limit of view marker tapes in the terrain.

6.2.2 Timed control maps

A timed control map can be a segment of the main competition map or a map from nearby terrain at the same scale. This segment is rotated so that the middle top of the map is in the centre direction of view of the control flags. Magnetic north direction is added.

The map, at its centre, shows a single control circle, together with a description. The map does not mark the decision point.

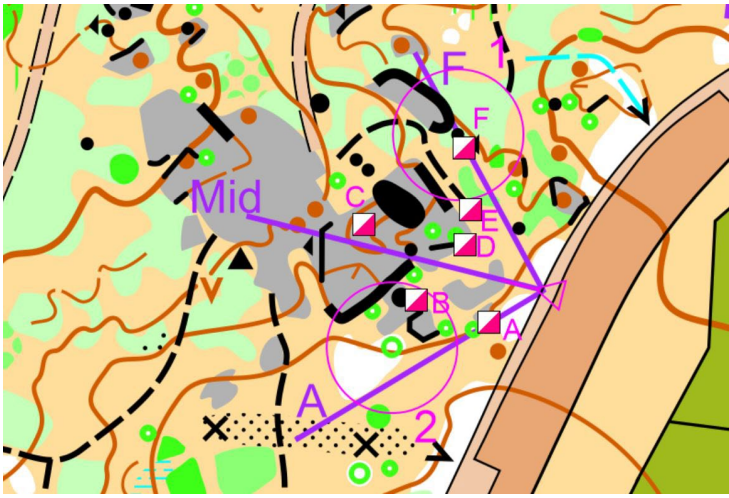
To ensure fairness at time controls, where as little as a second can separate competitors, it is important that the maps are standardized in form and appearance. The Rules specify the basic requirements and are repeated here with additional comment:

- The time control map is placed on a rectangular piece of stiff material.
- The map segment is either circular or square with diameter or side between 5 cm and 12 cm. If a square map segment is used the sides are parallel to the material the map segment is put on.
- The control circle for each control is marked at the exact centre of the map segment.
- The map segment must contain the area where the control flags are as well as the area of the viewing point.
- The map segment is oriented so that its vertical is at the mid-viewing angle between the A-flag and the furthermost flag on the right. **This angle is the same for all controls at the same time control station**. See the illustrations below.
- The time control map and procedure should be modelled before the competition to allow the competitors to confirm the arrangements.

Preparing timed control maps:

The process to correctly prepare the Timed Station Maps is described below with map samples to illustrate it.

1. On a conveniently enlarged map of the timed control area, mark the position of the control flags visible from the timed control station. In this case there were 6 flags visible from the Timed station site.

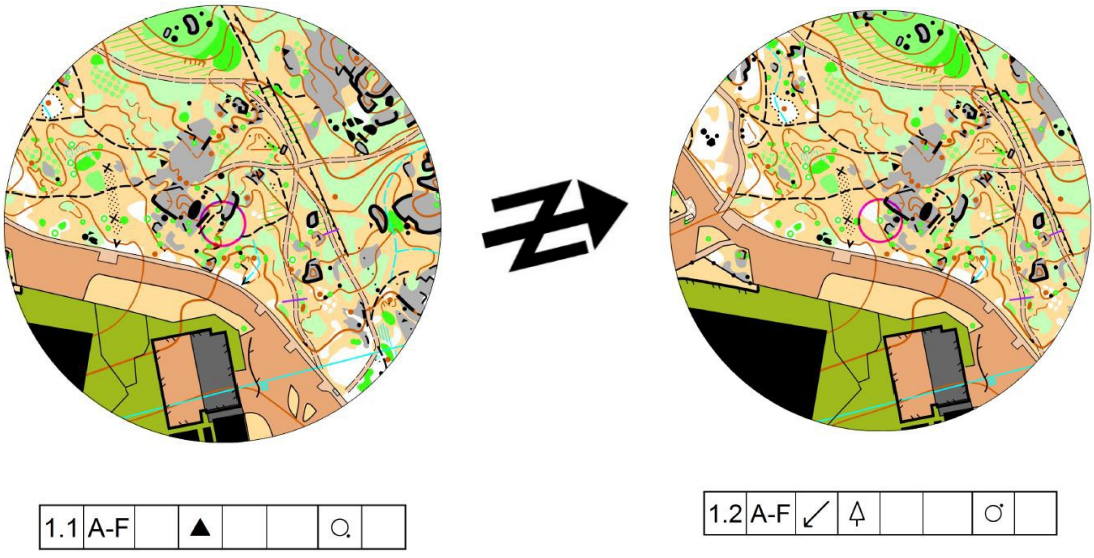


2. From the Timed Station site, determine the line bisecting the angle of view between the A-flag (purple line with A-label) and the F-flag, the furthermost on the right (purple line with F-label). This Mid-view bisector line is marked in the map with the label “Mid”.

3. Rotate the timed control area map (at competition scale) until the Mid-view line is a vertical line going up from the Timed Station site.

4. For each control, position a square or circular template of between 5 and 12 cm side or diameter so that, in each case, the control circle is at the centre of the segment. All maps at all stations must have the same shape, size and orientation. The cover sheet can optionally show a north arrow.

5. Extract the segments, add the descriptions and a north arrow, then print.

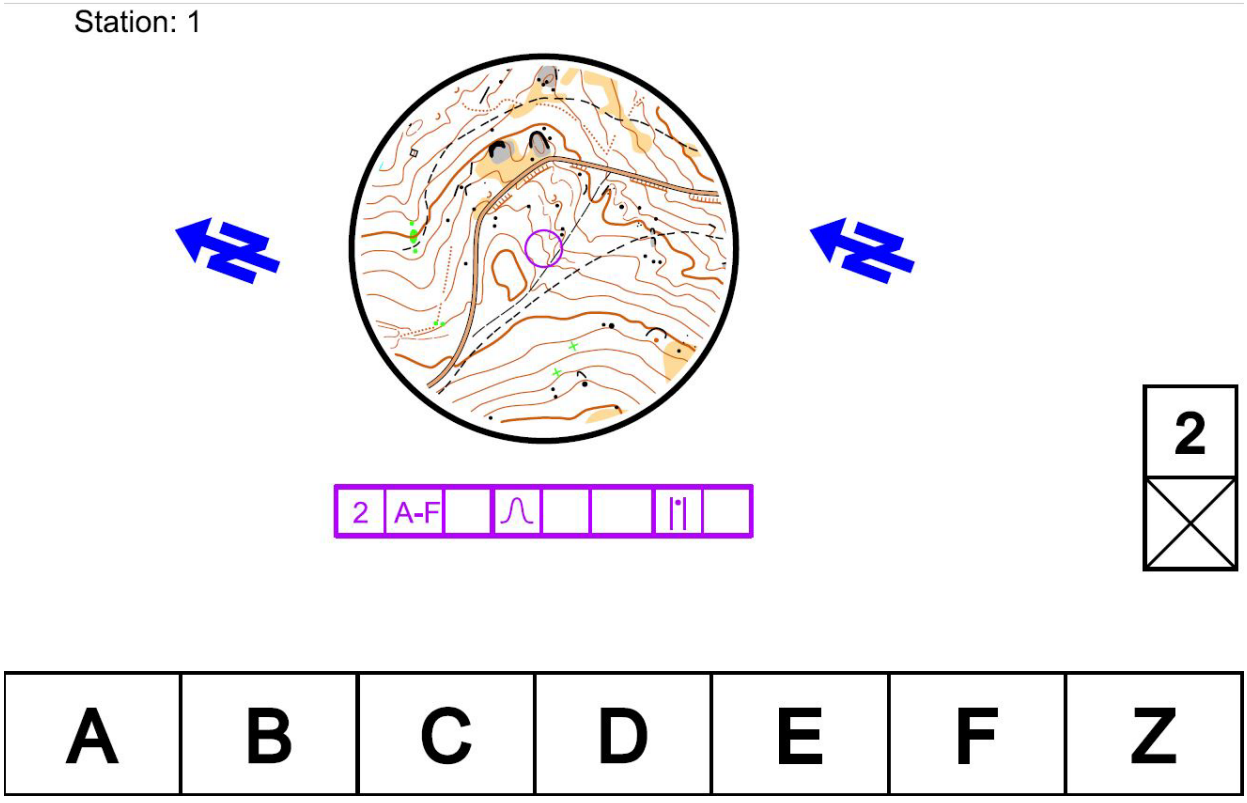


6. Comparing the two previous maps from different tasks on the same station, the background map has moved but both maps maintained the same direction for magnetic north.

There are several software tools that can execute all this process automatically, generating the maps according to this specification. The IOF site has a list of software tools for orienteering:

https://orienteering.sport/iof/it/list-of-software-for-orienteering/

Below you can see an example of a map automatically generated for a TempO station.



It might be asked why this single rotation of the map, followed by vertical and horizontal movement to bring the control circle to the centre of the segment, is preferred to rotating the map separately for each control so that the control and decision point are in line up the vertical middle of the segment, followed by vertical shift to place the control circle at the centre. The answer is that, with the map set at a fixed angle throughout, there is consistency on the map segments with any Column G directions given in the descriptions. And if each map was instead orientated to the correct kite, then it trivialises solving them to just orientating the map and the kite in front of you is the correct one.

6.2.3. Protocol at a timed control station

At any timed control station, the following protocol should be executed for each competitor:

- The competitor goes to the control station with as little as possible view of the flags and the area (see Screening section below)
- The marshals present two sets of maps (loose sheets or bound sheets) and the competitor picks one. Up to this moment the flags and area should be hidden from the competitor view as much as possible. The marshals will assume that the competitor will vocalize their answers. It is the competitor responsibility to let the marshals know if they prefer to point instead of speaking.
- The marshals point at the flags, at least to the A and F flag, with more emphasis on the harder to spot flags.

- As soon as the flags have been pointed out, the timing starts when the marshal says “Time starts now”. The competitor studies the first map, gives the first answer and only after proceeds to the next map, until all maps have been studied. Time is counted from the start until the last answer.

Two watches, or other time-keeping devices, are used. Both times and the answers are entered on a record sheet and repeated on the competitor’s control card.

More details about Timed Station management

The Timed Station is usually located in a shelter. In the shelter, over the decision point, there is a chair. For wheelchair users the seat is placed to one side and the wheelchair manoeuvred into position over the VP marker.

The normal staffing is for three officials, the recorder plus two timing-officials. It is possible, but more difficult, to manage with two officials by overlapping duties. Two is a minimum, four is fully staffed.

A timed control at WTOC 2008. Seated competitors have the same view as those in wheelchairs.

The competitors are held at a stop point some distance away, from which they cannot see the control terrain and flags. They are brought forward in turn. A fourth official could be usefully employed for this but an alternative is to place a suitable notice at the stop point and the recorder or one of the other officials calls the competitors forward.

As the competitor comes into the shelter the competitor control card is handed over to one official. The competitor’s details (name and number) are entered into the record.

The officials stand in front of the chair to block the view of the terrain and flags while the competitor settles.

Once settled, the competitor is handed a set of maps with a cover sheet. Then the competitor is introduced to the terrain with a standard routine. The officials step aside and one of them points out the 6 flags or at least the outermost flags: **Alpha** and **Foxtrot**.

It is essential that the maps have prominent sequence numbering that can be checked by the officials before being handed to the competitor AND by the competitor before timing starts.

Competitors are not allowed to slow this process by saying they cannot see one of the flags. Sometimes flags can be difficult to see quickly and easily (shadow, flags at very different heights or distances, etc.). In these cases, the official shall add additional information to precisely indicate flag positions to competitors, such as “far away”, “beside …”, “behind …”. **The official’s statement shall be the same for all competitors**. If the competitor is still unable to see any of the flags, the competitor can ask the marshal, but with time counting.

Equally the competitors are not allowed to speed this process by saying they see all the flags without them being pointed out. The pointing procedure is a ritual to give the same viewing time for each competitor.

Immediately following the pointing out of the last flag the official invites the competitor to view the map(s) with the words “**the time starts now”.** If the competitor does not see any of the flags, the official can point again to the flags, but with the time counting.

The competitor considers the problem on the first map and gives an answer, either by speaking, using the International Phonetic Alphabet “**Alpha** to **Foxtrot**” or by pointing out the letter on a pointing strip, or both. The pointing letters may be on a table in front of the competitor, or on a trestle in front of the competitor or in another suitable way.

Times are measured using two timing devices.

The answer is repeated by the recorder and entered into the records. [The reason the recorder repeats the answer is to confirm the selection and avoid problems of pronunciation.]

Without delay the competitor considers the problem on the **second map** and gives an answer, which is repeated and recorded. In like manner, the competitor continues to the **last map** and with the final answer, the **timing stops.** Competitors must follow the map order and deal with each map without reference to earlier or later maps. The times from the two timing devices are recorded, each rounded down to completed seconds.

In a Timed Station, the maximum total time allowed is 30 seconds multiplied by the number of timed controls. If there are two timed controls, a ten seconds-to-go warning is given at 50 seconds. If there are three or more timed controls, a twenty seconds-to-go warning is given when 20 seconds remain of the maximum allowable time.

Finally … Whatever system is in use; the answers and times are copied onto the competitor’s control card and the competitor departs the control station.

6.2.4 Screening

It is not desirable that the timed control terrain and the flags are visible when the competitors approach the viewing position after being called up. To avoid this, some form of screening may be required to interrupt the view.

In recent years there has been a trend by Event Advisors to require complete (100%) screening of the timed control terrain on the approach. To accomplish this in the forest some federations erect temporary 2m fencing covered with opaque polythene sheet. Other federations cannot do this without objection from environmental organisations (refer to IOF Environmental Charter). A recommended alternative is to use a string of national flags, weighted along the bottom edge. Experience has shown such an arrangement to be fully effective and acceptable to those with environmental sensitivities.

Another method introduced at ETOC 2014 in Portugal was the use of umbrellas. A marshal walks beside each competitor from the stop sign up to the station, hiding their vision with an umbrella. This method can be very effective but slows the process considerably.

Although screening is important, some visibility could be allowed if it is the same for every competitor.

