

# SUMMARY OF THE BOLTING CODE OF PRACTICE

## About this document

This is a very brief summary of the key points of the full length NZCA Bolting Code of Practice.

The full document can be found online at [www.nzcanyoningassociation.org](http://www.nzcanyoningassociation.org)

The NZCA Bolting Code of Practice provides guidance for bolting in recreational canyoning situations.

Anyone considering placing bolts in NZ canyons should ask themselves these questions:

- Are we allowed to bolt?
- Should we bolt?
- Who should do the bolting?
- How do we bolt?

Bolts that do not meet the legal, ethical or safety standards of this code of practice should be removed or replaced as soon as is practicable

For feedback on this document, contact [nzcanyoningassociation@gmail.com](mailto:nzcanyoningassociation@gmail.com)

## Disclaimer

*Whilst every effort has been made to ensure the accuracy of the information in this document, the authors and the NZCA accept no responsibility or liability for loss or damages in relation anyone's interpretation or use of this code of practice.*

*This document is **not** intended to provide definitive advice on canyon anchors. The extreme variability of rock characteristics in the natural canyon environment make that impossible. Installing safe anchors requires considerable knowledge, judgement and skill.*

*This document is **not** a substitute for the practical training and experience which is required to gain that knowledge, skill and judgement. The purpose of this document is to raise the awareness of those who are considering bolting of the known issues, and to offer guidance on good practice to address those particular issues.*

## Are we allowed to bolt?

Anyone considering bolting for recreational canyoning is encouraged to contact The NZ Canyoning Association (NZCA) for further guidance or assistance liaising with stakeholders.

Permission must be gained from the landowner and/or land manager. Local Iwi should be consulted where relevant. For conservation land, the relevant management plans should be consulted before seeking permission from the Department of Conservation or other relevant Territorial Land Authority.

## Should we bolt?

Before placing any bolt, we must think very carefully about the long-term impacts on the canyon and surrounding environment, as well as the impacts on the activity of canyoning. Bolting is only appropriate if the benefits outweigh the impacts.

The NZCA will assist in obtaining the views of the relevant canyoning community and other stakeholders on whether bolting is appropriate for a particular canyon or canyoning area.

## Permanent bolts

Any bolts in canyons that are likely to be repeated should be of permanent bolt standard.

Permanent bolts must have a sufficient margin of safety for all reasonably expected uses of that anchor. They must be made of quality, highly corrosion resistant materials and of sufficient strength to maintain the margin of safety for many years. Minimum construction standards and acceptable permanent anchor types are detailed later in this document.

The type of bolts and year of installation should be recorded and included in CanyonTopo diagrams and descriptions to aid in monitoring the scope and quality of bolting in NZ Canyons.

Canyons that, due to high flows, would require an excessive number of bolts (to establish a contrived line clear of the water) should not be bolted.

## Temporary bolts

Temporary bolts are acceptable for a single use and in the following circumstances only. If the canyon is likely to be repeated, any temporary bolts must be removed or upgraded to permanent bolt standards as soon as possible. Minimum construction standards and acceptable temporary anchor types are detailed later in this document.

- **Exploration/first descent bolting** - During exploration, bolts may be placed as a last resort where there is no other practical means of descending or escaping the canyon. When the location, length and difficulty suggest that the canyon descent may be repeated in the future, the temporary bolts should either be readily removable (temporary) or meet the technical standards for permanent bolts. Lower strength or quality bolts that cannot be removed are not acceptable for exploration of canyons which are likely to be repeated.
- **Emergency bolting** - When existing bolts have been damaged or destroyed without the knowledge of a canyoning group, it is acceptable to place emergency bolts as a last resort, where there is no other practical anchor to use in order to escape the canyon.

## Who should do the bolting?

Bolts should only be placed by competent people with experience in the current bolting techniques. Those people should be familiar enough with the canyon that they are able to choose the most suitable locations for anchors. Those that place the bolts have a moral obligation to ensure anchors are as safe as is reasonable for the situation. Individual users must accept all risks when using an anchor placed by others.

## How do we bolt?

### Bolting considerations

When bolting, we must ensure that the anchors:

- Meet the minimum construction standards.
- Are placed using the correct installation principles.
- Are placed in suitable rock.
- Are placed in a suitable position.

