

Chapter

Adventure Programming Facilities

Thomas Horne, Ned Crossley, and Donald Rogers

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There are literally thousands of adventure programs conducted in schools, colleges, summer camps, recreation programs, commercial adventure agencies, YMCAs, and fitness clubs. Adventure programs can be divided into three general categories: 1) Adventure Games, Initiatives Problems, and Trust Activities, 2) Adventure-Based Recreation Sports, and 3) Climbing Activities (Ropes Courses and Climbing Walls).

All three categories of adventure activities involve reasonable risk-taking activities designed to foster trust and cooperation, enhance self-image and confidence, improve physical skills, and be enjoyable. From a facilities standpoint, the least complex and structured category is Adventure Games, Initiatives Problems and Trust Activities. This category includes simple individual or group games, initiative problems involving

group cooperation and innovation, or trust-building activities. Adventure-Based Recreation Sports Activities are traditional adventure-based recreation activities like mountain biking, kayaking, canoeing, hiking, skiing, and caving. All of these activities are also appropriate activities to meet adventure program goals; however, neither of these two categories of adventure activities have distinct facilities associated with them. Although these Adventure Games, Initiative Problems and Trust Activities and Adventure-Based Recreation Sports Activities include popular and effective adventure-oriented activities, they will not be discussed in detail in this chapter since they lack distinctive facilities and utilize a wide variety of equipment and support materials.

Adventure program activities categorized as Climbing Activities usually include challenge ropes courses and climbing walls. There are many variations of climbing walls and a wide variety of both high and low ropes elements. Despite the variety of climbing walls and challenge ropes courses, both have distinctive facility requirements and common features. Climbing facilities may be natural rock climbs, freestanding towers, indoor or outdoor climbing walls, or low bouldering elements that involve lateral climbing. All of these climbing activities involve climbing facilities with handholds, ropes, climbing hardware, and safety equipment. Similarly, ropes courses all have poles or trees as a base and use ropes, wires and wire hardware, pulleys, and safety equipment. This chapter will provide an overview of the common steps in a facility planning process, discuss the structures, equipment, and supporting materials needed for climbing walls and ropes courses, and identify safety and administrative considerations for those developing or conducting an adventure program.

Learning Objectives:

After reading this chapter, the student should be able to

- discuss the four design and construction planning steps used to develop adventure facilities,
- identify and compare the three categories of adventure programs,
- evaluate selection characteristics for a variety of climbing wall and challenge ropes courses components such as, support poles, ropes, helmets and climbing hardware, handholds, harnesses, and flooring,
- apply sound safety risk-management and administrative practices to building and operating adventure facilities.

The Planning Process

The initial step in planning is to establish program goals and determine what type of facility is needed to achieve these goals. In some cases this may require a formal needs assessment. Once a general facility concept is developed, a facility construction strategy is needed. The facility may be self-designed and built, or be designed and built by an outside architect or contractor, or a combination of the two. For example, installing a small bouldering wall (low climbing wall designed for lateral climbing) on an existing wall can be done in-house; however, building a large climbing wall or climbing tower is better left to professional climbing wall designers and builders. There are some excellent references that provide detailed information about self-built climbing facilities. For the more complex projects involving outside designers and builders, considerable planning and coordination will be required.

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Many schools, colleges, recreation centers, fitness facilities, YMCAs, racquet clubs, commercial climbing centers, and even gymnastics clubs are building adventure program facilities to include ropes courses and climbing walls. Most of these adventure facilities support very popular, highly utilized adventure programs that achieve the goals and objectives of educators and operators. Ask any of the highly successful educators or operators what their secret to success is and almost every one will mention detailed planning and student-customer-focused programming. In short, they provide a quality product (the adventure facilities) and quality programs (safe, exciting adventure activities).

Whether in a school, community, or commercial setting, building adventure facilities and developing effective adventure programs requires

planning. Every parent's guidance, "Do your homework!" is excellent advice for anyone involved in a large project like building and operating an adventure program facility.

Adventure programming is relatively new, so, until recently, there weren't many successful adventure programs for novice adventure programmers to use as facility design benchmarks. Today there are many successful adventure programs in operation at schools, fitness clubs, commercial adventure program facilities, and specialized climbing gyms. Lessons learned from both successful and failed programs are valuable planning guidelines for individuals considering developing or improving an adventure program facility.

No two adventure programs are exactly alike, but the planning process for developing and building an adventure facility or other athletic facility is similar. Whether building an indoor or outdoor climbing wall, high ropes course, low ropes course, comprehensive adventure facility, or any athletic facility, there are common planning steps (see Chapters 3 and 4).

This common recipe for design and construction in Chapters 3 and 4 can be applied to almost any athletic facility development project. The exact steps taken and the supporting tasks, coordination, and decisions required will vary with each application. A more detailed description of these planning steps will provide sound guidance on how to proceed with any design process. The next section of this chapter, Climbing Walls, is written in a facility planning format using the design and development of an indoor climbing wall as an example.

Climbing Walls

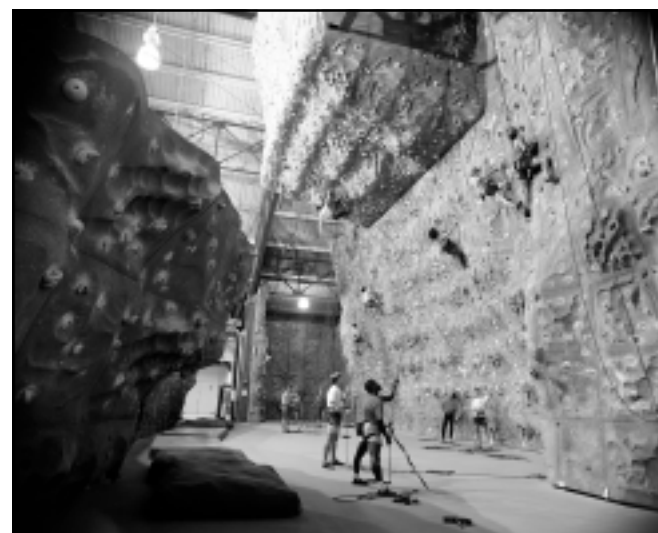
The design and construction steps used in this climbing wall example are similar to the steps that would be followed to design and develop a challenge ropes course or any other athletic facility.

