City of
MARYLAND HEIGHTS
Department of Community Development

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Building Your Own Deck

Homeowners' Information Guide

Permit and Construction Guidelines based on the 2009 International Residential Code

This guide will provide the homeowner or contractor the basic permit requirements and examples of the submittals necessary to apply for a building permit with the City of Maryland Heights. The homeowner should not misconstrue this guide as a deck construction manual.

The purpose of this document is to provide the public, contractors, homeowners and city officials with deck construction guidelines. The guide provides construction principles and practices that will satisfy the general requirements of the 2009 International Residential Code. This guide does not discuss fees or procedures for inspection. The guide also does not prevent the City of Maryland Heights from asking for additional information or making more stringent requirements based on an unusual circumstance.

This guide is limited to deck designs using a uniform floor loading of 40 pounds per square foot live load and 10 pounds per square foot dead load over the entire floor of the deck. Decks supporting loads in excess of the standard uniform loads will require specific approval from the Building Commissioner and may require design by licensed architects or engineers.

Decks supporting roofs, hot tubs, spas, sunrooms, etc., and decks with cantilevers exceeding 2 feet are examples of deck design elements that are not covered by this guide and will require an engineer's seal.

Part 1: *Plan Review Submittals*

The following information shall be submitted to the building department for their review in order to obtain a deck permit. All of the information shown on the sample documents should be contained in all plan submittals. Additional information may be necessary. Plan review and permit fees will be determined from the information submitted. Make sure it is correct.

The first requirement is submittal of a ***Site Plan***, drawn to scale, for the property where the deck is to be built. Please provide all the information shown on the sample.

All lot dimensions shall be shown on the Site Plan. The distances to property lines must meet any side and rear yard setback requirements.
This Site Plan may be drawn by the builder or the homeowner and does not have to be sealed by a design professional.

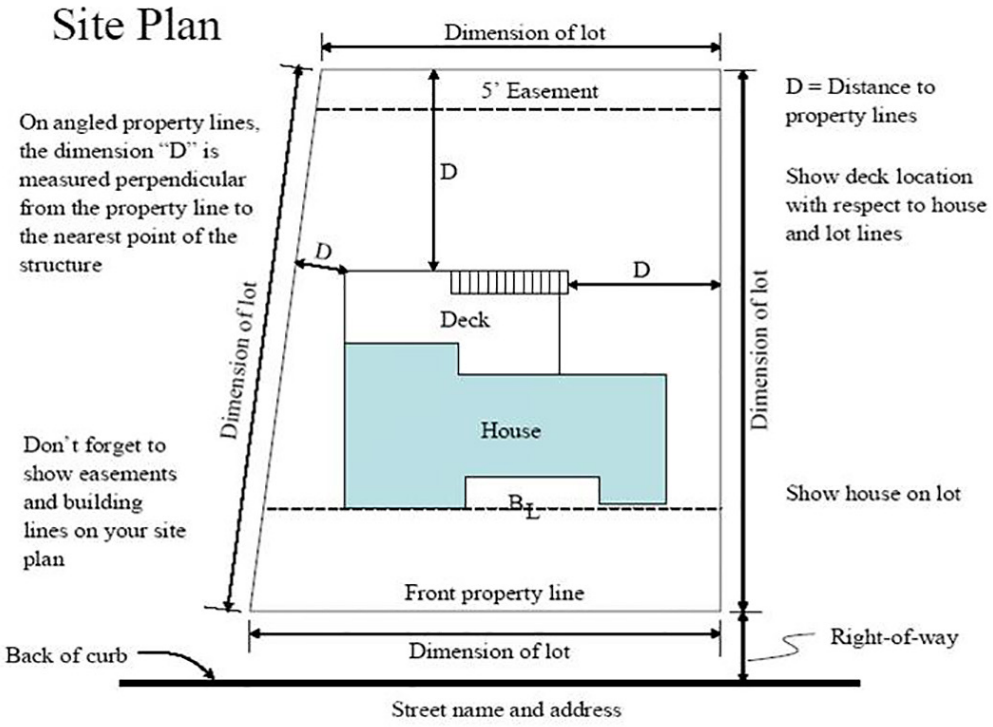

Figure 1

The second requirement in obtaining a permit is the submittal of a ***Deck Plan*** drawn to ¼ inch scale. This plan should contain as much information as possible about the deck and its construction. The information shown on the sample Deck Plan is the minimal requirement for the plan review process.

Additional information may be required by the building division in order to complete their review. This plan may also be drawn by the builder or the homeowner and does not require the seal of a design professional. Some designs and construction methods may, however, require the use of an architect, engineer or other design professional.

