Cyclocross Course Design & Construction Techniques
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What do I need to create a CX course?

Some of the information you need will be in the cyclocross section of the USA Cycling rulebook:

General Cyclocross Course Design Philosophy

Cyclocross is a unique bicycle sport. It is not a variation of either mountain biking or road racing. There are some common aspects of both those sports in cyclocross, but it is a mistake to view cyclocross with a road or mountain bike bias in either course design or race preparation.

*Cyclocross is a race of transitions:* on and off the bike, over natural or artificial barriers, quick entry and exiting of the corners, onto hard pavement or hard ground from soft ground, handling tricky off-camber sections, and or sprinting from a remount. Course design should emphasize these aspects of cyclocross.

A cyclocross course should be 2.5-3.5 kilometers in length. Lap times at race speed with good conditions are ideally 5:30 – 8:00 minutes in duration. Courses can be designed with up to 3 barriers sections per lap and up to two "natural" barriers per lap. Common "natural" barriers are sandpits (volleyball pits work great); long log(s) laid across the trail, extremely technical sections and exceptionally steep run-up sections. Artificial barrier sections can be placed on a climb or flat part of the course. A flat and fast barrier section, easily visible on the course, is recommended to encourage spectatoring.

The amount of pavement on a cross course should be none to 1/5 of the racecourse. At least 1/3 to 1/2 of the course should be over firm ground (pavement, hard dirt roads and paths, hard packed trails, or firm grass fields). 90% of the course shall be rideable.

The course shall not be placed near any object that could constitute a danger for riders. An exception to the course minimum width rule, and other rules, may be considered if it takes rider safety into consideration. Consult with the official(s) on race day if you have any questions.

Be creative in your course designs/layouts, designing a challenging, yet safe, course with the racers, spectators and officials in mind.
Course Surface

The surface of a cyclocross cross can be quite variable, but certain conditions should be avoided: rocky ground or heavily rooted ground, too much soft, grassy or mulchy ground, which when dry tends to be too bouncy and when wet turns into a complete quagmire. Some is good, but an entire course of it is not.

Intentionally wetting the course to create mud is poor form, and not advised. Sandy sections are acceptable, but too much can ruin a race. Use good judgement; cyclocross should be a fast race of transitions. Wide wooded paths, gravel and dirt roads, grass fields, pavement, mud and plain old all-American dirt are all good for cyclocross racing. The more variety there is in the course, the better.

Course Design Considerations

General
Courses should be designed with the racer and spectator in mind. A course that allows one to stand at one part of the course and see riders at different parts of the course is great. The ability to walk to different parts of the course quickly and easily is excellent, too.

The course should be designed so that it is dividable into thirds or quarters. Each of these sections having a physically hard or technical section/feature and a section that allows the riders to rest a bit. Remember, "A race of transitions." This allows the riders to maintain a faster pace and prevents the race from turning into a boring grind.

Single track is not appropriate for cyclocross. Wooded sections with adequate width can be a great addition to a cyclocross race, but tight, technical, rocky single-track is not suitable for a cyclocross race. Remember the course should be designed for a skinny-tired cyclocross bike, not a full-suspension mountain bike.

The course should generally be right turns (clockwise). Although not initially obvious, this places the pits on the right side of the course. When riders dismount in the pit, this places their bikes on their right side, adjacent to their mechanics that are waiting just outside the pit cabanas.

If a pit is on the left side of the course it is often called a “backward pit”. This is because it forces mechanics to stand in the pit lane to receive their riders’ bike. This clogs the pit lane and is not preferred. It also separates the mechanics from their tools which are in the cabanas.

Using a flyover allows a course to have both generally left and generally right turns.

Finish Area
The finishing stretch should be a straight line, of at least 100 meters and a minimum width of 6 meters for championships, 4 meters for other events. It shall be flat or uphill. The finish line should be set up as noted in the USAC Rulebook, free of obstacles or barriers, and wide enough for a group sprint.

A tent of some kind should be set up next to the finish line. It is shelter for the officials in the case of bad weather and points out to racers and spectators the finish area. A banner spread above the finish line with your sponsors name is a nice professional touch.

Build the course with a controllable gate after the finish line to allow traffic out and in. Traffic coming out will be racers finishing. Traffic coming in will be racers warming up at the completion of the previous race. Having a narrow "L" shaped gate forces the riders to slow down in and out, improving safety.
If fencing is not used, double tape the finish stretch before and after the finish line as far as possible. This is the area of the course with the most constant traffic - and possibly the highest speeds with sprint finishes. Double taping or fencing helps to control traffic and improve safety - as well as force riders in/out through the gate constructed for that purpose.

