Ropes in Trees

A Guide To Better Temporary Rope Elements

By Philipp Strasser

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Gelbe Reihe : Praktische Erlebnispädagogik

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Special thanks are due to Walter Siebert who provided the Standard Operating Procedures for many elements and performed the final check on this book. His indefatigable pursuit of safety and his will to question everything over and over again – combined with the ability to listen to other people's arguments and experiences and change his opinion if necessary – are very impressive.

Additionally, I would like to thank:
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… All those who provided feedback to the first edition (in German) of this book and now made this second edition even more comprehensive, informative, and practical

Philipp

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Preface

About 20 years ago, I introduced the term “zero accident” for high rope courses. As a mountain guide I found myself increasingly in a bind: my customers had great experiences but I was also confronted with serious accidents year after year. So I was very happy when my friend Bill Daniels introduced me to the “zero accident“ concept. I wanted to share my enthusiasm with other colleagues … and met with widespread refusal! So it goes, sometimes, with new ideas!

I am very happy to see that, with this book, Philipp Strasser refutes a frequent argument: that it is actually possible to set up numerous elements while applying the Zero Accident concept.

One example: He recommends spotting the Mohawk Walk and similar Low Elements with 4 spotters for every participant. It is known that this element is often done without any belay at all. So reading this book, how does a facilitator feel? A logical consequence would be to change the belay concept and from now on work with a team of four spotters. Unfortunately, my observations of some rope course operators in Europe have, all too often, shown that, although there are accidents, there is often little motivation on the part of the operators to correct the situation. “If a child breaks his arm, well, that’s part of the game”.

Such accidents do not have to be “a part of the game” anymore. And such attitudes will not be acceptable as ropes courses gain popularity in the United States, where there is less public tolerance when it comes to operator liability. This book will help show how we can keep the participant’s experience exciting and rewarding while simultaneously reducing accidents.

In this book Philipp Strasser has only included established elements and processes, to which he has added a new level of safety, while, at the same time, preserving the essence of the participant’s experience. By adopting his ideas, future courses can be built that promise both great experiences, accompanied by reduced risks.

Walter Siebert

Introduction

Nature has long been a place to find rest and adventure. At first it was approached in its pristine, original shape, accessible and enjoyed only by natural routes and means. Then, in the 20th century, the natural environment was adapted by mankind to make it more readily useful to the greater public and an expanding recreational economy. Ski lifts and slopes are obvious examples of these manmade intrusions.

More recently, the natural environment has been adapted for summer recreational activities. Summer toboggan runs and aerial adventure courses are booming. Today, there are daily discussions about using concrete in the woods or if drilling trees is really necessary.

It is time we ask ourselves: "Is it ethically acceptable to endlessly modify the natural world for recreational purposes? Is there a way to continue to have fun adventures in nature without destroying that world in the process?"

The use of temporary rope elements allows us to have fun and adventure in nature and yet leave nature in the same condition as we found it. It is, of course, inevitable that the presence of humans alone can disturb woodland animals, compact the ground, and leave small traces on the trees - even if tree protection pads are applied. But by employing temporary rope elements we can significantly reduce mankind's negative impact on the natural world and work towards the goal expressed by the mountaineer Edmund Hillary: **"Take nothing but pictures, leave nothing but footprints."**

Temporary rope elements are not only environmentally advantageous, they are readily adaptable to numerous locations as well. They allow us to create challenging rope courses in a wide variety of different places: trees, rocks, bridges, or houses can be used as well as concrete or steel buildings such as gyms or shopping malls.

Rope elements can be set up close to the ground or be built to elevate participants to dizzying heights. They can be set up in quiet forests and mountains or in buzzing cities. The possibilities are practically limitless.

But temporary rope elements do not only offer infinite location possibilities. A single element can also be altered to offer numerous variations for all kinds of participants. Small children or seniors, wheelchair users or people with special needs, accomplished climbers or sedentary office workers, individuals or large groups. Temporary rope elements offer a wide variety of options.

