

The STAIR REPORT

By: Tad Horning
StairMeister Log Works,LLC
April 21, 2004

How to *Intelligently*
and *Safely* take yourself
to the **Next Level...**
in your home!

Consumer Savvy Information on the **Design, Construction and Purchase of Stair and Railing systems** for your log or timber style home.

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The Craft of Stair Building

Stair building is esteemed by many as the pinnacle of the carpenter's trade. It is the culmination of a woodworker's skills combining the mathematical complexity of roof framing with the artistry of fine furniture making. Properly constructed using time proven techniques with new technology, a well crafted staircase is considered by some to be functional art.

The art dates back to 6000 B.C. and was originally used only in an outdoor application. During the 11th century, narrow interior stairs began to show up in England. Built primarily of stone in a narrow, circular fashion, they became a mechanism for defending the home whereby a skilled swordsman might stand on the staircase between an intruder and his household fighting for their safety.

Since then, stair design has evolved from defensive pragmatism to an architectural art form with such considerations as safety, comfort, drama, decoration, and statement included in its design. Traditionally, finely crafted staircases are a dominant architectural feature, if not the focal point of a home, often symbolizing a family's social and/or financial status.

Whether you're building a simple cabin or a grandiose log lodge, there are stair designs available to meet just about any design requirement or budget. As with other prominent woodworking applications, a fine staircase is often the collaborative, synergistic effort between owner, builder and designer.

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10 Questions You Should Ask **Before Buying a Stair Case.***

1. **How long has the company been in business building stairs?**
 - a. Good Answer: 5 yrs. minimum. 10 yrs. Is better! The longer, the more experience brought to the table.
2. **Does the company sales and administrative staff communicate professionally?**
 - a. Good Answer: Yes. Generally speaking, the level of professionalism you perceive over the phone is indicative of the levels throughout the company.
3. **Can the company meet your schedule?**
 - a. Good Answer: Yes. But, you be the judge. Sometimes good things are worth waiting for.
4. **Will the company guarantee Building Code conformance?**
 - a. Good Answer: Yes. Particularly when you are building in a code sensitive location. See appendix for Code design guidelines.
5. **Does the company highly recommend Building Code conformance even when you don't have any local requirements?**
 - a. Good Answer: Yes. The building codes are minimum standards of safety and structural integrity developed in your best interest.
6. **Does the company guarantee their product? Under what circumstances?**
 - a. Good Answer: Yes. All architectural features in your home should have a minimum of a one year conditional satisfaction guarantee.
7. **Does the company use air dried and or kiln dried wood?**
 - a. Good Answer: Yes. All components used in the construction of your log stair system should be air or kiln dried to a level at or below 15% moisture to help minimize natural occurrences associated with moisture loss(i.e. shrinkage, checking, splitting warping).
8. **Have the Stair systems been stamped or certified by a structural engineer?**
 - a. Good Answer: Yes. This is especially important for spiral and circular designs due the inherent structural challenges associated with building them.
9. **Does the company use "freight direct" shipping or "common carrier" shipping?**
 - a. Good Answer: "Freight Direct" for large highly valuable merchandise. "Common Carrier" is acceptable for shipping small easily packaged or palletized merchandise. Although "common carrier" shipping is without question the most economical way to ship, your merchandise has a higher probability of being damaged in shipment.
10. **Is the company a member of the SMA (Stairway Manufacturers Association)?**
 - a. Good Answer: Yes. The SMA is dedicated to research and education of stair building professionals in regard to safe stair and railing construction practices.

*The content of this report is no respect comprehensive or official in it's representation of stair construction practices or building codes. Please consult with your local building dept. for local code requirements. Always get unusual or atypical stair designs pre-approved by your local building official prior to construction.

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What Most Stair Builders Don't Want You to Know!

Your home's stairway - we often take them for granted. If overlooked, like children left to their own discretion, they can become a source of pain and frustration.

Climbing and descending stairs can be likened to driving a car with the exception that when you crash on stairs, you're likely going to be the only one injured. In both cases they serve a practical purpose. They help get you from where you are to where you're going, provide recreation for family members, shouldn't be used while intoxicated, and can prove extremely dangerous if not designed with **Safety** and **Structural Integrity** in mind.

Consider these statistics:

1. Approximately 3800 people die each year on stairs.*
2. About 2.5 million falls on stairs are recorded each year with 800,000 of them resulting in injury.*
3. People are more likely to hurt themselves on their stairs than anywhere else in their house.*
4. An accident involving stairs occurs every 18 seconds.*

“Falls on stairs are inevitable. What is not known is what percentage of falls occur because of user inattention or carelessness. The architect, builder, or manufacturer can not control conditions such as: stairs loaded with items to be carried later to the second floor..., stairs with loose carpet or treads in disrepair, users who change the friction coefficient on treads by wearing socks or slippers, users whose arms are loaded with laundry, and users who run up and down stairs. All of the conditions above have created the “stair accident epidemic”.*

The statistics are staggering. “Simply put, stairs are the most dangerous architectural feature in a house. It doesn't take much thought to realize that this problem is one that architects, engineers and builders create [and users exaggerate] and that it's also one that they can readily resolve.”*

It goes without saying that a thoughtfully designed and well constructed stairway along with an adequate budget, is something that should be carefully considered early on in the design process.