The approach

'Your time starts now'

from WTOC 2012

6.3 Zero Tolerance

The underlying reason for most dissent in trail orienteering is the existence of the Zero control leading to the argument that, unless the flag is exactly in the right position, it is in the wrong position –Zero! But how exact is exact?

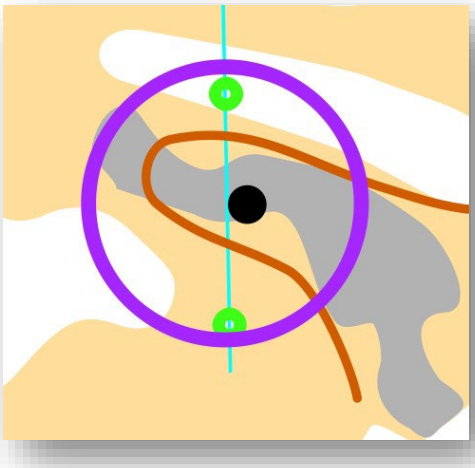
The Zero answer, no marker flag at the centre of the control circle on the map, is a feature of elite trail orienteering. Its use adds an extra dimension to control problem setting but also introduces increased difficulties with marker flag placement. This is because a minor misplacement, real or imagined, of the correct marker could wrongly be interpreted as a Zero answer.

Guidance on Zero problems is important to help competitors decide when to give a Zero answer. If a competitor has correctly understood the task, the map, and the terrain then they should be confident to decide whether any of the control flags is at the correct position or not.
Ideally, all Zeros must be clear and solved by map reading, but if a competitor believes the correct site should be a small distance away from the nearest control flag, Zero guidance

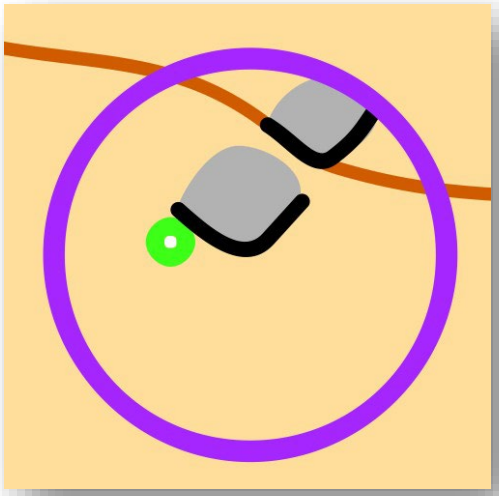
will enable them to decide whether the discrepancy is just a slight difference between their interpretation of the map/terrain and the interpretation of the planner and/or map maker, or a genuine Zero problem.
Tasks which do not adhere to the Guidance on Zero problems must not be used.

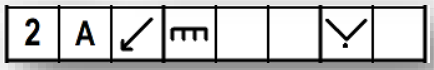
The objective of this section is to enable course setters to plan fair Zero problems and allow competitors who have correctly interpreted the terrain (and yet are unable to decide if the flag is close enough to the correct spot or not) to make a fair decision of their answer, rather than needing to second guess the intention of the planner.

Example 1
Imagine a control on a spur, with the centre of the circle touching the side of a boulder.If in the terrain the relevant flag is 2m away from the boulder, is it a Zero answer or is this because the boulder symbol at scale is bigger in the map than the actual boulder inthe terrain? In the example below, with the additional information that the flag should be aligned between the two bushes which can be checked on the terrain, is the flag correct or should the answer be Zero?



Example 2
Imagine a control set on the foot of a cliff corner, with the relevant flag on a very close unmapped minor cliff. Is the flag on a distracting cliff or just poorly placed on the correct cliff?





Is the flag on unmapped and incorrect cliff or just at the foot of what the course setter considered the right cliff?

These are examples of questions that a competitor should NOT have to worry about during the competition as these are not orienteering problems and often force the competitor to guess.
Thus, the aim of a clear Guidance on Zero problems is to avoid such ambiguities and improve fairness of the competition.
In the following sections we'll give some guidance to define this policy in a competition.

COMPETITOR VIEWPOINT

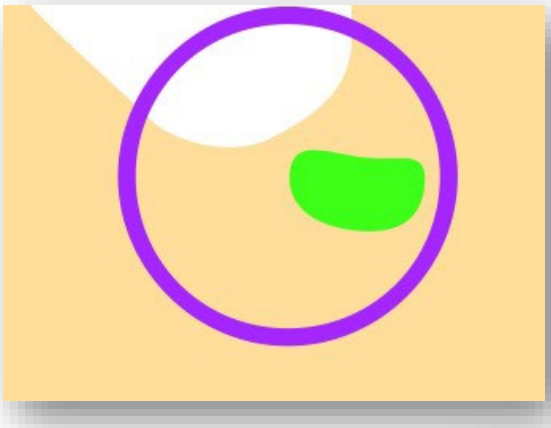
Guidance on Zero problems is to be provided by the organizer/planner of the competition and is meant to be used by the competitor in the competition.
It is mandatory that a clear Guidance on Zero problems is published at least in bulletin 2 prior to the event.
In a competition, a good Guidance on Zero problems should be as simple as possible and leave no room for uncertainty for a competitor who has correctly interpreted the map and terrain.

This guidance should, at least, meet the following standard:

> *"If the answer of a task is Zero, there should be no flag closer to the correct spot than 4m"*

This distance is equivalent to 1mm on the map at scale of 1:4000 and is the minimum gap that could be reasonably interpreted on the map. This minimum distance could be greater if the planner considers it appropriate, for example, terrain with indistinct large-scale features, long views etc.

Due to the application of this Guidance on Zero problems, side Zeros, that is, flag(s) placed on the correct feature but not placed according to the control description, including orientation, inside/outside, etc. are not allowed unless the point feature is larger than 4 m. In any case these are not interesting problems and therefore are not recommended.



As the bush diameter is more than 4m, is mapped to scale, and the flag is on the wrong side of the bush, this could be a valid Zero task, although not a very interesting one.

This guidance on Zero problems also indirectly affects those controls with several flags on the correct element, for example a re-entrant, taking 1mm as the minimum gap that could be reasonably interpreted on the map, all flags should be separated at least by that distance.

ORGANIZER/PLANNER VIEWPOINT

The objective for Guidance on Zero problems is to avoid uncertainty on the competitor side. It should never be used by the course setter to place the control flags with less precision.

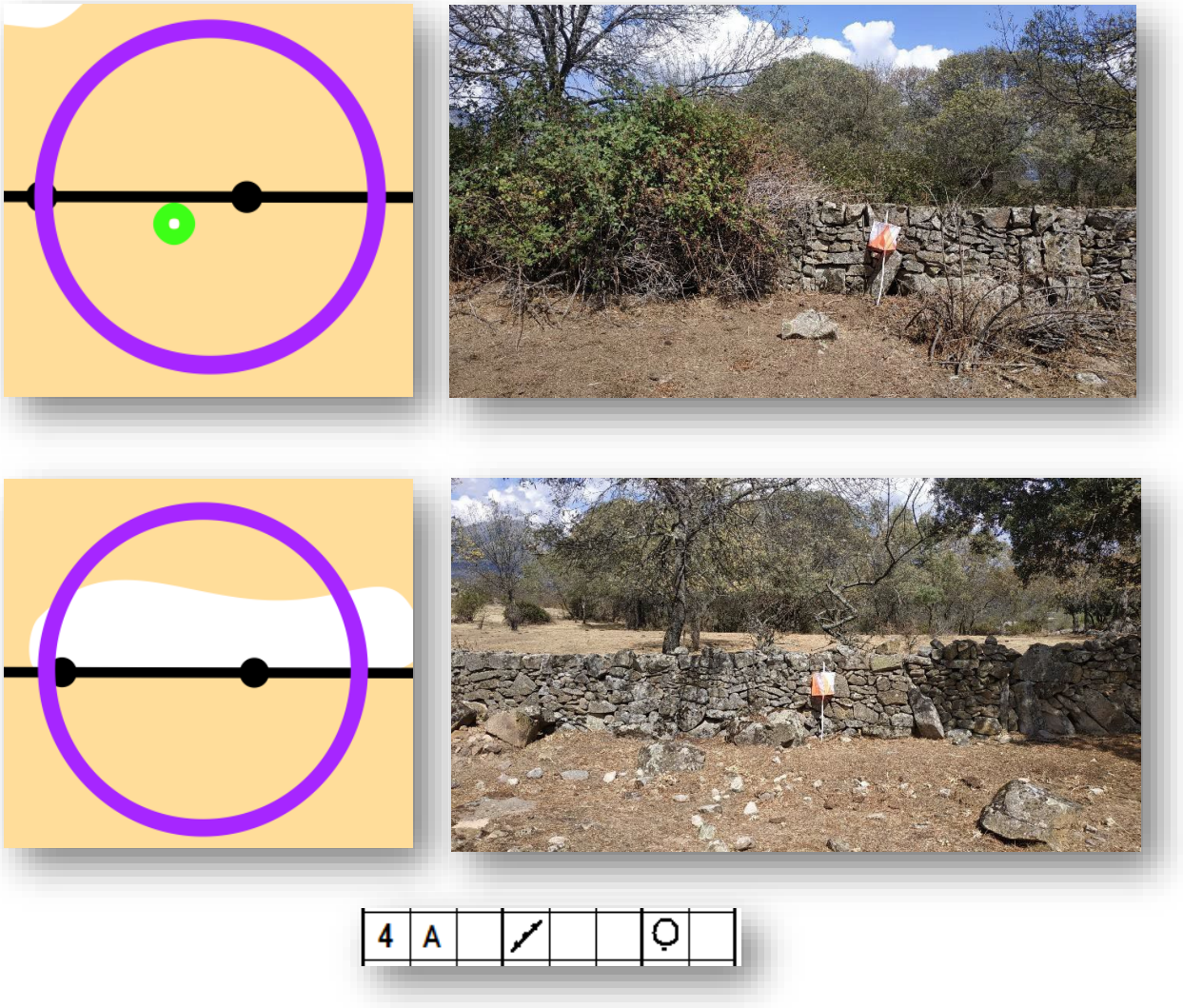
The Zero Tolerance is only for competitors, not for organizers.

It is the responsibility of the planner/organiser to decide on the Guidance on Zero problems, verify that all Zero tasks adhere to the policy by measuring the actual distances in the terrain, publish the guidance, and be very precise when putting flags in the terrain (both for Zero problems and when there is a flag at the correct spot).

The Planner's priority should be firstly to plan fair tasks, and secondly to plan interesting tasks.
When planning a Zero Control, all flags should be placed at a distance of at least 4 m from the correct spot according to the Guidance on Zero problems rule stated above. This minimum distance should be considered as a baseline for controls set on mapped point features and, if any of the following circumstances occur, it should be increased.

When to increase the minimum distance

1. Controls on long linear features without nearby point features (50% increase)
2. Controls on large area features without nearby point features (100% increase)

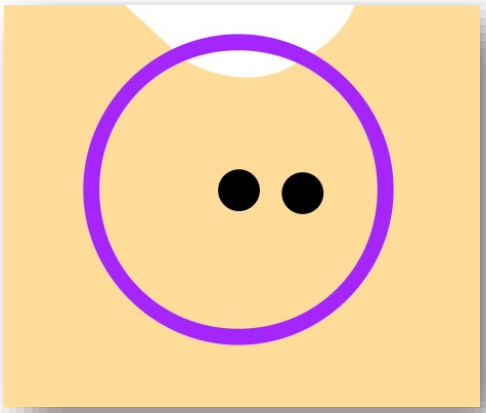


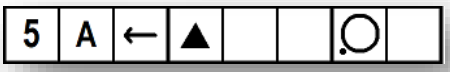
The upper part of the figure shows a control on a linear feature with a point feature (bush) nearby. In the bottom, a control on a linear feature without any point feature. Therefore, the distance between the nearest control flag to the correct position should be increased for the latter problem.

3. Long distance controls (100% increase per 100m distance)

4. These increments are cumulative. For example, if a flag is on an area element without close point features (100% increase) at 100m distance from the view- point (100% increase) then the closest flag on a Zero problem should be at least 12m away (4m baseline + 4m for area element + 4m for distance = 12m)

Exception to the 4m rule.
The only admissible exception to the 4m rule is in the case of problems set on a point feature with the distracting flag on a different mapped point feature clearly identifiable in the terrain. If this exception is used, it should be stated in the bulletin.





In this case, the two mapped boulders are closer than 4m but with this exception this can be a valid Zero task

Notes
For the purpose of this guidance, very small area or line features are considered in the same way as point features. Also, a distinct crossing between two-line features can be considered a point feature.
The minimal distances should be considered at horizontal level. Thus, in steep terrain, the real distance should be greater.

7. Disciplines

In this section the characteristics of each discipline will be described. The configuration of each event, what type of elements are used, how many of them, how long should be the event, etc.

7.1 PreO

PreO is considered the TrailO equivalent to the Long distance in foot orienteering. It is usually the discipline that involves more time to complete the course, the one demanding more “intellectual stamina” from the competitors and probably the one that requires higher map-reading technical skills.

A PreO event is composed of:

1. The main course
2. The Timed Control Station (used as a tie breaker)

7.1.1 Main PreO Course

The course is composed of several PreO Controls (see section 6.1). The quality of the event is mostly a consequence of the individual quality of the controls, especially their fairness and degree of interest. But there may also be synergies between controls that can increase the quality of the course. The variety of elements used, variety of orienteering techniques to solve the controls, controls at different distances, with different number of flags, controls used to bias decision at future controls, etc., are also factors that contribute to the quality of the event,

The number of controls in one event depends greatly on the objectives of the event. Generally, in an elite event, this number is usually between 20 and 30 controls. Each control successfully solved gives one point to each competitor. The classification of the PreO event is made according to the number of points. For those competitors with the same number of points, the time used (plus penalties) on the Timed Control Stations is used as tiebreaker.

How long is the course and what time is allowed?

The distance of a PreO course should be kept under control. The shorter the course, the greater proportion of the allowed time can be spent on solving the problems, and long distances disadvantage competitors with physical limitations. If there is a long distance between controls, introducing an untimed section is worth considering. The maximum time should not exceed 2½ hours.