Temporary rope elements also offer rich rewards for teambuilding, interpersonal communication, anger management, social interaction and interpersonal growth. Courses can be designed to simply provide a fun easy climb, or provide the rigorous challenge and exhilaration of exercising at great heights. The beauty of temporary rope courses is that they are endlessly adaptable to the environment at hand and the goals of the builder.

Equipment such as ropes, locking carabiners, rappelling devices or pulleys originate mostly from mountaineering, but we must not forget frequently used equipment that is used in industrial climbing or urban forestry. Conventional climbing equipment often limit us as we get close to the ground, especially if heavy duty round slings are necessary.

Logs and other similar wood can be integrated in elements, as well as car tires, balloons, tarpaulins and fabrics, etc. – as long as all safety requirements are met, there are no limits for creativity.

This book introduces numerous new elements, while the more familiar elements were reworked and updated with advanced safety requirements in mind. The focus of this book is on designing, building, and installing these elements.

In the second edition, some tips and tricks were improved and some figures slightly modified. From reader‘s suggestions, there is a chapter that deals with the different uses of steel maillon rapides and locking carabiners for temporary rope elements.

At first, low elements without belays are discussed. With the various techniques introduced, it is possible to build several low elements without leaving the safety of the ground. This can be beneficial for those who are not legally allowed to work at heights.

Second, high elements that are easily built and installed are described. For example, crate climbing only requires a top rope belay. Complex elements are also discussed such as the High Drawbridge or the Caving Ladder, which demand higher climbing and building skills. Each element is described and includes tips, techniques and safety instructions.

This book is sequentially ordered. First we explore tips and tricks of how to build an element and secure and use it. Then more elements are discussed where you can apply what you have learned previously.

Knots, ties, or designs that are necessary for setting up temporary rope elements are described in detail with many illustrations. Applications that are already generally familiar and frequently used in other areas, like the figure eight knot or the Munter Hitch, are not described in detail.

We applaud the fact that women are now more involved than ever in the world of outdoor recreation. Until the middle of the last century, there were almost no women working as mountain or ski guides. Today, the numbers are almost equal. However, in the interest of simplicity and readability we may employ single gender terms like “he” (when we are referring to either gender) in order to avoid sentences like: “He/she is responsible to show him/her, the safety procedures.”

This book not only addresses existing elements and new ideas but also introduces a discussion about techniques, safety, designs, and legal guidelines regarding rope elements. It also shows that there is no contradiction between creativity and safety – they can work hand-in-hand.

Risks and Hazard Notes

1. This book is addressed to rope course trainers and/or facilitators and other qualified persons who are already trained in practical rope techniques. This being the basic requirement for building and using the elements that are described here.
2. This book does not replace established rope work training.
3. Some fields are not completely covered by this book. The reader is assumed to have basic experience and familiarity with: urban forestry, ropes and materials, weather conditions, outdoor legal aspects, safety, rescue, knots, and team leadership.
4. This book covers the construction of temporary rope elements, their installation and use is secondary. Experience is taken for granted regarding installation areas, self-belay, belay of participants (ropes, spotting etc.), participant fitness etc.
5. The contents of this book were believed to be current at the time of publication. Operators must still inform themselves about possible modifications regarding installation, use, materials, legal aspects, norms and standards, etc. Please check the elements for suitability and function and report problems and concerns, as well as your experiences.
6. Well-trained and experienced rope element builders or users are able to detect material defects, wrong or misleading descriptions, to estimate potential risks and avoid problems and accidents.
7. The author is not liable for damages resulting from the installation and use of the elements that are described here.
8. Please only use elements if the physical and psychological well being of all participants is guaranteed.
9. Prior to setting up or using one of the described elements, please read all the comments and keep in mind that the book is set up chronologically.

Redundancy, Zero Accident, and Other Safety Issues

The elements described in this book were selected and prepared to the best of our knowledge and common practices. The elements are basically set up to provide redundancy.

Redundancy means that all safety relevant features are backed-up. This is not limited to equipment and design, but especially when human error can cause accidents. Cross-checking and clear communication between two responsible persons is crucial for redundancy – e.g. when checking belays or hooking a participant – even if this aspect is not covered explicitly in this book.