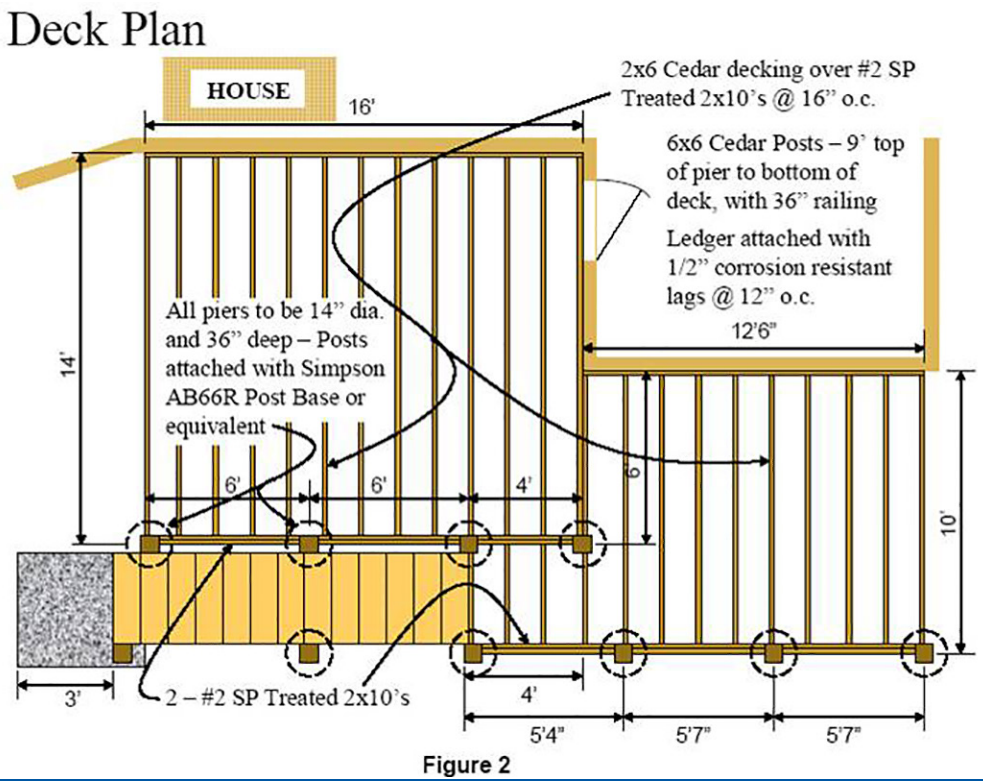

Figure 2

Part 2: *Structural Information*

The specific construction information shown on the sample Deck Plan can be found in the tables and diagrams that are provided with this document. Refer to the tables for specific requirements for designing joists, beams, posts, deck piers and connecting the deck to the house. The stair stringers must also be cut and connected properly and must not exceed the spans specified for safety reasons. The information contained in this document should not be considered a complete list of code requirements.

A variety of decking materials may be used for the flooring and railings. Please specify the size and type of material and the framing direction, such as '5/4 Radius Edge Cedar Decking running at a 45-degree angle to the floor joists. This is important because certain products like Radius Edge Decking have limited span capabilities as shown in the span table.

Spans for decking material

Decking — 300 lb. Concentrated Load		
Member	Species/Grade	Max Span
2 x 6	SP #2 ACQ	2′ 6″
2 x 6	Cedar #2	2′ 0″
5/4 x 6	SP #2 ACQ	2′ 0″
5/4 x 6	Cedar #2	1′ 4″
5/4 x 6	Trex	1′ 4″

Table 1

The deck must be constructed of either a naturally decay-resistant lumber or a pressure-treated lumber (ACQ) and be designed to support a live load of 40 pounds per square foot. All overhead power lines must be located at least 10 feet above the deck floor or be at least 3 feet horizontally away from the floor surface.

An exterior light for the deck and lighting on the stairs is required.

Columns and Piers

The size of the wood columns and concrete piers that are required to support a deck is based on the square footage of deck being supported by that column and pier. This square footage can be determined by using Figure 3 as an example. A column and pier supports an area of deck that is half way to the next support in any direction. The house is considered a support.

In Figure 3 below, the interior post supports half the joist span going back to the house and half the joist span going toward the outside edge of the deck. Since each set of joists span 8 feet, the post and pier supports 4 feet of the span in each direction. That means the interior post and piers are carrying a total of 8 feet parallel to the joists.

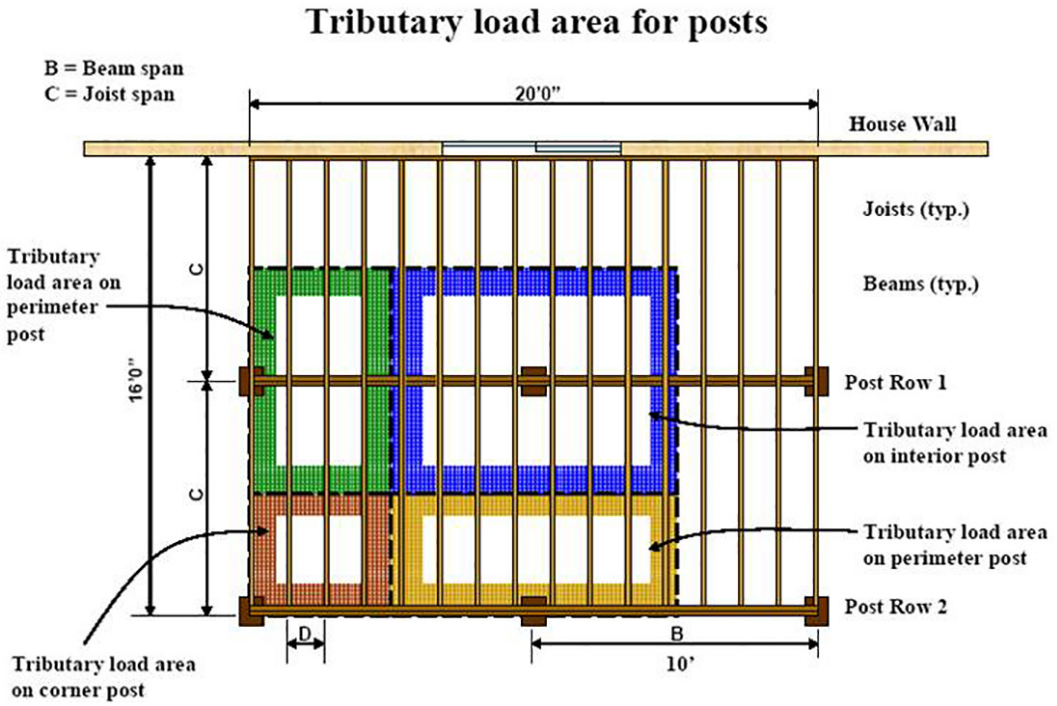

Figure 3

We then determine the distance between posts and piers parallel to the beam. Since the posts are set 10 feet apart in Figure 3, the interior post and pier supports 5 feet in both directions for a total of 10 feet along the length of the beam. These two dimensions then give us an area of 80 square feet of deck supported by the interior post. The perimeter posts carry half the area the interior post carries, or 40 square feet, and the corner posts carry half the area of the perimeter posts, or 20 square feet.