The time allowed depends on the number of controls and the length of the course. The Rules give a simple base formula for a course which is reasonably flat and well surfaced:

Max. Time = 3 min per control + 3 min per 100 m

If the course is considered to have additional climb over normal practice, an allowance of 3 minutes per 10 meters of additional climb may be added.

In FootO normal practice is for the climb not to exceed 4% of the total distance. In TrailO the following is recommended:

Additional climb in trail orienteering is that:

- in the O-class more than 2% of the course length,
- in the P-class more than 1% of the course length,

The extra climb is awarded a time allowance of 3 minutes for each 10 metres of height.

Example: 2 km course with 18 controls and 60m of climb has 20m extra climb for Open class and 40m of extra climb for the Physically Challenged class

Time (O-class) = (3 x 18) + (3 x 2000/100) + (3 x 20/10) = 54 + 60 + 6 = 120 min
Time (P-class) = (3 x 18) + (3 x 2000/100) + (3 x 40/10) = 54 + 60 + 12 = 125 min

There may be other reasons for increasing the allowed time, particularly for wheelchair competitors on narrow, uneven, or loose surface tracks. The Event Advisor has the authority to make such allowances in accordance with the Rules.

The target time can be set up to a rounded figure that facilitates the competitors' calculations of their remaining times. For example, a 118 min time can be rounded up to 120 min. The time spent at Timed controls Station is not considered for this.

The competitors cannot exceed this time to finish their course. If they do so, they will have a penalty of 1 point for each 5 minutes or fraction that they exceed the time.

How to increase the difficulty of a PreO control?

There are several ways to make a control harder. When applying any of these methods, extra care should be taken to assure the fairness of the control and the availability of information to solve it. Some ways of doing this are:

A) Define limits on the course from where the control must be solved

For example, in this example of the ETOC2016 in Jesenik, Czech Republic, control 5 must be solved before the arrow starts (slightly out of the image), making it much harder, but still solvable.

B) Sections of the course where it is not possible to stop, nor turn back. This is also useful to avoid any potential disadvantage for wheelchair users on steep sections of the path, etc.

C) Use Long Distance Controls
Long distance controls with larger features make potential valid control sites provided the marker flags are clearly visible and will remain so during the competition when light conditions may change.

An acceptable solution is to increase the flag visibility by using two standard flags hung one above the other on the same stake.

Individual increased size flags are not recommended. But for very long viewing distances, this may be the only solution. If increased flag sizes are used, all flags with increased size must have the same size. Their use has to be approved by the

IOF adviser and should have real benefit for the competition. The bulletin must also contain information about the size.

If a control has flags at short and long distances, it is not necessary to double-flag all flag positions, just those at long range.

Double flagging should also be used where there is poor visibility, such as flags in deep shadows viewed across brightly lit ground.

D) Plan shorter courses
If needed select the best terrain sections and use Time stop and restart between sections. This will provide less overall time to complete the course, but also less time spent in transitions between tasks.

E) Increase the number of controls on the course without increasing the distance of the course, to add pressure on the time needed to finish the course. When doing this, consider the number of competitors simultaneously on the course in order to avoid overcrowding in any section.

7.1.2 Timed Station for PreO

In the PreO form of trail orienteering the timed controls are used as a tie-breaker to separate competitors with the same point score for correct answers. The number of timed stations, additional to the main course, is usually 1 (2 in major events), each one with 3 tasks. The competitor with the fastest overall corrected time (including penalties) at the timed controls is ranked above slower competitors with the same number of points from the main course.

Incorrect answers or failure to answer at timed controls incur time penalties, which are added to the actual time taken to give the corrected time

The rules state the following for the PreO timed controls:

- In PreO competition the timed controls are used only as tie-breakers to rank competitors with the same points score.
- The Zero answer option is not allowed for timed controls in PreO trail orienteering competitions.
- At each station, the time allowed in seconds to answer all the tasks is 60 x number of tasks
- Each incorrect answer (including null answers) adds a penalty of 60 seconds to the total time of the competitor

7.2 TempO

The TempO discipline corresponds to the sprint in FootO. It is the more dynamic, quick discipline, requires fast map reading skills but usually not the highest technical skills.

A TempO event is composed only of Timed Stations. Each competitor answers to the tasks at the Timed Stations in the same sequence and obtains a total time based on the time taken to answer the tasks plus the penalties for each wrong answer (30sec). The competitors are ranked for the competition by their corrected overall times for all the controls.

7.2.1 Timed Station for TempO

The main difference between timed stations in TempO and timed controls in PreO is that in TempO, Zero answers are possible. This provides for a new dimension in difficulty for the station making it possible to have 4 to 6 tasks at each station.

The difficulty of the tasks should be carefully considered by the course planner. As the penalty for a wrong answer is 30 seconds, it makes no sense to plan tasks so difficult that the average competitor needs a time close to 30 seconds to answer. If so, it could happen that some competitors would prefer to guess the answers and expect to be lucky. The number of Z answers in the competition is closely related to this issue. The harder the terrain is, the less the number of Zero answers there should be. The course planner should always bear in mind that a competitor quickly answering Z in every task should not manage a time that could be in the first half of the classification (at least). Overall, on average, each task should take less than 10 seconds for the best competitors in the field.

7.3 Relay

The relay competition is still relatively new; the first major event where this discipline was officially held was the ETOC in the Czech Republic in 2016.

The relay is a team competition composed of a PreO part and TempO Stations. Each team mistake on the PreO part accounts for 60s penalty which is added to the time of all team members on the TempO stations (time + 30s penalties as usual). The team with least overall time is the winner.

The PreO part of the relay will have a time limit (same as any PreO course) that will be shared by the team members. That is, only the overall time taken by all 3 team members is taken into consideration. If the team pass the Time Limit the same penalties as in PreO will occur, although here they will be implemented as 60s penalties for each 5min, or fraction passed of the time limit. To avoid very long relay competitions, it is recommended to keep the time limit under a reasonable limit (no longer than 3h30).

The Relay starts with a mass-start for the first members of each team (joint for the 2 classes or independent) for their PreO course. After each team member finishes, their team-mate can start the PreO course. The first two members of the team will go for the TempO stations after finishing the PreO course.

The last member of every team will go back to a quarantine after finishing the PreO part. Classification will be calculated (without this last team member TempO station) and these last competitors will be called to perform the last TempO station in reverse order of the classification, counting all PreO courses and the first two team members TempO stations.

Two versions of the relay are described in the rules:

Free to solve:

- The PreO part consists of a course of PreO, with several points multiple of 3 (usually 30). The first team member to start will have to solve one third of the PreO controls, but can choose which controls to solve. After finishing, the second team member will solve another third of the controls, choosing from the unsolved controls so far. Finally, the third team member will have to solve the controls left unsolved by the other team members.
- After finishing the PreO part, each team member will be conducted to the TempO part of the course. This part will consist of 1 or 2 stations.
- The organizer should balance these 2 parts in order to make them equally important. If the TempO stations are hard, one TempO station would probably be the preferred choice. If they are easy, probably 2 stations are needed to balance.

Fixed course:

- In some circumstances, it can be hard to find appropriate terrain for the “Free to Solve” relay course. In these cases, another version of the relay may be planned. This version differs on the PreO course. All team members will be given a map with a PreO that they should complete, without choosing anything. This allows for a much smaller set of control sites as team members can solve 2 or 3 times the same control 2 or 3 times, or variations of the control (same flags, different circle). But this is also a version that lacks some of the challenges provided by the Free to Solve version.
- In this version of the relay, the course planner should take extra care to provide 3 courses of the same difficulty. If one course is easier, luck will play a major role in the results depending on which team member, the strongest or the weaker, gets to solve the easy or the hard course.

Of the two versions, the “Free to Solve” version is the one that provides the best competition, as it adds an extra strategy layer to the competition, as the first and second leg competitor will have to choose which controls to solve. Team members can plan different strategies to exploit this situation. Also, this version delivers all the responsibility on what controls to solve on the team members, reducing the chance that “luck” decides the results.

There is also a mixed version of both versions of the relay that could be used in national or local competitions (not in major events as this is not covered by the rules). In this version, each relay member will have to solve a small number of mandatory problems and some optional. For example, each relay member will receive a map with 20 controls, the first 5 must be solved by every team member, and the remaining will be solved similarly to the Free to Solve strategy. This format maintains the interesting challenges but reduces the number of points of the course.

8. OTHER TECHNICAL CONSIDERATIONS

8.1 Event Advising

The National Controller and IOF Senior Event Adviser at WTOC (and similar officials at other elite events) need to work with the Planner(s) and Mapper to produce unambiguous control problems of high quality. The careful double-checking of every problem is essential for the success of the event. All possible ways to the solution must be consistent.

Experience has shown that, if there is even a small mistake in the control setting or something that could be misinterpreted, several competitors will be misled and select the wrong answer. These competitors may then argue that the control be voided (see later in this section).

The competitors' viewpoint

Advisers/Controllers act on behalf of the competitors when judging and correcting control sites prepared by the Planner. This assessment must, initially and finally, be carried out when viewing from the trails and it must consider the viewpoint of wheelchair users, both regarding visibility of the flags and solvability of the tasks from a lower point of view.

As soon as Advisers/Controllers step into the terrain, they gain additional information that is not available to the competitors. There are frequently good reasons for accessing the terrain, adjusting the fine detail of the map to better reflect that visible from the trail, for example. Therefore, it can be useful, if more than one Adviser/Controller is appointed to the competition, for one controller not to enter the terrain when a control site is being adjusted, so as better to judge from the competitors' viewpoint. However, at least one of the Advisers finally has to go into the terrain to verify placement of all flags and check the accuracy of the map.

8.2 Unmapped and part-mapped features

The mapping threshold for size of features for including them on the map can produce problems, especially for linear features. The minimum height or depth of features to be included on the map is given as 0,5m-0,6m (depending on the elements) in the mapping specifications ISSPROM 2019. The mapper may choose, if the terrain has too many features for clear interpretation, to increase the threshold. Any changes from basic specification need to be in the event details.

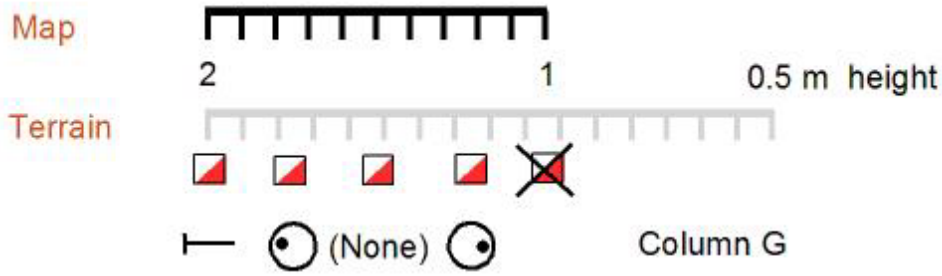
Terrain containing features where some are mapped and some are not, requires careful inspection to distinguish between them but, once this is done, there should not be too much difficulty for the competitor.

However, linear features which reduce in height can be much more problematic.

Consider the example of a rock face which is well above the mapping threshold of 0.6m at one end but reduces to below 0.6m at the other end. Only that part of the rock face which is 0.6m and above should be mapped. The planner needs to determine whether this is the

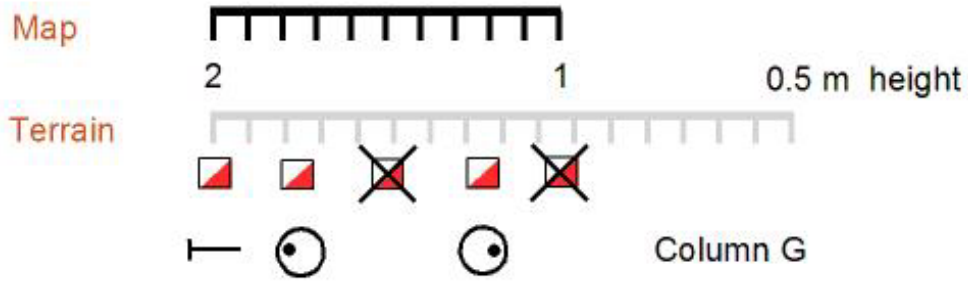
case and confirm that a competitor viewing the rock face from a distance can correctly identify the mapped section (possibly by reference to the height of a control flag).

If the mapped end can be identified with reasonable certainty, preferably by reference to other elements, then the following control positions are usable:



Even if the mapped end of the rock face is identified at 1m height, its use as a control point with the description ‘end’ is not recommended. However, the other flag positions, as in the diagram, are permitted. Note that the positional uncertainty of the mid-point of the mapped rock face is half that at the mapped end.

If the mapped end cannot be identified with reasonable certainty, then only the following control positions are usable:

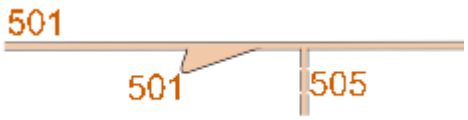


In any case these types of problems, that require that the competitor guesses small variations of the height of the elements in the terrain, are not interesting map reading controls and therefore should not be used.

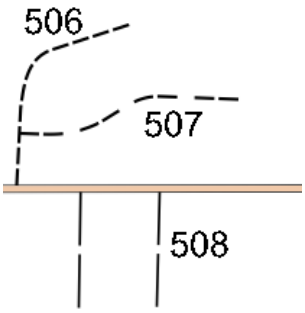
8.3 Marking of permitted and forbidden tracks

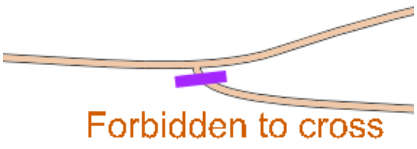
As a general rule, all paths in the map with symbols 501.x and 505.x are competition paths or areas, free to be used by all participants. All paths with symbols 506, 507 and 508 (black path symbols) are forbidden and considered out-of-bounds.

Allowed Paths and areas:



Forbidden Paths (apart from the main road):





In TrailO competition there are often several paths and tracks that shall not be used by the competitors. There are various reasons: they may not be suitable for wheelchair users; sometimes paths are forbidden to prevent the control site being viewed from a different direction; there may be a need to prevent unfair physical advantage from the young and fit running several hundred meters to get a better view to solve the control problem, etc.