Concept Development and Schematic Design

The initial idea leading to the development of an indoor climbing facility begins with a modest desire to build a simple wall. As the idea is discussed for possible action, it tends to grow. When the idea begins to receive serious consideration, the real homework begins by gathering information from as many knowledgeable sources as is feasible. Review recent climbing magazines, contact climbing wall builders, visit other facilities, talk to climbers, check local outdoor climbing sites, and surf climbing and climbing wall Web sites. Analysis of existing building codes is advisable at this point to avoid delays or costly changes. If the climbing wall is part of a multipurpose facility and the architectural engineer is unfamiliar with climbing wall design and construction (most are), the services of a climbing wall or adventure activity consultant may be needed. Most indoor climbing wall and adventure program equipment manufacturers and builders provide these consulting services. Using a professional adventure activities or climbing wall designer often speeds the planning process and results in a more efficient final design.

The motivation to develop a climbing facility is different in each situation; however, it is often desirable to:

- use the wall as part of an adventure program,
- have a climbing facility for personal use or use by a climbing group,



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- include some high-profile architecture (usually in commercial fitness facilities or college recreation centers),
- more efficiently use an underutilized area of the facility (racquetball court, gymnasium wall, hallway, lobby, or storage area),
- provide a training facility for serious climbers, and
- add another fitness development opportunity.



Assessing why you want to build a climbing wall helps you determine who will be using the wall and how they will use it. This will guide many of your design criteria decisions. The design concept should meet current needs and provide flexibility for future program growth and development.

The climbing-wall concept will vary greatly depending on how the climbing wall fits into the overall facility design. The type of wall designed for a commercial indoor climbing gym may be very different from a wall designed for an outdoor adventure program in a public school. Determining how the climbing wall will be integrated into other program and support facilities will also have an effect on the design concept.

The location of the climbing wall in relation to entrances and exits, locker rooms, storage areas, offices, pro shops, water fountains, and other program areas such as the ropes courses, gymnasiums, pools, fitness rooms, racquetball courts, and classrooms will affect design concept decisions. Designers should consider general design criteria like visibility, control, and safety. Also, they need to decide if the climbing wall needs to be near to or isolated from any of the other features. Schematic drawings that show general size, location, and adjacencies will help refine concept development. More than one design option can be explored at this time.

Design Development

The design development phase is decision-making time. If more than one design concept was developed, a decision needs to be made on which design will go to full development. Full development requires decisions on:

- What is the scope of the project (including budget estimates, funding available, and space allocated for the climbing wall)?
- What heating, ventilation, and air-conditioning (HVAC) systems are needed?
- What features are needed for the walls, floor, and framework? (The wall, floor, and framework designs must meet Climbing Wall Industry Standards.)
- Which wall surface is desired (the real-rock look, seamless cement, prefabricated panels, wood, or doesn't matter)?
- How much wall height desired (a 12-foot high bouldering wall used primarily for horizontal climbing or a high top-roping wall)?
- Will a climbing treadmill meet program needs?
- What wall features are desired, especially the number, type, and location of handholds? Other surface features may be built into the wall such as cracks, arêtes (corner), depressions, over hangs, caves, ledges, and so on.
- How much wall security is needed? (Will the climbing wall be in a self-contained lockable area or will the wall be in an open area and require some way to limit access to the climbing surface?)
- What type of flooring is most appropriate? Bouldering walls and walls located in multipurpose locations like gymnasiums often have movable landing mats. Areas used exclusively for climbing usually have specially designed flooring such as thickly padded carpeting, six inches of rubber pieces, or six inches of gravel. Most new facilities are using the heavily padded carpeting because it provides better protection, is easier to maintain, and is cleaner than gravel or rubber pieces. Current practice calls for protective flooring to extend six feet out from the furthest protrusion of the wall surface.
- How much storage is required? A lot of equipment is required to operate a climbing program, ropes, climbing shoes, harnesses, helmets, and carabiners. The equipment needs to be located near the climbing wall so the storage areas for some of the newer climbing walls are built into the back of the wall.

Planning Summary

Failure to adequately plan (do your homework) and develop a comprehensive project concept often results in a climbing facility that does not have the desired features or meet programming requirements.

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This may lead to a facility that is unpopular, unsafe, or prematurely obsolete.

Project planners must develop a comprehensive project concept that will guide specific design and operation decisions. Components of a comprehensive project concept for a climbing wall often address the following questions:

- Who are the target facility users? (Who will be climbing on the wall?) The design features for a bouldering facility to teach junior high school students will be very different from one designed to train lead-climbing mountain guides. Failing to identify the target facility users often results in an inefficient and ineffective climbing facility.
- Will the wall be a stand-alone entity, or will it be used with any other facilities? Climbing walls are often just one element in a comprehensive adventure program.
- What financial resources are available to fund the project?
- How many climbers will use the wall at any one time (peak load)?
- Is this a new build or retrofit of an existing area?
- How much space is available?
- How important are aesthetics? (Is a natural-rock look more important than having the maximum amount of climbing area?)
- What type of flooring will be best for the facility?
- Do the design features promote safety, minimize maintenance problems, and meet program needs?

Each climbing wall development project is unique and will require design and construction decisions not included in this planning model. This planning model does provide a template to guide the facility planners in developing adventure facilities or any other athletic facility.

Design Features

Building a climbing wall is, in many ways, like buying a car. Both are sizable investments that involve numerous decisions. Some of these decisions involve selecting which features and options are desired, which are affordable, which will be used, and which will provide the best value. When buying a car, decisions need to be made on the make and model of the car, engine size, color, and a variety of options like trim, floor mats, air conditioning, power steering, antilock breaks, and many others. When building a climbing wall, decisions need to be made on location of the wall (inside or outside), wall surface material, types and quantity of handholds, fixed wall features like overhangs, caves, or cracks, flooring materials, climbing equipment and hardware, and lighting.

