



SVENSK
ORIENTERING



Handbook for COURSE SETTING

MTBO

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It is hoped that this document will be updated regularly as new experience and knowledge emerges.
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Introduction

Good course setting is vital for a successful event where participants go home with a smile. Good course setting for MTBO also means that the course setter views their task from several perspectives:

- Courses must offer the right challenge for the competitor, neither too easy nor too difficult. This applies to both cycling and orienteering skills. An appropriate level of challenge is what makes it fun for the competitor!
- Courses must also be fair. Both the map and the course on it must provide fair conditions for competitors. Control placement, route choices, etc. must all be clear.
- Safety considerations are also important. Riders can move very quickly in places and good course setting can minimise the risk of dangerous situations arising.

This handbook comprises six chapters. It starts with general guidelines for course setting, where for instance the importance of good cooperation with landowners and the technical difficulty level of each course are discussed. This is followed by a text about the characteristics of each distance and what you should focus on for each. Chapter three discusses how courses can be made as safe as possible in order to avoid accidents and collisions. In chapter four you can read about how to make courses as fair as possible for competitors. This is followed by guidelines for how to ensure that course overprinting is clear and fair. The final chapter tackles the importance of working to produce an easily readable map, with regard to both safety, fairness and an enjoyable experience.

The material is compiled in three levels of information for course setters:

1. Instructions on what you must take into consideration.
2. Recommendations that are advised but are not absolute requirements.
3. Suggestions and advice worth considering both in terms of making your job easier and producing good quality courses.

If *must* is used in a text, this point is to be interpreted as an instruction. If *should* is used, it is to be interpreted as a recommendation.

TIPS

Deviations from instructions should be stated in the competition invitation.
Deviations from recommendations should be stated in the final competition details.

This course setting handbook is not an isolated document and must be in agreement with other documents. Several places in the text refer to these documents in order to obtain accurate and up to date information. The handbook is affected by the following documents, among others:

- IOF's *Competition rules for MTBO*
- IOF's *International specification for MTBO maps (ISMTBOM)*
- SOFT's *Tävlingsanvisningar*
- SOFT's *Tävlingsanvisningar för MTBO*
- SOFT's support document *Arrangörsguide för MTBO-tävlingar*
- SOFT's *Kartmanual för MTBO*
- The book *Banläggning* (2016)

We hope that the contents of this handbook – with its instructions, recommendations and tips – will give you everything you need to make great courses.

Good luck in your important and fun role as course setter!





General guidelines

This chapter covers a number of general points that apply when setting courses of all distances. Two important points are access to terrain and that, according to Swedish competition rules for MTBO, it is only permitted to cycle on paths and tracks as well as some types of open land, unless otherwise stated in the competition final details. There is also a heading about levels of technical difficulty and colour coding of courses, however this is subject to ongoing development.

Access to terrain

Access to terrain is a critical factor in the future development of our sport, regardless of whether this terrain is forest, parkland or urban. It is therefore important that we organise events in a way that means we are always welcome back. Even though the Swedish right of public access allows us to cycle both on and off paths, the competition organiser must consult with the landowner before a competition and in some cases must obtain special permissions.

RECOMMENDATIONS

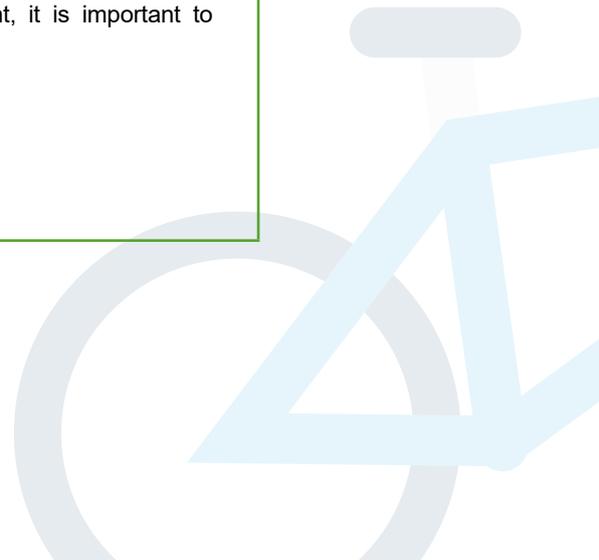
Collect information from landowners about any sensitive areas, both with regard to vegetation/surface and animals.

Although there is no clear evidence that cycling damages the ground more than running, many people hold that view. It is therefore best to avoid, for example:

- Very wet areas, such as when a path crosses a marsh.

There are also other types of land which should be avoided. These could be key habitats, ecologically protected areas and suchlike.

If courses use public roads, you may need permission from the County administrative board and if the event is in terrain (whether forest, park or urban area) where there could be many other people present, it is important to provide clear information before the competition.



Keeping to the paths is the norm

One thing which affects both the course setter and competitors is whether taking short cuts or riding (cutting) through the forest is permitted at a competition. This may vary from country to country and also within Sweden. It is worth noting that SOFT's competition rules also apply:

5.7.8. For MTBO the following also applies:

Cycling in the terrain is not usually permitted unless specified by the organiser. Information about this, as well as whether it is permitted to carry or walk with the bike between paths, must be provided in the competition final details.

Therefore, the main rule is that only cycling on paths, roads and other permitted areas (permitted open areas, tarmac and gravel surfaces, etc.) is allowed. Exceptions may be made if the terrain type allows and there is good enough reason for this, for example if the path network is sufficiently dense (and possibly unclear) to make it difficult not to accidentally deviate from the mapped path network.

RECOMMENDATIONS

The course setter *should* set courses in such a way that there is no possibility to take short cuts, or that a short cut would give as little advantage as possible. One way to do this is to use "steering" controls (see page 34).

Regardless of whether or not taking short cuts in the terrain is allowed (applies to both cycling and walking with/carrying the bike), it is very important that organisers are careful to provide information to competitors about what is allowed, for example in the competition final details and displayed on an extra sign at the start.

THOUGHTS & CONSIDERATIONS

If the rule about short cuts changes too often from one race to the next, it can be difficult for competitors to remember which rule applies on a particular day. Whether short cuts are permitted affects for instance the route choices made by the rider and a lot of time could be lost by remembering a rule incorrectly, even if the rider has not broken any rules.

From a fairness point of view, it's probably best to let competitors take short cuts if the terrain and landowner allow. Then there is no confusion. However, this must be weighed up against the main rule and the risk of causing damage to plants and animals.

Choice and use of terrain areas

In general, leisure areas and nature reserves near urban areas are suitable for MTBO events. These have many paths in a variety of sizes. But at the same time these areas can be busy (with walkers, runners, cyclists and others), so particular consideration must be given and information must be presented clearly.

Different areas are more ideally suited for different distances. Read more about what is suitable for each under the headings for the respective distances.

In general, from a safety perspective it is best to use the largest area possible, regardless of distance. As course setter you can make sure juniors/beginners use different parts of the area to elite competitors and spread competitors over a wider area.

Sometimes, however, you may be asked to set courses in a smaller area. One way to fit longer courses into a smaller area is to use a map change. In such cases, remember to consider the risks associated with riders meeting each other on paths and how suitable the courses are from a safety perspective.



Difficulty levels

There is currently no fixed colour coding/grading system of difficulty levels for MTBO courses. The table below is a first attempt and suggestion for how to approach difficulty levels for MTBO courses, both in terms of orienteering and cycling technique (how easy the paths are to ride on). The table below shows three difficulty grades for orienteering technique: white, orange and black. Green, blue and red are used to show the difficulty grades for cycling technique. Please use this table if you feel unsure and need guidance.

It is important to provide this information in the competition invitation and final details so that participants know what type of terrain to expect and the technical difficulty of the paths in the area.

Please see the table below for suggestions and guidance regarding the difficulty grading of courses.

Cycling technical difficulty	Orienteering technical difficulty	Who the course is suitable for
Gravel and tarmac roads and larger paths, e.g. lit ski tracks. Gentle climbs and descents.	Clear and few route choices between controls. Junctions are clear.	Beginners, younger juniors
Roads and paths without too many roots or stones. There are some steeper hills but mostly gentle gradients.	Clear route choices. Direction changes at controls.	HD 13-16 and HD 50+
There are paths with stones, roots and crossing marshes, long and steep climbs and descents.	Challenging route choices, direction changes. The ability to use contours and features in the terrain is a big advantage.	HD 17–20 up to and including HD 40

Photo: Stina Lohman



Junior and beginner courses

Remember that children up to around 12 years old do not yet have the necessary cognitive skills to overview and manage complex situations, such as handling a bike, orienteering and looking out for other path users at the same time. For juniors up to 14 years and beginners, the course setter should also aim for route choices along paths that are easy to cycle on. Ideally, these courses are also in areas where riders do not come into contact with the most competitive classes. You must also avoid courses that include trafficked roads. This applies in particular to our youngest competitors.