As shown in the figure, symbol 708 can be used to draw a ‘do not pass this point’ bar on the map. It is repeated on the ground with tape across the path at the same point.

Also, when it is needed to use some terrain that is not marked as a competition path or area, these can be made available by using symbol 707 (left figure).

In TrailO competition there is often a need for competitors to enter or cross terrain that is not marked as a path or track as part of the planned course. Such a permissive or obligatory path, or area, is marked in the terrain by marker tape, either continuous or at intervals, and on the map by dashed purple line (symbol 707) as the left figure below shows.

In these cases, it is recommended to change the map using the allowed symbols as in the right figure. Of course the surface of these paths and areas should be improved to become wheel-chair friendly and marked with tape in the terrain.

8.4 Post-competition solution maps

Once the last competitor has finished and the course is closed, the solution sheets for all the controls, including time controls, may be issued. These are:

- either a set of map segments cut, enlarged to twice map scale (or more for very 'tight' flag placements) and pasted onto a single, usually A4, sheet.

- or a map of the whole competition area, again normally twice scale. This map is very large compared with the competition map and without additional enlargement for tight controls.

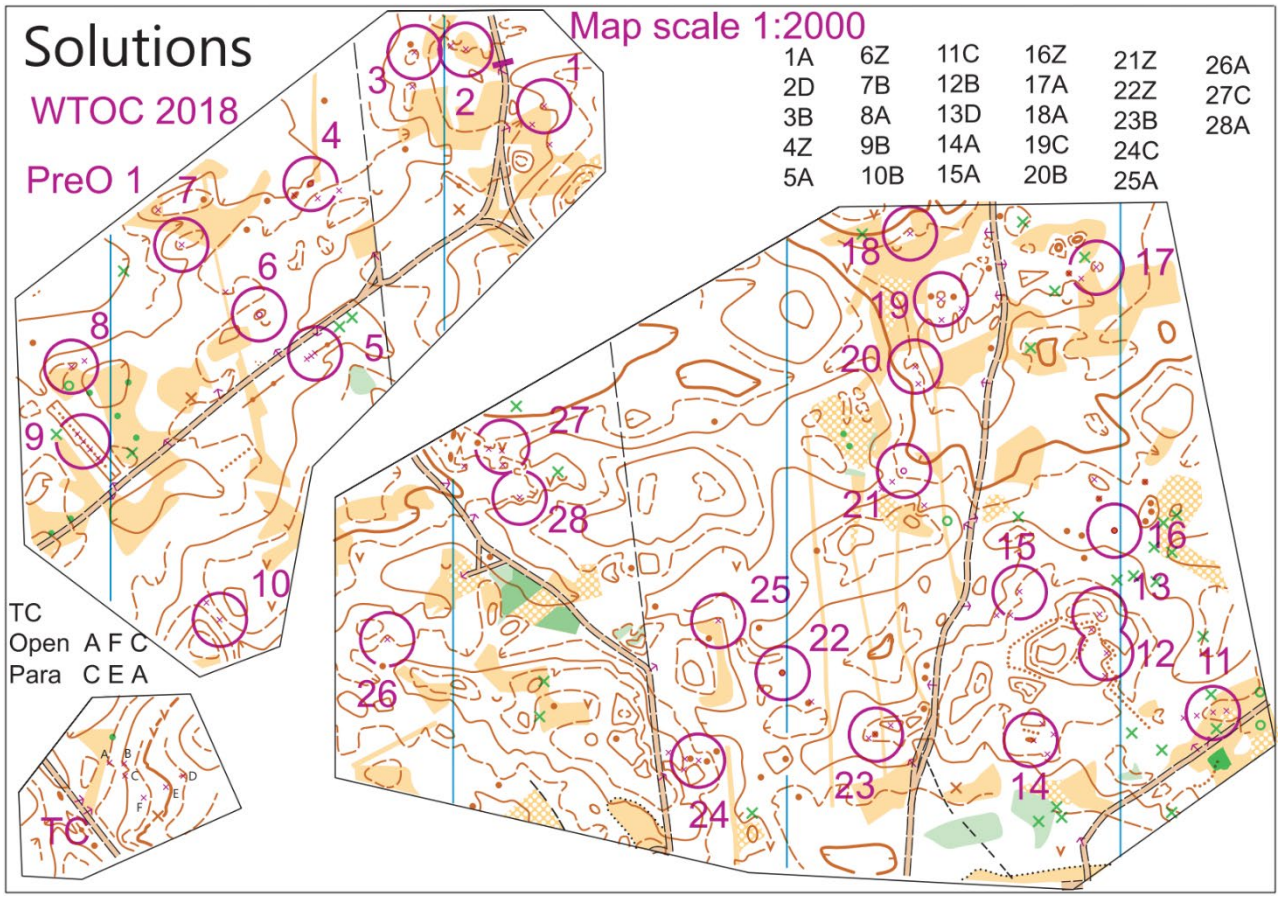
In each case the maps show the decision points and positions of the flags at each control, which of the flags is correct or, for Zero answers, the unflagged centre of the circle. Also included are the descriptions for the time controls.

It is important that the solution sheet mapping agrees exactly with the competition map. Late changes to the competition map that are not replicated in the solution maps produce difficulties and invite dissension.

A recommended procedure for mapping flag positions is to generate special symbols on the competition map, which can be used in the terrain at greatly enlarged scale for fine-tuning of the control and flag positions. On completion of the planning process these symbols can be retained for making up the solution sheets. Before printing the competition map the special symbols must be hidden!!

Of the two solution map options, the segmented maps take more effort to produce and are at risk from late changes to the competition map, but have more flexibility in presenting the solutions.

A segmented solution map from WTOC 2018 is shown below.



8.5 Disagreements, Complaints and Protests

"Trail orienteering is a platform for dissent" (the late Peter Palmer). Let us try to avoid this by careful course setting and advising.

Although most of the possible disagreements can be prevented by good course setting and advising, disagreement is a normal condition in trail orienteering. This is to be expected in a discipline that uses subjective judgment and shades of meaning. To the credit of trail orienteers, it is normal for differences to be settled by the opinion of the Event Advisor. Although complaints are submitted from time to time for consideration by the officials, it is rare for any to be raised to the level of protest.

Sometimes the validity of a control needs to be re-examined after it has been questioned by competitors or officials. If it is faulty, there is the option of advising the Organiser to void the control. Unlike in FootO this can be done without voiding the whole course.

However, the voiding of a control should be undertaken with great care. If it is decided to void a control, on the grounds that the control is unfair, this decision and the reason for it must be announced to the competitors without delay, so that they or the team managers have the opportunity to make representations.

A control shall be voided if the intended correct flag has not been placed in the position agreed on and controlled by the National Controller and Event Advisor prior to the event. It is not permitted to change the answer to a Zero answer.

A control shall not be voided if the intended correct flag has been mislabelled on the solution map or a move of the decision point has changed the lettering of the flags. In these cases, the mislabelling shall be corrected, and the re-lettering of flags shall be done.

The procedures for complaints and protests are given in the Rules.

Off-trail is off-limits

It is important that the Organiser makes it clear that at no time on the day that an event takes place (**including the Model event**) shall any competitor or official go off-trail to investigate control sites. By 'off-trail' is meant off permitted paths and marked routes. Since all TrailO controls are planned to be viewed from permitted trails, and the event controller/adviser has confirmed their acceptability, investigation of the terrain by moving off-track is not necessary, likely to confuse and unfair practice.

The Organiser is permitted by the rules to allow access to the competition area after an event closes, but this does not allow movement into the terrain off the permitted trails.

9. PLANNING LOGISTICS

Stage 1

The first stage of planning is, for each terrain area proposed, to identify possible trails of acceptable quality and length and to locate within them a suitable number of potentially usable control sites. Outline proposals for assembly, start, finish and timed controls will also need to be considered at this time.

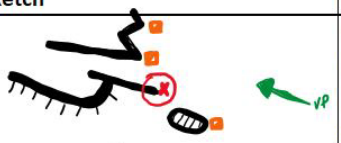
The first stage is best done when the visibility is good, not necessarily at the time of year of the competition. There is the possibility that seasonal vegetation can be cut, if necessary, to give acceptable visibility round the control sites. However, it should be confirmed, by visiting at the correct time of the year, that seasonal vegetation does not make the area unusable.

Stage 2

The second stage is to work on each proposed site in some detail, using flags, to develop a problem of good standard. The map needs to be sufficiently prepared to permit outline planning. The positions of the key flags and the decision point are marked in the terrain.

This stage needs to be completed for the visit of the IOF Event Adviser(s) at **12 months before the event**. The purpose of this visit, within the competition terrain, is to approve the courses and the main details of the control sites (including reserve sites). At this time map corrections which would be essential to the solution of the problem are identified.

The information relating to the control sites is marked on a planning/controlling sheet. An example of part of this type of sheet is shown below:

Nº	A-?	Control description	Sketch	Notes	Solution
11	AD	Cliff (one on the middle), East end		Sharing flags with CP10 View point just to the East of the bush in the path. Make sure flags B and C are clearly visible through vegetation	Z
12	AC	Rock (eastern one), South side		Delimitation angle needed. Bare rock on flag B, needs support. Adjust carefully view point to make clear A,B,C order of flags	C

Stage 3

The third stage is to revisit each control site for detailed final planning. For this, enlarged segments of the map are used to plot in the flag positions. The positions are marked in the terrain.

This stage is to be completed by the planner/controller and checked by the IOF EA visit at 3 months before the event. The objective during this visit is to confirm and approve:

- the overall structure of each course, the distance and time allowed.
- the standard and range of problems set.
- the exact positioning of flags at each control site and on the map segments for solution sheets.
- the description of each control.
- the map content (subject to further corrections identified).
- timed control procedures.
- And other essentials.

For this stage a more detailed control quality check sheet is useful:

Day __ Control ___		√
Part of competition map	**Map analysis around control** ○ All features on map identified in terrain ○ Features correctly positioned relative to each other ○ Features drawn with correct symbols ○ Map correction required?	
Part of solution sheet map	**Control analysis: position by Mapped feature** ○ Confirm correct feature ○ Confirm control flag position (including Zero) **Contouring** ○ Confirm height (altitude) of control feature ○ Confirm reference point from which contour line can be traced **Sighting lines** ○ Confirm possible lines on map and check that objects line up in the terrain	

	Compass bearing o Roughly confirm that bearing check in terrain **Distances** o All relevant distances between objects and flags numbered, checked and values recorded **Other flags** o All non-control flag positions sensible o All flag positions marked for efficient relocation	
Description	**Control description** o Conforms to rules and guidelines o Agrees with centre of circle o No better description possible	

Stage 4

These are the final checks, immediately before the event. Checking should begin not later than the number of days before the Model event equal to the number of days of competition, including the Model. With the format of one model, plus two days of championship PreO competition, one day of championship TempO, and one more for Relay, five days should be set aside for checking. This includes, for each event, the final draft of the course map, the final draft of the solution map, every control site with flags in position, and its decision point. The visibility of the flags and terrain from the decision point and any other essential viewing point needs to be confirmed as satisfactory for wheelchair contestants and any necessary vegetation cutting be carried out. Also confirmed at this time is the location and visibility of each punch, together with tapes within the course and the pre-start, post-finish and timed controls arrangements.

Once the above checks are confirmed as satisfactory, or any **essential** corrections made, the maps can be printed.

The reason for complete and careful checking of all aspects of each competition several days in advance is that experience has shown that errors or omissions are often found at this stage, despite very careful preparation. If found two days or so before the competition, there is time to put them right. Last minute changes can generate mistakes (such as differences between the competition map and the map segments on the solution sheets) and should be avoided.

For an international event the Planner will visit the terrain very many times, the Controller will visit many times. The IOF Event Advisor and/or the Assistant Advisor will normally visit three times: a preliminary visit to confirm the suitability of the terrain(s) and deliver any technical training necessary, and visits at one year and at three months before the event. At the one year visit the planning proposals should be complete so that the courses can be approved, and map corrections identified. At the three months visit the final courses, the detailed flag positions, and maps (including the solution sheets) are confirmed.

Mechanical aids for flag placement

The method of marking the positions of flags by tag or tape is commonly used but can lead to unnecessary difficulties. With multi-day events, such as the world championships, there are very many flags to be placed in position in a very short time. It is essential that the flags are installed in exactly the positions agreed in the final controlling session. This means locating each tag and searching for the hole made earlier. More often than not, the hole is not found, and the flag stake/rod has to be driven in afresh. All this takes time.

A much-improved method is to use plastic or metal tubing driven into the ground and left in position. With metal rods for holding the flags, these are dropped into the tubes, taking just a few seconds for each. The savings in time and the certainty that the flags are in the correct positions are invaluable.

A particularly useful version of this method with a tube flanged at one end and closed to a point at the other is used in Scandinavia.

APPENDIX 1. PLANNING EXAMPLES for ELITE TRAILO

There is a wide range of different problems that can be set by TrailO planners to give elite TrailO competitors the necessary variety and technical level of challenge.

In this section some interesting examples of PreO Controls and TempO stations are shown. We have tried to show examples from all World and European Championships held since 2016. Also, some examples of not interesting controls will be given.