Maximum post heights for 40 lb/ft² deck design

Species	Post size	40 lb/ft² live load – 10 lb/ft² dead load Tributary load area to post (ft²)													
		36	48	60	72	84	96	108	120	132	144	156	168	180	192
Southern Pine	4x4	10′	10′	10′	9′	9′	8′	8′	7′	7′	6′	6′	6′	6′	5′
	4x6	14′	14′	13′	12′	11′	10′	10′	9′	9′	8′	8′	8′	7′	7′
	6x6 (No. 1)	17′	17′	17′	17′	17′	17′	17′	17′	17′	17′	17′	17′	16′	16′
	6x6 (No. 2)	17′	17′	17′	17′	17′	17′	17′	17′	16′	16′	15′	14′	13′	13′
Redwood Western Red Cedar	4x4	10′	10′	9′	8′	7′	7′	6′	6′	5′	4′				
	4x6	14′	13′	12′	11′	10′	9′	8′	8′	7′	7′	7′	6′	6′	5′
	6x6 (No. 1)	17′	17′	17′	17′	17′	17′	17′	17′	16′	15′	15′	14′	14′	13′
	6x6 (No. 2)	17′	17′	17′	17′	17′	16′	13′	7′						

Table 2

To use the table, simply find the square footage of deck being supported by the post, and match it with the species and size of the post to find the maximum height of that particular column.

Now the size of the columns and the piers can be determined using Tables 2 and 3. Table 2 on the left shows the size of post that is required to support a specified area of deck and the height that post may be. The maximum post height is measured from the top of the concrete pier to the bottom of the beam the post supports. This same post may continue on up to provide support for the guardrail around the deck, but that additional length is not counted as part of the maximum post height.

A critical part of the deck construction is the concrete pier that supports each post. If they are too small the deck could settle over time and become uneven. To use Table 3, select the square footage of deck supported by the pier. This is the same area that was just used for the post sitting on the pier. Based on the square footage being supported, select the base diameter of the pier required. Remember that all piers are to be a minimum of 30 inches deep to go below the frost line. At least 1-inch of the pier should be elevated above grade with the top sloped for drainage.

Pier sizes and deck area supported

Pier diameter	Square footage of deck that can be supported
8″	14
10″	20
12″	32
14″	40
16″	56
18″	72
20″	88
22″	104
24″	126

Based on 2000 psf allowable soil bearing capacity

Table 3

Pier sizes can be chosen individually, based on the square footage of deck supported by each pier. That would mean each pier might require a different diameter hole. An easier way is to determine the largest diameter hole required and make all the holes that size. This method will, however, require more concrete. Whichever way it is done, this information must be shown on the Deck Plan. Once the post and pier sizes are determined, a connection must be made between the post and the pier. This connection must resist lateral movement as well as uplift. That means a column anchor must be used to attach the post to the pier. A 'drift pin' simply drilled into the bottom of the post is not sufficient. The sample plan states a Simpson AB66R Post Base or equivalent is being used to anchor the post to the pier. Be sure to specify some type of column anchor on the plans. Column anchors are made to fit 4x4 or 6x6 posts. Some column anchors are designed to be set directly in the concrete when it is poured. Others can be drilled into the concrete later so they can be placed exactly where they need to go after the concrete has set up.

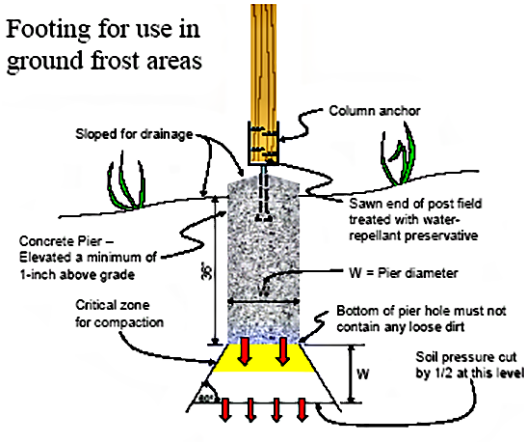

Figure 4

Part 3: *Ledger-to-House Connections*

Decks are usually supported on one side by a ledger attached to the house. This ledger attachment is critical to insure the deck is safely and securely supported at this point. When the ledger is attached to the house, there are very specific requirements that must be met. Follow the diagrams closely for the proper attachment of the ledger. If the ledger is supported by the house, the deck must be positively anchored to the structure and designed for both vertical and lateral loads.

The deck ledger ***shall not*** be nailed to the house. It must be lagged or bolted to the rim joist of the house which in turn must be securely attached to the framing of the structure and sitting on the foundation wall. Use Table 4 to determine proper lag bolt attachment of the deck ledger to the rim joist of the house.

