



Fixed Hardware Project - Charter

Boulder Climbing Community

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Introduction

The primary purpose of this document is to provide a consistent direction for the Fixed Hardware Project (FHP), which is administered by the Boulder Climbing Community. This is intentionally kept concise, and is limited to the following section entitled “Scope”. The remainder of the document addresses various supporting information and rationale.

Scope

Mission

It is the mission of the Fixed Hardware Project to assist in the reduction of potential climbing injuries by providing hardware to, and organizing events for, independent volunteers involved with replacing sub-standard fixed hardware (Mechanics), and adding content to the base of public knowledge regarding the last-known condition of fixed hardware (Assessors).

Intention

It is the intention of the FHP to:

1. Assist the climbing community, in and around Colorado’s Front Range, in taking steps to assess and replace sub-standard fixed hardware.
2. Provide guidelines for receiving assistance, such as, but not limited to, the reuse of existing bolt holes and the minimization of visual and physical impacts.
3. Assist the climbing community with training, by organizing events where volunteers can learn from each other about the techniques and tools used for fixed hardware assessment and replacement.
4. Add to the already publically available knowledge bases regarding the last known state of fixed hardware on particular climbing routes.
5. Provide the fixed hardware used for replacement.
6. Provide some, but not all, equipment required by Mechanics to replace fixed hardware.
7. Utilize volunteer help for the assessment, data logging, and replacement of fixed hardware.
8. Allow collection of, and public access to:
 - a. Aggregate data, by geographic area, on volunteer hours expended, and cost of equipment and hardware installed.
 - b. Aggregate data, by geographic area, on count of estimated total fixed hardware, total assessed fixed hardware, and sub-standard assessed fixed hardware.

- c. Aggregate data regarding individual volunteer performance, e.g. number of pieces assessed and replaced, and/or percentage of bolt holes reused, etc.
- d. Data linking the BCC/FHP to the assessment, removal, and installation of specific pieces of fixed hardware, e.g using stamped hangers, or logging linkage data to publicly accessible databases.

It is explicitly NOT the intention of the FHP to:

1. Maintain fixed hardware, whether or not it was provided by the FHP.
2. Be involved with establishing new routes.
3. Fund or employ personnel to assess or replace fixed hardware.
4. Certify volunteers or equipment as being suitable for the assessment and/or replacement of fixed hardware.
5. Allow collection of, or public access to, data linking individual volunteers to the assessment, removal, and installation of specific pieces of fixed hardware.¹

Actions

The FHP will attempt to assist volunteers as specified in the following sections. Note that in all cases approval of the landowner (or its designated steward) must be obtained if required.

Actions for which the FHP will provide assistance:

1. Replacing bolts, that have been deemed by the community as unsafe, in the same location.
2. Adding or removing anchor chain, quick-links, webbing/cord, and/or rappel rings as deemed necessary.
3. Moving the location of bolts because the old location could not be reused, e.g. the existing bolt could not be removed.
4. Moving the location of bolts because the old location was objectively unsafe, e.g. existing bolts are less than the manufacturer's specified distance from each other or the edge of the rock, the existing location results in the rope running in an unsafe manner, or similar situation that would result in a safety issue.
5. Adding information to publically available sources regarding the last known state of existing fixed hardware.
6. Patch and/or cover or otherwise repair or mitigate damage or aesthetic problems incurred during the course of work, e.g. camouflaging an old chopped bolt or unusable hole.

¹ Individual volunteers may choose to create these links, but BCC/FHP will not facilitate this creation, or collect these data.



Actions requiring approval prior to providing assistance:

Assistance for the following actions will be approved on a case-by-case basis. Substantial unanimity of the community, board, and first ascensionists (when available), is required to approve the action.² Approval is granted by a committee appointed by the board of the BCC.

1. Replacing non-bolt anchor fixed hardware (piton, nut, sling, etc) with a bolt.
2. Moving the location of bolts for aesthetic or practical reasons.

Actions for which the FHP will not provide assistance:

1. Replacing non-bolt fixed hardware with non-bolt fixed hardware.
2. Replacing non-bolt lead fixed hardware (piton, nut, sling, etc) with a bolt.
3. Funding and/or placing fixed hardware to establish a new route.
4. Funding and/or placing fixed hardware on an existing route, to be installed where no hardware previously existed, in an effort to make the route safer, i.e. retro-bolting.

² See the Glossary at the end of this document for our definition of “substantial unanimity”.

Appendix - A: Why Do We Do This?

