General Considerations For Cross Country Orienteering Courses: Design and Set Guidelines

Objective

Orienteering's slogan is that it is "the thinking sport." Doing well requires a combination of physical and mental skills. These skills are put to the test by the course setter, working in the framework of the given map and terrain. It is nearly impossible to set a course that does not offer a good physical test, providing that it is of the proper length; the challenge for the course setter is to *offer a mental test appropriate to the skill level* of those for whom the course is intended.

Skill not Luck

You are setting the course for an orienteer, not a surveyor, so *the feature you use must be distinct*. You should avoid such control sites as "the middle of the marsh" (unless it is a very small marsh) or "the hillside" because they introduce too much of an element of luck into the competition. The competitor should be able to orienteer directly to the control if he is skillful, and not have to count on finding it by using a systematic search (he may end up doing that anyway, but he should not have to). Your features for control sites can be small, but they must be distinct. A contour line might have a gradual bend in it that could be called a spur (or reentrant) but it may be hard out in the woods to tell just where the spur or reentrant is.

In general, avoid dense areas for controls, especially if the terrain is somewhat vague. Again, it is a matter of what is fair; are you requiring skill or luck? Finding a control point (for example, a pit) in the middle of a large, flat, dense area places too great a premium on luck, even if the point itself (for example, a pit) is distinct. Dense areas may be okay if the terrain is well defined.

Start-Finish Location

Good terrain for White and Yellow courses with plenty of linear features often dictates where the Start will be. Most competitors like to have the *Finish/Competition Center* as close to the parking as possible. Moving the Start to a higher elevation can reduce climb on the courses. Almost without exception, the ideal location for the White course, because of its length, dictates or constrains the Start area for all courses. The practice of having separate Start areas for one or more of the lower courses *should be discouraged*. Herding beginners and youngsters to a separate competitive area is detrimental to development as a whole, both of the individual and of the sport. The mix of competitors of widely different ages and skill levels epitomizes the fun and vitality of orienteering.

Avoid Doglegs

Leaving a control, there should not be a logical route that doubles back through the same area from which the control was approached. Why? Because competitor A may have competitor B just behind him, so that A reveals the location of the control as he is leaving it, thereby helping B. Since some competitors may be luckier than others it is at least potentially unfair. Doglegs may be obvious or not so obvious. For example, the best route to a control may be along the base of a hill to a reentrant and then continue along the base of the hill. This route creates a dogleg into the reentrant, even though the straight lines you use to connect the points on the map do not show this. To avoid doglegs, you can put in a short leg -- 100 to 300 meters long -- to move the competitor away from the previous control to the start of another long leg. A similar problem can occur if you use the same control on more than one course, if runners on one course leave the control in the direction from which the people on the other course are arriving. Avoid this situation as well. Under some conditions, it may be necessary to have a dogleg on a White course in order to have clarity. While not desirable, a dogleg on White is preferable to a course that is confusing or too difficult.

Avoid Dangerous Areas

Avoid including dangerous areas such as cliffs with poor visibility, sink holes, large areas of poison ivy or poison oak, or deep swamps. Remember, a White or Yellow runner may go into these areas accidentally, while a Red or Blue runner may be tempted to try a dangerous short cut.

Controls on Similar Features

Have no *less than 60 meters distance between any two controls* on different courses if the features are similar enough to be confused at all and no less than *30 meters* between any two controls on different courses *regardless of the feature*. For Sprint courses (on 1:5000 or 1:4000 maps) the minimum control spacing is 30 meters on similar features and 15 meters regardless of the feature.

Optimum Route and Climb

Determine the "optimum route" that an orienteer would take on all of your courses. Measure its length in meters with the edge of a piece of paper or a string. Then count how many contour lines this route crosses going uphill. Multiply this number of contour lines by the contour interval in meters. This "climb" *should normally not exceed 4%* of the optimum route distance. For example, a 6.7km Red course with an optimum distance of 7.5km should normally not have over 300 meters of climb. If it does, change your course so that there is less climb. Try a design that offers contouring along hillsides as the optimal route. A longer walk to get to a higher Start area can also help.

Split Courses

If for some reason you are having multiple courses for any level, try to make them very similar in length, climb and number of controls. *The first control must not be the same for any two courses*.

Course Purpose

For the design of the less difficult courses, it is important to be mindful of three overriding considerations which distinguish these courses from the advanced courses (Brown, Green, Red and Blue):

1. While as a general rule the advanced courses each should be designed to be as technically difficult as terrain and map permit (and of equal technical difficulty), each of the lower courses -- White, Yellow and Orange -- must be designed to fit a distinct range of technical difficulty.
2. Because each of the lower courses is an A level or championship course for certain classes, the correct design of such courses is just as important as that of the advanced.
3. Because beginners and developing orienteers spend at least a season or two (usually longer) running the lower courses, it is especially *important to the development and success of the sport* that these courses be well designed.