Route choices

The ability to assess route choices and choose the best one is a key element of MTBO. Most legs have two or more route choices, although the course setter can include a steering or transport leg (with no route choice) to create a better route choice from the next control or include a leg with no route choice but difficult orienteering for variety.

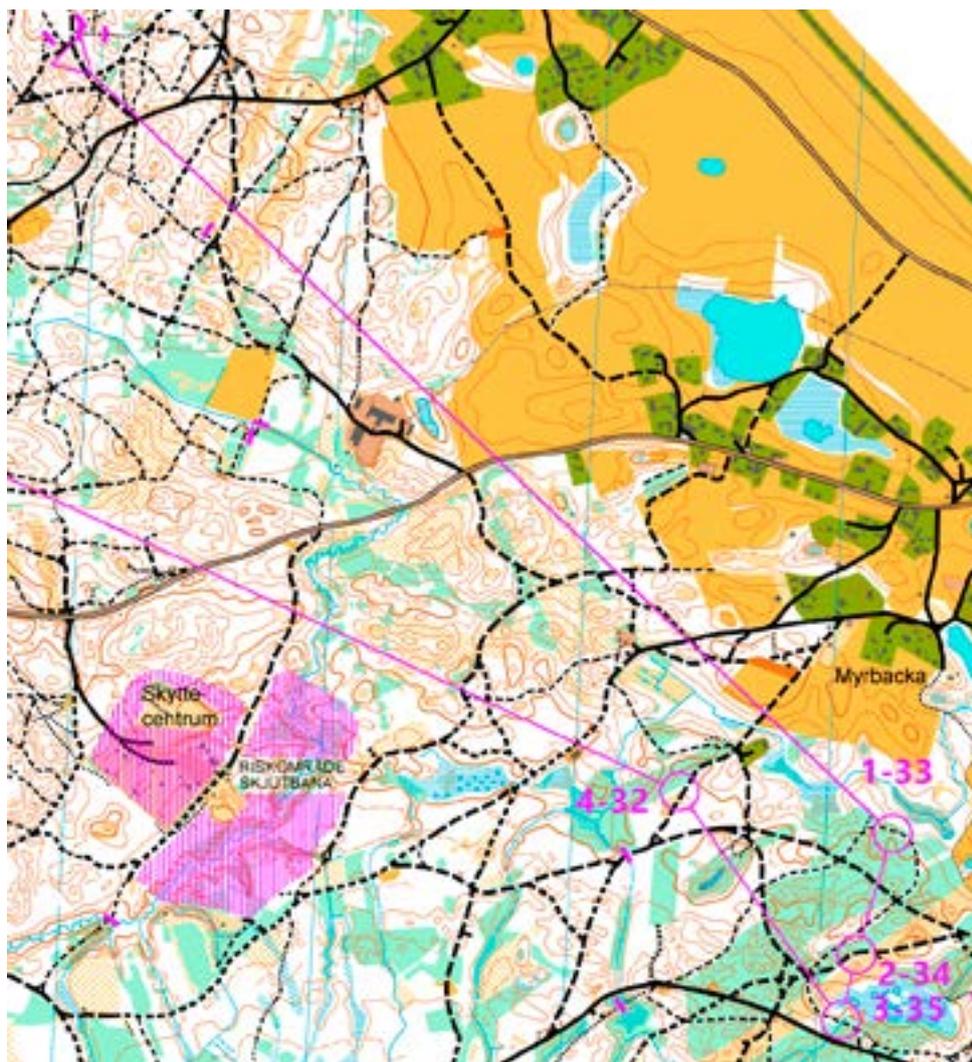
As course setter, it is good to consider the role of each control by asking two questions about each control:

1. What is the purpose of the control, why is it there?
2. Which ambiguities, possible short cuts and other situations will competitors discuss after the competition?

TIP

Don't set a very long leg with a crucial route choice right at the start of a course. Let competitors get accustomed to the map, terrain and how the rideability of paths is mapped before they have to make any crucial decisions.

Remember that the choice of timing equipment, traditional or touch-free punching, can affect which route choices are best.



Example of a long leg that does not feature any crucial route choices.

Control placement

In general, control placement must be clear. The rider should not have to look for the flag when they are near to a control. The map must also show clearly the exact position of the control. Do this by using a dot in the centre of the control circle (see page 32). This is particularly important in very detailed areas with a dense path network, fences and walls.

From a safety point of view, it is worth thinking about:

- Avoid putting controls on steep downhill sections.
- Avoid putting controls in narrow passages or where visibility is limited
- Minimise risks by using two punching units, one on each side of the path/road. This applies especially to places where lots of competitors might need to punch at the same time.



In addition, remember to vary whether you place the control unit on the right or left side of the path/road so that the race is fair no matter which hand the competitor is wearing their timing unit on.

Work closely with the mapper

Successful course setting requires good cooperation between the mapper and course setter; it's not unusual for the map to need updating 2–3 weeks before the competition for whatever reason. The terrain and path network can change significantly, for example with new forestry work. Paths' rideability can also vary depending on the time of year. Anything that is not clear on the map, for example unclear path junctions, can be adjusted if the mapper and the course setter work together (see page 33).

2.

Guidelines for each distance

In order to make MTBO an interesting and varied sport, it is important that the course setter is familiar with how the distances differ from each other. This applies to both winning times and to the characteristics of the course and terrain. This chapter includes suggestions and advice for setting courses which bring out the unique characteristics of each distance, as well as instructions regarding winning times. The distances covered in this text are:

- Long distance
- Mass start
- Middle distance
- Sprint
- Relay (two types)

TIPS

As course setter it can be difficult to decide on winning times. For example, these may be affected by how many people are starting in a particular class. An analysis of several middle distance races in Sweden in 2017 found for example that

- winning times were too long for the youngest classes, 12–14 years
- winning times in many other classes varied greatly from race to race.

In order to avoid too much spread in the results, where one or more cyclists in a class are a long way ahead, it may be appropriate to adapt the course length so that the recommended winning time is instead achieved by those just behind the winners in the results. The course setter should also be flexible and adapt the course to the expected standard of competitors in a class.

Winning times for each distance

Long distance	105-115 minutes
Middle distance	50-55 minutes
Sprint distance	20-25 minutes



RECOMMENDATIONS

- Long distance usually takes place in forest terrain.
- The course must feature some long legs, but there must also be variation in leg length.
- Try to vary the difficulty level between legs (for instance to allow changes in pace).
- Use clear features as control sites, with clear control placement.
- Test competitors' tactical skills. For example, create a scenario where a competitor might choose a slower route choice, but one where they could read ahead on the course and gain time in the long run. Or where route choices can be chosen to save energy.
- It is important for the course to maintain a long distance character all the way through.
- It's great if spectators have the chance to see competitors during the race, for example with arena passages.
- If there is a risk of groups forming, you *should* use forking.
- The map scale *should* be 1:15 000 for D/H 21 (IOF's recommendation), but *should also* be adapted for age groups. Younger juniors and older veterans can use 1:10 000. Maps *should not* be bigger than 30 x 42 cm and *must not* be bigger than 35 x 42 cm. Read more about the size and scale of maps on p38–39.