Climbing is potentially dangerous. Most climbers expend significant time, energy, and money to understand and minimize this risk. Most guide books/resources provide 2 measures which allow climbers to make educated decisions about the risk of climbing a given route:

1. the route's *climbing level*, or *difficulty*: usually using the Yosemite Decimal system in the US.
2. the route's *danger level*: often rated using the movie scale (G,PG,PG13,R,X) in the US.

Yet there is another aspect of this risk that has, historically, not been represented: the quality of fixed hardware. There are an estimated 14,000 pieces of fixed hardware just in the Boulder area alone. This hardware has a finite, and variable, life expectancy. Some of the fixed hardware has already degraded and is no longer safe. Much of it will need to be replaced in the next 20 years. It is reasonable to assume that climbing-related accidents due to fixed hardware failure will increase if some of this hardware is not replaced, and if climbers are not made aware of this risk.

In order to minimize this risk, two goals need to be achieved:

1. Fixed hardware needs to be replaced as it degrades and becomes unsafe.
2. The most current known state of existing fixed hardware on all routes needs to be made available to climbers.

Why Reuse the Hole?

In many cases removing the old hardware (which was not designed to be removed) in order to reuse the hole takes heroic efforts, both physically (to haul the required extraction equipment to the site), and mentally (to figure out a means to do it). Chopping the old hardware, and redrilling a new hole often requires less equipment, less time, and less effort. Why bother?

1. **Location:** the FA party often spends significant time determining the optimal location, for clipping ease, safety, and minimizing rope drag. This location is no longer available if the old hardware is chopped. Given the spacing required for safety, new placements will need to be located further and further from their optimal location as time goes on.
2. **Visual Impacts:** Although chopped hardware can be patched, it is currently unknown how long the patch material will last. Even a good patch job is often still detectable by many climbers. If holes are not reused, future generations will see

more and more chopped and patched sites, detracting from the aesthetics of the route.

3. **Safety:** Manufacturers specify minimum distances that bolts may be placed from each other, and from rock edges. If patched holes were to be undiscovered by a Mechanic replacing a bolt, he or she might unknowingly locate the replacement bolt too close to the hidden hole, compromising safety.

All the above impacts accumulate as time goes on. Future generations of climbers will most certainly appreciate any efforts we put into preserving this limited resource.

Appendix - B: Estimated Quantities, Effort and Cost

Estimated values for the scale of this project, along with the effort and cost required to meet this demand, are listed below. The basis of these values are the climbs listed in Mountain Project within the Boulder area:

Total Number of Bolts	14,000+
Number of Bolts Requiring Replacement per Month	60
Effort Required (Mechanic Days per Month)	20
Cost Required (per Month)	\$1000

The above numbers are a very crude estimate, but serve as a starting point for the project. They were calculated using the assumptions listed below.

Assumptions

In order to make estimates, assumptions must be made. Here they are:

Quantity of Routes

As of 9/4/2015 Mountain Project is listing the following route counts:

Area	Trad Routes	Sport Routes
Boulder	2458	1326
Colorado	7940	7733

Quantity of Bolts

This estimate is gleaned from... not much. It is a very crude estimate based on personal experience.

Route Type	Average Lead Bolt Count	Average Anchor Bolt Count
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Trad	1	0
Sport	7	2

Combining these values with the estimated number of routes:

Area	Number of Bolts ³
Boulder	$(2458*1) + (1326*9) \approx 14,000$
Colorado	$(7940*1) + (7733*9) \approx 78,000$

Life Expectancy of Bolts

Unfortunately, data on fixed hardware life expectancy do not currently exist. Additionally, there has not been, nor is there currently, a standard for the type of fixed hardware used. Guestimates range from a few years, for 1/4" legacy bolts, to 20 years for plated steel 3/8" bolts, to 40 years for stainless steel 1/2" bolts, to 150 years for glue-ins. Bottom line is: at the moment, we don't really know. For the present, what matters most is the large existing base of 3/8" plated steel bolts that were installed in the 1980's thru the present – thus **we use a 20 year life span** for our estimations.

Effort Required to Replace a Bolt

Since we're making SWAGs (scientific wild ass guesses), why stop now? The time requirement for replacing a bolt is a highly variable value, depending on approach time, setup/tear-down time, the type and condition of the bolt to be removed, the proximity and number of bolts at a site, and the skill set and tool set of the person doing the replacement. Current experience suggests that on average about **3 bolts can be replaced per day, per Mechanic⁴**.

Replacement Hardware Costs

Once again, this is a highly variable value, based on type, quantity, availability, and any special deals that may be arranged. Assuming 1/2" x 2.75" stainless steel Powers 5-piece bolts are used:

Description	Cost per Placement
Lead bolt	\$7.00
Lead hanger	\$3.00
Anchor bolt	\$7.00

³ These are likely conservative estimates as many routes are not yet entered into Mountain Project, and many routes contain multiple pitches.