Please review or refer your design professional to our section on **Safe Stair Design**.***

*Statistics taken from an article by Bill Bevacco, Stair Manufacturers Assoc. Inc. entitled [Stair Manufacturers Code Update](#).

**Quote from an article [Design Guidelines for Safe Stairs](#) By Gregory Harrison.

***See appendix for Code design guidelines

Building Codes! Who needs them? You do! Here's why!*

While building codes at first glance seem tyrannical, and generally a thorn in your derriere, they exist in philosophy to help ensure one's safety and the structural integrity of your home.

The latest stair and railing building codes** all have one thing in mind: your personal safety. In most cases when followed, they will help keep you from bumping your head, give you something to grab onto if you lose your balance, provide a reasonable surface to step on and generally speaking help to keep you upright while ascending or descending on stairs.

Don't be led to believe that code conformance is the pinnacle of stair design because it isn't. The codes are *minimum* standards and are by no means exhaustive or without fault.

When constrained by budget or space, architects or designers will often design stairs that push the limits of building code requirements in order to preserve space. Be aware that a code conforming stair isn't necessarily a safe or comfortable stair when built within throwing distance of code minimums. There are universal and time tested stair design principles that should be considered in addition to code conformance.**

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Safe Stair Design*

As a veteran stair builder, I've shoehorned many a staircase into a space that was grossly inadequate. Not because it was a retrofit, but because the stair had not been given thoughtful consideration during the home design process. Make sure you provide ample floor area for your stair system so that it doesn't get crammed into a corner as an after thought. With early collaboration between home owner, architect and builder in regards to stair design, this kind of architectural oversight can be easily circumvented.

First, lets take a look at some fundamental design guidelines that can be applied somewhat universally and then we'll get into the pros and cons of different stair types.

The Pragmatic Side of Stair Design - Based on my experience designing and building hundreds of stair systems, there are just a few basic elements that should be considered.

1. **A reachable, continuously graspable, and structurally stable handrail** on at least one side; on two sides if the stair is over 3 ft. wide is essential to a safe stairway. This is probably the most neglected, least understood component of a stair system. A graspable handrail is the most important characteristic of a safe stair...key word: graspable! It appears that proper handrail design and construction is beyond the *grasp* of many builders and designers. A graspable handrail is a rail that you can curl your fingers and thumbs around and should be continuous the full length of the stair. "The Acid Test of Graspability" as related by Architect and Stair-Safety researcher Jake Pauls, suggests that a handrail is adequately constructed if the designer is comfortable hanging from two sections of their proposed handrails, one grasped with each hand, and maintain that grasp while hanging over a vat of acid. While I highly recommend other testing techniques, I think it is a powerful illustration nonetheless. Please refer to your local code requirements for details regarding handrail design**.
2. **Properly proportioned risers and treads** are key to a comfortable stride while climbing or descending a stairway (otherwise you will need that graspable handrail all too often)**. Through the centuries, various "rules of thumb" or formulas have surfaced to help carpenters determine rise and run factors for stair treads. These formulas include:
Rise + Run = 17 to 17.5 inches.
Rise x Run = 70 to 75 inches.
2 risers + one tread = 24 to 25 inches

While all of these formulas can be helpful at times, they don't work all the time. Research has shown that the ideal rise/run ratio is 7/11 (7" risers and 11" runs) to provide a smooth comfortable stride when using a stair. The current building codes allow a tread run of as

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little as 9” which is very questionable given that the average adult foot with a shoe on exceeds this number. In my opinion, tread run should not be less than 10” regardless of the riser dimension. Risers are limited by most codes to a minimum of 4” and a maximum of 8”. This is a broad range and extremes should be avoided. If a stair is built using the minimum allowable tread run and the maximum allowable tread rise (and many are which should cause you deep concern), the stair will approach an angle of almost 45 ° which is dangerously steep.

3. **Non-slick tread surfaces deserve thoughtful consideration.** Most stair treads made out of wood typically have smooth finishes applied to them to protect and seal the wood. This seems to be the proverbial *Rose with Thorns*. These finishes beautify the wood by enhancing the natural grain and character of the wood. Simultaneously, they can turn socked or bare feet into “out of control” skates, landing you on your derriere or your head. The remedies to this are obvious but not always desirable. Some of these include the use of slip resistant products applied to tread surfaces, leaving tread surfaces rough prior to finishing, inlaying carpet into the surface of treads and not using stairs without rock climbing shoes on. The bottom line is, if you’ve got adequate tread run, you’ve already begun to mitigate the problem. Most people inadvertently skate down stairs with insufficient tread run (or depth).

