Mountain Bike Trail Design Sheet 010 // TTF: Berm

Description
A berm is a banked and curved cornering feature on a trail that provides support for the rider when turning a corner allowing them to turn in a smooth manner. A berm allows the user to maintain speed while cornering. The features are usually used on flat or downhill sections of trail. A blue graded berm will be generally open and shallow with more difficult berms encompassing tighter angles, steeper surfaces and higher entrance speeds. The speed at which a berm is ridden increases with rider skill and experience. Berms may also be used as trail feature in themselves, with a series of berms on a descent being a typical feature of modern bike trails.

Design Comments
It is important to ensure that a berm is continued around a bend to a point where the rider is able to exit safely on the line of the trail. Riding the feature during construction will indicate the correct exit point much better than design sketches. The trail formation specification needs increasing for berms that are to be ridden at higher speeds or are on steep gradients. When referred to as an XL berm the specification should be quadrupled for 10m. This additional fill will ensure sufficient height, tread width and angle of batter for these larger turns.

Construction Methodology
Berms are created by either constructing a bank from earth or stone or identifying an existing bank/gradient that has suitable properties for the trail. A basic 20-45° bank should be formed in a rough semi-circle with an inverted dished face and a suitable turning angle for the grade of trail. An excavator should sit on top of the bank and distribute local stone into the face of the feature. A whacker plate may be used to compact the stone into the face of the berm, which should appear sealed when finished with no loose stone. An appropriate drainage area on the inside of the berm should be excavated to ensure water is shed successfully off the surface.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whackerplate

Health and Safety and Construction Design Management
The main health and safety issues to be addressed with relation to the construction activity will be: The presence of large machinery, manually moving heavy weights, communication when working in remote locations and protection of public and unofficial persons as well as staff on site. CDM regulations apply to any trail build project. If more than 500 person days or 30 working days on site are due to be completed the project will be notifiable to the Health and Safety Executive and a CDM coordinator will need to be appointed—Tel: HSE 0845 345 005

Mountain Bike Trail Design Sheet 100 // TTF: Rollers

Description
A roller is a trail feature where the trail surface rises then falls smoothly, which should be ridable without pedalling. As the name suggests, rollers are designed to be rolled over. Skillful riders can use rollers to gain speed and control by 'pumping' them. Rollers can occur on the trail singularly, or in series, depending on the grade of trail. On blue grade trails, rollers should generally be singular, although multiple rollers could be used if there is a minimum of a bike length (~1.5m) gap between them. Red grade rollers can occur in succession and are steeper, taller and spaced closer than blue grade. Black grade rollers should be technically challenging to ride, due to their steepness and height. In some cases on black trails, riders can jump from one roller to another.

Construction Methodology
Rollers can be constructed from material on site or from imported material from local sources. Rollers can be built up on flat terrain, or use naturally occurring features. If built on flat terrain, a roller can be expected to use typically 0.5t of sub base. Machinery should be used to import and manipulate material into the appropriate spacing and heights. The shape of the rollers should then be refined using hand tools. The trail surface should be built according to specifications.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whacker Plate

Health and Safety and Construction Design Management
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Mountain Bike Trail Design Sheet 101 // TTF: Jump

Description
A jump is an exciting trail feature allowing riders to take off from the ground and land safely using their momentum. The larger the feature, the more severe the grade of jump. The entrance to and exit from a ramp is usually long which provides a safe environment within which to gain momentum, undertake the feature and land safely. Jumps may be constructed on all gradients, making them ideal trail features.

Design Comments
Poorly constructed jumps are dangerous. Focus should be on creating the correct entrance and exit to the feature which will enable users to take the jump at different speeds requiring different skill levels.