⁴ We strive to achieve 6 bolts/mechanic/day as an eventual goal.

Ring hanger	\$8.00
Trad hanger	\$10.00
Drill bit	\$7.00

Assuming a drill bit can be used to drill approximately 20 holes before it needs to be replaced, and that 50% of the anchors replaced will require trad (chain) hangers, the variable costs are as follows:

- **Lead Placement:** Lead Bolt + Lead Hanger + (Drill Bit / 20) = **\$10.35**
- **Anchor Placement:** Lead Bolt + ((Ring Hanger + Trad Hanger) / 2) + (Drill Bit / 20) = **\$16.35**

Equipment Costs

This estimate assumes the BCC will provide (loan) a drill and the materials required to build a bolt extraction device for each volunteer. Each volunteer will need to provide the remaining gear required. The equipment count of 12 assumes that 8 mechanics will use their own equipment, thus allowing 20 mechanics (the required number) to be active.

Equipment	Cost	Life Expectancy
Bosch 36-V Hammer Drill	\$450	5 years
Bosch 36-V "Fat Pack" Battery	\$200	2 years
Bolt extractor materials	\$30	1 year

Equipment	Count	Cost / Month
Bosch 36-V Hammer Drill	12	$(\$450 * 12) / (5yr * 12mo/yr) = \$90/mo$
Bosch 36-V "Fat Pack" Battery	12	$(\$200 * 12) / (2yr * 12mo/yr) = \$100/mo$
Bolt extractor materials	12	$(\$30 * 12) / (1yr * 12mo/yr) = \$30/mo$

Thus equipment costs total to \$220/month, although initial seed funding will be higher.

And the Grand SWAG at Effort Is...

The formula used is:

$(\text{Bolt Count} / 20 \text{ years}) * (1 \text{ year} / 12 \text{ months}) * (1 \text{ Mechanic Day} / 3 \text{ Bolts})$

which results in the following number of mechanic-days per month to maintain the required re-bolting rate - EVERY month of the year:

Area	Monthly Effort Required
Boulder	$(14000 / 20) * (1/12) * (1/3) \approx \mathbf{20 \text{ Mechanic Days / Month}^5}$
Colorado	$(78000 / 20) * (1/12) * (1/3) \approx \mathbf{110 \text{ Mechanic Days / Month}}$

And the Grand SWAG at Cost Is...

Given the above SWAGs, we see that the current average replacement rate for sustainability is 14,000 bolts / 20 years / 12 months \approx 60 bolts/month (every month of the year).

Assuming a ratio of 2/7 anchor-to-lead bolt, this results in 47 lead bolts and 13 anchor bolts requiring replacement monthly.

Type	Replacements / Month	Cost / Month
Lead Bolt	47	\$486
Anchor Bolt	13	\$213
Total	60	\$700

Combining the above with \$220/month for equipment costs results in \$920/month total estimated expenses. Rounding up to compensate for routes not currently contained in the Mountain Project database, as well as additional unspecified expenses, and we end up with:

Area	Cost / Month
Boulder	\$1000
Colorado	Using a scaling factor $78000/14000 \approx \mathbf{\$6000}$

Appendix - C: References

Boulder Climbing Community: FHP - Assessor's Field Guide; TBD

Boulder Climbing Community: FHP - Mechanic's Field Guide; TBD

⁵ Our goal is to eventually only require 10 Mechanic Days / Month for the Boulder area as Mechanics approach a 6 bolt/day replacement rate.

Appendix - D: Glossary

Term	Definition
Anchor fixed hardware	Fixed hardware at a location intended, by the first ascensionist(s), to be used for a belay or lowering.
Assessor	Person contributing to the evaluation and logging of the current condition of fixed hardware.
BCC	Boulder Climbing Community
FHP	Fixed Hardware Project
Fixed hardware	Any type of hardware or software that is left in the rock, including, but not limited to, bolts, pitons, trad gear, and wire or nylon slings around natural formations.
Lead fixed hardware	Fixed hardware at a location intended, by the first ascensionist(s), to be used for protection while climbing.
Mechanic	Person contributing to the efforts to extract and replace fixed hardware.
Substantial unanimity	A desire or goal to achieve 100% consensus, while recognizing that this may be impractical or unachievable. Understanding that circumstances in this field vary significantly, the term is intentionally ambiguous, giving leeway to the deciding organization to define the requirement as they deem appropriate, on a case-by-case basis. If an action appears to be legitimately controversial, then it does not meet the substantial unanimity test.