Climbing Wall Types

Before selecting individual features of a climbing wall, a decision must be made on what general type of climbing wall is desired. Here is an overview of climbing wall types:

- **Homemade**—These are usually relatively simple walls made of framing lumber, plywood, paint, and handholds. Individual climbers build homemade walls for their personal use and institutions with limited resources build homemade climbing walls to support their program needs.
- **Prefabricated panel system**—Prefabricated panels are usually 4 feet by 8 feet plywood or fiberglass panels with predrilled holes for handholds.
- **Portable walls**—There are three general types of portable walls: disassemble and reassemble, assembled walls on a trailer, and the portable treadmill type wall.
- **Steel structure wall systems**—These systems are usually professionally designed and constructed walls with a structural steel frame and plywood surfaces. The surfaces may be coated with a cementitious, fiberglass, or



blown synthetic material. Some of the cementitious surfaces have natural features like cracks, ledges, and indentations that are troweled in while others replicate a real rock-style covering.

- Climbing towers—Towers are usually freestanding wooden towers built outside. They are often just one element of an outdoor adventure course.



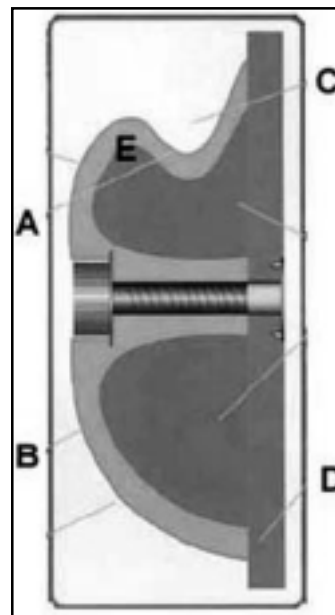
The selection criteria most often used in making decisions on the general type of climbing wall to be built are program requirements, funding amounts, space available, and staff proficiency.

Climbing Wall Features and Equipment

Most new climbing walls have movable handholds that are attached to the wall with a T-nut insert. These T-nut inserts may be installed by the contractor as part of the construction, purchased as part of pre-drilled wood or fiberglass panels, or added to climbing panels as part of a homemade project.

Handholds may be simple wood blocks fixed to the wall surface with epoxy glue, wood screws, T-nuts, or a combination of these. Wooden handholds are

relatively inexpensive, have a forgiving texture, and can be formed in a wide variety of shapes and sizes. Wooden handholds don't duplicate real rock shapes and textures very well. If a real rock shape or texture is desired, commercially manufactured handholds made of resin and fillers may then be the way to go. Serious builders of homemade wall can fabricate handholds from automobile body putty; however, this is a technical process not recommended for most wall builders. Most of the commercial handholds are designed for use with a T-nut system but some can be attached to the wall with epoxy cement. There are literally thousands of different types, sizes, and shapes of handholds. Handhold packages are available that include handholds that replicate natural features in rocks and require climbers to use specific grip and foot techniques. Handhold color and texture may attempt to duplicate natural rock, match the existing wall surface, or add color and flare to a climbing wall. Colored-coded handholds may be used to designate specific climbing routes or difficulty levels. Colored or numbered tags can also be attached to the handholds to mark specific climbing routes. The greatest benefit of having movable handholds is that the handholds can be moved, replaced, or simply rotated providing the climber with an infinite variety of climbing opportunities and route changing.



Climbing Equipment

The size and the scope of the climbing program and climbing wall will determine how much climbing equipment is needed. Magazines and catalogues are filled with a plethora of climbing gear and hardware. Standard equipment for general climbing programs include ropes, harnesses, helmets, belay system, and locking D carabiners. The Union of International Associations of Alpinists (UIAA) certifies that climbing equipment is safe and effective. Purchasing UIAA-certified climbing equipment is a sound practice. The specific selection criteria used to purchase equipment will vary with each application; however, the following are general selection criteria for standard pieces of climbing equipment:

- Ropes—Most climbing programs use 11 millimeter dynamic kernmantle ropes (continuous parallel nylon fibers surrounded by a nylon sheath) as their primary climbing ropes. They provide an excellent combination of strength, stretch, and suppleness. Kernmantle ropes are classified as “dynamic ropes,” ropes that stretch so they can absorb some of the shock if there is a fall.
- Harnesses—The harness secures the climber to the climbing rope. Step-in premade commercial harnesses are recommended because they are more secure, comfortable, and convenient than self-made rope or tubular nylon harnesses, but they are more expensive.
- Helmets—Climbing helmets are essential pieces of safety equipment for many climbing and ropes course elements. Purchasing quality adjustable helmets will provide an extra margin of safety, make adjustments easier, and prove to be good investments since they will last longer.
- Belay system—There are numerous types of belay systems and all are designed to protect the participant from making an uncontrolled fall. Most belay systems are a rope threaded through some hardware (usually two carabiners or a shear reduction device) or over a belay bar at the top of the wall. One end of the rope is secured to the climber's harness and the person belaying holds the other end, which is anchored, to the floor.

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- Climbing shoes—Serious climbing programs should have climbing shoes available. Tight-fitting climbing shoes with high-traction rubber soles facilitate good footwork. Climbing shoes clearly make for a better climbing experience even when climbing on outdoor all-wood walls or when climbing on novice bouldering walls.
- 11 millimeter locking carabiners should be used for climbing and challenge ropes courses activities.

Purchasing, inspecting, and maintaining high-quality climbing gear is very important in protecting climbers from injury and owners and operators from costly litigation.



Climbing Wall Standards

The Climbing Wall Industry Group (CWIG) and the Climbing Gym Association (CGA), both sub-groups of Outdoor Recreation Coalition of America (ORCA), have helped establish enforceable climbing wall industry standards. CWIG and CGA standards are not presently required by law or government regulation, but a climbing facility, whether homemade or commercially designed and constructed, should comply with CWIG and CGA technical standards.

The American College of Sports Medicine (ACSM) has also established guidelines and standards for operating climbing facilities (Sol & Foster, 1992). The ACSM guidelines and standards focus much more on program and administrative procedures and less on technical design and construction features. ACSM recommends:



- Climbing wall areas must be supervised at all times by a qualified instructor.
- Supervisors should have CPR and First Aid certification and emergency equipment and supplies must be available.
- Climbing staff should undergo periodic in-service training.
- All policies and emergency procedures must be posted.
- Individuals participating in climbing activities must show proficiency in belay techniques, rope-handling skills, and climbing signals.
- All climbing equipment and facilities must be inspected on a regular basis and appropriate corrective actions taken.
- All climbing ropes must be UIAA static ropes.
- The climbing wall area must be allotted sufficient space.
- Negative air pressure should be maintained in indoor climbing areas as external air is drawn into the climbing area.
- The surface area of the climbing wall should have a moderately abrasive texture.
- Appropriate temperature (68° to 70° F), humidity (60% or less), and air circulation (8 to 10 changes per hour) should be maintained in indoor climbing areas.
- Mercury vapor or fluorescent lights are recommended with a lighting level of 50-footcandles at the surface of the floor.