### Minimum construction standards for anchors

#### Permanent anchors

- The complete anchor system must have a minimum ultimate strength of 20kN.
- Each bolt must have a minimum ultimate strength of 20kN.
- All anchor components must be constructed of the same material, being 316 (or better) Stainless Steel.

#### Temporary anchors

- The complete anchor system must have a minimum ultimate strength of 15kN.

### Installation principles

- Two bolts must be used for abseil anchors and the start of handline anchors. A single bolt is acceptable for intermediate handline anchors.
- Bolts must be installed according to the manufacturers guidance.
- Ensure the anchor site is in sound rock, at least 1.5x the bolt length away from any fissures or cracks.
- Check the rock surface before drilling, to ensure hangers will sit flush with the rock.
- Hangers must not be loose or able to spin.
- The bolt should not protrude excessively.
- Double bolts must be at least 2x the bolt length or 200mm apart (whichever is greater).

## Positioning of anchors

Anchor stations should be positioned such that:

- They are easily reached by a canyoner of average height and with appropriate skill for the grade of canyon.
- They are reachable from or via a durable surface, in all reasonable flow conditions.
- They are positioned such that it is difficult for a careless canyoner to shock load or incorrectly load the bolts.
- The bolts are oriented in a way that allows the use of single rope technique, minimises wear on the rope and allows for easy retrieval.
- They encourage a line of abseil descent which is on a durable surface and minimises the risks of hydraulic danger in all reasonable flow conditions.
- They are protected from damage in floods by being clear of the anticipated current and flood debris.
- Space is available for possible future upgrade or replacement of the anchors.

## Assessing the suitability of the rock

Assessing the strength of rock in a canyon is highly subjective, and whenever there is *any* doubt that the rock is hard enough for mechanical bolts, then chemical bolts should be used.

Check the hardness and uniformity of the rock using a bolting hammer. Feel for the 'bounce back', listen for the noise and watch for any deformation/cracking.

Ensure you have a clear view of the rock surface, then visually scan within an arm length circle around the intended site to look for deformities, cracks or weak layers. Check that the rock is part of the canyon, not a loose block or detached flake.

- For rock greater than approximately 50MPa: Suitable mechanical anchors will likely meet the strength requirements.
- For rock between approximately 25-50MPa: 10mm eye bolt chemical anchors will likely meet the strength requirements.
- Less than 25MPa: There is insufficient evidence to be able to give a good recommendation on choice of anchors.

## Acceptable permanent anchor types

### Expansion bolt (Collar-Stud)



10mm is typically the minimum diameter required for an expansion bolt to meet the permanent anchor construction standards of 20kN. Expansion bolts should be at least 75mm in length for very hard rock, longer in less hard rock.

Expansion bolts are not removable, and while they can be rendered unusable and hidden (by tapping in to an over-drilled hole), the same location cannot be used for future permanent bolting. Expansion bolts should therefore be avoided for emergency or exploration use in any canyon which is likely to be repeated. An acceptable exception is if they are extremely carefully situated, so they can be used for the long term by future canyoners.



## Chemical Anchors

Chemical anchors are the best solution for softer rock. P bolts and Eye bolts which are specifically designed for climbing anchors are the most appropriate types of chemical anchor for canyoning.

They require a practical minimum diameter of 10mm to meet the permanent anchor construction standards. The minimum recommended bolt length is 75mm in hard rock, 100mm in soft rock.

The adhesive used should be a high-quality adhesive specifically designed for structural anchoring applications.

The hole should be thoroughly cleaned; the strength of the bolt is proportional to how well the hole is cleaned.

The head of an Eye or P bolt should be recessed into the wall to reduce any torque loads on the glue bond.



## Acceptable temporary anchor types

### Sleeve anchors



Sleeve anchors are appropriate temporary anchors because they can usually be removed, although damage to the hole is possible. The load bearing part (stud) of the bolt is thinner than it appears, which must be taken into account if using this type of anchor.