Lag Bolt Spacing for Deck Ledger Attachment						
Lag Size	Joist Span (feet)					
	0 – 6 ft.	6 – 8 ft.	8 – 12 ft.	10 – 15 ft.	15 – 20 ft.	20+ ft.
1/2 inch diameter lag bolts	30" o.c.	24" o.c.	16" o.c.	12" o.c.	8" o.c.	engineered calculations required
Equivalent Spacing joists at 16" o.c.	Every other joist space	Two every other joist space	Every joist space	Every joist space with two every other space	Two in every joist space`	engineered calculations required

Table 4

The span of the floor joists determines how much load is being transferred to the ledger and thus to the lag screws. Use Table 4 by finding the span of the floor joists. Under the span will be the required on-center spacing of the lag screws. Since some lag screw spacing will interfere with the framing layout, an equivalent spacing is also provided that may be used in lieu of the specified on-center spacing when the joists are laid out at 16" o.c. Pilot holes shall be drilled for lag screws 1/2 inch or larger. The lead hole for the threaded portion shall have a diameter equal to 60% to 75% of the shank diameter. All lags and nails used to connect framing members will be placed at least 2 inches from the ends and edges of the lumber as shown in Figure 5.

Deck Ledger Attachment to House

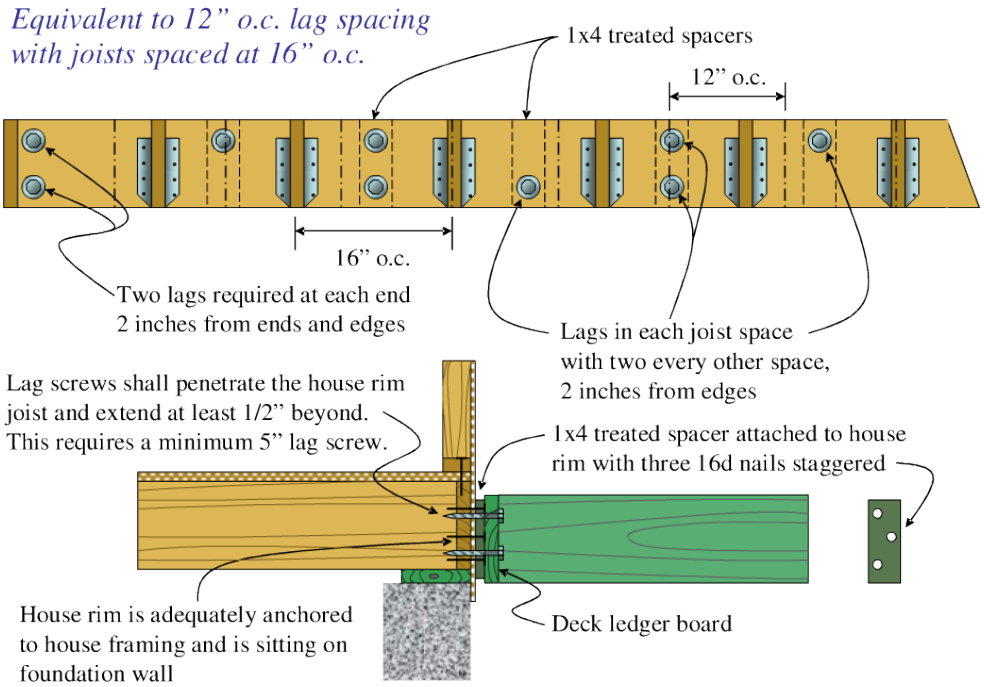

Figure 5

Deck Attachment for Lateral Loads

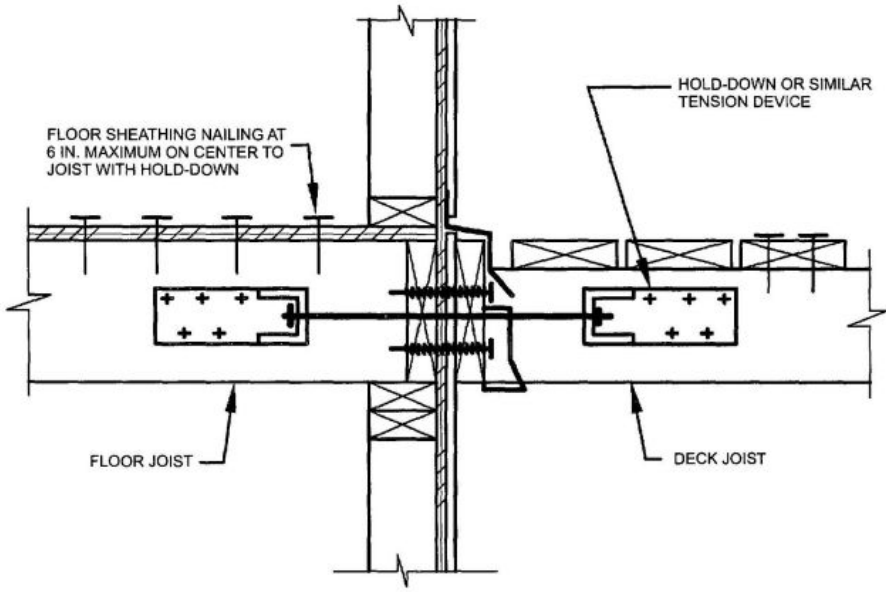

Figure 5.1

The figure to the left is an illustration of a lateral load connection. This is the prescriptive type provided in the International Residential Code.

This example represents one method of providing lateral bracing. There are several others.

When the rimboard is other than dimensional lumber, 1/8" steel or 2" nominal dimensional lumber shall be installed as a backing plate and carriage bolts may have to replace lag screws. Lateral load brackets must be installed when the rimboard is other than dimensional lumber.