Construction Methodology
An excavator should construct a solid ramp out of local or imported earth or stone. Dumpers may import material and ramps may be shaped roughly by an excavator, before being finished by hand and compacted using whacker plates. Rocks and boulders may be installed on the lip of the ramp to allow users to drop off or roll out of the jump if the feature is not to be 'jumped'. Slabs or extra stone may be laid on the feature landing to reduce erosion caused by landing bikes. The route corridor at the entrance and exit to the jump should have a good line of sight.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whacker Plate

Health and Safety and Construction Design Management
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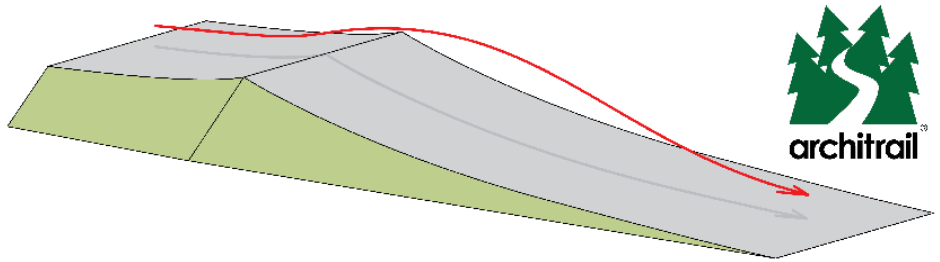

Mountain Bike Trail Design Sheet 102 // TTF: Tabletop

Description
A tabletop is a jump feature allows riders to experience jumps with a gap between the take off and landing in a safe and controlled manner. The feature is fundamentally a take off ramp with a flat top and a downslope. The advantage of using this type of jump is that the gap is not mandatory allowing a rider to jump onto the flat top of the jump, working their way up to jumping to the downslope of the landing. The difference in tabletop design between the moderate (blue) and severe (black) grades of trail is focused on the gradient encountered on the up and down slopes, the height of ramp to be navigated and the overall length. Tabletops can be constructed out of earth or stone material. It should be noted that whilst tabletops allow riders of all abilities to attempt the jump, the lip of the take off is therefore more susceptible to erosion than jumps with mandatory gaps.

Design Comments
Dividing the entry route into two will provide opportunity to offer users different approach options to the same feature (e.g. steeper and cambered options for more difficult grades).

Construction Methodology
A tabletop feature is usually constructed from stone or earth that has been imported from appropriate local sources. An excavator should be used to form material into a flat topped mound of 2m-15m long which has a side batter of no more than 45°. A dumper may be used to bring material onto the site if appropriate. The excavator should be used to compact the material at regular intervals until a tabletop is achieved. A final stone surface should be installed within a tray on top of the feature and compacted with a whacker plate so that the surface appears sealed to the naked eye. Grass seeding may be required for landscaping purposes.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whacker Plate

Health and Safety and Construction Design Management
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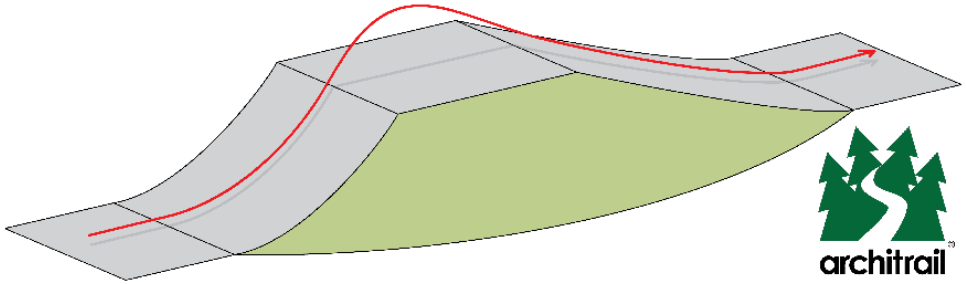

Mountain Bike Trail Design Sheet 104 // TTF: Roller Double

Description
A roller double is a manmade jump feature with a smooth, shallow bowl bettween the take off and landing slopes. This allows the feature to be rolled over providing an inclusive feature with no opt out route necessary. The difference between a moderate (blue) roller double jump and more severe grades (red/ black) is the length, height and angle of transition.

Design Comments
Roller double jumps are good for trails requiring features to be included for a variety of skilled users. Less able users will be able to simply roll over the feature where as better riders can perform a large jump.