A practical minimum bolt diameter of 10mm, gives an 8mm stud and approximately 15kN ultimate strength. Sleeve anchors should be at least 75mm in length

### Screw anchors



Screw anchors can easily be removed. The same hole can then be drilled again with a full diameter bit and a permanent bolt placed if required.

A practical minimum dimension of 7.5mm x 60mm corresponds to 18.6kN shear strength

### Self-drilling anchor



Self-drilling anchors cannot be removed and there is very little margin for error when placing them. However, they *may* be considered acceptable in cases when it was not anticipated that bolts would be needed and a lightweight hand drill kit was carried for use as a last resort.

## Other anchor components

### Quicklinks (maillons) and rappel rings



These must be manufactured specifically for climbing and have been tested by the manufacturer to meet the appropriate (temporary or permanent) anchor construction standard. Non-rated chain links, D-shackles or quick links are not acceptable.

When used as the focal to thread the rope through, the internal dimension should be large enough to allow common rope diameters to be threaded and retrieved easily, but small enough to prevent a carabiner passing through (ie, when using a carabiner block). Common rope diameters are 9-10mm. The gate on a quicklink should be tightened firmly with a spanner.

### Bolt hangers



Ring hangers should be regarded as the standard for all permanent canyon anchors that use expansion bolts.

Hangers must be designed for height safety use and the hole in hanger must match bolt diameter. Hangers must have either the manufacturers name and rated strength, or UIAA/EN symbol/certification stamped on them.

### Anchor linking materials

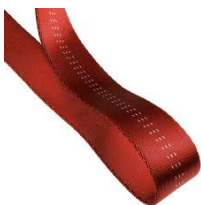
#### Chain



Steel chain that is sold by the meter must be 316 stainless steel or better, must be grade 80 or above, "approved for overhead rigging" and have a rated strength from the manufacturer. Purpose built climbing "belay stations" must meet EN959/UIAA123 standards.

Placing the chain directly between the rock and the nut/head of a bolt is not acceptable, even when using a washer. The width of the chain places an additional bending moment on the bolt stud, which results in a weaker anchor.

#### Webbing



Only 25mm or 16mm tubular webbing conforming to EN565 is acceptable.

The ultimate strength of webbing configuration must be calculated to ensure it meets the minimum anchor construction standards (temporary or permanent). Webbing can be tied directly through bolt hangers provided there are no sharp edges. The tail of any knot can be used to 'pad' the hanger.

#### Rope



Offcuts from core-shot canyoning abseil rope may be used, provided the rope is still fit for use (no mechanical damage/fraying or UV damage).

When tied, the ultimate strength of the rope/anchor configuration must be calculated to ensure it meets the minimum anchor construction standards (temporary or permanent).



## Dyneema Cord

The use of Dyneema cord is only acceptable for temporary (exploration) anchors, on very long and/or remote canyons where at least one night is planned to be spent in the canyon. Any expedition considering the use of such anchors should contact the NZCA to discuss their plans.

## Anchor configurations

When choosing an anchor configuration, consideration should be given to:

- The direction of the load throughout the pitch.
- The location of suitable rock to place a bolt and the anchor as a whole.
- The exposure of the anchor to flood water or air turbulence caused by flood waters.
- The ease of retrieval of the rope.



### Y hang configuration

This is the preferred configuration when canyon geometry could make rope retrieval difficult.

The angle between anchor arms should be less than 60 degrees (60% on each arm).

### Inline configuration



This configuration has the advantage of using less linking material (chain or webbing) than the Y hang configuration, while still facilitating easy rope retrieval in most cases.

The linking material should be attached to the lower maillon/ring and be tight between the anchors when loaded. This ensures the load is shared as evenly as possible between the anchors.

The proximity of the lower bolt to the rock may cause rope to be pinched on retrieval if not carefully situated.

### Independent configuration



This is the preferred configuration for chemical anchors, or anywhere the anchor is likely to be exposed to flood water (or air turbulence caused by flood waters).

When using P or Eye bolts, the lower bolt should be oriented 90 degrees to aid rope retrieval (see image; arrow indicates direction of load).

This configuration may also be used with symmetric ring hangers. Double bolts with maillons or parallel rings are usually not suitable as they hinder rope retrieval.



May require temporary linking with a quickdraw, or similar, to provide redundancy.