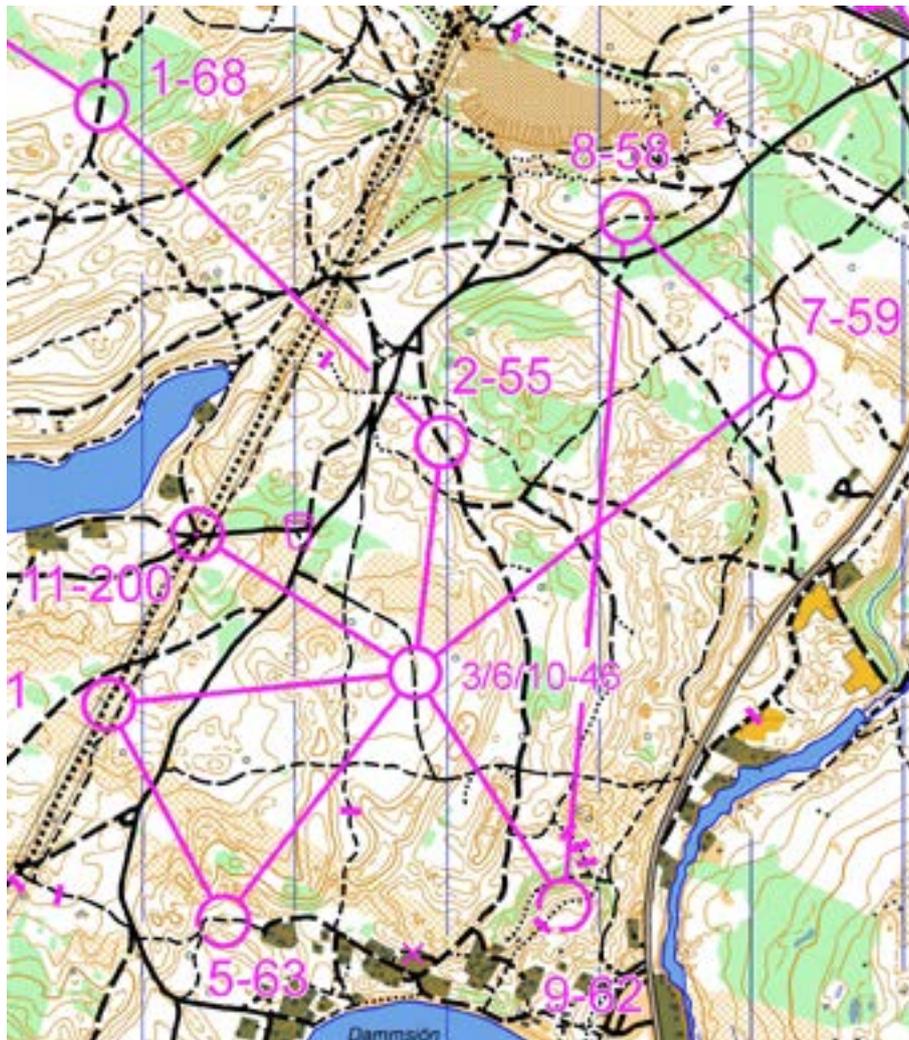
TIPS

Try to avoid the steepest areas for the youngest juniors and oldest veterans.
Don't be afraid to set very long legs (3–6 km) for the longest courses.



Mass start

An important part of a mass start competition is head to head racing. The course *should* be both physically and technically challenging. The competition area must consist mostly of forest terrain but can include open or urban areas. The path network must be both dense and varied to ensure many route choices and to split competitors.



Part of the mass start course from the Swedish Championship 2016 at Säterbygden, scale 1:15 000.

RECOMMENDATIONS

- Have a long leg to the first control to avoid queuing and collisions at the control. Remember to use wide and technically easier paths at the start.
- The character of the course should be more like middle distance than long distance.
- Courses *should* be forked.
- If/when forking is used, it is important that the last part of the course is not forked.
- The map scale can be between 1:7 500–1:15 000. The map *should not* be larger than 30 x 42 cm and *must not* be larger than 35 x 42 cm. Read more about the scale and size of the map on pages 38–39.

TIPS

For a mass start different maps can be used and these can be different scales, too, to create variety in the orienteering.

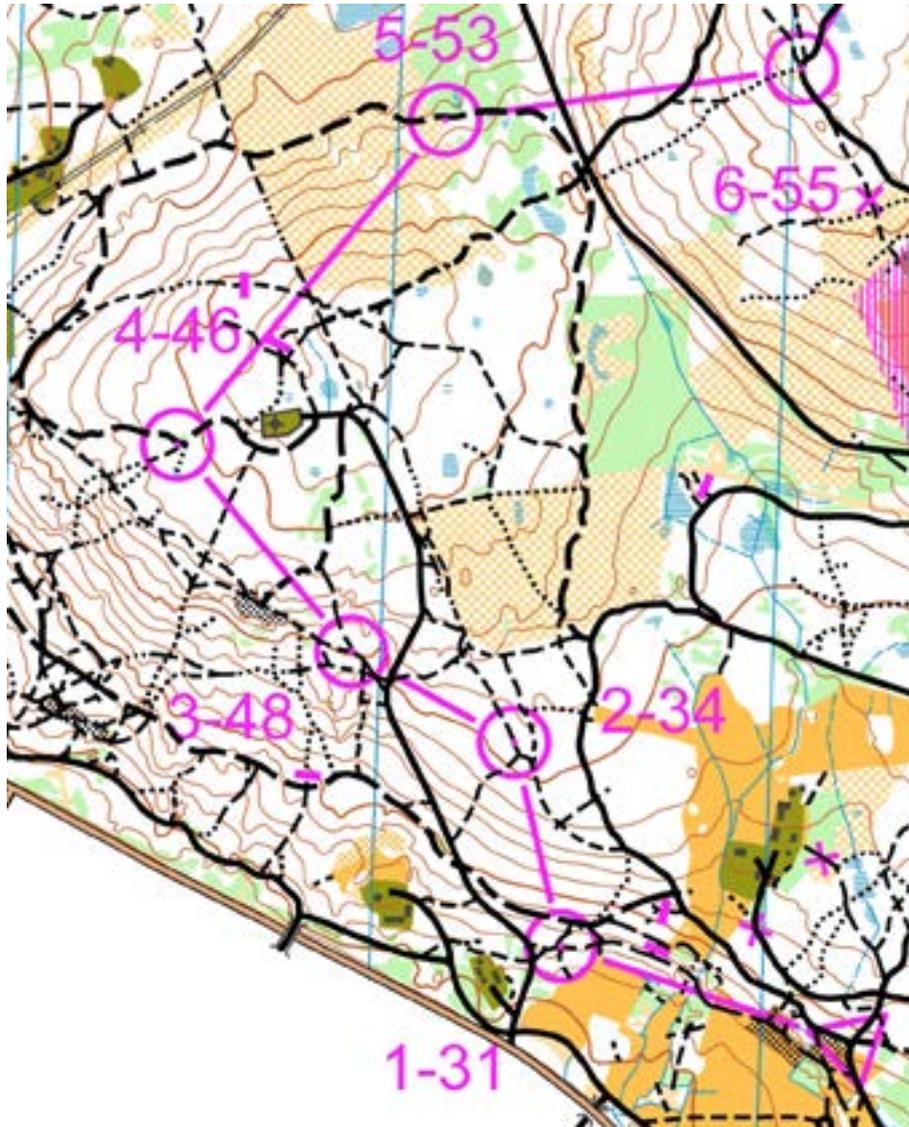


Photo: Stina Lohman



Middle distance

Middle distance is characterised by intensive map reading, which requires full concentration for the entire race. The competition area must consist mostly of forest terrain but can include some open or urban areas. The path network must be both dense and feature some variation.



Part of a middle distance course from the Swedish Championship 2018 in Falun, scale 1:10 000.