To check if an element is set up with redundancy it is important to ask: "What would happen if this carabiner, rope, or branch breaks?" If the primary safety system fails, then the participant must still be able to return safely to the ground. The secondary safety system is not meant to preserve the element, but rather to secure the participant. Therefore, it is not necessary to employ two identical safety systems. Due to the possibility of an accident caused by human error, redundancy is an essential component to the design.

Occasionally, redundancy is limited or its aim is reduced. Chapters of this book with limited redundancy are clearly labeled and explained.

Conclusion

Apply redundancy whenever necessary and feasible to limit the need for extra measures.

Redundancy and continuous safety are very important. This book does not show consecutive elements where the participants have to switch their equipment from one element to another: in the worst case they have to unhook themselves and face mortal danger.

Redundancy and continuous safety are important for the “zero accident” concept. This term, coined by Walter Siebert, does not mean that there will never be any accidents. It means that no accident or situation must remain unconsidered.[1] If the equipment, design, or methodology creates a hazard or causes accidents, then the link between the accident and method must be investigated. If there is a link, then this method must be improved or abandoned. If a potential hazard risk is discovered, it is important to inform others. This can be done in special internet forums or other public social networks.

Various course designers and operators develop their own designs and construction approaches and have acquired knowledge through experience. This information is generally not shared as it gives them an advantage over competitors. However, due to the importance of safety, it is a matter of ethics to publish accidents or other incidents and provide new developments to the open market.

1 Walter Siebert: Zero Accident. Qualitätsstandards für erlebnisorientierte Wirtschaftstrainings

What Is a Temporary Rope Element or Temporary Rope Course?

The European construction standards (EN 15567, effective since 2008) define the terms and distinguish between *static rope courses, mobile rope courses,* and *temporary rope elements.*

Static rope courses are amusement rope courses or forest rope courses secured by self-belay, rail systems, semi-continuous systems (e.g. SBB system) or top rope. *Static rope courses* are also defined by the standard as seminar rope courses and installed seminar elements like "Pampers Pole" or "Giant Ladder" which are normally secured by top rope or N belay.

Mobile rope courses can be set up at different locations. Mobility means that the supporting structure is mobile, such as steel or wood scaffoldings where seminar or amusement courses can be installed. Various set up versions exist for seminar elements, such as "Pampers Pole" or "Giant Ladder." Other concepts prefer quick mounting of amusement rope courses with several elements in a row at exhibitions or other events, such as the Burma Bridge or multiline traverses. These rope courses must meet the standard requirements.

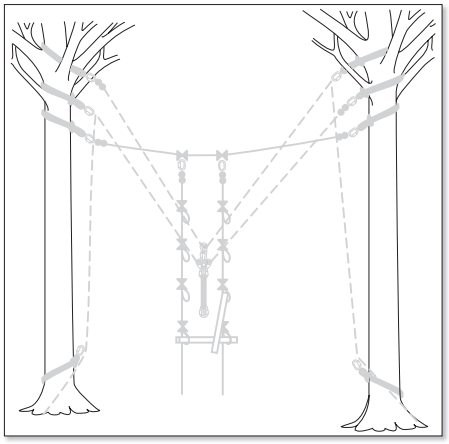
Temporary rope courses or temporary rope elements are usually set up between trees or other non-mobile structures in a short period of time, for a limited period of time. They are completely dismounted after use. The trees and structures should be left in their original condition after use.

If the course is set up for less than seven days, it is not considered to be under the rope course standard. This means that they do not need to be released by a certifying authority like other rope courses and the sling points do not need to be checked by structural engineers or arborists. Regarding due diligence, every constructor must apply the most updated expertise regarding materials, sling points, and all other criteria, even if they do not have to be inspected by external officials. In case of an accident, the European construction standard may be referenced by accident investigators.