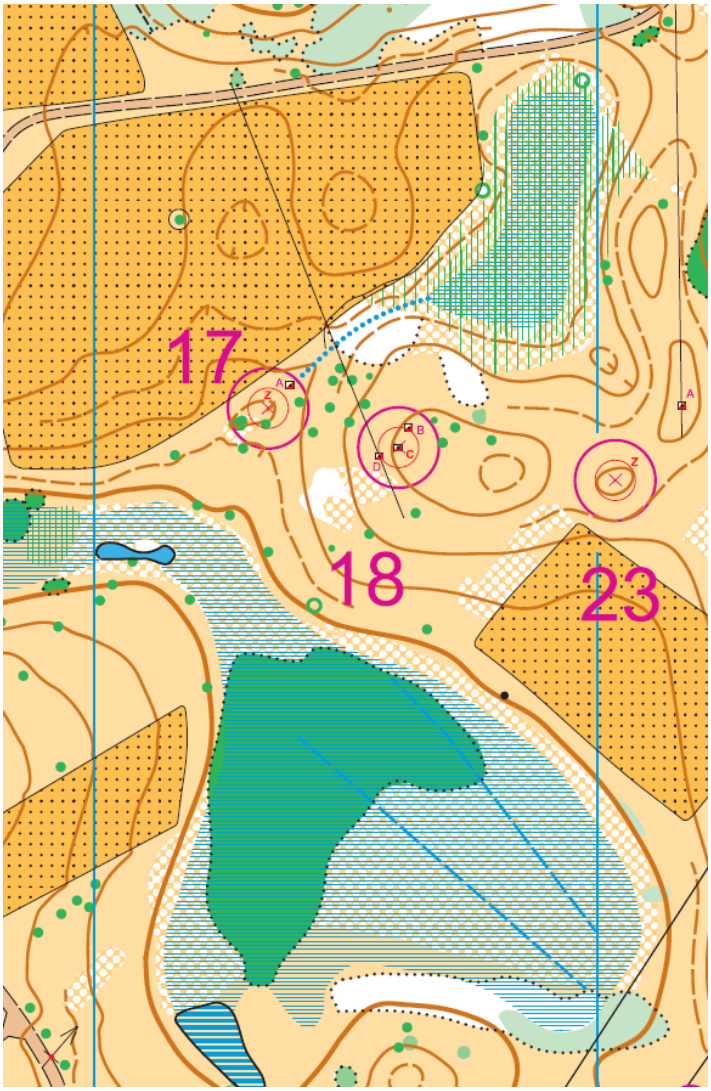
Pre-O Examples

In this section some examples from Pre-O major competitions held since 2016 are given.

WTOC 2017 Birštonas, Lithuania

PreO day 2
Course setter: Andrius Jovaisa.

Both examples shown here are from the second PreO, arguably the hardest one from this championship. The first example, control number 4, was set on an area with micro-relief. It was not a very hard control (86% success rate in class O) but required careful map reading to identify all the spurs, hills and re-entrants.



In the second example, from the same competition, there is a completely different situation. To solve control 23, it was very helpful to read the map from the north at a much earlier stage in the competition (around control 12-14). If not, when looked from the viewing point from Southwest, both hills are in the same direction, and it is very difficult to determine if the flag is correct or not.

ETOC 2018
PreO day 1
Course setter: Jan and Dusan Furucz

The first day of this championship was held in a terrain rich in contour detail. The map sample shows an apparently overcrowded map, but there was a map change after control 19 and controls 20 through to 24 were solved with another map, avoiding the confusion. This also allows for the chance to set controls in similar places with opposed viewpoints producing very different challenges.

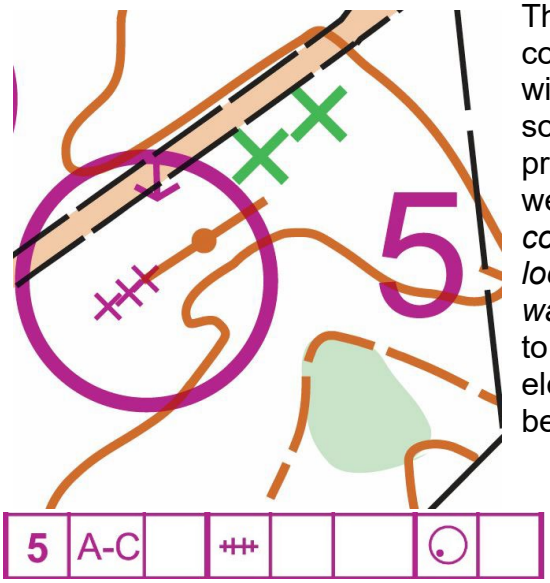
WTOC 2018 Daugavpils, Latvia

PreO day 1.
Course Setters: Janis Gaidelis & Atis Ruksans.
According to the survey held after the championship this was the control that had most votes for best control. Some of the comments included "*Different contour reading skills required to identify the terrain & its height levels in different area, for determining the flag's actual altitude*", and "*Good Zero control setting with solvable clues and well defined Zero tolerance*".

PreO day 1.
Course Setters: Janis Gaidelis & Atis Ruksans.
Another example of a good control exploiting an area with complex contours. Some comments from the competitors were "*Nice terrain illusion*", "*Very detailed terrain reading necessary*", "*Controls very visible but tough terrain to read*" or "*combination of contour and flags problem*".
This control had to be solved before a one-way section, increasing its difficulty.

The survey about the competition also included questions about the worst controls. It is interesting to see that the 2 worst controls voted by the competitors are precisely two controls that these guidelines are trying to discourage.

Control 5



This is the control with most negative votes. The control requires distance judging from the path, without any mapped element that could be used to solve the problem. It is not an interesting map reading problem. Some of the comments from the competitors were "*Old style course setting*" "*If you used the contours, the answer was unequivocally A. But if you looked at the distance from the mapped rootstocks, B was better*." This last comment is an additional reason to avoid these types of controls. Without mapped elements close by, any small imprecision on the map becomes critical to correctly solving the task.

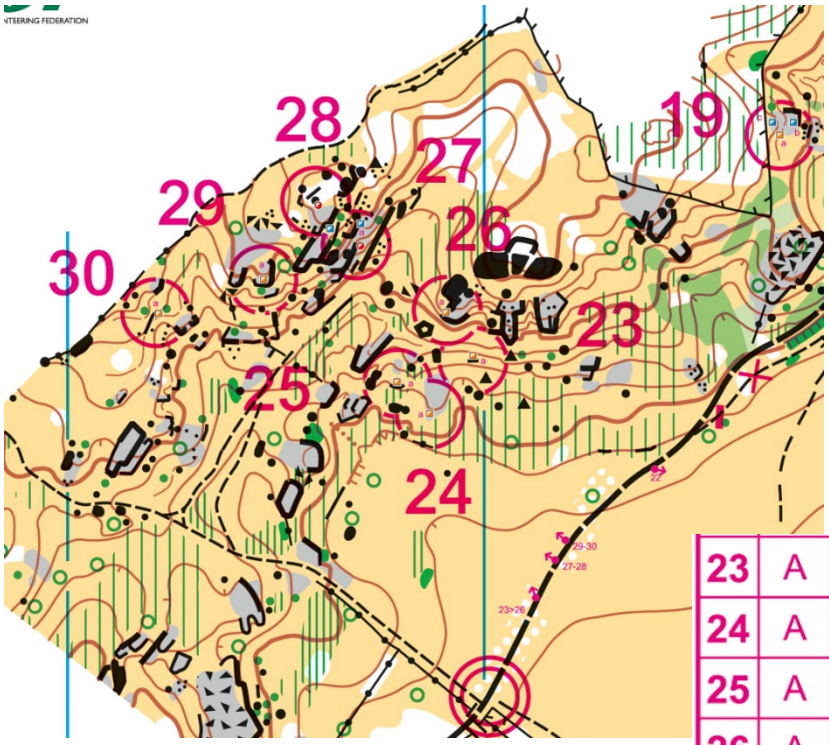
Control 9.

Similar type of problem, this time using distance judging across the terrain. Probably this control had less negative votes than the previous one due to the small inflexion of the depression that could be used to sort the task. Nevertheless, some comments were: "*Not interesting orienteering, too close flags. Difficult and steep track for wheelchairs to go back up to see terrain/trees. And not fair visibility from low position*" "*No map reading required*" and "*Not a fun control to solve*".

WTOC 2019 Idanha-a-nova, Portugal

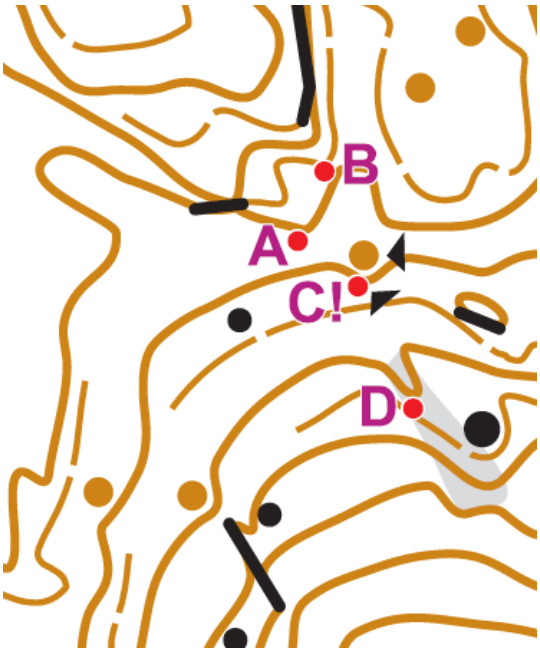
PreO day 2
Course Setter: Luis Gonçalves

The last controls of the PreO competition in Portugal were grouped in a Cluster A on a very detailed rocky slope. Here are the words of the course setter describing his thoughts when planning it.
"*The use of Cluster "A" on PreO stages in big competitions is very common. For its use at the last part of the competition at WTOC 2019 PreO - Stage 2 I contribute some facts: a previous map didn't exist, it was the final part of the PreO competition and stage 2 was divided in two parts which didn't allow the athletes to anticipate a long time in advance the difficulties of the resolution of the final controls.*
With this and the fact that it was an area with a lot of rocky details, we wanted the athletes to have more pressure and less time of map analysis which could lead to some mistakes for the best ones, in a competition that was expected to be tight. The challenges demanded map reading to be based on rocky details (stones, cliffs), at the position and relation between visible and invisible elements at the path."



23	A				A		←
24	A				A		
25	A				A		
26	A				A		
27	A				Z		
28	A				Z		
29	A				Z		
30	A				A		

ETOC 2022 Finland

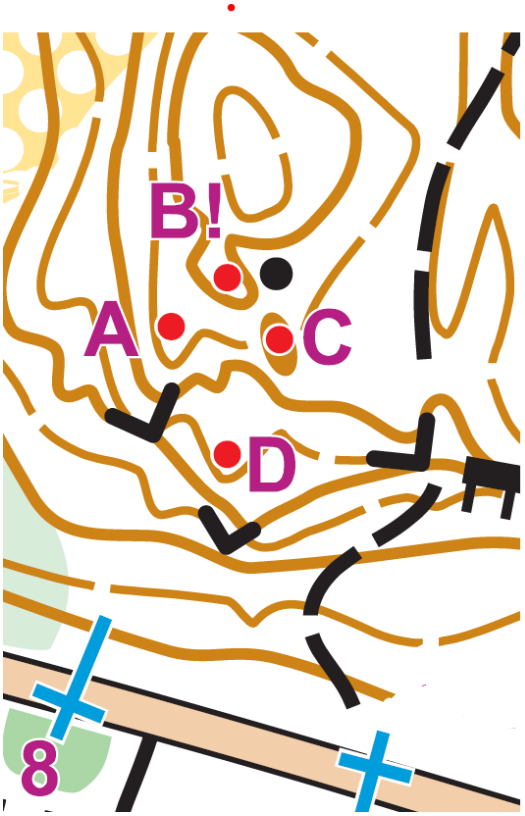


PreO day 2
Course Setter: Åke Jacobson

This nice example is a typical control in Finland, very detailed terrain with complex contours, where it is hard to interpret the terrain, especially at some distance (50-80m in this case), but once the terrain is correctly interpreted, the solution is straightforward.
All flags were placed on features that could resemble the foot of the small spur where the right flag should be. The exclamation mark shows the correct flag.

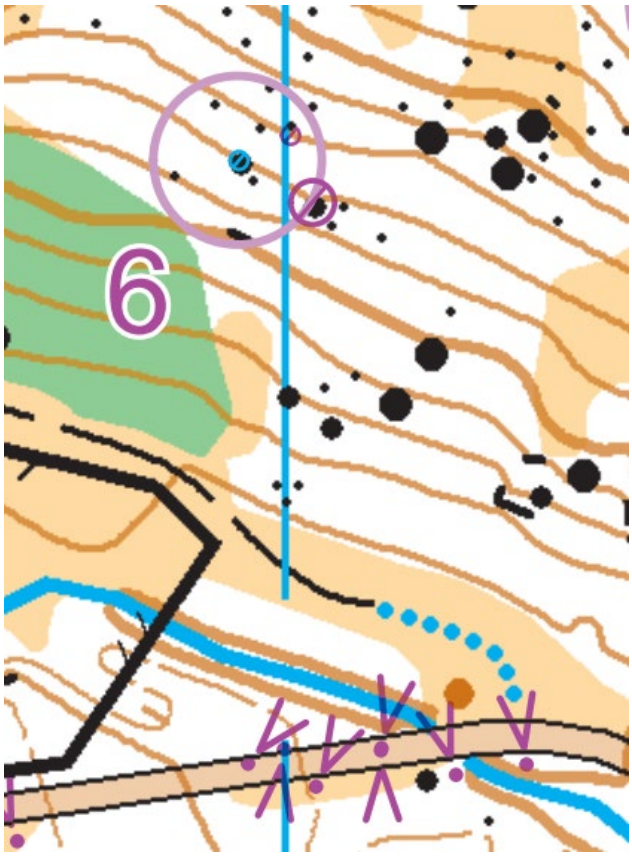
PreO day 2
Course Setter: Åke Jacobson

Another example from this fantastic terrain in Finland. The set-up of this task is quite similar to the previous one, very detailed terrain with complex contours and relief point features. Also, the height difference from the path to the terrain makes it harder to interpret the relief.
In this case the circle is placed on the centre of a small spur, and again all flags were placed on similar features. All flags are relevant to the task, as they should be.