Government laws and regulations do not currently cover adventure activity design, construction, and program operations. Everyone building or operating a climbing facility should follow CWIG, CGA, and ACSM guidelines. Local laws and regulations that governing zoning, construction, and safety must also be reviewed to ensure compliance.

Climbing Facility Operation

Climbing is an exciting activity that isn't nearly as dangerous as it looks, but certainly is not without risk. Owners and operators of climbing facilities must protect themselves and their organizations with insurance. Establishing sound standard operating procedures and conscientiously enforcing them will protect climbing participants and provide some legal protection for owners and operators. Each

climbing program and facility will require custom made policies and procedures to maintain a safe and secure climbing environment. The following is a list of recommended policies and procedures for conducting climbing and adventure programs:

- Warn participants that climbing is a potentially dangerous activity. (The participant will then assume at least part of the risk of climbing.) Have climbers sign a waiver of liability prior to climbing.
- Post appropriate signage with safety warnings, policies, and procedures to be followed, emergency contact numbers, and any facility specific rules.
- Hire highly qualified instructors and staff and keep their training current.
- Conduct regular formal equipment and facility inspections and keep documented records of inspections made and corrective actions taken.
- Supervise climbing activities with a qualified instructor.
- Secure the climbing area when not in use.
- Buy quality equipment and keep it well maintained.
- Train and certify belayers.
- Maintain a written set of policies and procedures operations manual.
- Keep emergency equipment and supplies available.
- No horseplay should be permitted.
- Warn participants about loose clothing or allowing long hair to hang loose because it may become tangled in the ropes or hardware.
- Always make a final equipment check before beginning a climb. (A buddy check is recommended.)
- Review communications procedures prior to starting a climb.
- Jewelry, including watches, should not be worn while climbing.
- Students must be given proper training and demonstrate appropriate skills before attempting the more difficult climbs.



This is not a comprehensive list of all risk-management issues associated with climbing but it does provide guidance on the kinds of issues to be addressed.

Challenge Course Adventures

This section of the chapter will define challenge courses, discuss the philosophy of challenge course programming, provide an overview of the industry, describe some challenge course elements, provide strategies for how to include people with disabilities, and provide guidance on how to develop and maintain challenge course elements for an adventure program.

“A Ropes Challenge Course is a series of individual and group activities designed to foster team-building, group cohesion, cooperation, leadership, problem-solving skills, communication skills, healthy risk-taking, and individual commitment” (Upward Enterprises, 2000). There are three basic types of challenge courses that meet the above-mentioned objectives and those are Teams Courses, low courses, and high courses. These and other adventure activities, including climbing walls/towers, are usually used in combination to achieve program, group, and individual goals.

At the core of adventure is risk taking. On challenge courses, participants are faced with physical, psychological, emotional and social risks. Of particular value with challenge courses is that the actual risk is low while the

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venture Recreation, Personal Growth and Enrichment, Developmental, and Treatment Services. While a program will have a predominant purpose that identifies it with one of these categories, it is typical to draw on approaches used in the other categories, depending on the needs of the group. In the fields of health, fitness, recreation and sport, most programs will be based on adventure recreation and personal growth and enrichment, or some combination of the two. Mental and physical health treatment programs such as psychiatric centers, stress-care clinics, and physical rehabilitation centers will utilize a treatment services approach. They too will blend treatment with the other categories. Challenge courses are often utilized in team or group development programs. These programs would use design components found in all but the treatment services area.

In order to provide effective programs, it is necessary to assess client/participant needs. Determining outcome and process goals plus individual needs establishes the foundation for program design. In fact, knowing as much as possible about the kinds of groups that will use the courses and what they will expect from the experiences is critical to courses' design.

Outside of the military, challenge courses were first used in Outward Bound to prepare groups for and supplement outdoor adventures. The first course, built at the Colorado Outward Bound School, was built with hemp rope, wood, and minimal safety systems (belays). About ten years later, in 1971, Project Adventure built its first course in a Massachusetts high school. This course was used primarily within the physical education program but it led to applications in a wide range of settings, which today includes schools, camps, community centers, organizational development, and therapeutic settings (Rohnke, Wall, Tait, & Rogers, 2003).

The Association for Challenge Course Technology (ACCT) is the professional organization dedicated to developing standards for challenge course programs. The ACCT has developed challenge course standards for materials, construction, inspection, operations, and ethical behavior. The ACCT began as an organization for vendors who design and build challenge courses. It has since evolved into a full-service organization that has an associate membership option for programmers, managers, and operators. The challenge courses business has evolved into full-service vendors who build courses, provide customer staff training, recommend equipment purchases, and conduct annual inspections. Though not directly involved in design and building standards, both the Association for Experiential Education (AEE) and the American Camping Association have accreditation standards that address challenge course staffing, programming, and risk management.

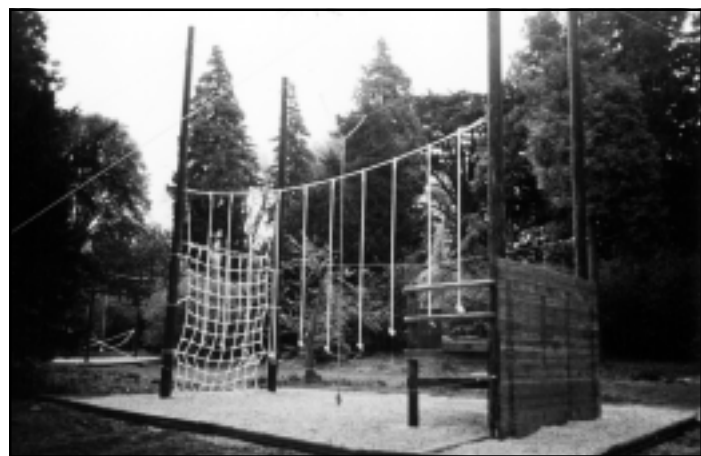
Design and Development of Challenge Courses

The design and development process for challenge courses is the same as described in the previous section on climbing walls. In an ideal situation, the vision of the desired facility and program would be clearly stated and agreed upon by all involved parties. There would be adequate funding to plan and build the challenge course plus provide the necessary staff training. To locate a reputable challenge course vendor, contact the ACCT via their Web site, <http://www.acctinfo.org>. This site provides a list of vendor-members each of which has gone through a thorough screening process to determine the quality and reliability of their products and services.