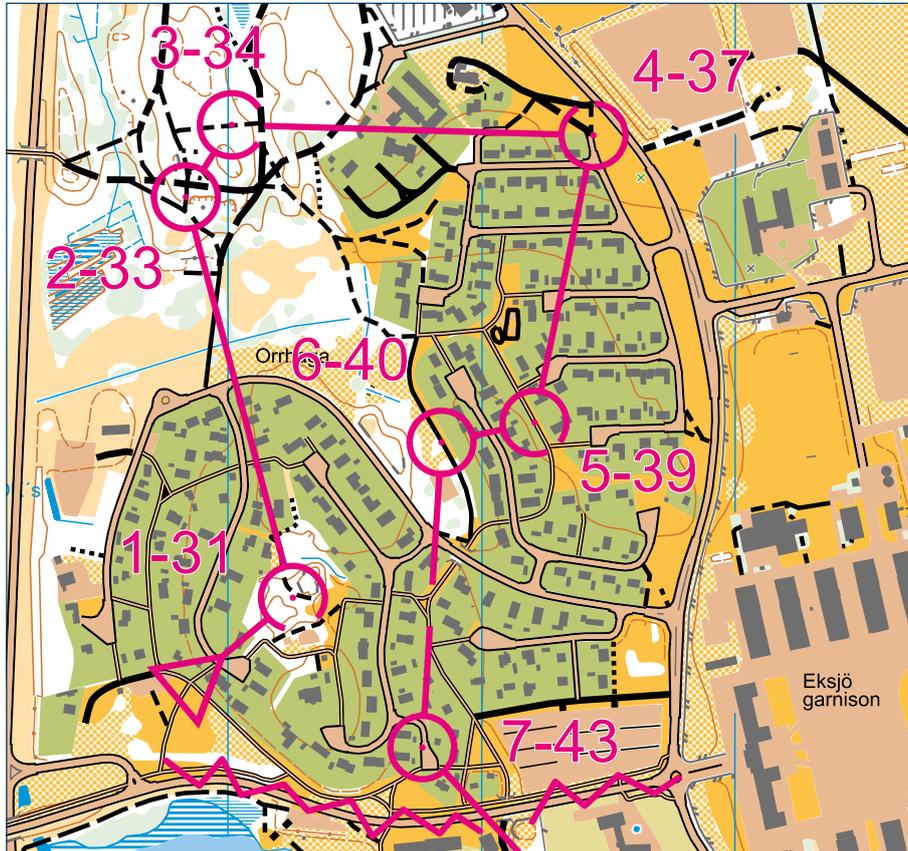
RECOMMENDATIONS

- Vary the length of the legs, include plenty of changes in direction.
- Use detailed areas for difficult and moderately difficulty courses.
- Challenge competitors with tempo changes – include variation in terrain, leg length and difficulty of legs.
- A key characteristic of middle distance is shorter legs. But the course must also include some longer legs, 1 - 3 km depending on class and terrain type. Route choice legs are shorter than for long distance and must include a lot of map reading.
- Make a course with many changes in direction, especially on short legs.
- The map scale can be 1:7 500, 1:10 000 or 1:15 000 and *should* be chosen based on the age of the participants. The size of the map *should not* be more than 30 x 42 cm and *must not* be more than 35 x 42 cm. Read more about map scales and sizes on pages 38–39.



Sprint

High speed is central to sprint races. This distance must test the competitor's ability to read and interpret the map in complex areas, at the same time planning and executing route choices at high speed. The course should be set in a way that requires the competitor's full concentration for the entire race.



Part of a sprint course from the Swedish Championship Sprint 2014 in Eksjö, scale 1:7 500.



RECOMMENDATIONS

- Use terrain that is easy to cycle in, ideally some open areas with housing, school grounds, industrial areas, etc. but mix these with forest terrain. If such areas are not available then forest can be used, but in this case try to find an area suited to the unique characteristics of the distance.
- The focus is on route choices and changes in direction. The rider must be forced to think ahead. However, the map reading required and intensity must not be so great that the rider needs to read several legs in advance.
- The course should have short legs, but a maximum of two longer legs of 0.8–2.0 km (for HD 21) can be used.
- Avoid terrain that is technically difficult and tough to cycle in.
- Control points must be simple, with an easily visible flag. The control only marks the end of the problem.
- High speed and action must be prioritised throughout the course.
- The arena is important. Ideally, have an arena start and include an arena passage if possible.
- Spectators are allowed along the whole course.
- Consider safety when setting courses, both for competitors and spectators.
- If courses pass through built-up areas, it is important to inform both the local council and any residents about when the event will take place, and to obtain any permissions required.
- In most cases, the map scale *should* be 1:5 000 or 1:7 500. The scale 1:10 000 *should* be avoided but can be used in some circumstances when the map is not complex or detailed. The map *should not* be larger than 25 x 30 cm. Read more about the size and the scale of the map on pages 38–39.

TIPS

If courses pass through a built-up area, it is a good idea to use marshals for any possible sensitive areas or on building corners where it is possible that competitors may meet – all to ensure safety.

If km-times for sprint are compared to middle and long distance, they are often longer for sprint. So avoid terrain that is steep, technical or may otherwise slow down times.



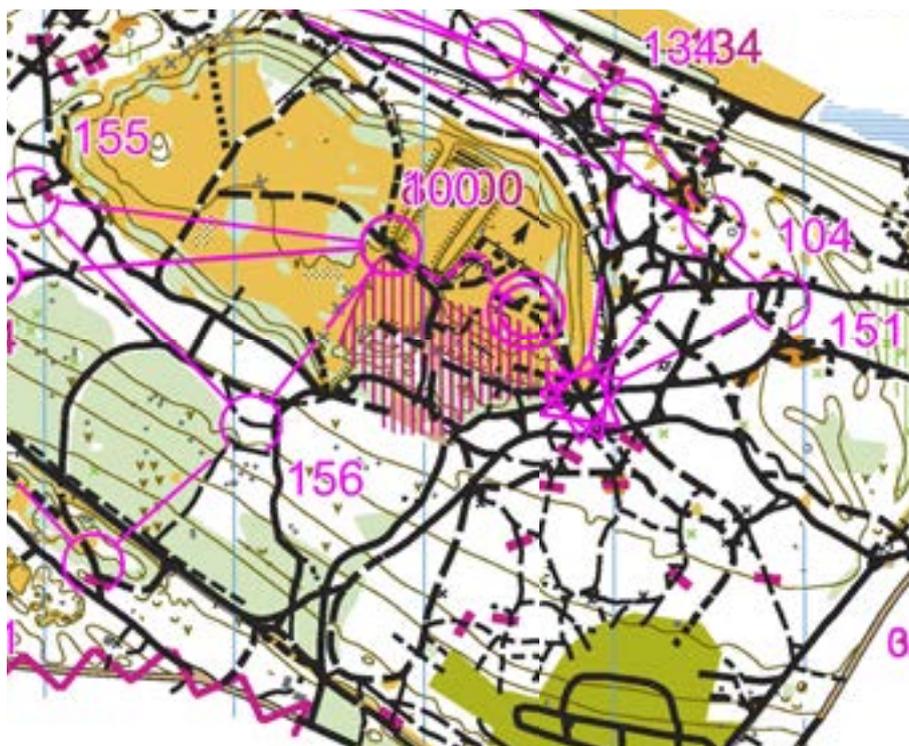
Two-person relay – sprint or middle

At the time of writing (2018), two relay disciplines have been suggested in Sweden. Either a two-person relay where each team member rides two legs, with four legs in total. Or a three-person relay with shortened middle distance legs and where each team member rides one leg, with three legs in total.

Depending on the terrain you have access to, you can choose to have a relay that has either a sprint or a shortened middle distance character.

So far there are not very many orienteering clubs with a MTBO section. This means that it can be difficult to gather a team of riders in same age group, making it appropriate to introduce the relay to the programme as a two-person relay.

However, bear in mind that with a sprint relay it can be difficult to spread riders in the terrain, which can be a problem for safety. For the same reason, a sprint can also make it difficult to give competitors a new area and new orienteering challenges on their second leg.



Part of a relay course from the Finnish Championships 2018, scale 1:10 000. This is the D 21 course held as a pairs relay, where competitors rode two legs of 4.6–4.8 km each. Organiser: Kankaanpään Suunnistajat.

RECOMMENDATIONS

Sprint relay

- Courses must have the same character as for sprint.
- There *should* be some longer route choice legs where competitors lose sight of each other. For example, in terrain with a dense path network where the paths have different characteristics.
- Forking must be used.
- The time difference between each leg *should* be minimal.
- A sprint relay means that competitors ride twice and have the same finish both times. If the last part of the course is the same for all courses, cycling speed and not orienteering speed will decide the final part of the relay. Include forking at the end of the courses, but in the interest of fairness it is important that the different forking alternatives take the same amount of time.
- The scale *should* be 1:5 000 or 1:7 500. 1:10 000 can be used for HD21 if this is appropriate for the race terrain. The map *should not* be larger than 25 x 30 cm. Read more about the size and scale of the map on pages 38–39.

RECOMMENDATIONS

Middle distance relay

- Courses must have the same character as for middle distance.
- There *should* be some longer route choice legs where competitors lose sight of each other. For example, in terrain with a dense path network where the paths have different characteristics.
- Forking must be used.
- The time difference between each leg should be minimal.
- In the interest of fairness, the final part of the course should be the same for all legs.
- The scale *should* be 1:7 500 or 1:10 000. The map *should not* be larger than 30 x 42 cm. Read more about the size and scale of the map on pages 38–39.