Construction Methodology
A roller double jump may be constructed from stone or earth found on site or which has been imported from appropriate local sources. An excavator should be used to form local material into two ramps with a rollable center and side batter of no more than 45°. A wacker plate should be used to compact the material at regular intervals to a required height. A final stone surface should be installed in a tray on the top of the ramps and compacted with a whacker plate so that the surface appears sealed. The entry on the first ramp may be split into 2 to provide different angles of approach. The landing points on the downhill of the second ramp can be fortified with extra stone and should be elongated to provide a safe landing strip.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whackerplate

Health and Safety and Construction Design Management
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Mountain Bike Trail Design Sheet 110 // TTF: Grade Reversals

Description
Grade reversals are a feature that can be used when traversing a side slope where a full bench cut is required. The feature helps to maintain trail flow, add interest, control speed and shed water at strategic points across a traverse, by using the undulating trail gradient. The line of the trail can be descending, slightly ascending or flat. The gradient of grade reversals can vary hugely in length, height, gradient and frequency. Riders can gain speed by pumping the down sides of the reversals and carry momentum up the next incline before repeating. Grade reversals are also very useful for managing runoff on the trail surface, as water can be shed quickly from the troughs of the grade reversals. This avoids high volumes of water flowing on the trail surface and therefore reduces erosion. Grade reversals on a blue trail would typically have a wavelength of 15m-25m, red 10m-15m and black 5m-10m. Grade reversals on a blue trail are generally smooth and low, with more technical grade reversals encompassing shorter wavelengths, higher amplitudes and faster entrance speeds. The speed at which grade reversals are ridden, increases with rider skill and experience. For best practice, the trail gradient should always be less than half that of the side slope.

Design Comments
Routing the trail above large boulders and trees helps to provide natural demarcation and avoids undermining root systems.

Construction Methodology
Create a full bench cut (either by creating a platform as the 360 excavator works its way along, or using a walking excavator) and make sure the trail is constantly moving up or down. It is important to ensure that water can exit on the grade dips- a ditch and/or a culvert may be necessary. Once the shape is correct, a whacker plate should be used to compact the stone, which should appear sealed when finished with no loose stone.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whackerplate

Health and Safety and Construction Design Management
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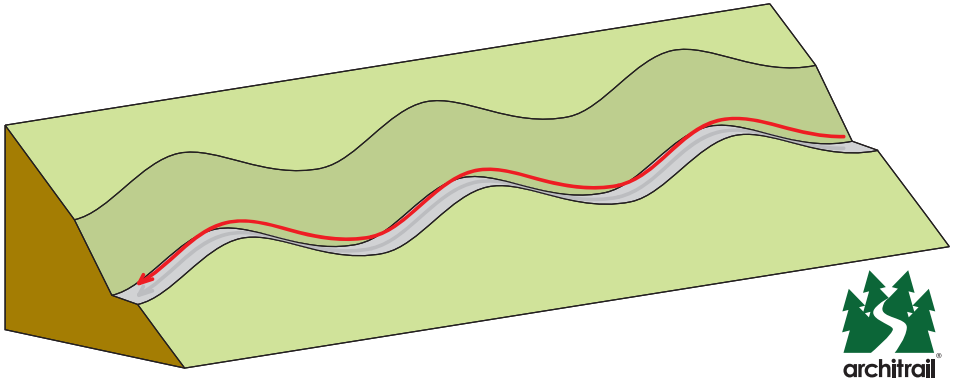

Mountain Bike Trail Design Sheet 201 // TTF: Drop Off

Description
A drop off is a feature on the trail where the rider will undertake a step down from a high level to a lower level, defined by instantly losing vertical height over a trail edge. Commonly stone is used in drop offs features as it is not subject to rot or erosion and can take continual braking and impacts. At the moderate (blue) end of the scale, a drop off may be no more than a 10cm step down which will cause the rider a minor disturbance in the ride. At the severe (black) end of the scale the drop off may be several metres, which will require significant commitment to the feature and high levels of skill. It should be noted that a landing slope might be required for larger drop offs.

Design Comments
Drop offs need to have a suitable landing area installed as part of the feature. This is dependent on the exit speed and next trail feature. This will prevent erosion of the trail surface immediately following the feature, which increases durability.