Most organizations that want to build a challenge course do not have an ideal situation. They have to find a suitable location, struggle for adequate funding, promote the adventure facility and program,

participant's perception of risk can be quite high. This is helpful in situations where groups want to build the skills necessary to face actual risks in other activities or situations. When people are being asked to take risks, they should have the opportunity to at least co-create those experiences and have the option to control how they participate. The concept of "Challenge by Choice" was introduced by Karl Rohnke (1989) to address this need for freedom and self-direction within the challenge course adventure. It continues to be an important philosophical and programmatic guideline for most adventure programs.

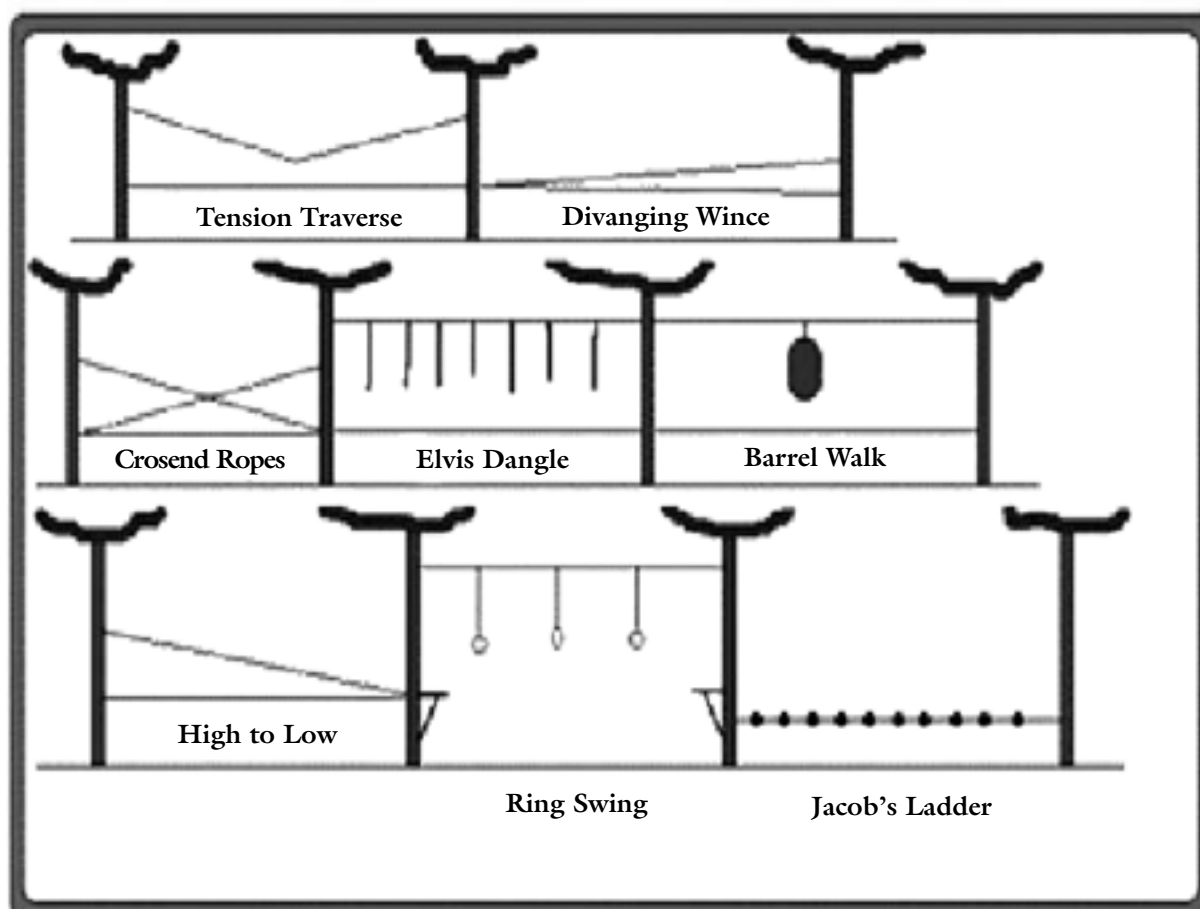
The design of most challenge course programs fit within four categories: Ad-



and search to find qualified people to staff the program. These are typical constraints that should not deter organizations from developing a course. There is considerable evidence that supports the value of using a challenge course. Challenge courses contribute to physical, emotional, and social development of the participants and are high visibility features that may be beneficial for program marketing and public relations. A well-run program with a quality staff can also be a productive source of revenue.

One approach to securing a challenge course is to build it with existing staff and the help of local talent. Many programs have done this in the past with considerable success. While this may be a tempting option, it is now strongly recommended that only experienced and qualified challenge course builders direct the process and build these courses. The designs, materials, and standards have become so very sophisticated that the do-it-yourself challenge course builder has gone the way of the wooden tennis racket. In addition to complex design and construction principles, there are substantial risk management and legal liability issues to consider. Insurance companies are very reluctant to cover a program with a challenge course that was not built by and is not being regularly inspected and maintained by a reputable vendor. Insurance companies still providing coverage for challenge courses have very specific criteria to assess the construction, inspection, maintenance, administration, staff training, clientele, and other risk management concerns. Course builders or the ACCT may be able to help locate an insurance provider. In lieu of a purely build-it-yourself course, some builders allow user assisted planning, design, and construction projects. Program staff may be able to assist with course design, layout, site preparation, basic carpentry, and even physical labor. Actually helping with the process is an effective way to foster staff buy-in and to help them learn about the course, how it works, maintenance needs, and programming potential.

For organizations with limited financing to build the desired challenge course, it may be necessary to develop a multiyear building and funding strategy that begins with short-term attainable goals and a limited course. Additional program support and funding will hopefully be made available as the program experiences success. With new ideas like a challenge course, those with decision-making power may be



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reluctant to commit resources until program benefits can be assessed. In this situation, starting with a small project, such as a Teams Course or a scaled-down complex, provides an affordable opportunity to demonstrate the viability of the program. Challenge course vendors can help with course planning and design that may easily be expanded in the future.