**Staging Area & Starting Grid**

Racing rules allow for a starting section of the course that is not part of the main loop of the course. This makes the course “Q” shaped, instead of “O” shaped. By placing the staging area and starting grid on the tail of the “Q” one race can be staging while another is racing. This will reduce staging time between races by 10 – 15 minutes.

The tail of the course needs to be long enough to allow riders to spread out along the course so there is no bunching up of the riders when they arrive at the first obstacle.

The staging area length should be evaluated to be long enough to manage the largest field of the day - plus some walk ups. The number of rows will be the number of riders registered divided by 8, plus a couple rows in case of a good day for walk ups.

Depending on the size of the event, construct the staging area in a way that requires single file entry during call-ups. In UCI level events officials will need to check riders as they enter staging, single file entry allows a control point to ensure compliance.

Double tape or fence the starting grid and a reasonable length of the start. This is also a very fast section of the course and safety is of high importance on each start. Double taping minimizes course crossing through that segment of the course.

**After the Start**

After the starting grid, the starting stretch shall be a minimum of 200 meters in length and at least 6 meters wide to allow the field to string out properly. It shall be as straight as possible and not downhill. The first narrowing or obstacle after the starting stretch may not be abrupt but shall allow the riders to pass easily." (USAC Rule Book). The start section does not have to contain the finish line and does not even have to be part of the regular lap. The purpose of the start section is to allow the field to string out before the first dismount or technical section.

**Construction Supplies**

**Course Stakes**

A typical cyclocross course is 2.5 – 3.5 km in length. That means that you may need 1000 – 2000 stakes. Stakes can also be broken during crashes. You should have extra stakes available on race day.

Most courses are temporary, rather than permanent. For temporary courses, a step-in stake is often used. These are a farm supply item, typically used to hold temporary electric fencing.

Here is a popular step-in fence post.


These normally have a discount when ordered in bulk, and are available in a variety of colors.

Another option, from Amazon, Key words: step in fencing


For areas that need to be more permanent, or areas that need more strength, wooden 2X2’s are very popular. Extra rigidity can be given to stakes and wooden fence posts by adding rope or twine between the posts. Metal posts or wire should not be used on the course.
Course Tape

In an ideal world the entire course would be marked with tape. This is not required, but the larger the race, the more it is expected. The purpose of marking the course is to direct racers, and to prevent spectators from crossing the course and/or getting run over by a cyclist. In some areas taping may not be needed on both sides of a course. Examples would be along a tree line, hedgerow or cornfield. All of these may create a natural fence line, possibly eliminating the need for tape.

A typical cyclocross course is 2.5 – 3.5 km in length. That means that you should have a minimum of 6000 – 8000 meters of tape on hand to mark your course. You will need even more if you are going to double tape parts of your course.

In quiet areas of the course it is common to single tape each side of the course. In complicated or busy areas it is common to double tape or sometimes triple tape each side of the course. Double tape also makes it more difficult for pedestrians to cut across the course. Consider double tape in areas where you do not want pedestrian traffic. Examples would be the starting grid and finish areas.

Tape should always be right side up with no twists, so that it is readable by the riders on the course.

Although you can buy rolls of caution tape at the local hardware store, they tend to be smaller rolls, and pricey in the long run. Tape that is blue or red in color is more difficult to be seen by riders. Consider using tape that is white or yellow.

Several cycling vendors will provide course tape at a reduced price, or even for free. SRAM and Specialized are two such vendors.

If you want customized tape, you can purchase it with your own artwork. Here is one source for custom course tape:

http://www.omnipromo.com/#!course-tape/c20pb

Snow Fence / Scrim

As mentioned above, double tape helps reduce pedestrian traffic on the course. It will reduce it, but not eliminate it. To prevent pedestrian traffic, consider using snow fence, on at least on one side of the course. Snow fence (Scrim) can be printed with sponsor logos, and sometimes can be gotten at discount or free, similar to course tape.

Snow fence is heavier than tape, and will need extra support. Consider using double or triple step-in stakes, or wooden posts to support the snow fence. As mentioned above, String or rope between stakes can also increase their rigidity.

Starting Grid / Finish Line

The starting grid is made of 8 lanes that are 30 inches (75 cm) wide. The start is preferably on pavement, but is not mandatory. To mark the grid, several options include:

Duct Tape,
Spray chalk http://www.amazon.com/Marking-Chalk-White-17-oz/

The finish line may or may not be on pavement. The same construction materials apply for the finish line.
Typical Starting Grid
The start line is at the front, and eight lanes. Course tape and stakes limit access. The barrel in the background has been placed behind the grid to create a gate for call-ups.