Temporary rope elements consist of the support system (poles, trees), the activity element, and a safety element (if the participants are lifted more than half a meter above ground level.) For elements less than half a meter from the ground, no safety element is required. The standard does not distinguish between high and low elements but refers to "adequate safety measures."

"Low elements" are elements where the participants do not wear belays but are secured by other persons. "Low elements" might be covered under playground standards EN 1176 and EN 1177. The difference between a playground and a rope course is that a playground is a public domain and may be used without supervisors. Strictly speaking, an unsupervised and accessible temporary rope element must meet the playground standards. These standards define that there must be no risk of getting stuck or trapped. There must be no sharp edge, which means ratchet snaps must not be applied. EN 1177 defines the height of playing elements and the underlying dampening ground. It can be applied as a manual when securing rope elements.

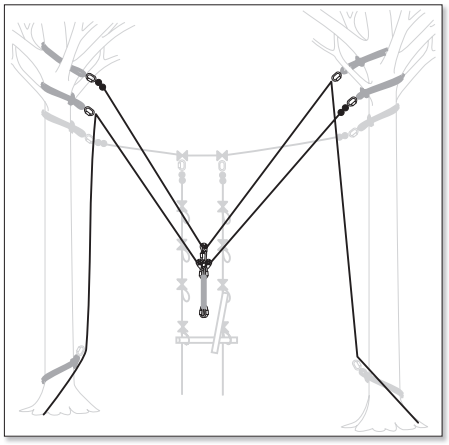
"High elements" are elements that require participants to wear harnesses, and are secured from falling by several belay ropes.



Support System

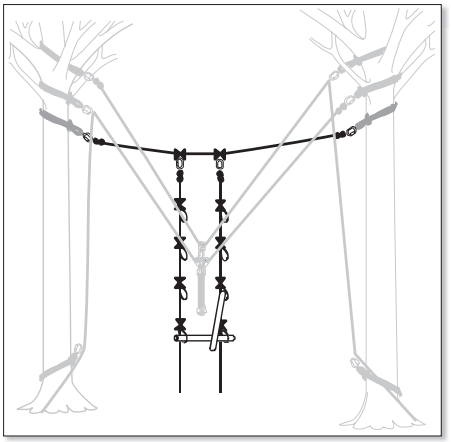
The support system is the part of the construction to which the activity element and the safety elements are attached. For temporary rope elements, these are typically trees but can be other fixation points like rocks or buildings.

The support system must resist the same forces as the suspension points, such as heavy duty round slings and carabiners. Trees can be guyed for additional support.



Safety Element

Safety elements are those parts of the element that prevent the participants from injury in case of a fall. A safety element like top rope can also serve to abseil a participant or to support him while ascending the element. Low elements usually have no safety elements since they are already secured by other conditions, like underlying water or soft ground. High elements are secured with canopies with top rope or N belay.



Activity Element

The activity element is the element itself. Safety requirements should protect participants against injury while using the element. For example, boards must not have sharp edges and low lashing straps should be secured. No parts of the activity element must harm passive participants or damage the ground if components fall.

Material Stress at Temporary Rope Activities

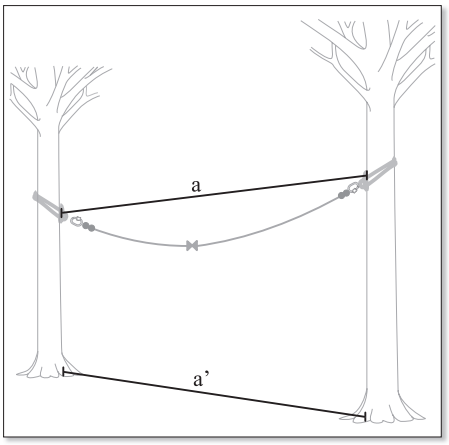
All elements described here are set up between two or more anchoring points, typically trees. Loads on ropes or lashing straps can stress the material as well as the anchoring points. So before describing the very first event, this book will deal with a very important subject.