White Course

Winning time: Sprint 12-15 min, Middle 20-30 min, Long 20-30 min, Classic 20-30 min.

The White course should be designed for people who may have no orienteering experience and have had perhaps *15 minutes of instruction* before setting out. While it is the championship course for M-12 and F-12, the major complaints about White courses have been that they were too difficult.

A White course must be designed in a section of the map which has an appropriate sequence of linear features, where the mapping is absolutely accurate and where, preferably, there is an interesting variety of topographic features. An ideal example would be a small lake, which can be circumnavigated without fear of losing one's way and with the expectation of a good trail system and interesting features. Usually the area of the map having the most trails is best for White course location.

1. An Easy Start. Make the first two or three points particularly easy. This allows the competitor to get familiar with the map and keeps him from getting discouraged from the very beginning. The first control should be as simple as possible -- in fact; *it can even be visible from the starting point*.
2. Linear Features. Generally, the terrain you use for a White course should be "friendly," with lots of good handrails, no excessively rugged features, etc. Keep every leg along well-marked trails or a similar linear feature such as a road, a stone wall, a field edge, a stream or the like (trails are much preferred, however).
3. Short Legs. Generally the legs should be kept fairly short -- certainly *no more than 400 meters*. It is better to have six to eight short legs than three or four long ones. On the other hand, don't use twenty legs each 100 meters long.
4. Large features for control points. Make the difficulty of the control fit the course. Use large, obvious features -- top of a big, distinct hill, rather than the backside of a three-meter knoll; a trail junction rather than a reentrant. Rarely, therefore, will a control be suitable for both the White course and the Orange course.
5. Avoid vague and dense areas. As with any course, the features you choose for control sites must be distinct; even large features can be vague, as for example the top of a large flat-topped hill. Also, if you pick precise spots, you will get fewer comments about controls being a little bit off. Never put a White control in a dense area.
6. Very simple route choices. It is not necessary to have a route choice on a White course, but sometimes it is nice to offer a little toward the end. The options should be rather simple. Remember, people on the White course may take routes that you would never dream of! A good example would be a leg having a long, safe route (e.g., along a trail) and a shortcut (through woods, along a stream, etc.), provided there is no danger of getting seriously lost. Such a design introduces some elementary navigation factors and adds challenge and variety. If necessary, a leg can be run through the woods guided by streamers, but this should be used only in exceptional circumstances where needed to optimize distance due to lack of linear features.
7. No Use of Compass. Avoid directions or features that require the use of a compass. A White course should be able to be completed without having to use a compass.

Yellow Course

Winning time: Sprint 12-15 min, Middle 25-35 min, Long 30-45 min, Classic 25-40 min.

The Yellow course is designed for males or females who are 13 to 14 years old and for older orienteers who are relatively new to the sport. It offers the beginning orienteer an initial experience with the application of orienteering techniques, and the course designer should make an effort to involve as many fundamental skills as possible -- compass, map reading, distance measurement and pace:

1. Basic Design. Just as with White, it is critical that the Yellow course be set in an area having well-mapped, clear features. It is vital to appreciate that, in several senses, the basic difference from White is that Yellow takes the runner from the trail into the woods. While trails can be used for a route on a Yellow leg, an off-trail route should also be available for the same leg.
2. Easy Start. Make the first two or three controls relatively easy so that the competitor may become familiar with the map.
3. Easy Course. Yellow should still be an easy course. The technical difficulty for Yellow is confined to a rather narrow range whose objective is accomplished by the use of a handrail for much of each leg's length, with a catching

feature near each control (within 25-50m). The best Yellow legs are along handrails such as streams, ridges, and vegetation boundaries or stone walls.

4. Variety of lengths of legs. Vary the lengths of the legs, but tend toward keeping them short. *The maximum length should be about 600 meters*. Legs should be longer than for White; usually 200-400 meters is good for Yellow.
5. Large features for control points. Use large features within visual distance and rather obvious features, such as a large boulder near a trail junction, on top of a hill, north side of pond. When a point feature is used, it should be within visual distance of a large feature.
6. Route Choice. As with White, again some challenge can be used by shortcuts through open woods, but only if the distance is relatively short (up to 200m, at most), and provided a catching feature exists. And even in such cases, a longer "safe" route should also exist.
7. Control placement. Put each control on or just after an obvious collecting feature. If the control is not on a collecting feature, put it within 100 meters of one, preferably just after it.
8. Catching Features. If a control is not on a collecting feature, a catching feature must be within 100 meters after the control.
9. Avoidance of Dense Areas. Never put a Yellow control inside of a dense area.
10. Limited Use of Compass. A Yellow course should be able to be completed with minimal the use of precision compass. A leg where use of a compass could result in a faster route is appropriate; however, that leg should have a reasonable route where a compass is not required.
11. Shared Controls. The practice of sharing a leg or control with White or Orange should be avoided, especially if a large turnout is expected. Because each of the three lower courses has a *discrete range of technical difficulty*, overlaps invariably cause compromise with correct standards.