Pit
It is good to have something in the pits that will hold the riders spare bicycles. This can be saw horses, sections of portable fencing, or triathlon type bike racks. To predict how much bike storage will be in the pit, estimate that 80% of the category 1-2 race will have spare bikes.

If you are anticipating the course being muddy on race day, plan on having water in the pit so that the bikes may be cleaned. The simplest option is several five gallon buckets, half-filled with water in each pit.

The ultimate option is several gas operated power washers in each pit. This will require several hose lines and hose splitters to do this. Power washers also generate a LOT of excess water, and will end up creating a swamp in the area where they are used. Place them in an area where water will drain away from the pit and away from the course. To keep bikes out of the swamp, it is common to us a wooden shipping palette where the washing is done. The slats in the palette act as a bike stand, and also raise the bike above the muddy water generated by the washing.

Tools
The tools needed to build the course will vary, depending on how rough your course is. Assuming that the course is mostly complete, the following tools may be required:
- Gas powered weed-eaters.
- Chain saw or pruning saw.
- Leaf blowers
- Rakes, shovels
- Hammers for driving fence posts & rebar for barriers
- String, rope, or twine
- Duct tape or parking lot paint, or spray chalk.

Measuring device
Used to determine 3 meter course width, and to mark .75 meter lanes within the start grid.
My personal favorite measuring device is a replacement camping tent pole that is 3 meters long. It folds to 18 inches long for storage. I have also marked it every 30 inches along its length, so that I can use it to measure the lanes in the starting grid.

**Construction Techniques**

**The Obvious**
Use enough stakes to define the course. When stakes are too far apart, the wind can blow the tape around, altering the width of the course, and blowing the tape into riders.

**Good example of Course Tape**

**Bad example of Course Tape**

Above Left: Course Tape should have a single wrap around the stake, with no wrinkles or twists. Any advertising should be right-side up and readable by riders on the course.

Above Right: Course tape was not unrolled, instead it spiraled off of the roll, making tape appear smaller, less visible, and hiding sponsor logos on the tape.

Course tape should be right side up, and un-curled, so that it is readable from inside the course
If the tape stretches or sags, wrap it around the post a second time. If it still sags, wrap until it is
tight. Do NOT use the clips on the stake to hold the tape. If you do this, you will increase the time
it takes to tear down the course.

Note that tape is on the inside of the course, and that the stakes are on the outside of the course.
If there are trees on the course that you are using as stakes ( a bad idea, but some promoters still
do it ) do the same thing, wrapping so that the tape is on the inside of the course, and the tree is
on the outside of the course.

Course stakes should be on the outside of the course and tape on the inside of the stakes.

CORNERS AND 180’s

Correct way to mark a corner

Wrong way to mark a corner

In the above wrong examples, stakes are 3 meters apart, but not enough stakes were used,
pinching parts of the course.

Often times riders having problems with difficult corners will crash through the tape on the outside
of the exit of the turn. There are a couple of options:

   a) Have course repair staff stay at the corner to rebuild it each time the tape is damaged.
   b) Use a LOT of tape and stakes and maybe snow fence so tape can withstand damage.
   c) Widen the exit of the turn, to better reflect the actual line through the turn.
TREES

Trees, especially large ones, should not be used as course stakes. You can see that the tree stump and roots encroach into the course.

Feeding Zones

Not really a course design issue, but if feeding is to occur, it will be done in the pits. Feeding is not permitted in USA Cycling-sanctioned cyclocross races unless specifically authorized by the chief referee. No feeding is allowed the first 2 or last 2 laps, so a race needs to be at least 5 laps long for feeding to occur.
The PIT

Preferably a large, area that is mostly flat. See the drawings in the USAC rulebook and end of this document.

Besides the 3 meter wide course adjacent to the pit, the pit lane itself is also three meters wide. The mechanics area needs to be a minimum of 2 meters (7 ft.) wide.

So to build a minimal double sided pit requires the 3 meter course on each side, the pit lane on each side, and a single mechanics area (even though 2 mechanics area are preferred) for a minimum width of 14 meters or 47 feet.

The entrance and exit need to be at least 3 meters wide. These need to be marked with yellow flags. The flags go on both ends of the short piece of fence between the entrance and exit. Most novice promoters use signs to mark the pit, but yellow flags are what is actually required in the rulebook.

To make cheap flags, go to a craft store like Michaels. Buy four dowels, 3/8”-1/2” in diameter, and 4 yellow bandanas / handkerchiefs. Staple the bandanas to the dowels and you have 4 flags for under $8. Use duct tape or course tape to fasten flags to the stakes at the entrance / exit to the pit.