3.

Safety aspects

MTB Orienteering is a discipline within the sport of orienteering which is in a steep development curve both internationally and nationally. There is a greater range of competitions, which is important for the development of the sport. With an increasing number of competitors at competitions, the risk of incidents and accidents is also increasing. However, there are currently no specific guidelines for how to minimise accidents and injuries.

The International Orienteering Federation has started collecting information about accidents from active riders and some statistics are now available. Data available in early 2018 shows that:

- 75 % of accidents involve one rider, 25 % are collisions between two riders.
- There does not seem to be a higher risk of accident for any particular distance.
- Accidents involving one rider are most likely to happen when reading the map at high speed.
- A collision between two riders is usually caused by: someone riding on the wrong side, a blind corner or one/both riders reading the map and not realising they are riding into someone. The most serious frontal collisions have occurred on wide paths with only gentle gradients, where cyclists have been riding at high speed with one of them riding on the wrong side.

There are different safety issues for different distances in that sprint is often held in areas with road traffic, or in parks with pedestrians. Middle and long distance are usually held in areas with less traffic and instead usually feature more paths and steeper forest terrain. Forest terrain varies a lot and places a range of demands on the MTBO competitor's ability to pick out suitable route choices. One aspect of the course setting challenge is that on one hand, each rider wants to test their technical cycling ability and maintain a high tempo. On the other hand the course setter is responsible for minimising the risk of accidents. Beginners should not be required to do any technical cycling at high speed.

This chapter starts by outlining some general thoughts on safety and is then has sections on each distance. This is followed by suggestions and advice for using map symbols and various ways to alert competitors to potential dangers in the terrain.

General safety considerations

As MTBO grows, the number of competitors at events is also growing, which can mean more risks to safety. As the course setter, there is a lot you can do to limit these risks.

Make optimal use of the terrain

It's a good idea not to have the youngest age classes and open classes in the same area as other classes any more than necessary. Younger riders and beginners, for instance, have not yet learned the "rules" of MTBO cycling and react a little more slowly. If you can, use different areas of the competition terrain for different courses. Remember, however, that at least one of the longer open courses will share the same competition area as other long courses.

Start interval

If there are a lot of competitors, it may be a good idea to have a longer start interval to spread competitors more effectively. However, this should be balanced with competitors (families and clubs) having a reasonable start interval that means they do not need to spend all day at the competition.

Avoid U-turns at controls

Try to avoid controls on small paths where it is likely that many people will turn round and ride back the same way. This applies especially for relays and mass starts.



After punching control 3 it is likely that riders will turn and ride back down the small path. If the path is narrow with limited vision, this is not suitable course setting.

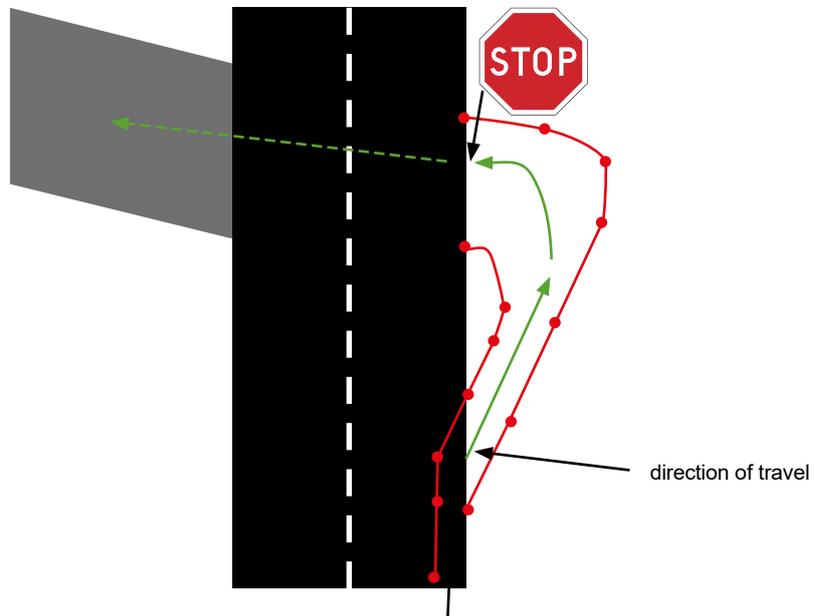
Direction of riding

Aim for all competitors to be moving in the same general direction. This is especially important in hilly areas, where course setting must ensure that competitors do not meet on steep hills.



Crossing larger, busy roads

For a crossing/left hand turn on a trafficked road, you can ask competitors to first turn right then wait to cross the traffic. It is also important to have marshals to warn riders and that riders give way to any vehicles.



Control placement

Do not put controls on steep hills unless all courses that pass the hill have that control.



Sprint

Sprint's key characteristics (see pages 18–19) are high speed in combination with quick decisions. These characteristics can be achieved in terrain close to built-up areas and parks. The competition area is usually shared with residents, road traffic and families walking with children and pets. Ideally the area should be closed for the competition but this is not usually possible. The use of sprint areas where there is a risk of colliding with members of the public requires good preparation in order for the sport to be accepted and be able to develop. Of course, general traffic rules apply and any local traffic rules for the area must be made clear in information for competitors.

High risk places and situations include:

1. Exits from paths out onto trafficked roads. Try to ensure that the cyclist have a good view of the road. Use marshals who have the right experience and skills for this situation. Even if the junction is shown on the map, it can be a good idea to use a warning sign in the terrain allowing sufficient distance before the junction (the distance depends on how quickly competitors will cycle on that path). Alternatively, place a control just before the junction to reduce speed.



On this leg there should be a marshal at the crossing and a warning sign for cyclists.

2. There may be special obstacles such as concrete blocks, barriers and steps in the competition area. Concrete blocks are not usually marked on the map. It may be appropriate to move these obstacles before the competition to minimise risk. Where possible, barriers can be opened before a competition. Steps must be marked on the map but can also be marked in the terrain with warning signs.
3. Entry to and exit from controls. Control points are usually clearly marked on the map and easy to see in the terrain. Speed is high, so ensure that there is plenty of space round the control to allow competitors to see each other and pass without collisions. Controls and sections of courses in smaller forest areas with narrow paths should be designed so that riders do not meet.

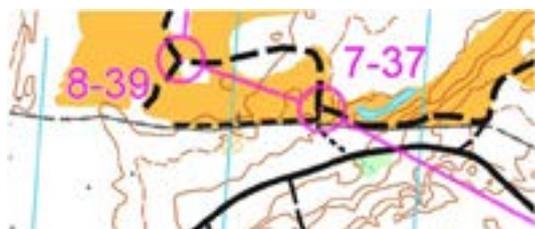


Middle distance

Key characteristics of middle distance are on pages 16–17. Middle distance usually takes place in forest terrain and sometimes in urban areas. Cycling in urban areas and nearby areas with many pedestrians carries the same risks as those listed under the heading Sprint (pages 18–19). Middle distance requires good contact with the map throughout the course. In particular, this distance tests the competitor's ability to choose "personal" route choices, maintaining a high tempo and avoiding stops, collisions and accidents while choosing the correct path at high speed. The rider's ability to focus on all these things decreases as they become tired.

High risk situations and places include:

1. Most injuries happen due to falls caused by failure to notice dangers on technical paths. It's difficult to read the map while moving, which contributes to these failures and thus is a risk factor. And of course it's up to each competitor to be able to adapt their speed to their own ability. So using a larger map scale and minimising clutter on the map are factors that can help map reading and minimise risk. Read more about map scale and size on p38–39. Consider the possibility of using a map change to allow a larger scale.
2. Collisions and accidents occur at different places and with different results, depending on the speed at the time of the collision. Of course it is difficult to avoid any risk of accidents due to route choices and meeting competitors on other courses, however these risks and places can be identified during the course setting/terrain reconnaissance process. Collisions on downhill sections with multiple path junctions are more likely to result in serious injury than junctions on an uphill or on a flat surface.



There may be ditches at the sides of larger paths and roads, which may be a risk at higher speeds. Make a note of these risks when testing courses.

High-risk places *should* be marked both on the map and in the terrain. A warning triangle/exclamation mark on the map and a warning sign in the terrain can alert competitors to potential danger (see page 28).