Construction Methodology
A drop off may be constructed from boulders and large rocks /slabs found on site or have been imported from appropriate local sources. Natural rock features may also be adapted to create the features . Appropriate machinery should be used to move earth/stone to create desired levels for height differences and excavate a bed into the existing route surface into which boulders may be set. A dumper may be used to bring boulders on to the site and tip them in rough positions. Hand tools may be used by multiple labourers to align the boulders into final position. Boulders should be set with at least 30% of their mass within the ground to avoid movement.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator

Health and Safety and Construction Design Management
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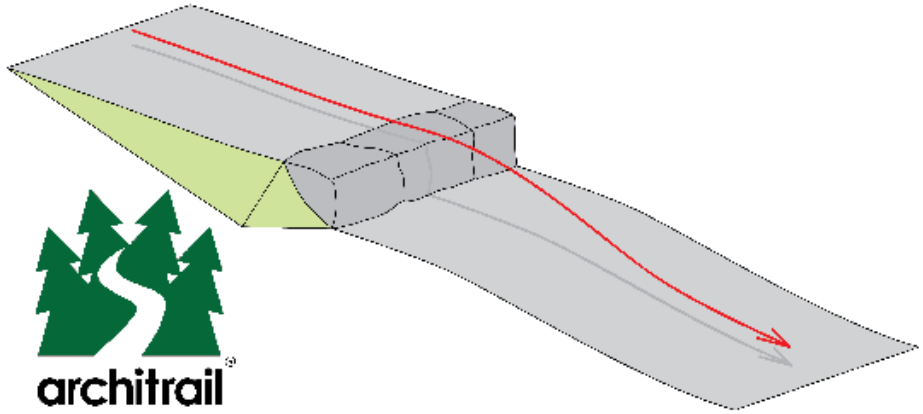

Mountain Bike Trail Design Sheet 202 // TTF: Rock Garden

Description
A rock garden is a technical feature where rocks and small boulders are installed into the trail surface in close proximity to each other providing unavoidable small obstacles. This roughened surface is fun to ride as it tests bike handling skills as well as slowing riders down over the section of trail. The difference between moderate (blue) and severe (black) rock gardens may be down to gradient on which the rocks are set, the size of the rocks (height above ground) or the distance between the individual rocks, which limits navigable options.

Design Comments
Some users may try and avoid the rock garden sections due to the uncomfortable nature of the ride. The use of larger boulders or timber at the edge of the trail will prevent users from diverting off the line of the trail.

Construction Methodology
A rock garden should be constructed using locally won or imported rocks which are no bigger than 500 x 500mm. Rocks may be imported using a dumper or tracked wheelbarrow. The rocks should be installed to a shallow depth by hand in the existing trail surface. Rocks should be positioned in appropriate positions relating to the grade of trail. A surface/wearing course should then be installed over the rocks, which should be compacted down with hand tampers. The finished trail should be finished with at least 40% of the rock mass within the ground. This will prevent movement as bikes run over the rock sections.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whacker Plate

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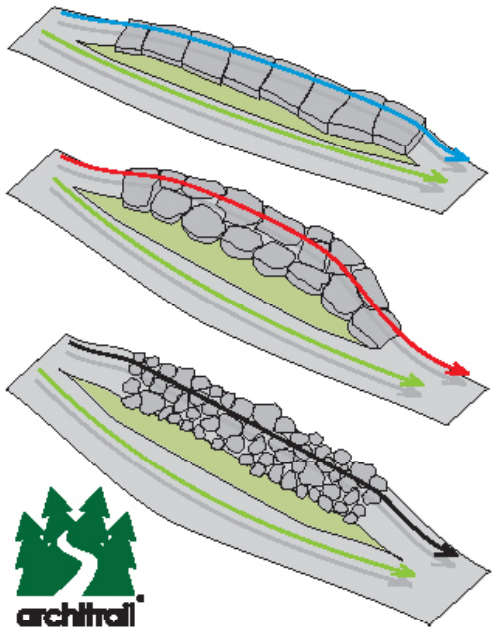

Mountain Bike Trail Design Sheet 203 // TTF: Rock Causeway

Description
Rock Causeway is simply a section of trail constructed from rock boulders rather than crushed stone. At the moderate (Blue) end of the scale, a causeway may be no more than flagstones, or large flat boulders and provide a change in surface. At the severe (Red and Black) end of the scale boulders will provide a more challenging technical feature for riders to overcome with greater momentum required to navigate the feature. This may feature small steps where a rear wheel lift is required or might include small drop-offs. Rock Causeways can be used in trail of any gradient and also in order to provide a shorter, more technical route as an overtaking braided feature. Causeways may also be used as a practical trail tool to overcome wet areas where standard trail section may not be sustainable. Causeways may also be used in areas of high usage where stone trail will become eroded quickly.