One of the first decisions is whether the challenge course will be an indoor course, an outdoor course, or a combination of the two. Many challenge course programs are part of a larger outdoor education program that may or may not have access to a multipurpose indoor facility. There are very creative designs available that utilize indoor spaces, both large and small.

Having an indoor component provides options for rainy days, multiple groups, and possibly groups that would have difficulty using an outdoor course.

The next two decisions, site location and primary support structures, are often linked. A decision needs to be made whether the challenge course will be tree-based, using existing trees to support the challenge course, pole-based, which uses telephone type poles, a combination of trees and poles, or climbing tower-based course, where a tower is used as part of the support structure of the challenge course. A tower-based course may also use natural trees, poles, or both for additional support points. There are many new designs that combine these ideas with steel structures, tree houses, suspended yurts and gazebos, movable platforms, and prefabricated panel components. There is little to limit the types of designs that may be created.

The nature of the site available greatly influences the type of support structure used. If there are no trees at the proposed site, then poles or towers must be used. If appropriate trees are available to be used as the challenge course foundation, the amount of rock base, ground slope, erosion potential, natural water, and environmental sensitivity of the area are all factors to consider in selecting the type of support structure. Using natural trees is less expensive than using poles or towers, so financial considerations may also be a factor in both site location and support structure. Visiting a challenge course program that is operating in a similar setting, observing the program in action, interviewing the staff, and reading the operating procedures are all helpful in the early stage of planning. Be certain that local zoning regulations and building specifications are checked before making the final site and support structure decisions.

Selecting Challenge Course Designs

A challenge course is a set of tools that helps programs and participants achieve goals. As presented previously, outcome goals will fall within the Recreation, Growth and Enrichment, Developmental, and Therapeutic categories. When providing adventure recreation, participants are given safe but challenging opportunities to solve group initiative problems and climb on the higher elements. There is very little briefing or debriefing of the experience. The emphasis is on participants having fun while they are being challenged physically and mentally. As program goals become more diverse, course design becomes more complicated. In order to meet the programming needs of diverse groups, highly versatile and flexible courses must be designed. A higher degree of design specificity can be employed if the course will only be used with a specified clientele.

Among the programming areas, there may be similar outcomes or benefits although the means and reasons may differ. The positive outcomes that are possible with challenge course programs are enhanced



- self-respect and respect for others,
- communication skills,
- sense of physical and emotional exhilaration,
- personal comfort zone,
- leadership skills,
- fears management,
- teamwork and cooperation,
- conflict-resolution strategies,
- problem-solving skills,
- safety awareness,
- planning and organization skills,
- caring and compassion,
- physical fitness and coordination, and
- stress-management skills.

Achieving goals with a challenge course requires skillful application of a well-conceived plan. When planning a challenge course, consider the

- course lay-out,
- program goals,
- actions of facilitators (program staff), and
- needs and desires of the participants.

These four primary components are highly interrelated. Given the phenomenal nature of the experience, these factors could be described as having a synergistic relationship. In addition, factors such as environment, weather, and support facilities (restrooms, lodging) will have some influence on the process. The effectiveness of the course depends on the quality of the program and how skillfully it is administered. The course design is important, but it is just a means to an end within a dynamic cognitive, emotional, and social experience.

Any attempt to categorize challenge courses will be flawed in some way since challenge courses are such a versatile tool. Despite this limitation, courses tend to fall into three general types of courses, Teams Courses, Low Courses, and High Courses. Some adventure facilities, by design, include multiple types of courses, which are called challenge course complexes. Combining course types in a complex may be done because there is limited space available, to be clustered together, or simply to provide program flexibility. There are situations in a complex where staff can overlap, allowing economy of staffing. Building all the course elements in one central location may reduce building costs by allowing for the sharing of poles or trees among courses/elements. From a programming standpoint, there are important questions to answer before deciding on a complex approach. Some of those questions include:

- Will participants on other course elements be distracted?
- When running multiple groups, will the visual and audible overlap be a problem?
- Does a complex format create safety concerns with some groups?
- Will being able to see other groups on the course have a negative effect on accomplishing desired outcome goals?

Complexes tend to offer more logistical, staffing, and economic benefits than programming benefits. Challenge course planners and designers must decide if the benefits of a challenge course complex outweigh the possible negative impacts on the intended program.

Teams Courses

As the name implies, Teams Courses are designed to provide group experiences. The height of a course element should not create unsafe situations for user groups. Keeping elements close to the ground (usually two feet or less) is the primary factor that allows these elements to be used by the entire group without employing ropes, harnesses, or extensive spotting when group members or staff position themselves to provide support if someone falls. On Teams Course elements, spotting is provided as needed while the entire group negotiates the element.

Teams Courses are designed to have groups work together to solve problems. These problems or initiatives have a variety of physical and mental challenges that the group must overcome. During the process of planning and implementing solutions, the participants interact in ways that generate valuable group dynamics. Teams Courses are also called initiative courses, since they require the group to use a problem-solving approach to group learning and development.

Teams Courses are relatively inexpensive, which makes them a good option for adventure programmers wanting a challenge course, but have limited funds. They are also a good idea when space is an issue. Each element of a Teams Course is independent of the other so it is easy to locate them in many different configurations. Decentralizing the elements (i.e., placing them away from each other, out of sight and hearing distance) is a good strategy. It limits the “Hey, I wonder how that one over there works?” distraction within the group. Decentralizing also allows for multiple group programming by rotating groups from element to element without them coming into contact with each other. Decentralizing course elements is only one of many strategies that can be considered. Challenge course builders sometimes provide design, operation, training, and maintenance consultation service to program personnel.

Many of the well-known Teams Course elements are listed in *The Complete Ropes Course Manual* (Rohnke et al., 2003), which provides details about these and other challenge course elements.

Low-Challenge Course

A Low-Challenge Course incorporates elements that are normally about two to five feet above the ground. Low course elements are generally designed to present individual challenges within a group context. Individual group members negotiate the elements while the others provide spotting, performance feedback and encouragement. Since the elements are relatively low, participants perform most of the spotting and safety procedures without the aid of ropes and harnesses.