3. Entry to and exit from controls can result in collisions and accidents but these are not usually serious. The development of "touch-free" timing units at controls can, however, mean that speed is higher around controls. Course setting can affect this by ensuring that the natural exit and route choice is to continue in the same direction. In some cases using two timing units, one at each side of the path, can make entry and exit easier. Another alternative could be to use a "one-way" path, which must be marked with special symbols.

Long distance and Mass start

The key characteristics of Long distance are given on pages 12–13. Long distance races are almost always held in forest terrain. In cases where courses use built-up areas, attention must be paid to the points in the sprint and middle distance chapters (pages 16–19). Long distance offers more of an endurance challenge than other distances. Of course, tiredness affects orienteering ability. Tiredness is also a factor on technically challenging paths. This does not mean that technically challenging paths should be avoided as the competition final details can say that there are technically difficult paths and that these are marked with warning signs.

High risk places and situations include:

1. Long distance races that use a forking method where competitors have the same control more than once have an increased risk of collisions. Ideally, the central control should be placed to allow lower speed and good visibility and the control can have at least two timing units. It is also common for competitors to make mistakes on the first butterfly loop and need to make a U-turn after turning onto the wrong path. The course setter should try to ensure that the paths between the central control and the first controls on each forking are safe with regard to such U-turns.
2. Long distance sometimes has a mass start, which requires wider exit routes from the start point, longer opening legs and several timing units at the first controls. Think about what a rider might do if they realise that they have gone towards the wrong forking and have to make a U-turn. If possible, avoid lots of steep ground and hills at the start of the course.
3. An arena passage may be used and this should be designed in a way that limits speed, for example with a slightly slower riding surface, such as long grass. You should also make sure that incoming riders at a map change/arena passage do not meet large groups of outgoing riders, for example in a mass start.
4. Long distance can mean a map scale of 1:15 000, which must then be weighed up against clarity and choice of control points. Lots of stopping to be able to read the map means a risk of collisions. It is better to use scale 1:10 000 with a map change.

Relay

Thoughts concerning safety and risks in relays include parts of the text under previous sections the headings Sprint, Middle distance and Long distance/mass start and these should therefore be used as guidance where appropriate.

Other high-risk places and situations are:

- Start.
- Changeover.
- First few controls.
- Forked legs.



Map symbols

At the time of writing, map symbols relating to safety are obstacles, out of bounds areas and to some extent paths that are difficult to ride on.

Map symbols such as a warning triangle are now being used to inform competitors about difficult passages, eg. drops/steps, ditches, steep sections. These can be used together with warning signs in the terrain. Use these symbols advisedly so that they do not clutter the map and make it difficult to read.



THOUGHTS & CONSIDERATIONS

Might it be worth removing even more superfluous symbols on MTBO maps to enhance safety in MTBO? In other words; in order to preserve the readability of the map, remove irrelevant features and make more room for symbols related to safety. One example is form lines, which can be removed since they are not useful for MTB orienteers.

The symbol for a one-way road/path can be used in certain parts of the course, such as from the last control to the finish.

Warnings in the terrain

Warning competitors about passages, riders coming from the opposite direction that are difficult to pass, and not least about runners pedestrians, etc. should be more of a rule than an exception. Warnings in the form of signs and tapes can be one way to prevent accidents. Marshals may also be necessary in some especially sensitive places.

If there is a significant risk of collisions and accidents, consider using another area that is more suitable from a safety point of view.

Of course, course setting work must not be too cumbersome but anticipating any dangers and risks, working to prevent these and informing competitors is surely an important part of the future and development of the sport.

4.

Fair competition

A fair competition means that all competitors must have the opportunity to compete under the same conditions. Uncertainty or ambiguities create unfairness wherever situations, course setting or the map rely on an individual's interpretation.

This section is written based on the timeline of an event and what competitors encounter during the competition.

Before the competition

All competitors should have the same chance to prepare for a competition. If there is an existing map and any competition open to competitors outside the organising club has been held on the area, old maps must be made available a few weeks before the competition.

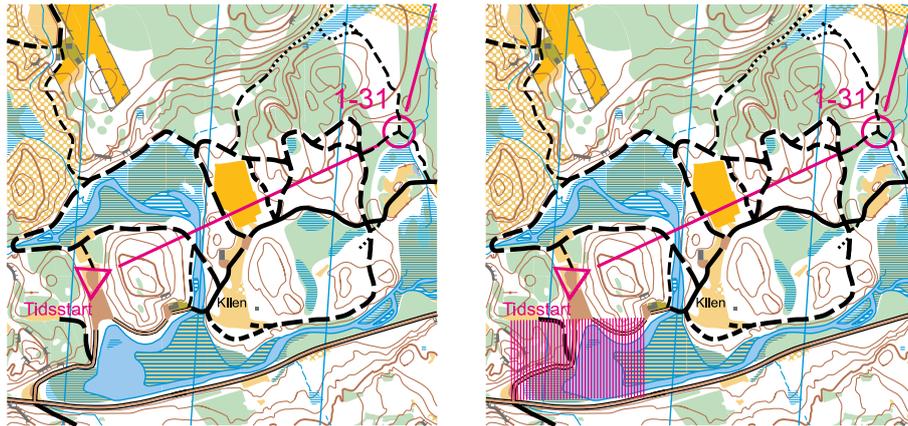
For national championships and other major competitions, the area competition must be embargoed as soon as the venue is finalised.



At the start

The start area *should* be chosen so that competitors are not able to see the start point or subsequent route choices (if there are several possible route choices) from the start area.

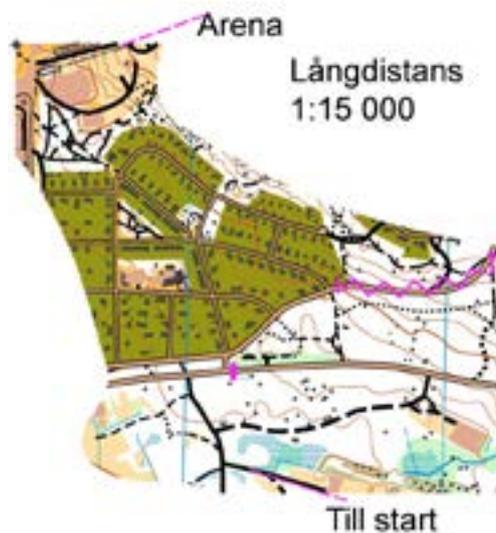
Courses *should not* be set such that any ideal or natural route choice passes back through, close to or somewhere visible from the start area. If this is nevertheless possible, the route choice should be prevented by marking the area as out of bounds. A course does not start before the start point, so it is possible to let competitors pass through an out of bounds area with tapes from the start line to the start point.



By marking an out of bounds area on the map, competitors are prevented from taking a route choice passing back through the start area. The map is reduced for space reasons.

TIP

Ideally, competitors should have a chance before the start to familiarise themselves with the terrain and how paths are mapped. This can be achieved by providing a warm-up area or by competitors being given a map extract on the way to start.



During the competition

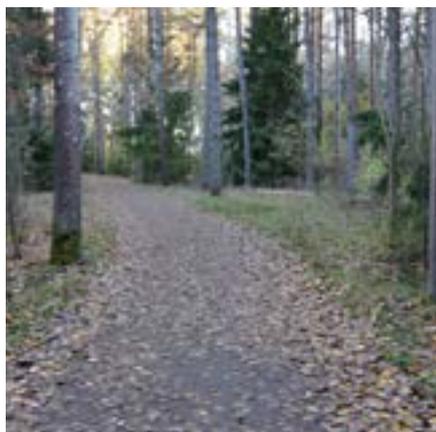
Circumstances such as the number of competitors out in the terrain, how controls are placed and whether they have an early or late start should affect the competitor as little as possible.

Shared entry/exit for controls

At the start of the course and near the finish area, courses should be set so that competitors are riding in the same direction wherever possible. This avoids competitors being helped by seeing others. Try to avoid route choices where a natural entry direction to a control is also a natural exit direction from the same or another control. This is less of a problem further out on the courses, where there are fewer riders.

Tyre marks and flattened vegetation

Competitors with late starts often have an advantage from being able to see tyre marks or flattened vegetation at path junctions, especially those that are less clear in the terrain. In order to ensure the same conditions for early and late starters, try to make junctions clearer, for example by making clear markings on the paths (eg. with flour). Remember to make these markings clear enough to be seen at high speed.