Deck Ledger Attachment to House

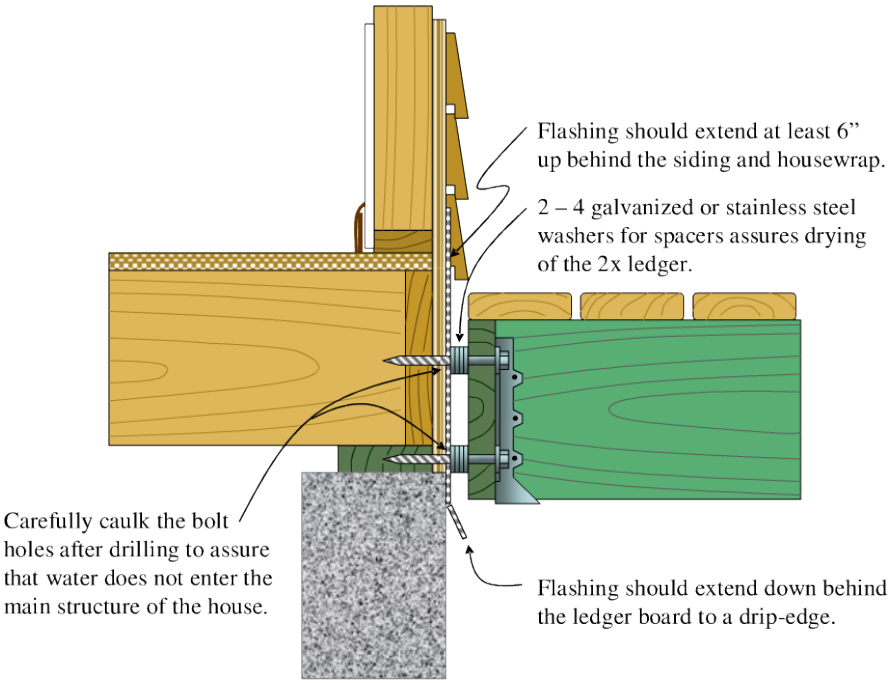

Figure 6

The use of lag screws, along with all the other metal connectors used to build a deck, brings us to a very important point. The use of proper fastener and connections with treated lumber is critical to the overall performance of the structure. The lag screws supporting the ledger, and all other connectors used in constructing a deck, **must be hot dipped galvanized or stainless steel**. G60 Electroplated fasteners are not allowed for use with treated lumber.

The new ACQ treatment that replaced CCA after December 31, 2003, is much more corrosive than its predecessor. Therefore, it is even more important to use hot dipped galvanized or stainless steel connectors in lieu of standard carbon-steel fasteners. Check with your supplier to be sure you are getting the proper corrosion resistance on all connecting hardware, such as joist hangers and column anchors as well as lag screws, deck screws and nails.

Approved hardware is required to be stamped or labeled for use with ACQ lumber. If you do not see the label, do NOT buy it.

Many individuals have attached ledgers directly against siding. This will lead to the eventual deterioration of the siding. Therefore, a 1x4 treated spacer or metal or rubber flashing shall be placed between the siding and ledger board to allow for drainage and for air get to the siding so it can stay dry.

The attachment of the 1x4 is made using 3-16d hot-dipped galvanized nails in a staggered pattern, nailed through the siding and into the rim joist of the house. The lag screws must go through the 1x4 and into the house rim joist. Note that this attachment requires the lag screw to penetrate the house rim joist and extend at least 1/2" beyond. That means this connection requires a minimum 5" galvanized lag screw with a standard galvanized washer.

Some builders or homeowners may want to remove the siding and attach the ledger directly to the rim joist of the house. This requires very close attention to flashing details so water cannot get to the house rim and cause structural damage to it and possibly even the ends of the floor joists. Figure 6 shows that proper flashing extends at least 6 inches up behind the siding and house wrap. The flashing should then extend down past the ledger board and end with a drip-edge at the bottom. To avoid deterioration, the flashing should be stainless steel, lead, vinyl or rubber, not aluminum. Holes drilled for the lag screws should be caulked before the ledger is applied to prevent water from entering the main structure of the house. Galvanized or stainless steel washer spacers assure drying of the 2x ledger.

The house rim joist must be securely anchored to the house framing and it must be sitting on the foundation wall. Ledgers shall not be attached to cantilevers unless the connection is engineered or the following prescriptive method is followed. Note there are limitations imposed on this prescriptive method. Be sure to follow all the details very closely.

Part 4: *Attaching a Deck to a Cantilever*

In order to attach a deck to a cantilevered portion of a house, it is critical that the rim joist be able to carry the added load of the deck in addition to the weight of the exterior wall, which is already sitting on it. Since the rim joist is only nailed into the ends of the floor joists, that connection is not sufficient to support the extra load imposed on it by the deck.

To attach the deck to a cantilever, the house joists must be 2x10's or wood-I joists spaced at 16 inches on-center. Each 2x10 joist must be doubled with an additional 6-foot, 2x10 nailed together with 10d common nails at 16" staggered. Wood-I joists must also be doubled with 60" web stiffeners added. The web stiffeners shall be nailed on with a row of 4 – 10d nails every 16 inches. The original joists and the added joists will each be toe-nailed to the sill plate with 3 – 8d nails. Solid blocking between the 2x10 joists or wood-I's shall be provided over the foundation wall.