Orange Course

Winning time Sprint 12-15 min, Middle 25-35 min, Long 40-55 min, Classic 35-50 min..

1. Moderately but not extremely difficult navigation. The controls and best routes should invite the intermediate orienteer away from strong collecting features (roads, trails) that the beginners must rely on. However, *the penalty for navigational errors should not be extreme*. An Orange control may be placed in an area of intricate small features, but only if there is at least one good attack point nearby (preferably several) to help the competitors find it, and also a catching feature nearby to which they can "bail out" if they become confused.
2. Route Choice. Set a course that *forces the orienteer to make decisions constantly*. Make sure that the competitor must continue to pay attention and think in order to execute his choice properly -- it should not be, for example, just a matter of choosing which one of two main roads to follow for one kilometer. The best Orange legs require, and reward, constant navigation. Handrails should be more suitable than for Yellow -- e.g., a long, broad reentrant. Rather, the runner should pick off point markers (cliffs, boulders, knolls, marshes, etc.) as he proceeds along his chosen route. A trail -- or a road -- run should seldom be the best choice.
3. Variety. For variety, easy legs near Yellow in difficulty should be mixed with challenging, more advanced; in addition, a mix of short (200-300m) and longer (500-600m) legs is desirable. It is important that the whole course contains as much variety as feasible. This variety should also cover *control features*, *direction, route choice and navigational problems*.
4. Control Features. The control feature should be fairly prominent, unless a good attack point and catching features are nearby. The Orange runner should be forced to *use all of his orienteering skills* in the overall course.
5. The fastest time appropriate to the format. Keep in mind that some very skillful -15-16 runners will be on Orange: so the course must not be too easy. A typical mistake is failure to reduce length due to climb, difficult footing (rocks) and slow run (fight).
6. Precision Compass, Measure and Pace. Legs requiring nothing but precision compass, measure and pace should be limited to one or two.
7. Difficult Controls. Difficult controls may be used, but a good attack point should be *within 50 to 200 meters.*

Brown, Green, Red and Blue Courses

Winning times:
Brown: Sprint 12-15 min, Middle 25-35 min, Long 45-55 min, Classic 40-50 min.
Green: Sprint 12-15 min, Middle 25-35 min, Long 50-65 min, Classic 45-55 min.
Red (except F21): Sprint 12-15 min, Middle 25-35 min, Long 70-90 min, Classic 60-75 min.
Red (F21): Sprint 12-15 min, Middle 30-40 min, Long 70-90 min, Classic 60-75 min.
Blue: Sprint 12-15 min, Middle 30-40 min, Long 80-100 min, Classic 70-80 min.

The advanced courses should be set so that the very experienced orienteer is well challenged. The element of luck should be eliminated if possible. The Brown, Green, Red and Blue courses all should be of the same technical level -- difficult. General requirements are the same; however, special consideration noted at the end of this section is required for Brown.