In recent years there has been a trend to make low course elements more team-oriented by creating situations where two people are on the element at the same time. These participants work together with

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the support of the rest of the group. Spotting is still provided by the group, though some incorporation of belay systems (a safety rope attached to the climber's seat harness) is being used. Having a belay system is very beneficial when programming with a diverse clientele. More information on programming for special populations is provided in the final section of this chapter, Accessible and Universal Designs.

No two low-challenge courses are exactly alike, but most have variations of common low-ropes elements. *The Complete Ropes Course Manual* is again a good resource to find examples of additional Low Course elements.

High-Challenge Course

The High-Challenge Course has challenged many since it was first developed. Innovative design components include steel structures, hydraulic auto belay devices, moveable platforms, suspended yurts/gazebos, shock absorbing systems, multiple levels, and improved safety equipment. With these and other cutting edge designs, High-Challenge Courses have become sophisticated, technical facilities. Elements on these courses range in height from between 20 and 60 feet. Additional safety systems and procedures are required for High-Challenge Courses. Each person negotiating the course must be connected to a belay system. There are variations to how these systems are set up, but generally they consist of a rope connected to a harness being worn by the participant. This rope is usually run through a pulley and then down to the ground where another participant or staff member is prepared to prevent a fall. Another approach is to employ a pair of short ropes that the climber clips onto cables or other approved anchor points. The ACCT has developed strict standards for belay system materials and construction.

Typically, a single participant negotiates his or her way through High-Challenge Course elements. Although this approach is still widely used, more programs are seeking designs that will allow multiple climbers or small groups on individual elements. Benefits are derived from the collaboration among participants on an element, sometimes called partner climbing. Partner climbing seems to more effectively capture and hold the attention of the group members who are on the ground observing. This also provides added value to the process with observers being supporters through encouragement and feedback.

High-Challenge Courses have administrative and financial factors to consider that are not as important for Team and Low Courses. High Course planners, builders, and operators must consider:

- Increased staffing requirements—One facilitator can manage a group of 12 to 15 on Team and Low Courses. On High Courses, a minimum of two or three staff would be needed depending on the design of the course and the needs of the group.
- Additional equipment costs—Typically, all the necessary start-up climbing equipment is part of the course package. This equipment will need to be replaced on a three-to-five-year schedule depending on usage and environmental factors.
- Possible higher insurance payments—Although the High Course is statistically safer than non-belayed courses, the majority of catastrophic injuries have occurred on High Courses.
- Access control—Preventing unauthorized access to the High Course can lead to an extra expense (fencing and other devices) and liability concerns.
- Staff training—Considerable staff training is needed to safely and effectively facilitate the High Course. The safety of everyone on the course, including staff, depends on having knowledgeable and experienced facilitators running the program. A year-round staff training schedule is recommended to maintain reliable skills and operating procedures.

This list is not intended to discourage agencies from adding a high course to their program. To the contrary, a high course adds features to a challenge program that are not available with the other types of courses. These features include a heightened sense of perceived risk, greater physical challenges, greater awareness of individual effort and concerns, greater sense of individual accomplishment, a visually striking apparatus, and a greatly amplified "WOW" factor. It also compliments other courses if available, by providing powerful individual challenges that serve to take the person's group-based learning to a higher level of commitment.

High Course elements are often similar to those included in Low and Teams Courses. This provides a chance to apply newly learned skills under greater stress and by adapting skills learned on the lower courses. Again a more detailed description of many High Course elements can be found in *The Complete Ropes Course Manual* (Rohnke et al., 2003).

Universal and Accessible Design Considerations

For the past 10 years, finding ways to make challenge courses accessible to participants with disabilities has been an industry priority. There have consistently been sessions on this topic at Association for Experiential Education (AEE) and ACCT conferences. The ACCT has published a position statement that supports the inclusion of individuals with disabilities in challenge course experiences. Standards within both organizations address inclusion and challenge course vendors have been incorporating accessible and universal designs into many of their products and training.

In an ACCT general membership survey (unpublished, 2001), the ACCT tried to assess the status of inclusion in adventure challenge courses. Those responding indicated that 48% of the courses had design and program features to include participants with disabilities. This number has increased since the survey. Nearly 84% of the respondents agreed or strongly agreed that it is important to continue re-

searching, advocating, and reporting challenge course designs that provide opportunities for people with disabilities. While only about half of the respondents' courses are designed to include participants with disabilities, a significant majority of respondents support accessible challenge course design. The challenge is to incorporate designs that create relevant participation opportunities for participants with a wide range of physical and mental functioning.

The Universal and Accessible Design Committee of the ACCT (http://www.acctinfo.org/leadership_committees.html) and *The Complete Ropes Course Manual* (Rohnke et al., 2003) are excellent resources for additional information on making challenge courses accessible. A partial checklist of concerns/considerations is included below:

- Environment.
 - Are trail systems that lead to and link elements accessible? Planners need to consider slope, cross-slope, surface stability, and trail widths. Trail widths must be a minimum of 32 inches.
 - Are areas around individual challenge course elements level and firm with few obstructions?
 - Are drop-offs and steep embankments protected?
 - Are overhead clearances sufficient for participants with vision impairments?
- Elements.
 - Is independent access available to each element?
 - Are platforms, decks, and elevated walkways large enough and at heights that are usable by all participants?
 - Do transitions from element to element have options that consider the need for intermediate belay clip-ins and movement from one element to the other?
 - Are hand- and footholds of various sizes and shapes used to include enough large holds to improve access?
 - Are options for how individual elements can be negotiated (traversing, scooting, crawling, rolling, climbing) available?
 - Are access ramps handicapped accessible (a slope of 12:1)? Ramps that are part of the element do not have to meet accessibility slope standards.
 - Is edge protection used where participants with bony prominences might hit or have prolonged contact with a hard edge? Rounding edges and using foam to cushion edges and surfaces is recommended.
 - Are belay systems and elements designed so there are options for participants with mobility or balance concerns?
- Equipment.
 - Are mechanical advantage systems included to provide access to high courses? (A 3:1 or 4:1 pulley system is commonly used.)
 - Are full-body harnesses available and are course staff members trained to work with those who may need a harness? Many different harness configurations are available so handicapped climbers can minimize pain, support critical body parts, and make best of existing muscle function. Additional padding for harnesses may be needed when prolonged hanging in a harness is a concern. In most cases, no one should hang in a seat harness for more than 15 minutes. Harness suppliers will provide specific information on safe harness usage.
 - Are body protection systems available for participants with poor balance, diminished sensation or impaired muscle function? Areas to consider protecting include the head, elbows, hip-girdle, knees, and ankles. Padding used in other activities, such as skateboarding, works well in challenge course activities. Custom-fitting foam and other products to achieve a safe level of protection may be required.
 - Are hauling and counter-balance systems available to assist with access to high elements and climbing structures?
- Support facilities need to be accessible.
 - Do restroom facilities meet current accessibility standards?
 - Are storage facilities usable by all staff and participants?
 - Are debriefing areas, like the log circle, handicapped accessible?