4. **Adequate width as to allow multiple users to pass comfortably is very desirable but highly neglected.** Most residential building codes require a stair to be a minimum (note the word minimum again) width of 36 inches**. Why? Because that’s what it takes for two adults to comfortably pass *sideways*? I would guess that 95% or more of all stairs built today are 36 inches wide. Why? Because a comfortable 42 inch wide stair would take up an additional 5.5 sq. ft. of floor area on each level? Go figure! Why do people consistently design and build stairs (the potentially most dangerous architectural feature in their homes) to code minimums? To save a few bucks? I think some of us need to reassess our values!

5. **Structural integrity ranks pretty high in my book.** Question: Can your stair support your 300 lb. Aunt Lou? Will it still support her in 10 yrs.? Most building codes require a stair case to support a 300 lb. point load at any point on the tread. Most staircases built, particularly log staircases, have not been engineered to substantiate this 300 lb. load requirement. Most builders fly by the seat of their pants when it comes to these things, guessing about adequate timber sizes and grades, proper fastening systems and appropriate joinery methods. “Has the stair system been engineered?” is always an excellent question to ask.

The Artistic side of Stair Design- The possibilities available in stair design are limited only by your imagination, budget, and the willingness of your construction team to support you in turning your vision into a reality. There are a variety of traditional stair types that can be translated into log and timber formats: The Straight-Run Stair, the Circular Stair, the Spiral Stair and any number of hybrid combinations.

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First, let's take a look at the **Straight-Run Stair****. Being the most common, they are typically the simplest to design, easiest to build, meet most egress (i.e. exit) requirements, and are usually the most economical to build. Due to their inherent simplicity, the options in terms of building materials include the use of logs, heavy timbers, steel, conventional lumber, hardwoods, and even particle board (commonly used but should be discouraged). Keep in mind that the common old "Straight-Run" Stair can be transformed into a work of art with the application of a little love, creativity and know-how.

Circular Stairs** represent the upper echelon of stair design and construction, requiring the highest level of skill and expertise to build. A curved stair used for primary egress should be designed into the home at the very beginning. Traditionally found in higher-end homes, they exude a timeless elegance that is redefined when crafted from select logs and timbers.

Circular Stairs by definition turn a continuous radius or curve that is both comfortable and safe by virtue of size and design. Fundamentally, the larger the diameter of the circle, the more safe and comfortable the stair. Circular Stairs by nature have treads that taper from one end to the other. This poses the challenge of identifying what an acceptable tread run is at critical points (walking paths) on the stair. This task is performed subjectively by collaborating code requirements, practical standards that may exceed code requirements, and space considerations. Depending on the total desired degrees of turn, a Circular Stair must be a minimum (I hate minimums) of 9 ft. in diameter for a 270° turn and 10 ft. in diameter for a 180° turn, depending on the floor height and the number of risers.

The Spiral Stair** has been around for centuries and is a wonderful complement to any home. Spirals are most often used as secondary stairs and when space is limited. Frequently they will lead to a loft, a master suite, a library, or in some cases a deck. Traditional Spirals are small, tight, and not very safe. The building code has an entirely separate and unique set of rules governing the design of Spiral Stairs. Built to code minimums and maximums, they become quite questionable in terms of function and comfort. Built to dimensional standards similar to those of Circular Stairs, they become quite functional. An average code conforming Log Spiral Stair will range from a minimum of 5ft. 6 in. in diameter to about 8 ft. in diameter depending on the species of wood used and the diameter of the log center column. Typically built with sculpted half log treads mortised and cantilevered off of a log center column, most Spirals have an elegant open freestanding appearance. When a diameter of 8 ft. or greater is desired requiring treads over 36 inches long, decorative log or timber knee braces become necessary to help support the treads. Whether used as a primary or secondary stair, a well crafted Spiral Stair distinguishes even the simplest of homes.

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Glossary of Terms

Baluster- Spindle. Picket. The vertical components of a balustrade or guard rail system. They typically interface with the underside of the top rail and the top of the tread on the stair.

Balustrade- The complete railing system on a staircase including balusters, newel posts, and rails.

Guard Rail- A balustrade on the sides of a stair, around a stairwell, on a balcony, or the edge of a loft designed to prevent an individual from falling off. Guard rails are required by code to be a minimum of 36” tall in residential applications and 42” tall in commercial applications. Most codes require that a 4” sphere cannot pass through the openings any where in a guard rail system.

Hand Rail- The graspable rail on one or two sides of a stairway designed to help balance and stabilize a stair user while ascending or descending a stair. Handrails are preferably round and should not exceed 2” in diameter.

Newel Post- A post with the purpose of supporting a balustrade or railing system whether located intermediately in a rail section or serving as a termination point.

Rise-The numerical vertical height of each step from one tread to the next.

Risers- The Physical space between one tread and another often used synonymously with the **Rise**. On closed riser stairs, this is the piece of wood used to close off the space between the treads.

Run- This is the horizontal distance covered by each tread typically measured horizontally from the nose of one tread to the nose of the next.

Stringers- Sometimes referred to as horses or carriages. These are the structural members on the sides of most stairs that support the treads. These are commonly made out of 2” x 12” lumber but are preferably made of heavy timbers or logs.

Treads- Referred to commonly as steps, these are the structural surfaces that you place your feet on when using a staircase.

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