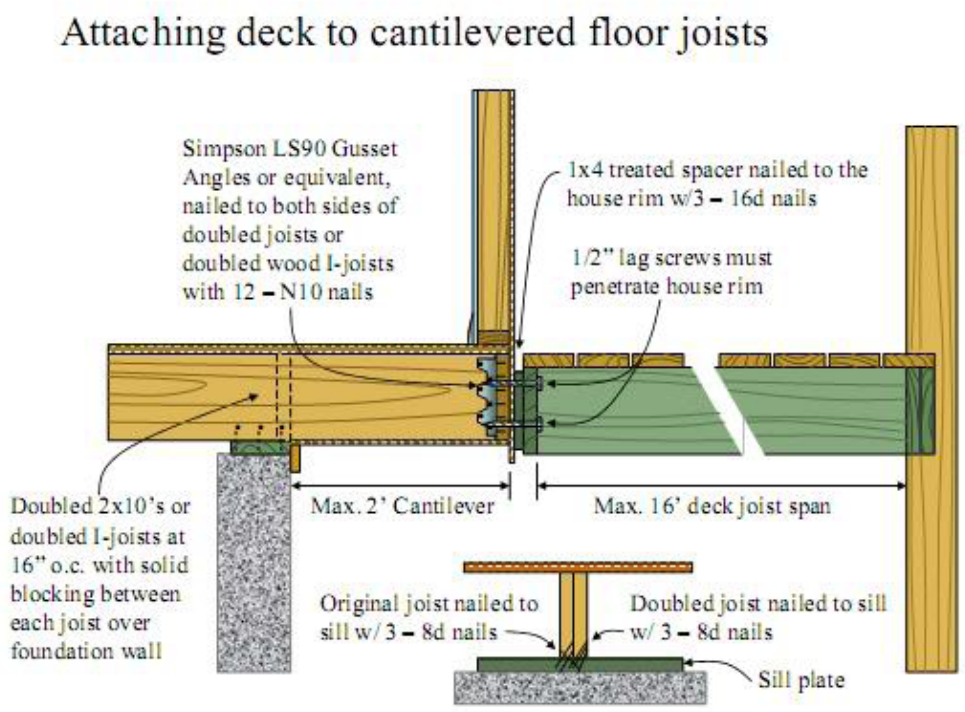

Figure 7

All decks attached to engineered lumber cantilevers must comply with Figure 5.1 shown on page 6. All cantilever decks must have lateral load brackets installed.

The next thing that must be done is to attach the rim joist to the doubled floor joists with Simpson LS90 gusset angles or their equivalent. These angles are designed to transfer the load imposed on the rim by the deck back into the doubled joists. Each of these gusset angles shall be nailed on with 12 – N10 nails, six nails into the rim and the other six into the doubled joists.

The maximum deck joist span for this application is 16 feet. This maximum span would require two 1/2-inch lag screws between each deck joist if they are laid out on 16 inch centers. Figures 7 and 8 show elevation and plan views detailing how a deck ledger shall be attached to a cantilevered floor system.

Framing around a chimney or bay window which extends beyond the exterior wall of the house may be accomplished by headering across the chimney or bay window area with a double header attached to double joists on each side.

Doubling of these members is required when the header span is greater than 4 feet. The double joists and header shall be of sufficient cross section to carry the tail joists framing into the header.