When making decisions about how to make a challenge course experience accessible to participants with disabilities, it is important to understand that functioning levels and needs vary greatly. Conducting a needs and abilities assessment on each participant will help with activity selection and developing adaptations. When it is not clear how to include individuals with disabilities, it is best to ask them about their needs to assess their capabilities. Involving the individuals in the inclusion plan becomes a valuable part of the learning process. Providing a meaningful experience that maintains personal dignity for participants with disabilities may not be easy but with additional planning and a commitment to inclusion, challenge courses can provide exciting developmental experiences.

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Challenge Course Operations, Administration, and Staffing

The overall safety record of challenge courses is impressive. They are among the safest of all physically demanding programs (Project Adventure, 2001). The ACCT has established safety and construction standards to provide guidelines for the safe and efficient operation of challenge courses. Even well-planned and operated challenge courses are potentially dangerous; therefore, all participants need to be informed of the potential danger and should sign a waiver of liability (Assumption of Risk). Other challenge course operation considerations can be divided into Administration and Staff, Equipment, and Maintenance issues. An overview of these operations issues is provided but is by no means a complete list of all operational considerations. Additional operational guidance is available in the ACCT Technical Operations and Inspection Standards.

Challenge Course Administration and Staffing

- Purchase and maintain liability insurance for the organization and the staff.
- Provide professional training for all staff members. Administrators must provide sufficient funding to ensure that staff members are up-to-date on current policies and operating procedures, including rescues and emergency response.
- Have a risk management plan that clearly indicates actions and responsibilities. Be certain all staff members are up to date on their responsibilities by providing periodic training. Monitor staff credentials regarding current first aid and CPR certification.
- Keep accurate records of staff training, program operations and procedures, annual and periodic inspections, maintenance and repairs, liability forms, insurance, student training records, and accident reports.
- Maintain a comprehensive equipment inventory and use equipment sign-out sheets to maintain property accountability.

Challenge Course Maintenance

- Inspect the entire challenge course and the supporting equipment on a regular basis depending on use rates, environment, and nature of the equipment. An ACCT vendor-member inspector should conduct a comprehensive annual inspection, preferably.
- Use pressure-treated lumber for outdoor challenge courses. Weatherproof wood parts as needed. (Annually is best, if feasible.)
- Use only healthy trees with a solid root system as support trees. Before building in trees, consult a qualified arborist about the condition of the trees.
- Use wood chips or bark mulch around the base of trees to protect the soil from compaction. Provide for drainage under the chips or mulch.
- Immediately replace dead or insect-infected trees. Trees are susceptible to weather, insects, disease, rotting, ground impaction and need to be checked regularly.
- Trim and clear broken or overgrowing limbs.
- Remove splinters and rough edges on all wood parts.
- Replace and repair all rotten or cracked wood.
- Peen down sharp metal edges and pad protruding bolt or metal ends that are in participant traffic areas.
- Reset protruding nails as necessary.
- Check for rotting of the poles in the ground.
- Use only corrosion resistant bolts, cable, cable locks, rapid links, and other metal parts.
- Critical cables such as belays, zip wires, and most guy wires should be 3/8 inch diameter galvanized aircraft cable (GAC) that is 7 x 19 (seven strands with 19 wires per strand).
- Tighten nuts and bolts, turnbuckles, and clamps as required.
- Temporarily cover all frayed cable ends with tape until they can be re-fitted with a serving sleeve.
- Inspect cables for smoothness and rust. Cables need to be smooth if a participant's hands or feet will touch the cable.

Challenge Course Equipment

- Use UIAA or European Community Norm (CEN) certified climbing ropes and locking gate carabiners.
- Install only stainless steel or galvanized hardware on outdoor challenge courses.
- Have participants wear an adjustable harness. A full-body harness is used instead of the seat harness when there are concerns about distribution of forces such as with the Pamper Pole activity.
- On static or self-belayed courses, maintain constant vigilance to assure that participants are using their "lobster claws" correctly when they switch from element to element. (Two locking steel carabiners are attached to the participant by two shock-absorbing lanyards.) One carabiner is locked onto the next element's belay cable before the other carabiner is unclipped from the previous belay cable.
- Minimize rope wear and damage by using a shear reduction device.
- Always have a first-aid kit available.
- Have a communication system in operation, such as two-way radios, as part of an emergency response plan.

- Store equipment in a cool, dry place, preferably adjacent to the challenge course.
- Include lightning protection on high-challenge courses.
- Require helmets to be worn on high elements and whenever anyone is beneath an active high activity.
- Keep a rope log that tracks hours of usage and falls taken on each rope. Also inspect belay ropes regularly for wear, cuts, discoloration, glazing, stiffness, soft spots, and any other changes in specifications. If you are not sure about the integrity of a rope, do not use it!

Summary

Adventure programs involve risk-taking activities designed to foster trust and cooperation, enhance self-concept and confidence, include all people, and improve physical skills while being fun, exciting, and safe. Adventure activities are usually done as games or problems, sports or recreational activities, or as climbing activities. These are technical facilities with standards for design and operations, which will necessitate the involvement of qualified designers and builders.

The planning, designing, and building process for these adventure program facilities is similar to that of most other athletic facilities. Common design and construction planning steps include determining its purpose, creating a schematic design, developing this design, establishing construction drawings, and contracting with a contractor to build the facilities. Throughout this process, a wide range of design, construction, and equipment decisions need to be made. Having a comprehensive vision for both the program and the support facilities will guide these facility and equipment decisions.

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