The pit should have a gate or entrance so that mechanics do not need to walk across the course to gain access to the pit. At larger events a volunteer will be at the gate to the pit, to ensure everyone in the pit has a pit pass. As mentioned elsewhere in the article, the pits should be on the right side of the course.

As mentioned previously, above, if the course is wet/muddy additional space will be required for washing the bikes.

How big does your pit need to be?
These mechanics are supporting 100 riders in a men’s Category 1-2-3 event.
Yellow flag marking exit to the pit. In the distance you can see the flag marking the entrance to the pit. Pit lane is 3 meters wide. It is a high traffic area, and you can see that 2”X2” wooden stakes were used. Sections of fence are in the pit, creating mechanics cabanas and holding spare bikes. Pit is on right side of course, so is not a “backwards pit”

**Barriers**

The purpose of barricades in cyclocross is to force a dismount, and not to test a rider’s ability to bunny-hop.

The overall length of obstacle, or barrier section, shall be no longer than 80 meters (262 feet), in accordance with USAC rules. Distance between hurdles should be set at 4-6 meters (13 - 19 feet) on flat ground, mainly to discourage bunny hopping. The number of hurdles per section is 2. If the course conditions are poor, due to rain, ongoing wetness, or snow, it may be a good idea to shorten long running sections, as runs in poor conditions may slow the race and fatigue the racers beyond reason.

A barrier section, natural or artificial, should be placed on the course only if a wide, flat, or slightly uphill area is available for remounting onto the bike. A remount part of the course should not be technical, exceptionally rooted or rocky, skinny, or downhill, to ensure rider safety.

Fifteen years ago the minimum course width was 2 meters ( 7 ft.) and a barrier could be 8 ft. wide. Then USAC adopted the 3 meter width used by the UCI. Since the course is now a minimum of 3 meters ( 10 ft. ) wide, using a barrier that is 8 ft. wide, will leave gaps that could allow a rider to ride around a barrier. Read the rulebook link above.

Barriers can be no higher than 40 cm (16 inches) and need to be consistent in height along their length. To raise or even out an irregular barrier, put a section or two of 2X4 that is 12” long under each end of your barrier, and preferably outside of the course tape. You can also use a shovel to dig out dirt under the barrier, but this is harder to do and is not recommended unless only minor digging is required.

Since 3 meters (10 ft.) is the minimum course width, consider purchasing a barrier that is 12 feet long. Home Depot sells a treated 2” X 12" that is 12 feet long for around $20.

Do not use particle board or plywood, as the top of the barrier will get a lot of abuse, and these will break down more quickly than a solid board.
Use rebar on the back side of the barrier for support. Make sure that when the rebar is driven into the ground that it is at least ½ inch below the top of the barrier. This is to ensure that the rebar cannot touch / damage bikes, tires or riders.

Fasten the rebar to the barrier with conduit or wiring clamps from a hardware store. Keep them at least two inches below the top of the barrier so that they cannot be touched by bikes or riders.

If the barrier is held in place with rebar on the front AND back of the barrier, place the rebar as far to the edge of the course as possible, preferably outside the course tape.
ADVANCED COURSE FEATURES

Course Gates for Pedestrial Crossings

Crossing gates are used at larger events, and are usually made out of 2” PVC pipe. Rebar is driven into the ground and the PVC is slid over the rebar, and then attached to the course tape/fencing.

Build the crossing gates wide enough for two-way traffic. It also needs to be wide enough that an EMT’s gurney or a Gator can pass through if needed.
UCI Examples

Below are diagrams of the start grid and pit area from the UCI rulebook. The USAC Rulebook does not have their own examples. Instead, they use these from the UCI.

UCI Diagram of Start Grid
While it may be overkill for most events, this gives a good idea of the space needed for a pit. The "pit" size is really the area that excludes the race lane and exchange lane. 3m for race lane, 3m for exchange lane - on each side. If you have 12m wide area, you don't have a pit. You need at least 18m wide section to have a reasonable pit.
Post Event

TEARDOWN
Make sure to schedule volunteers to assist with teardown. Courses tear down a lot more quickly that they go up. A course that took a crew 4-6 hours to set up can usually be torn down in 1-2 hours. Course tape should not be considered to be recyclable, and should be disposed of.

POST EVENT REPAIR
Depending on the property owner and weather conditions, returning your course to pre-race conditions may require no work, or lots of work, including grading and re-seeding. The landowner may charge you for any repairs needed after you have done your post-event repair. A local promoter was recently charged $2000 for repairs to the park where his event was located.

Photos: John Fovel

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