WTOC 2022 Jelenia Gora, Poland

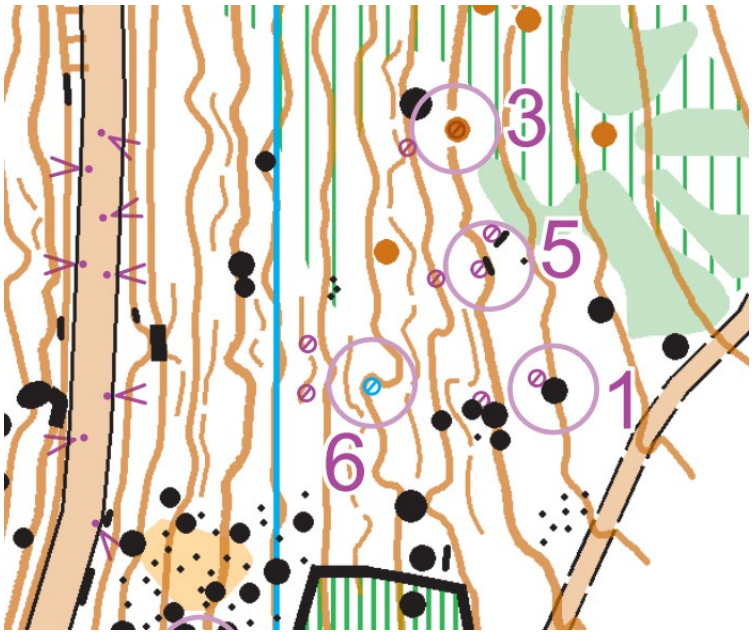
PreO day 1
Course Setter: Joanna Puternicka



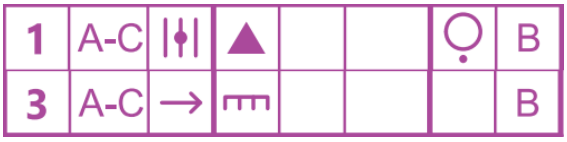
PreO 1 control 6 comments from the organizer Jacek Wieszaczewski: "*looking into the terrain from the path and trying to understand which objects are visible, the fake unmapped stone (where flag A was placed) has been noticed. After setting the flags and a quick test it turned out that the task is interesting enough. The fake stone turned out to be conveniently outside the Z-tolerance but not too far, on the other hand definitely higher than the other stone, making the task possible to solve. Task went to further testing and survived unchanged all the way until the competition*".
This task was made harder by the fact that seen from the other side of the river; the canopies of the white forest looked very similar to a green forest.

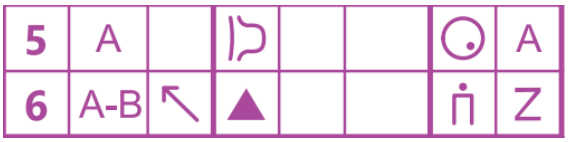
PreO day 1
Course Setter: Joanna Puternicka

PreO 2 area 1-3-5-6
This area was interesting as the organizers managed to set several points in a small area, and all of them had different decision points and different flags. In this event there were 2 maps printed on the same sheet of the competition map, with different controls, to avoid confusion. Here are the organizers thoughts on how they managed this: "*Creating all of this took about 90 minutes of going back and forth, moving flags, looking what changes, trying various ideas. During this we kept one person on the path all the time, to work within information available to the competitors. Once done, the main problem of this area was changing vegetation (especially as, due*



to nature reserve rules, in PreO 2 area we could not just cut plants that got in the way) and some flags have been moved due to this two months before the competition".



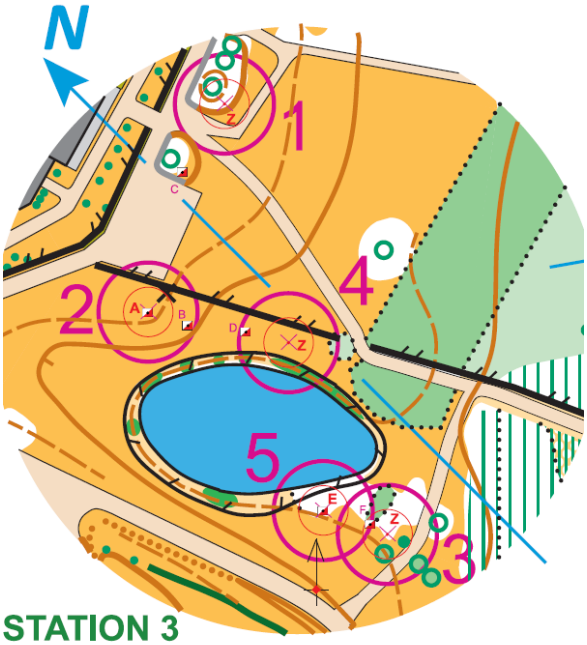


With this type of planning, organizers should consider the fact that such use of the terrain with 2 maps will probably lead to a congested area around decision points that is not desirable.

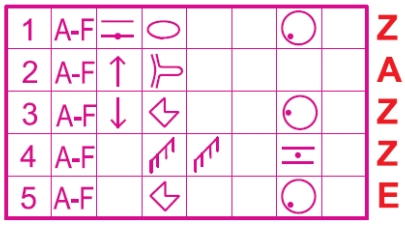
TempO Stations

In this section some Timed Stations from TempO major competitions are shown.

WTOC 17



STATION 3



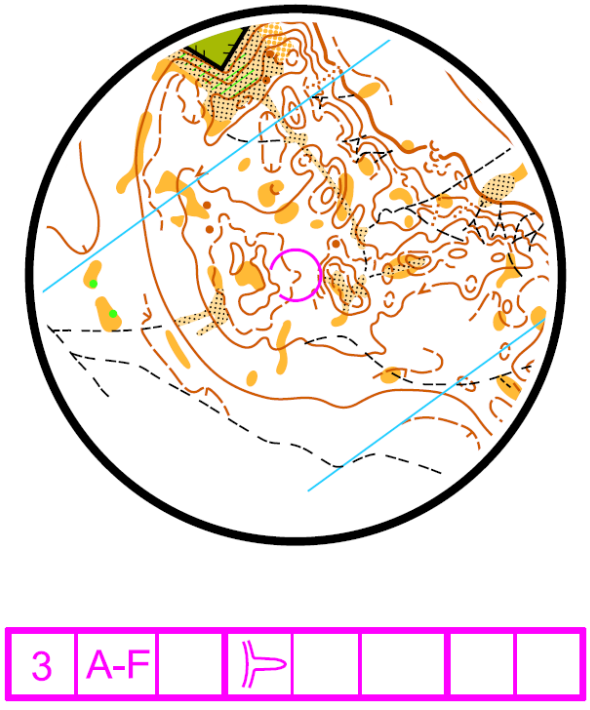
Course Setter: Andrius Jovaisa

This example is from the WTOC 17 TempO final. This was the hardest station of the course, according to the final results. The terrain includes a variety of elements, both human (fences, paths, parking areas) and natural (a lake, vegetation and some contour detail). The hardest control was number 3. Control number 4, that could seem harder on the solution map, was easily solvable by considering the trees and the green in front of the flag.

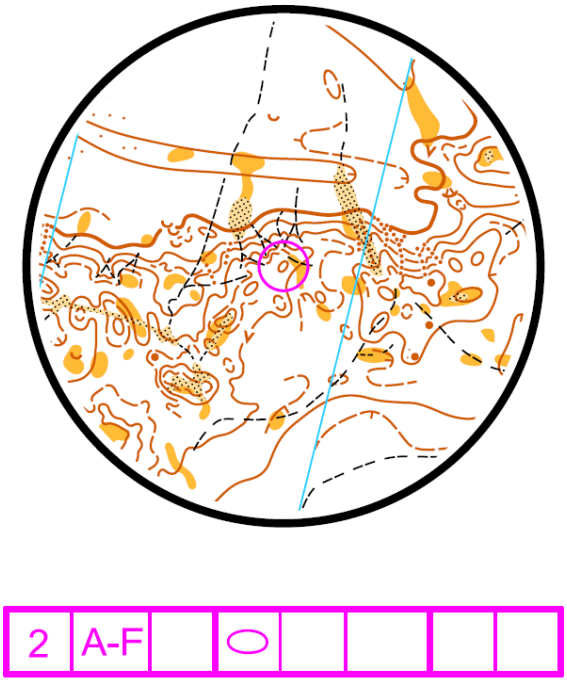
ETOC 18

TempO Final
Course setter: Jan and Dusan Furucz

The final of the TempO event was held in a micro relief area, with very detailed contour elements. Without paths and other easy elements to identify, it was hard for the competitor to position himself on the terrain and to solve the tasks. All tasks were clear, but hard to avoid mistakes with the time pressure. Here are two examples of maps from that final.



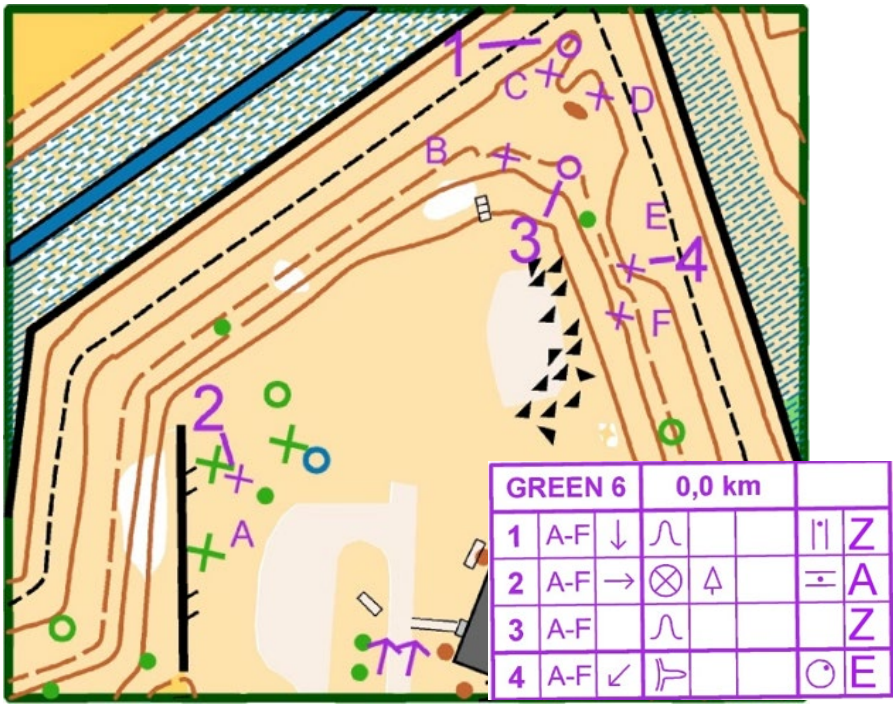
Station 1, control 3



Station 3, control 2

WTOC 2018 Daugavpils, Latvia

According to the post-competition survey among the athletes, this was the best TempO station from the competition. The terrain included both contour features and point objects of different nature. This diversity was appreciated by the athletes, who also liked that every flag was positioned in a clear spot, and although the station was hard, it was quite fair to solve.



WTOC 19

TempO Final
Course Setter: Luis Gonçalves

The TempO Final in Portugal was held on a fantastic terrain, with many gigantic boulders and lots of other rocky detail. The intense heat added to the difficulties of the terrain. Again, here are the thoughts of the planner, with the solution map of station 7 as an example.

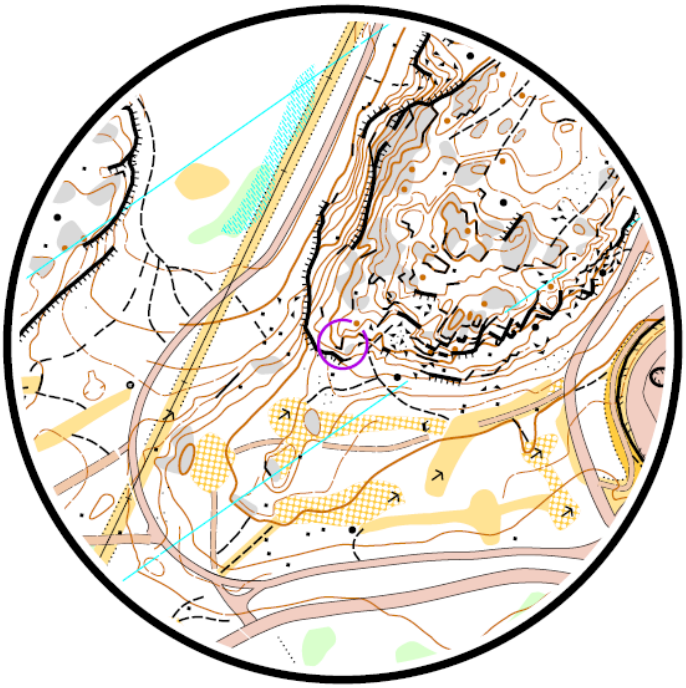
Control Station 7
"For the TempO Final there was already a FootO map known by the athletes as well as street view, which could facilitate their training and preparation. With a final with eight stations, we tried to prepare different challenges (low visibility, more or less flag proximity and some stations almost without the usual and expected rocky elements). Control Station 7, the first with spectators, as it contained a lot of rocky details in a very small area showed some differentiated characteristics. The course setter wanted the quick transposition between the terrain and the map and vice versa as well as the identification and positioning of the mapped elements to be the main challenge, and this contributed to some errors on the athlete's answers."

TC 7							
1	A-F		▲			☌	D
2	A-F		⋀				E
3	A-F		▲			☌	C
4	A-F		⋀			‖	Z
5	A-F	↗	▲			⌕	Z

ETOC 22

Course Setter: Roope Näsi

The ETOC TempO final started with 4 stations in a forest park, with both human and natural elements. The last 3 stations were tough, set in a steep cliff with many rocky details. Critical comments were received for some stations as the map had a lot of detail, very close together, and it was too hard to spot the center of the circle. Nevertheless, the example on the right, from the last station, shows a very interesting and difficult station with a lot of detail but not in excess, producing a fair TempO station.



4	A-F						

WTOC 22

TempO Final S1
Course Setter: Jacek Wieszaczewski

This was the solution of the last station of the TempO final of WTOC 2022, also a spectator station. Here are the thoughts of the organizer when planning the TempO final and this station 9:
"*The main idea for TempO was to avoid making it too difficult. It was supposed to be fast, with mistakes happening when competitors take too many risks. This station has been created by finding a place with wide view into three different groups of features (two groups of stones and some contour objects), setting two flags in each group and creating the tasks so that the competitor had to constantly switch their focus to another area. No task was very hard individually, but people ended up solving this at very varying speed (from 25 to 70 seconds) and 40% of them made at least one mistake*".