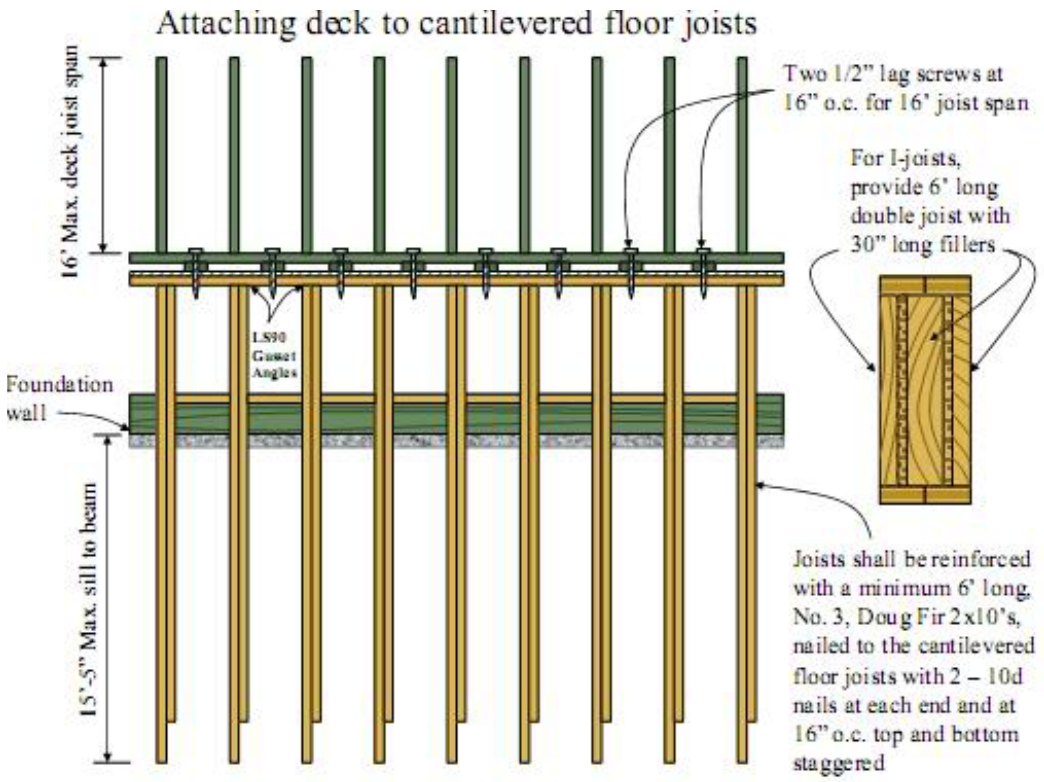

Figure 8

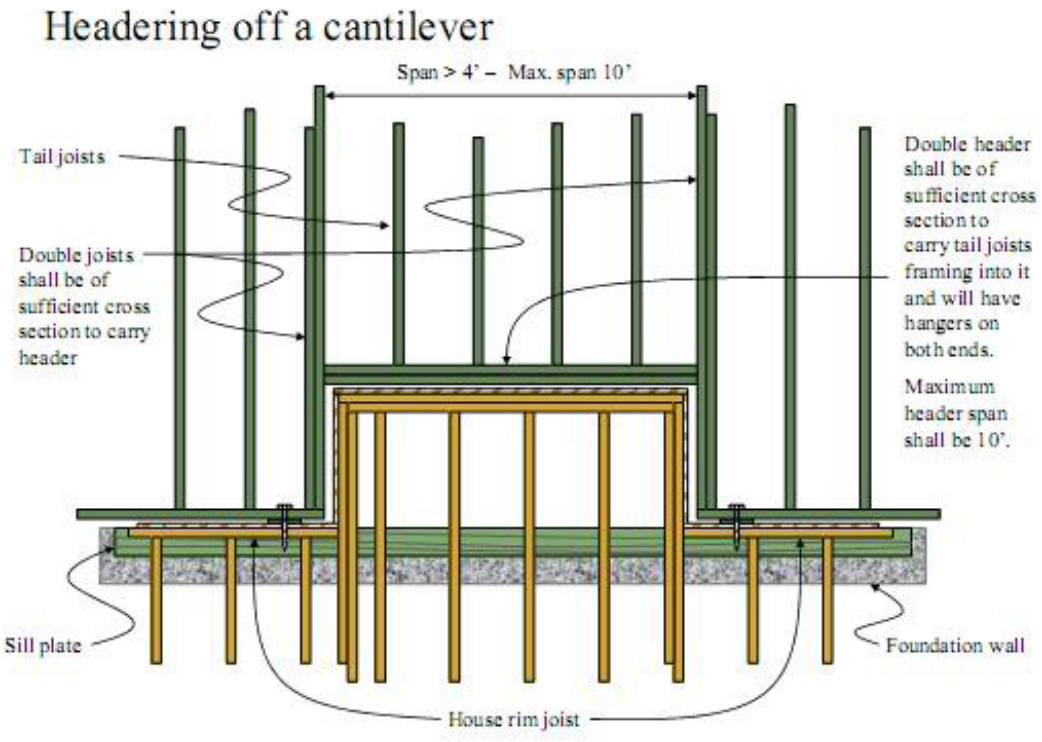

Figure 9

The header shall be supported on each end by a double joist hanger when the header span exceeds 6 feet. Tail joists over 12 feet long shall be supported at the header by joist hangers. A space shall be provided between the doubled framing members and the house to allow for water drainage and air circulation.

Part 5: *Joist and Beam spans*

Floor joists and beams have certain span capabilities based on the size, grade, species and spacing of the material used for the joists or beams and the loads that are imposed on them. Deck joists are required to be designed for 40 pounds per square foot, just like a residential floor. Floor joists must be constructed of No 2. or better grade of lumber. All lumber approved for construction is clearly marked with the grade of the lumber and other important information. The grade stamp must be from an approved agency, not the lumber yard. The chart below indicates the maximum span for each species of lumber. Calculations from a Missouri Professional Engineer will be reviewed and accepted in lieu of the chart.

Joist spans are measured from unsupported edge to unsupported edge. See Figure 10 for a visual representation of how a joist span is measured.

Species	Maximum Distance Between Posts or Supports			
	Joist Size	12″ o.c.	16″ o.c.	24″ o.c.
Southern Pine	2x8	13′ 8″	12′ 5″	10′ 2″
	2x10	17′ 5″	15′ 10″	13′ 1″
	2x12	18′ 0″	18′ 0″	15′ 5″
Douglas Fir-Larch, Hemlock-Fir, SPF	2x8	12′ 6″	11′ 1″	9′ 1″
	2x10	15′ 8″	13′ 7″	11′ 1″
	2x12	18′ 0″	15′ 9″	12′ 10″
Redwood, Western Cedars, Ponderosa Pine Red Pine	2x8	11′ 8″	10′ 7″	8′ 8″
	2x10	14′ 11″	13′ 0″	10′ 7″
	2x12	17′ 5″	15′ 9″	12′ 4″

Remember that the ends of the joists will need to be properly supported. If they are running between the ledger and a beam, they will need joist hangers on both ends.

Calculating beam spans is a bit more complicated than floor joists. First, the tributary width supported by the beam must be determined. For simple spans the tributary width is 1/2 the joist length. For a center beam the tributary width is the sum of 1/2 the span from each side. If there is a cantilever, we add in the total length of the cantilever. Note that 2x8 and larger floor joists cannot cantilever more than 2 feet.

Once the tributary area has been determined, the beam span can then be determined using Tables 6 or 7 on the next page. Decide what will be used for the beam and check the span based on the tributary load width. If two 2x10's are going to be used as the beam and the tributary area of the beam is 7 feet, the maximum span for the beam is 9 feet, 2 inches (highlighted on the next page).