Aluminum carabiners usually bear breaking loads up to 19–24 Kilo-Newton (kN) at regular stress (lengthwise) and about half of that at irregular stress (open or cross stress). To simplify matters, we define the regular climbing material stress to 20 kN. 20 kN are about 2000 kilograms (kg), which is the approximate weight of a limousine. The average human's bodyweight is between 70 and 90 kg, which is less than one kilo-newton. This great safety range can be deceiving: the following example shows how load limits of ordinary climbing material are easily reached at temporary rope elements and even exceeded if not used properly.

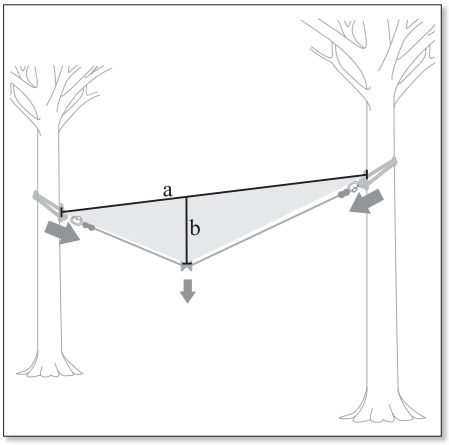
Other than the participant's bodyweight, the following criteria must be taken into account:

- **Number of People:** Do one or more people use the element at the same time? How can I control the number of people who climb the element? In case of a fall or when rappelling with a top rope, the weight of both people affect the element!
- **Kinetic Energy of the Weights:** The factor 2.5 will be applied to gauge kinetic energy of the weight, which varies from actual weight. For example, if you step on a scale calmly and steadily; your real weight will be shown. If you jump on the same scale, it will show a much higher weight for a short amount of time. An individual weighing 80 kg will cause a load of 200 kg (2 kN).
- **Horizontal Rope Sag:** This issue must be discussed more closely, as – other than the factors above – it can be affected by the way the rope element is set up.

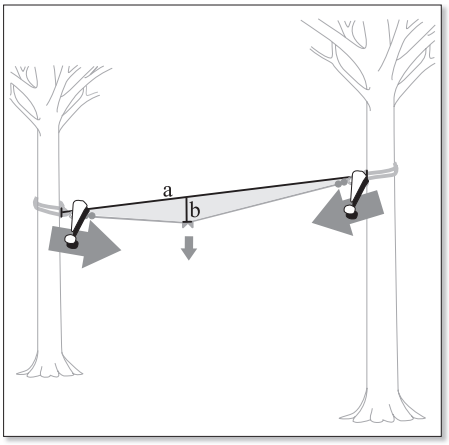
Determination of the Sag of Ropes or Lashing Straps



To determine the sag of a rope, the horizontal distance between the two suspension points (a) is measured. If, for example, both trees are quite straight, it is also possible to measure at ground level (a').



Then, measure or conservatively estimate the maximum distance that will occur between the loaded rope and the imagined horizontal line between the two suspension points (b). Divide the values (b divided by a) and you get the value of the sag. If the distance between the two trees (a) is 10 meters and the imagined horizontal line distance (b) is 2 meters, the value of the sag is 0.2 or 20%.



The following picture shows a smaller sag. The smaller the sag, the stronger the forces that affect the rope, the suspension points (carabiners), the heavy duty round slings, and the trees. This is shown in the following table.

Ropes in Trees

A Guide To Better Temporary Rope Elements

Nature provides us with endless options for adventure, learning, and relaxation. Trees are among nature's greatest gifts for these possibilities. With the techniques in this book you will be able to find new adventure in the trees by simply bringing some ropes, carabiners, and pulleys into the forest and creating a variety of exciting temporary rope elements or challenge courses that are both fun and environmentally sustainable.

Rope elements can be created for children and adults of virtually all abilities, are healthy fun for individuals or groups, provide great exercise, and are a wonderful way to build team spirit, partnership, and self-esteem.

This book is written for people who already have some experience with rope elements and want to refresh and extend their knowledge about design, belay techniques, and the uses for rope elements. Inside you will find details on new elements, belay updates for common standard elements, and useful tips on safety, best practices, and minimal environmental impact.

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