Design Comments
Changes to the gaps and heights between the boulders can change the nature of the feature to a large extent. Minor changes can be used to challenge or encourage the user.

Construction Methodology
A causeway may be constructed from boulders found on site or imported from appropriate local sources. An excavator should be used to clear a route corridor (if not already done) and excavate a bed into the surface which boulders may be set. A dumper may be used to bring boulders on to the site and tip them in rough positions. Hand tools may be used by multiple labourers to align the boulders into final position. Boulders should be set with at least 30% of their mass within the ground to avoid movement once in place. If being set into boggy ground allowance should be made for some downward movement within the first few weeks.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator

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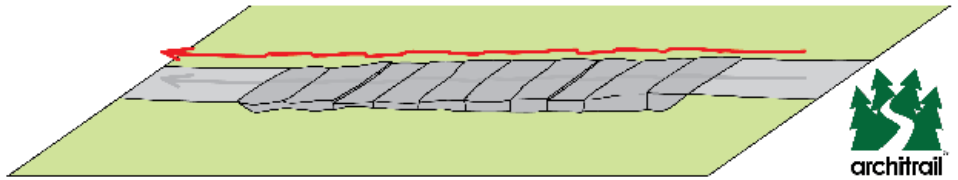

Mountain Bike Trail Design Sheet 207 // TTF: Rocky Inside Line

Description
A rocky inside line is one that is designed to reward those with better corner and handling skills. It is a difficult skill to be able to turn on technical and challenging surface and terrain whilst keeping forward momentum and pedaling. This feature allows a user to pick an inside line which is shorter but more technical, allowing their handling skills to let them overtake, as long as they can ride it in a controlled but fast manner. The inside line is usually a difficulty grade above the trail which it cuts the corner of. See individual rock garden or rock causeway TTF sheet for grading.

Design Comments
Riding the feature during construction will indicate the correct technicality of both corners.

Construction Methodology
Construct a rock causeway from locally won stone or large flat boulders that have suitable properties for the desired inside line. Stone pitching may also be used. This is in addition to the corner, which it is inside of. Most shaping should be carried out by a 360 Excavator with multiple laborers finishing with hand tools. A whacker plate may be used to compact the stone, which should appear sealed when finished with no loose stone. An appropriate drainage plan to allow water to exit either side of the feature should be created to ensure water is shed successfully off the surface.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whacker Plate

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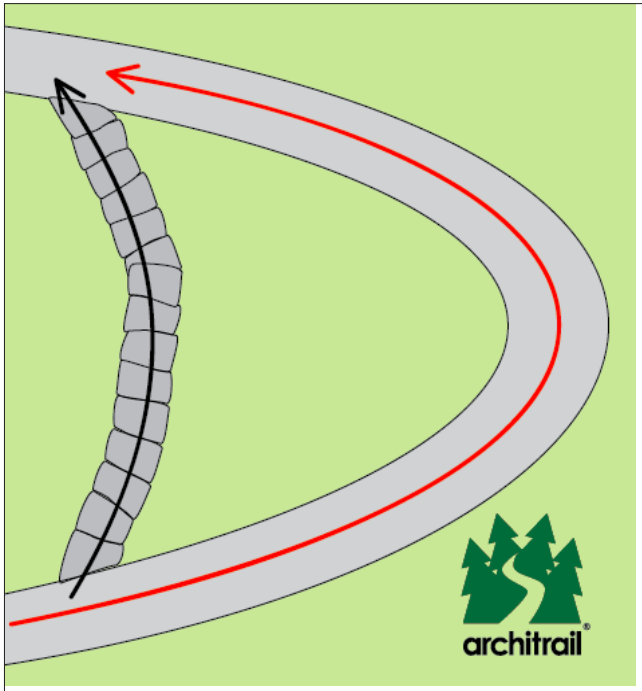