THOUGHTS & CONSIDERATIONS

Perhaps the way course setters mark unclear junctions should be standardised to make things as clear as possible for competitors?

Grass or bracken can be cleared to open up a junction. Check with the landowner what you can and cannot do..



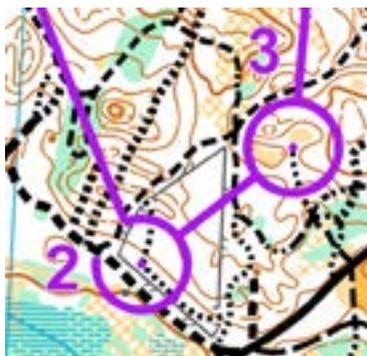
Taping indistinct paths

Some smaller paths that a course setter wishes to use may have smaller sections that are indistinct. It's a good idea to make the path clearer. The easiest way to do this is to tape the path with white tapes. Remember to hang the tapes at a height that makes them easy for cyclists to follow.

Control placement

Control units *should* be placed on both the left and the right side of paths so that competitors with SI or EMIT units in their left or right hand do not have any great advantage or disadvantage. Try to ensure that control placement does not result in narrow passages and that competitors can pass a control on both the left and the right side of the control unit.

Control placements that are not clear, for example with regard to which side of a fence or wall a control is placed, should be avoided. The control should be placed far enough from the object in question so that the map clearly shows which side the control is on. The centre of the control ring should be clearly offset. Another way to add clarity is to use a dot in the centre of the control circle.



Use a dot in the control circle to show clearly exactly where the control is in relation to the fence, other paths, etc.



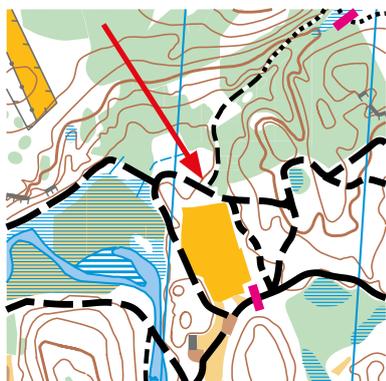
The map

It is important to mark out of bounds areas/compulsory passages clearly in order to avoid ambiguities. Use a continuous line of tape where possible.

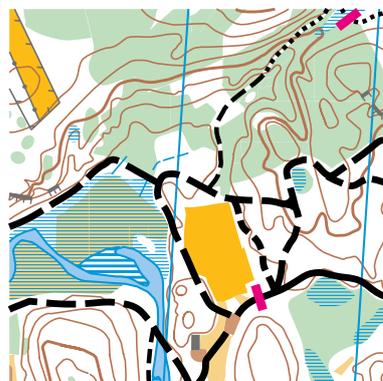
Ensure that all permitted or compulsory passages or out of bounds passages are sufficiently clear. Paths that run parallel but not together should be represented clearly by exaggerating the distance between the paths on the map.

It is also important for the course setter and mapper to work closely – the result must be a balance between a map that is easy to read and faithful to reality.

An unclear junction where there is a gap on the map can sometimes be interpreted as if the paths do not meet. This must be clarified, either by taping the junction in the terrain or by marking it clearly on the map. Or by making the gap larger on the map and covering the junction with an obstacle in the terrain.



Before clarification



After clarification

Parts of the terrain that are difficult to map well and allow luck to affect the result should not be used for fine orienteering. The map must be good from the attack point into the control.

TIPS

It can be difficult to classify paths. Should the mapper use visibility or rideability? And how is this affected by the mapper's cycling ability? The profile and steepness also affects rideability.

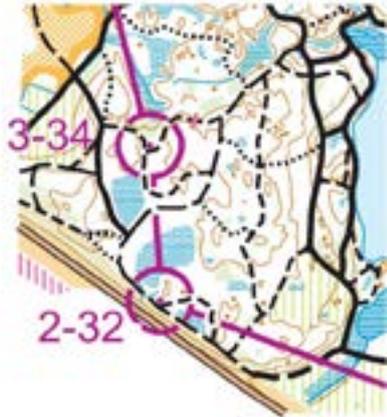
Remember that the rideability of paths is also affected by the season. For example, if the map was made in early spring and the competition will take place in the summer, the map should be reviewed and updated at an appropriate time of year.

Avoid forbidden short cuts in the terrain

Taking short cuts when these are not permitted – how can you avoid it?

Use tapes, a control guard (with authority) in the forest, avoid route choices or control placements that make short cuts tempting.

Use an extra control, a “steering control”, to avoid competitors taking short cuts. A steering control can force competitors to avoid taking a short cut in a place which could otherwise invite cheating, either intentionally or unintentionally.



Risk of short cutting just south of C3.



A steering control removes the risk of short cutting.

After the competition

The map must be removed from the map board at the finish to avoid anybody else being able to look at it.



5.

Overprinting

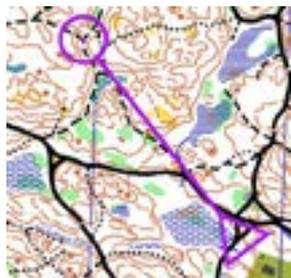
The purpose of overprinting is to (1) show the direction of the course (2) show where the controls are. The overprint should therefore be clearly visible. Overprinting must not make reading the map more difficult, or obscure important details or other map symbols. Achieving all these things isn't easy but it is possible.

In MTBO, overprinting is done slightly differently to foot orienteering for two main reasons:

1. On a bike the competitor cannot "thumb" the map and does not have time to search for "where am I on the map", so the overprint must be easy to read.
2. The course overprint uses the same line width as the most important symbol on the MTBO map (wide path). To avoid wide paths and the course overprint being mixed up at high speed, the overprint must not be too dark or too deep red (half of people with colour-blindness cannot differentiate between deep red and black).
3. The overprint highlights danger points, for example barriers and steep slopes, as well as out of bounds areas, roads and paths.

The purple colour must be clearly distinct from all other colours on the map. It must not be too dark.

Please note that the purple colour used for control circles and connecting lines must be behind certain map symbols in the print order, for example paths, so that it does not obscure important information.



Purple printed over the map print, which obscures important paths.



Purple printed under the black colour for paths. The leg is easier to read.

TIP

Warning! Ordinary four-colour printers cannot print the IOF's purple colour and it is easy for it to end up too dark when the printer mixes cyan and magenta. Make sure that the course overprint is not too dark!

Out of bounds areas

Draw the out of bounds area 1 mm from roads/objects to avoid cluttering the map.

Roads that are forbidden to ride along

It is recommended to use the zigzag symbol 711. If there is enough space on the map, you can also draw an out of bounds area, symbol 709, making an out of bounds area either side of the road.

Forbidden to cross

If a path or road is forbidden to cross, it is recommended to use the X symbol 844. Pay attention to the direction of the cross in relation to a path or road. In some positions it can look like an obstacle on the path/road. Also, remember that it is permitted to cycle up to a cross without going past it.



TIPS

Help competitors with colour-blindness

Not all riders with colour-blindness can distinguish the X symbol on a road or path. If the X symbol is used, riders with colour-blindness must have a map with appropriate colours.

Instead of the X symbol you could draw an out of bounds area, symbol 709 or 711, which helps any riders with colour-blindness.

TIP

It is not permitted to cross fences (unless there is a crossing) and because they are grey they can be difficult to see on the map. Think about how you, as a course setter, can minimise ambiguity and luck. If appropriate, one way is to draw an out of bounds area around the fence.

Permitted/recommended/compulsory passages

Sometimes, for the sake of clarity, it may be appropriate to use symbol 708 for crossings over roads or fences, through tunnels or over bridges. If you use the zigzag symbol over a road, do not add symbol 708 but instead break the zigzag lines to leave a clear passage.

Connecting lines

Connecting lines must be drawn as a purple overprint in a way that allows paths, contours and any boulders, crags and other details to be seen through the course overprint. Avoid cutting connecting lines wherever possible. If you break the connecting line it is more likely to be confused with a larger path, especially for competitors with colour-blindness. Sometimes, however, you may nevertheless be forced to break the line to achieve the desired readability. There must not be any gap between the connecting line and the control circle.

Control circles

Control circles must be overprinted in purple. Avoid breaking the control circle wherever possible. Breaking the circle makes it more difficult for competitors to read. Sometimes, however, you may nevertheless be forced to break the line to achieve the desired readability. The overriding aim is to avoid important detail being obscured by overprinting of lines and circles. Path junctions should not be obscured.