9.1	A-F	↙	▲			⊓	E
9.2	A-F		✳				B
9.3	A-F	⫴	⫍			⊓	Z
9.4	A-F		▲			○	A
9.5	A-F	⫴	▲			○	D

Championships held up to 2014

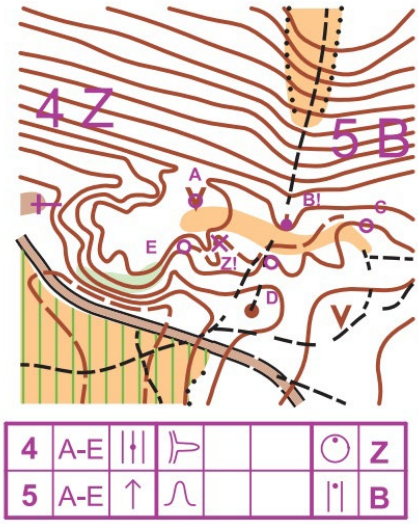
In this section some very good examples from the 2014 Guidelines are kept with the original text. Other examples, not according to the spirit of these guidelines have been removed.

Classic contouring

Example: PreO WTOC 2013, Finland, Day 2-4/5

A complex contour area with overlapping controls, in this case the 5 flags giving two problems.

The Zero control was testing.

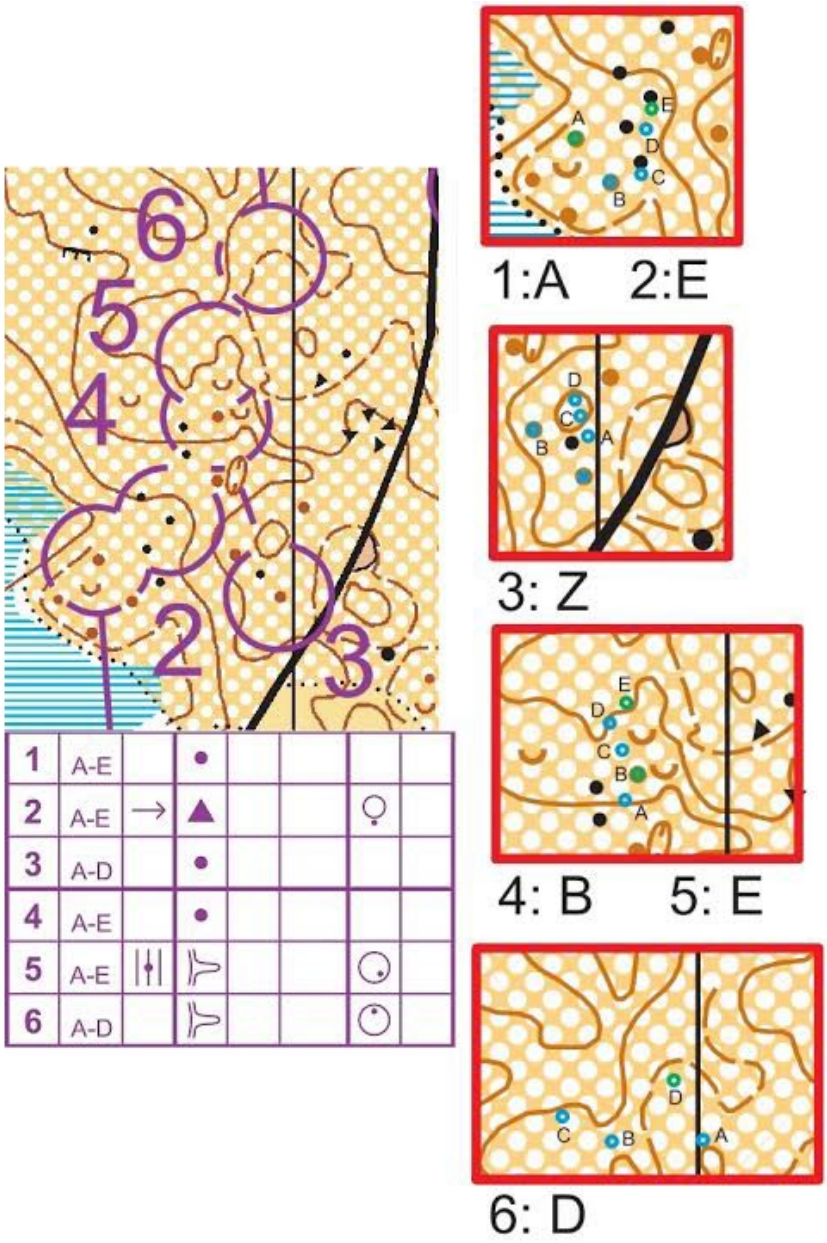


Complex control clusters

Example: PreO 2: ETOC 2010 day 2:

This shows full use of a detailed semi-open contour area with 18 flags providing 6 control problems, two pairs of overlapping A-E controls and two stand-alone A-D.

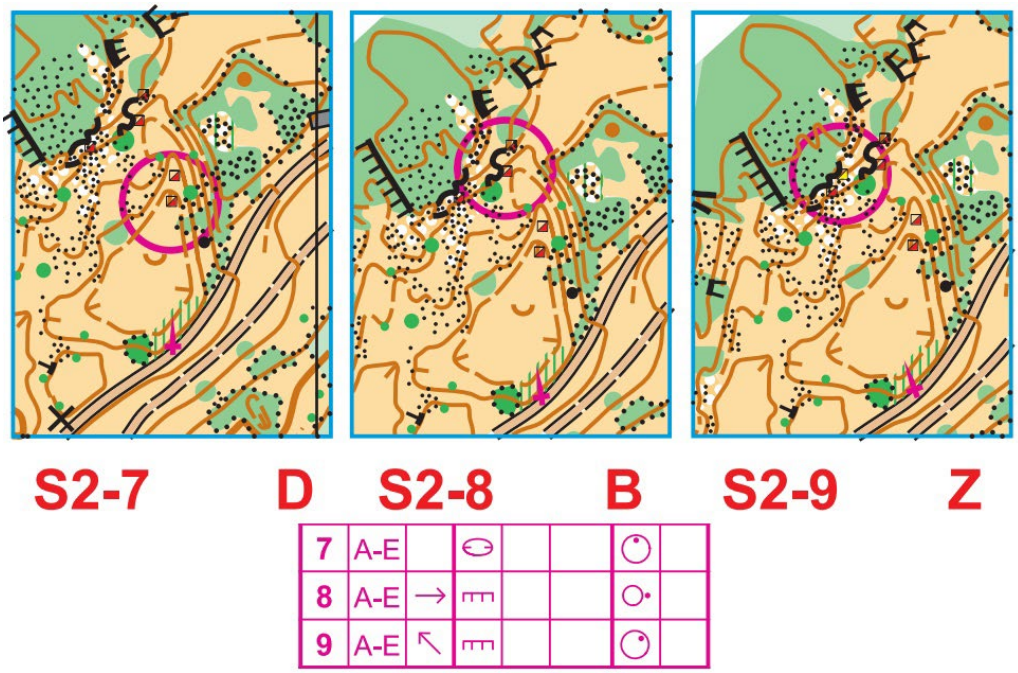
The flags were placed on mapped and unmapped features. Marker tapes separated the clusters, as necessary.



Another example of complex control cluster

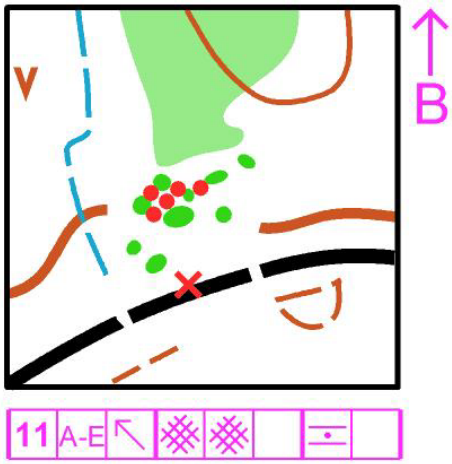
PreO WTOC 2011, France

Three control problems from five flags. The three solution sheets are easy to interpret but locating the centres of broken circles on the competition map required care.



Between

The mid point may be easily determined between features with clear sides and, in such cases, the degree of difficulty of the 'between' problem is increased by setting it in a cluster of features, some mapped and some not.



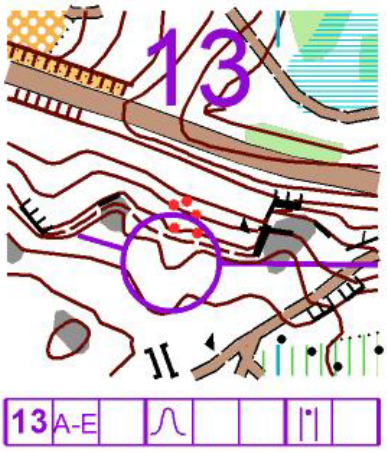
Example: WTOC 2005, Japan, Day 2-11.

Here there were a large number of small thickets. All the flags were set at mid points between pairs of thickets. The correct pair could be identified by the centre of the circle on the map and by the control description referring to the NW pair. Carefully checking which thicket was which led to the correct flag.

Invisible features (including Zero control example)

Features (such as pits) which cannot be seen from the decision point or any other permitted position can be used in elite competition but with very great care. If nearby visible features can be used to locate the flags with the necessary precision, the problem may be acceptable.

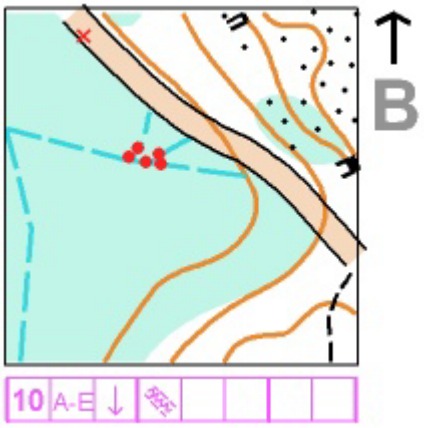
A more straightforward option for using an invisible feature is the Zero answer in which all the flags are clearly identifiable on other features, as with the following example:



Example: WTOC 2006, Finland,
Day 2-13,

The re-entrant could not be seen from the road but, if its position was correctly judged, and not confused with the small, shallow re-entrant down slope, the existence of the five flags in incorrect positions leads to the Zero answer.

Partly-invisible features



Features (such as ditches and paths) which cannot be seen from the decision point but **are** visible from other points along the track can be used for legitimate and testing problems.

Example: WTOC 2004, Swede,Day 2-10

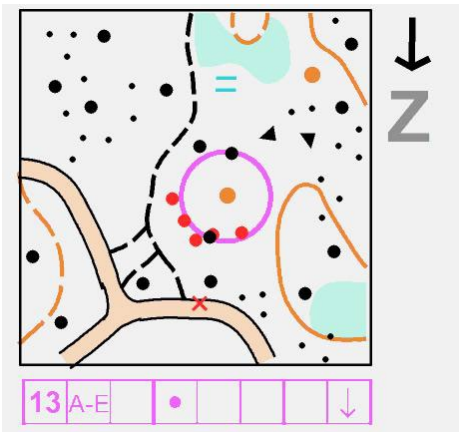
None of the ditches were visible from the decision point. However, each ditch was visible when viewed along its length. By sighting along the three ditches in turn, it was seen that all flags were marking ditches and the correct flag, just east of the E ditch junction could be identified.

Unmapped features (including Zero control example)

The use of unmapped features can provide useful problems. These features are legitimately unmapped because they fall below the mapping threshold that the surveyor has set, but there is potential for confusion with similar features that are prominent enough to be mapped. Perhaps the most common, but usable feature, is the small boulder, but there are other possibilities.

Example: WTOC 2004, Sweden
Day 2-13

This was a particularly testing control. Three flags were on unmapped knolls, one on a mapped boulder and another on an unmapped boulder. Visibility was restricted, even after some clearance work but a good line of sight from the decision point showed a good knoll with no flag.

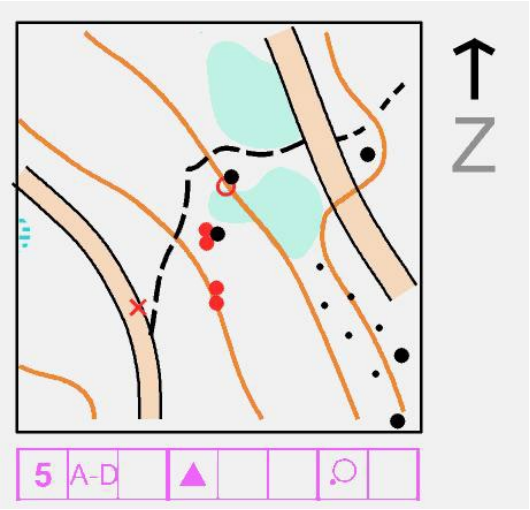


Displaced similar features (including Zero control examples)

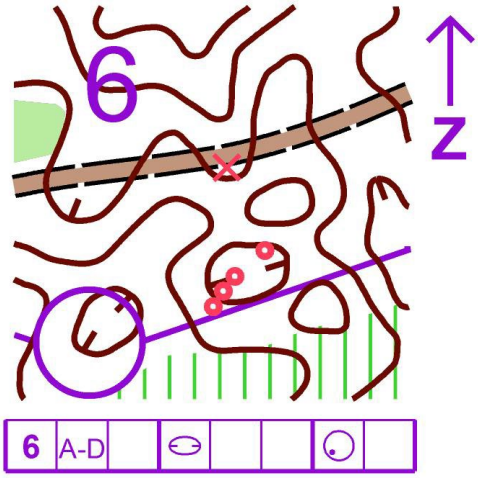
The existence of two or more displaced or **parallel** similar features can be used to set testing problems. The intention is to invite misidentification of which feature is which. These normally are set to give a Zero result, the correct feature being unmarked with the parallel feature(s) being flagged.