1. Start. Choose the Start for Brown, Green, Red and Blue courses with regard to proximity to a good White/Yellow course area with lots of trails and linear features. In hilly areas, place the Start at a high elevation to help minimize unnecessary climb on the courses.
2. Course Length. Try to keep your course length reasonable, especially on hilly courses or in thick vegetation, to meet these times. Remember that it is “expected winning time” which is decisive in determining course length. Try not to over set courses. [Use previous course results if available and talk to previous competitors who have used this terrain to gage length and climb.]
3. Control Feature Size. Avoid large features, which are usually very easy to find such that the competitor does not need to use precision skills. *Too big a feature* might be the top of a large hill, the edge of a large clearing, a point along a trail or stream (if there are any confusing trails or streams, this could be okay), etc. In fact, having a control *within 50-75 meters of a big feature* is probably too easy as well. Use small features -- boulders, cliffs, small reentrants, spurs and knolls, small marshes, depressions, etc.
4. Controls too close to attack points. Placing a control soon after a collecting feature, for example, 100 meters after a road, will usually make it too easy to find even if the feature is small. Furthermore, the competitor will probably be able to run to the road without thinking, making the leg too easy. Instead, place the control some *200 meters before the road*. That way the less skilled orienteer will have to cover the extra 400 meters if he must use the road to find his bearings. Collecting features are long features lying across the competitor's direction of travel, such as roads, large trails, streams, ridges, clearings, large marshes, etc. Concentrate on this: if the competitor uses them to make his route or his navigation easier, make him travel farther out of his way. *Don't make the direct route the easier route*.
5. Lost Kilometers. Any parts of a course that require little or no thinking, merely physical effort, should be avoided as much as possible. If a control is on top of a large hill, the leg becomes a hill-climb event instead of an orienteering event. If the control is placed right after a big collecting feature, the competitor can turn off his mind until he reaches the feature. If the best route is along a trail for several hundred meters, again the leg becomes a racing event requiring little or no thinking.
6. Handrails. Try to avoid having the routes parallel to obvious linear features such as roads, trails, streams, fences or power lines. To prevent a parallel route from simplifying the leg significantly keep such features more nearly perpendicular to your route unless the linear feature network is complex.
7. Catching Features. Advanced courses should not have controls placed too close to catching features. Controls should not be located beyond a catching feature; rather, any catching feature should be at least *200 meters beyond a control*.
8. Climb. Climb should normally not exceed 4%. See "Optimum Route" on the second page for computation method.
9. Long Legs. *For Classic/Long courses, include at least one* long leg (~600 meters on Brown and 800 meters or greater for the longer advanced courses). Courses should include multiple long legs if the terrain allows it.
10. Route Choice. Maximize route choice and navigation difficulties while minimizing the luck element and the lost/dead kilometers. The navigationally challenging route should be faster for those with good woods running skills than the "easy way around."
11. Variety. A good course offers variety in both controls and routes. The larger the number and the greater variety of O-tests built into a course, the greater the chance that luck is eliminated and the orienteer with the best ability wins.
12. Brown Course. Some orienteers on this course may have some vision problems and only limited leg strength. The climb should be closer to 3%, at most 4%. Tough and dangerous areas must be avoided. While it must be less demanding physically, the Brown course should require the maximum in orienteering skills. Since vision may be a major problem for the older orienteer, try to keep controls out of areas that have *much fine detail* on the map so that finding the control is by skill rather than luck.

USOF Cross-Country Orienteering Course Setting Guidelines

Control Flag Placement

It is fair, and often desirable, to block the view of the control flag by a mapped feature, especially where it is the control feature, such as a cliff, boulder, etc. But, be sure the feature is appropriately visible. It is hard to improve upon a control on the far side of a knoll, seen first as the runner reaches the crest or comes around the side. On the other hand, nothing is worse than a control flag hidden behind a tree, log, bush or other unmapped obstruction, which punishes all but the lucky few who stumble upon it.

It is required to place controls from different courses at least 30 meters apart regardless of the control feature.

Hidden Controls

The only reason we hang a flag is to help competitors find the find the punch or marking device. A non-mapped feature for any course should never hide control flags. It is extremely frustrating for the orienteer to navigate a leg properly only to lose time searching for a hidden flag. Likewise, it is just as frustrating to reach for a marker or punch and find that it is attached to something other than the flag or stand near the flag. We call that hidden in plain sight. Remember, unless the control description clearly implies otherwise, every control flag should be equally visible from all directions.

Despite the consideration that the feature, not the flag, should be seen first, do not hide flags, especially in pits.
Do not place the control against the side of the pit in the bottom because it may be hidden from certain approaches.
If you use a pit, place the control in the middle so that it is visible from all approaches.

White and Yellow

Control flags should usually be visible from the trail or road used to navigate. If not, locate the control at such a feature, but be sure it (the feature or even the control flag) can be seen from the trail. Make sure that there are no similar features nearby to confuse the competitor. Flags for White courses should be hung higher than on advanced courses. Flags on Yellow courses can be lower; approximately waist-high on an adult. Remember that the participants on White and Yellow may be children, so place flags and markers at a height which they can see and reach.

Orange

Orange controls should be hung just above the knee of an adult.

Brown, Green, Red and Blue

For all of these courses, the *control feature should be seen first* and then the flag. Flags should be hung just below the knee. *Make the competitor orienteer to the feature first*. If he is coming from the South, for example, place the control flag on the North side of a knoll or boulder.

The flag should always be fully open when hung, not folded on the ground. In no case should the control be hung with any part of the bag resting on the ground. Err on the side of visibility. If you have to build something to gain the placement you desire (such as laying a stick across a pit to hang the control on) do not hesitate to make a small construction out of available materials. It pays to have a good imagination.

Field Check (Vetting)

You *must* check the planned control locations out in the field. Many control locations that look good on the map are unsuitable due to map problems. An alternate control can usually be found only a short distance away, so that the leg can remain intact.

White courses

For White Courses, be sure to check the other courses to ensure that there are no nearby controls from them which may confuse the White course runners.