Clarification of control placement - dot in the control circle

As stated previously, a dot in the centre of the control circle must be used to clarify the control placement.

Control codes

Always use a white outline for control numbers and codes. The white outline means numbers are visible against both green (dense forest) and olive green (private land), so it is easier to find a suitable place for the numbers.

Overprinting and colour-blindness

Purple is a difficult colour for competitors with colour-blindness. There are two main types of colour-blindness and unfortunately, that which works for one group does not work well at all for the other, and vice versa. Do not optimise the course overprint for one or two people with colour-blindness: If you start to make adjustments yourself, you need groups with different types of colour-blindness to test the results.

If you follow the directions for course overprinting in this handbook, the print will work for competitors with colour-blindness. Some of the instructions may seem unnecessary but remember that they will help somebody older or with colour-blindness.

TIPS

If you want to experiment and are knowledgeable about printing.

If you have an unconventional map or terrain, or are printing some club training on an unsuitable printer, one of the following options may work better than the official norms:

- Use a highly transparent purple with a strong chroma and use a very thick line for connecting lines and control circles, double the width of the symbol for a wide path.
- Use a non-transparent purple with a strong chroma and use a very narrow line for connecting lines and control circles: half the thickness of the symbol for a narrow path.

Map readability

The requirement for readability is extremely important in MTBO. In order for MTBO to be fun, the competitor needs to be able to read the map when cycling at speed, without needing to stop and put their foot down. But in MTBO the course setter (and mapper) must put in extra work to achieve good readability. In foot orienteering the competitor can slow down, stop running and read the map at a shorter distance in order to read small details or in detailed areas. This is not possible in MTBO. Therefore, MTBO maps must be more enlarged so that there is more white space between map symbols. Good readability is also a matter of safety. If readability is poor, competitors must read the map for longer, which increases the risk of falls and collisions.

Young elite riders can also read the map when they cycle for short periods of time. Reading distance can be as little as 10 cm. After around 42 – 48 years, people find it more difficult to read at close distances. Reading glasses work for around 35 cm reading distance. An older MTBO competitor therefore needs a 3.5 times enlargement compared with a young elite orienteer to achieve the same readability and experience if the map is very detailed.

Reading an MTBO map is much easier if the competitor has seen the map previously or has previous experience of the terrain. If the map is difficult to read, the competition becomes unfair because those competitors with previous experience in the terrain will have an additional advantage.

As an organiser, it is difficult to assess the map's readability yourself, even if you test ride, because previous knowledge of the map and terrain have such a big effect when you cycle. Map readability should be tested by club members with no previous knowledge of the map or terrain.

Consider the following to help readability:

- When the mapper or course setter feel that the map is easy to read, around 1.5 times enlargement is often then needed to ensure that even participants in 21-classes looking at the map for the first time find the map easy to read.
- The scale should ensure that all map details are readable at high speed. HD45+ cannot usually read the map any closer than around 35 cm. If you are a younger course setter or have very well-trained map reading skills, take a test ride in the terrain to test the map's readability from 35 – 40 cm away, ideally in poor light
- Age classes 45 years and older *must* have at least 1.5 times enlargement compared with 21-classes. If there is no 45 class, the 40 class *must* be enlarged.
- For classes 17–40: avoid using 1:15 000. Scales 1:5 000 – 1:10 000 are recommended. Symbol size and line width are always the same. A larger scale is used if the terrain is detailed, not to enlarge the symbols. If 1:15 000 is still used, make sure this is stated in the invitation so that competitors know what to expect and are not disappointed.

- For classes over 45 years: use the same map as for classes 17–40 but enlarge everything (including symbols) to at least 1.5 times larger. If for example classes 17–40 have map size A4, so classes over 45 have the same map but printed on A3. If possible, the map can be more enlarged than X 1.5.
- 1:15 000 is highly unusual for middle distance, and then only for HD21. But you can almost say that if the map is suitable for HD21 at 1:15 000 then the terrain is not detailed enough for a middle distance competition.

See also the table below and the readability template in Appendix 1, page 41 But what can you do if the course does not fit on one A4 or A3 page?

- The usual solution is a map change. With 2, 3 or even 4–5 maps, the problem can often be solved. All the maps can be given out at the start in a bundle.
- If the terrain is mainly lacking in detail with “islands” of more detailed terrain, different scales can be combined. This has even been done at the World Championships.
- At the map change, the next map can have a new scale. At the mass start at the 2016 World Championships in Lithuania, organisers used three maps in three different scales and with three different characters. The start was middle distance, then sprint and the last part was long distance style.
- If part of the map is very detailed, it can be enlarged in a “zoom window”. This was used at the World Championship for Sprint in Portugal 2015.

Recommended scales and symbol enlargements.

Competition distance	Scale for elite (17-21)	Scale for veterans (40+)	Symbol size for veterans (45+)
Ultralong	1:20 000	1:15 000	X 1.5
Long	1:15 000	1:10 000	X 1.5
Middle	1:10 000	1:10 000/1:7 500	X 1.5
Sprint	1:7 500/1:5 000	1:7 000/1:5 000	X 1.5

TIP

As a way to increase the readability of the map for older competitors, a symbol size X 2.0 for 60 years and older is currently being considered. Try it if you think that it could be useful.





Läsbarhetsmall

Aldersklasser 17 - 40

1X Minsta acceptabla symbolstorlek

- 110 Smal väg
- 100 Bred stig
- 67 Smal stig
- 58 Mur, staket, rörlinje
- 30 Kantlinje, väg
- 20 Kantlinje, asfalt-/grusyta
- 23 Höjdkurva
- 51 Ministorlek för hus/byggnad
- 133 Speciellt föremål, vatten/vegetation
- 166 Speciellt föremål, byggt



Age classes 17-40
1x Smallest permitted symbol size

1.5X Tillräckligt stora symboler för alla

1.5X Minsta acceptabla symbolstorlek

- 110 Smal väg
- 100 Bred stig
- 67 Smal stig
- 58 Mur, staket, rörlinje
- 30 Kantlinje, väg
- 20 Kantlinje, asfalt-/grusyta
- 23 Höjdkurva
- 51 Ministorlek för hus/byggnad
- 133 Speciellt föremål, vatten/vegetation
- 166 Speciellt föremål, byggt



1.5X Large enough symbol size for all classes
1.5X Smallest permitted symbol size

- Instructions:
1. Print out table on transparent plastic, A4 size
 2. Place over symbols on a map
 3. A difference in line width can be seen easily

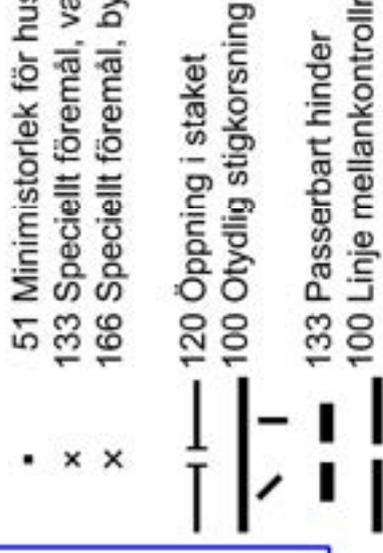
Instruktion:

1. Skriv ut denna mall på genomskinlig plast, storlek A4.
2. Placera mallens linje på en symbol på kartan.
3. En skillnad i linjebredd syns tydligast vid gapet i mallens linje.

Aldersklasser 10 - 15 och 45 - 90 Öppna banor

2.25X Tillräckligt stora symboler för alla

- 110 Smal väg
- 100 Bred stig
- 67 Smal stig
- 58 Mur, staket, rörlinje
- 30 Kantlinje, väg
- 20 Kantlinje, asfalt-/grusyta
- 23 Höjdkurva
- 51 Ministorlek för hus/byggnad
- 133 Speciellt föremål, vatten/vegetation
- 166 Speciellt föremål, byggt



1000 Öppning i staket
100 Otydlig stigkorsning
133 Passerbart hinder
100 Linje mellankontrolleringar
1000 Kontrollring

Age classes 10-15 and 45-90
Open courses
2.25X Large enough symbols for all classes

Check that this grey box is 100mm x 10mm on the printed template

Kontrollera att detta grå fält är 100 mm x 10 mm på den utskrivna mallen.



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