Mountain Bike Trail Design Sheet 403 // TTF: Climbing Switchback

Description
Grade reversals are a feature that can used when traversing a side slope where a full bench cut is needed. The feature helps to maintain trail flow, add interest, control speed and shed water at strategic points on a traverse, by reversing the trail gradient a number of times over a distance. The line of the trail can be descending, slightly ascending or flat. The gradient of grade reversals can vary hugely in length, height, gradient and frequency. Riders can gain speed by pumping the down sides of the reversals and carry momentum up the next incline before repeating. Grade reversals are also very useful for managing runoff on the trail surface, as water can be shed quickly from the troughs of the grade reversals. This avoids high volumes of water flowing on the trail surface and therefore reduces erosion. Grade reversals on a blue trail would typically have a wavelength of 15m-25m, red 10m-15m and black 5m-10m. Grade reversals on a blue trail are generally smooth and low, with more technical grade reversals encompassing shorter wavelengths, higher amplitudes and faster entrance speeds. The speed at which grade reversals are ridden, increases with rider skill and experience. For best practice, the trail gradient should always be less than half that of the side slope.

Design Comments
The turning pad should be no less than 3m diameter in order to give the rider enough space to turn.

Construction Methodology
Construction starts at the end of a bench cut trail where the direction needs to be reversed. The lower leg should come up to the pad in the form of an out-sloped ramp to shed water. Then the pad itself should be slightly domed in shape in order to shed water. Revetment can be used to sure up the turning pad on the lower side. The upper leg of the trail coming out of the turn will be gently in-sloped for 10m-15m above the turning pad so that water will drain off the backside of the turn. Building all components of the feature together ensures that the lower half will be firmly tied into the upper half.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
	360 Excavator
	Whackerplate

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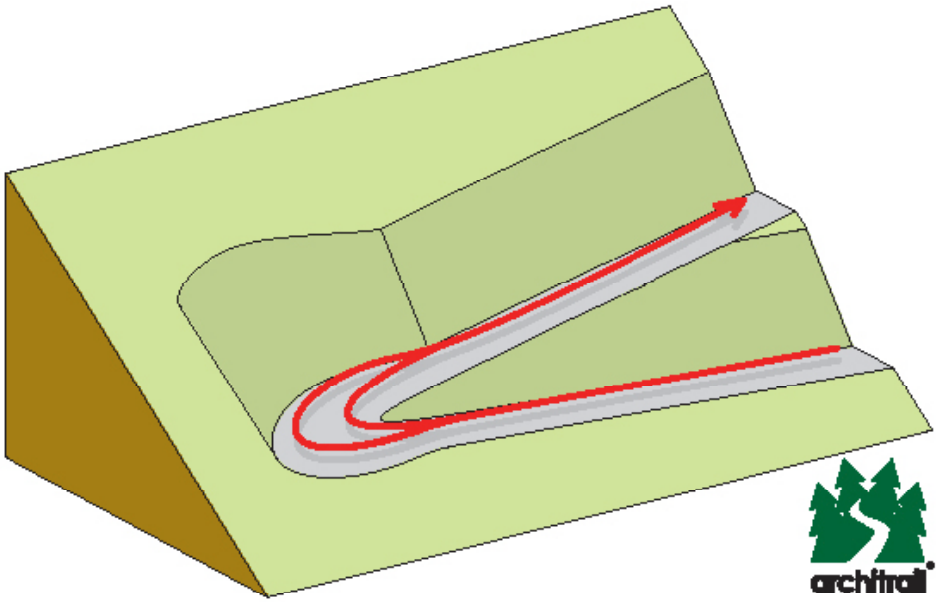

Mountain Bike Trail Design Sheet 602 // TTF: Chicane

Description
A chicane is used to force riders to slow down in a controlled manner by using two two tight corners. The chicane consists of a minimum of two boulders placed on the inside of two opposite tight corners.

Design Comments
The trail should haopacity more than 6m of straight trail before reaching the chicane, in order to avoid heavy braking and therefore erosion before the chicane. A small drop off may also be installed to further control speed, and can also dissuade users from entering the trail in the wrong direction. Location, entry speed and gradient will determine whether a pinch point is also required. In some cases it may be necessary to use additional boulders to block any potential desire lines avoiding the chicane that could occur.

Construction Methodology
Large boulders (>200kg) set into the ground to a minimum depth of 400mm with a corner radius <4m. Boulders should be orientated so that they cannot be ridden over or used as a jump. Boulders should be secured in the ground and should not move.

Construction Materials	Construction Machinery
Locally won stone	Hand Tools
Local earth/soil	Dumper
Boulders	360 Excavator
	Whacker Plate

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