Example: WTOC 2004, Sweden, Day1-5,

The southern pair of flags was on an unmapped (undersize) boulder. The northern boulder was not visible from the decision point, being hidden by the thicket, but could be seen from further along the track. Careful map reading of the thicket and small path confirmed the boulder to be at the centre of the circle and unflagged (marked o)



A much more difficult version of the parallel feature(s) problem is met when the general features along the track are broad and repetitive and do not permit easy location. In such circumstances it is easy to be misled by the false control, with flags set so as to appear as a problem requiring very careful analysis, as in the following example:

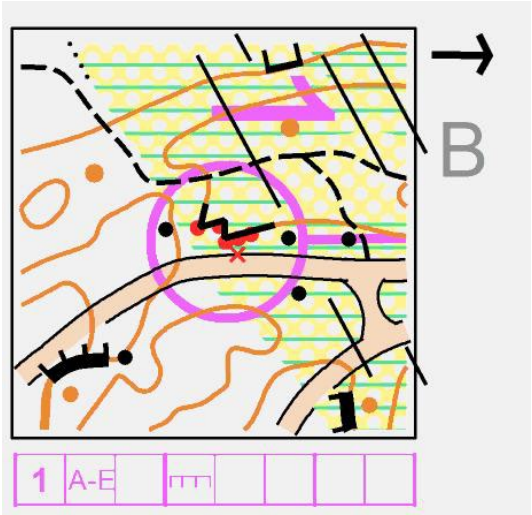


Example: WTOC 2006, Finland
Day 1-6

The approach from the west had a number of repetitions of the re-entrant and spur combinations, all with pockets of denser vegetation on the north side of the track. The false depression was surrounded by higher ground which, at first sight, matched that mapped round the correct depression. This control needed careful back-checking along the track to confirm its true position.

Irregular rock face

*The mid-point foot of a rock face is the middle of the actual **mapped** length, including changes of direction.*



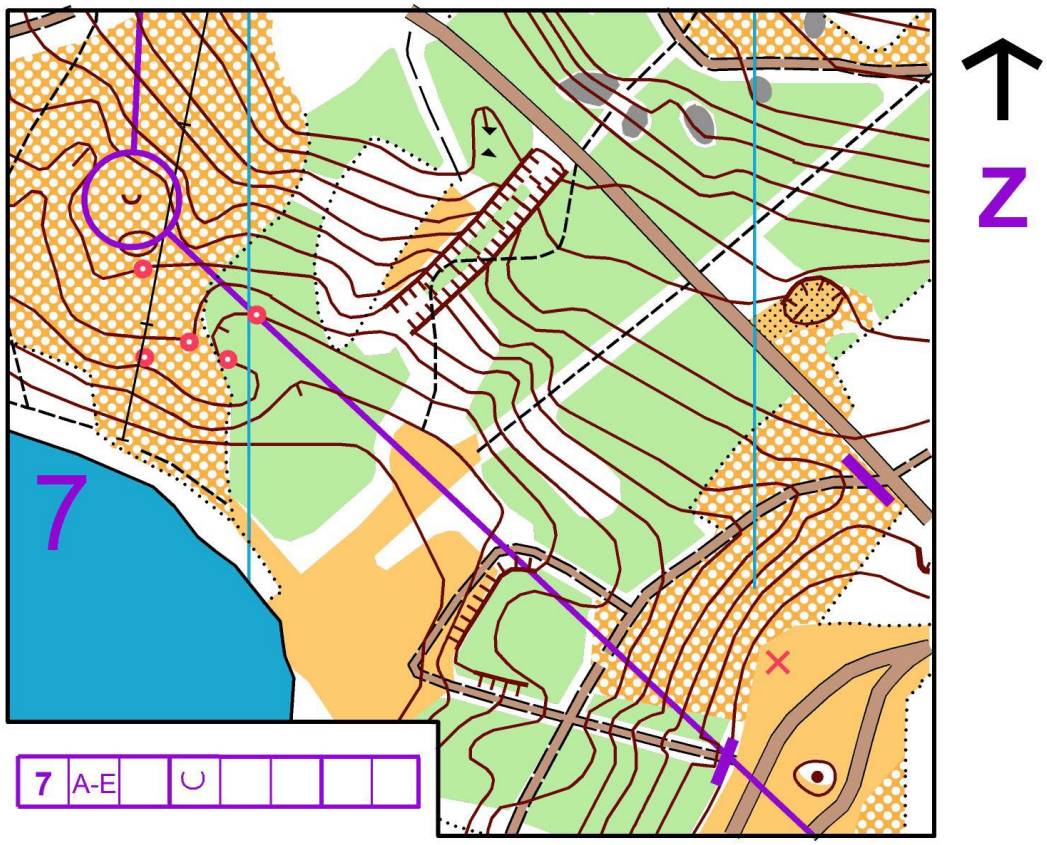
Example: WTOC 2004, Sweden
Day 1-1

Since Column G has no description, the control is at the mid-point foot. The mid-point of the mapped feature is at the nearest SE corner. The centre of the circle precisely indicates this SE corner and eliminates the distractor flag E at the mid-point of the SE face.

This was set as an easy first control on the first day of the first World Championships.

Long-range control (including Zero control example)

These are acceptable for occasional use, provided the visibility and contrast is good (and there is no fog on the day). The following is an unusual example:



Example: WTOC 2006, Finland, Day 2 –7

This viewing distance, at 200m, was well beyond normal limits, but the decision point was elevated, giving an overview of the distant terrain. There was good contrast so that the flags could be picked out against the rough open ground and the trees. The problem was relatively easily solved by sighting the power line and noting that only one flag was beyond it, this flag being the wrong side of the hill.

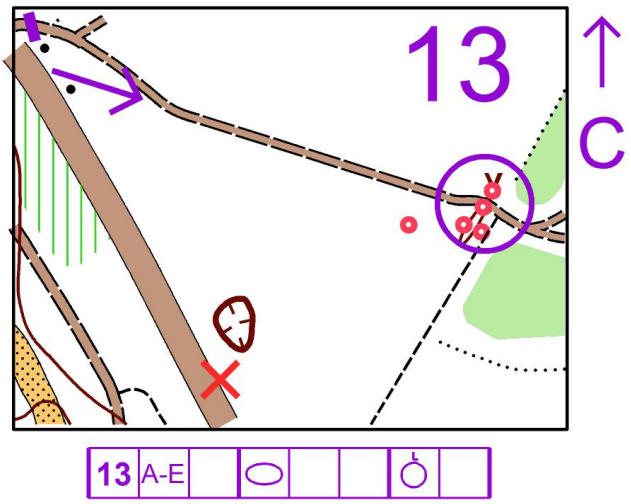
Although this problem was only of moderate technical difficulty, it demonstrates that, with care, long-range problems can be set up successfully.

Parallax

Parallax is the 'apparent change in position of objects caused by change in position of the observer'.

This property is used in elite trail orienteering when the sighting point from which the correct flag is decided is distant from the staked decision point and the relative sequence of the flags is different at the two points. It demands skills of identifying the same flag in the terrain when viewed from the different points, particularly when the correct flag cannot be viewed continuously when moving from the sighting point to the decision point.

Example: WTOC 2006 Finland
Day 1-13.



From the decision point the precise positions of the two flags north of the knoll could not be seen. However, when viewed along the path (as shown by the arrow), it was possible to see that one flag was at the northern foot of the small hill. From this sighting point this was flag B. The same flag from the decision point was flag C.

The principle of parallax can be also used to separate nearer and further features which are some distance away and tend to merge together. Viewing the features while moving along the track identifies those which are in front of the others.

Example: WTOC 2004, Sweden, Day 2-1.
This, at 125 m, was another long-range control with good visibility and contrast. From a stationary position the copses merged and appeared to be at the same distance. Moving along the track showed which were in front and which behind. Reference to the building identified the various copses.

Extrapolation

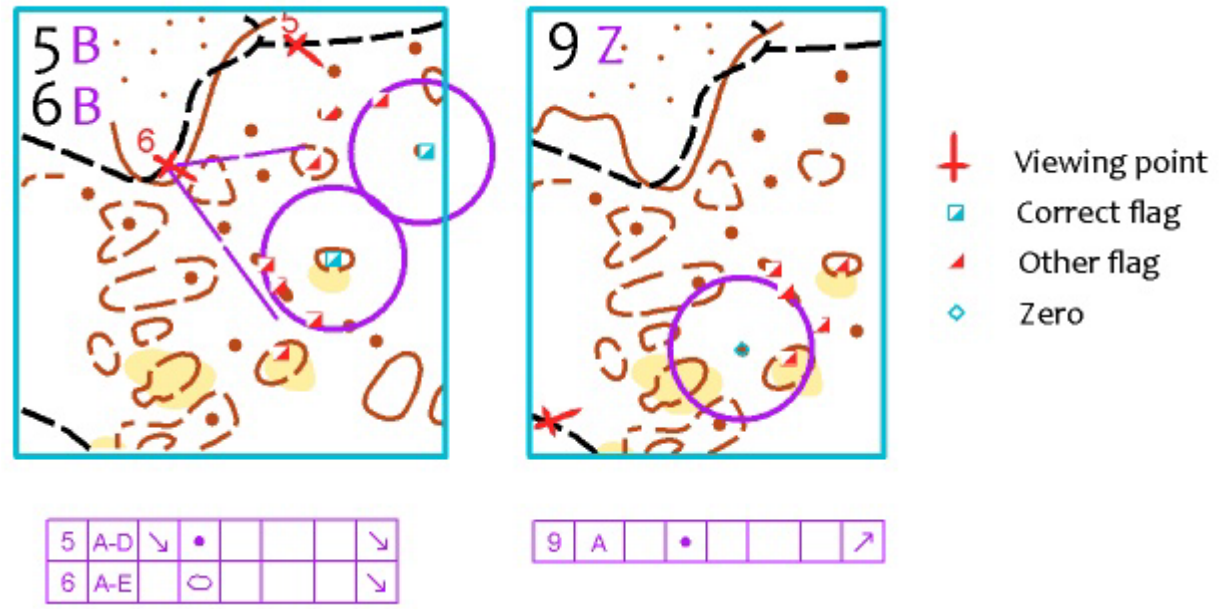
This is the extension of a linear feature, sometimes the other side of the track from the control area, to fix the position of the required flag.

Example: WTOC 2007, Ukraine, Day 1-1.

The contour ring representing the hill had its NE end just intersecting the rough open. The remainder of the contour could then be traced at that height. This could be checked against the long diameter of the ring. The flag at the centre of the circle was just inside this contour, as required.

As a further check, the extrapolation of the line of the path on the other side of the track passes through the centre of the circle.

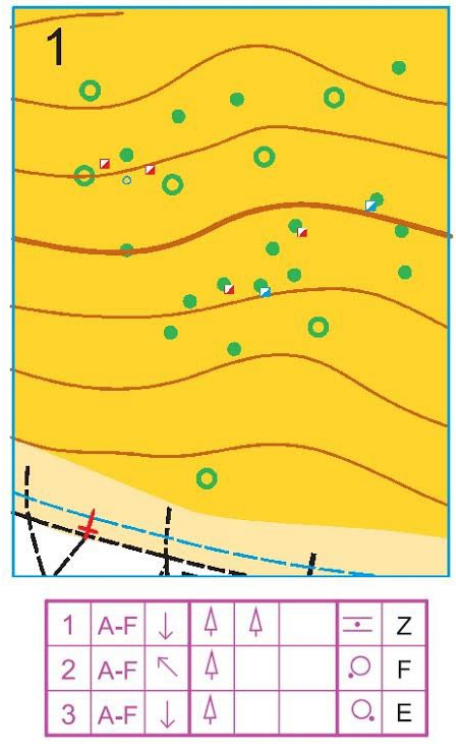
'A" control in the presence of other flags (including Zero control example)



Examples: WTOC 2012, Scotland Day 2

The terrain carried mid-aged pine trees restricting visibility:
For Control 5 only the four NE-most flags were visible from the decision point.
For Control 6 all nine flags were visible, so tapes were laid.
For Control 9 only the five flags shown on the map were visible.

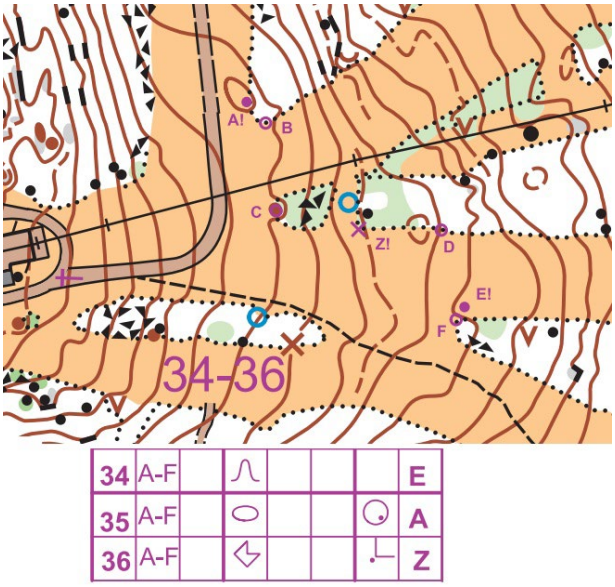
SOME TEMPO EXAMPLES



Example: TempO WTOC 2012, Scotland, 1-3

This is a map very easy to read, with negligible contouring and a considerable number of individually mapped single trees, some fully mature and the remainder much smaller. All three control problems referred to trees. The problem of identifying which tree was which was assisted by the large trees having a different symbol.

This trio of control problems would be easy for PreO but is well suited to TempO.



Example: WTOC 2013, Finland.
TempO final, 34-36

This is a more featured map with four readily identifiable blocks of forest, three of which were associated with the controls. In each case the right block of forest had to be identified and the choice made between two flags or Zero.

The terrain sloping down made the re-entrant less obvious but the reduced height of the flag confirmed its position.

A good TempO combination of different features.

Example: TempO WTOC 2013, Finland,
TempO final 31-33

A difficult set of controls at very short range (note the greatly enlarged solutions map). The map of rocky knolls and bare rock is much more difficult to interpret quickly than the example from Scotland.

A testing set appropriate to a World TempO final. But even at the highest level, care has to be taken not to set over-difficult TempO controls. In this case, the seating position was easy to spot, with steps behind, there was good visibility and close-range flags allowing identification of all mapped features.