Joist span measurement and beam to post connection

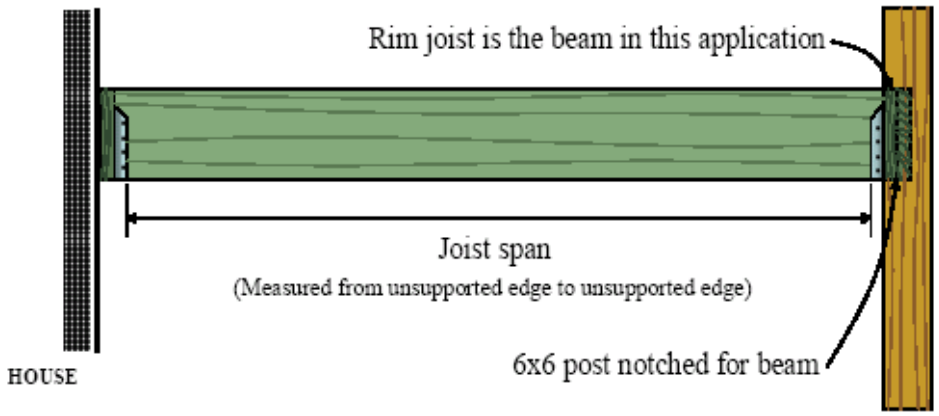

Figure 10

When multiple members are used, they must be attached so they act as one. This requires nailing the members together with 10d nails at 16 inches on-center staggered.

If a single Cedar 4x10 were going to be used instead of a built-up treated beam, then Table 7 would be used. In the case our 7 foot tributary area, a 4x10, which by the way, is not the same as two 2x10's, has a span capability of 8 feet, 11 inches.

A beam should always be supported by the columns beneath it. This is usually accomplished by notching the beam into the post so there is direct wood-to-wood bearing. Note the 6x6 posts are recommended if the beams are to be notched into the posts.

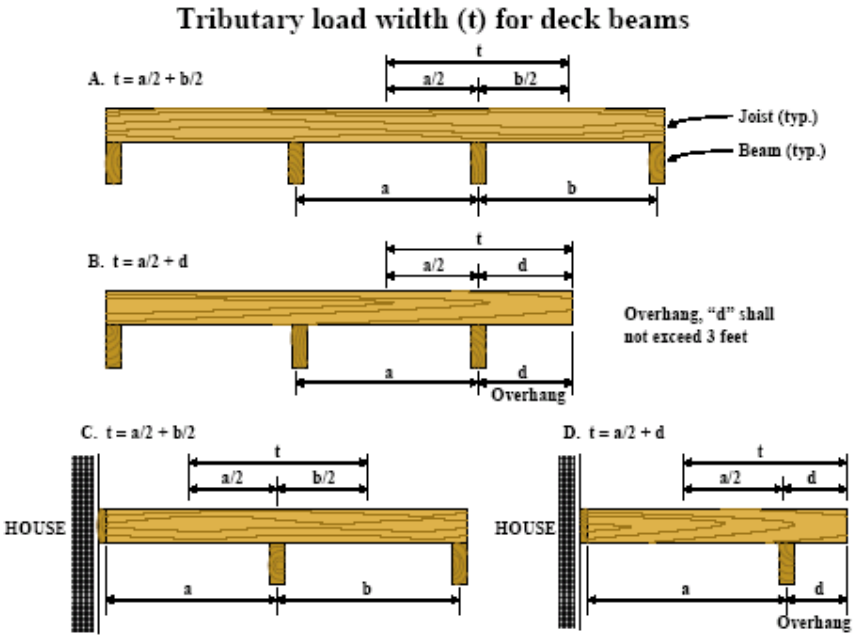

Figure 11

Maximum beam spans for Treated Southern Pine

Beam Size	40 lb/ft² live load – 10 lb/ft² dead load Tributary load width (ft)								
	4′	5′	6′	7′	8′	9′	10′	11′	12′
2x6	5′ 7″	4′ 9″	4′ 2″	3′ 8″	3′ 4″	3′ 1″	2′ 10″	2′ 8″	2′ 6″
2x8	7′ 2″	6′ 2″	5′ 5″	4′ 10″	4′ 3″	4′ 0″	3′ 9″	3′ 6″	3′ 4″
2x10	8′ 7″	7′ 8″	7′ 0″	6′ 2″	5′ 7″	5′ 1″	4′ 9″	4′ 5″	4′ 3″
(2) 2x6	7′ 10″	7′ 0″	6′ 5″	5′ 11″	5′ 7″	5′ 2″	4′ 9″	4′ 5″	4′ 1″
(2) 2x8	10′ 1″	9′ 1″	8′ 3″	7′ 8″	7′ 2″	6′ 9″	6′ 3″	5′ 10″	5′ 5″
(2) 2x10	11′ 0″	10′ 9″	9′ 10″	9′ 2″	8′ 5″	8′ 1″	7′ 8″	7′ 4″	7′ 0″
(2) 2x12	14′ 0″	12′ 7″	11′ 6″	10′ 8″	10′ 0″	9′ 5″	9′ 0″	8′ 7″	8′ 2″
(3) 2x8	12′ 10″	11′ 10″	10′ 10″	10′ 0″	9′ 5″	8′ 10″	8′ 5″	8′ 0″	7′ 6″
(3) 2x10	15′ 7″	14′ 1″	12′ 10″	11′ 11″	11′ 2″	10′ 7″	10′ 0″	9′ 7″	9′ 2″
(3) 2x12	18′ 3″	15′ 5″	15′ 0″	13′ 11″	13′ 1″	12′ 4″	11′ 9″	11′ 2″	10′ 9″

Spans are distances in feet-inches between centers of posts or supports. Grade is No. 2 or better. Number in parentheses is number of full-length nailed laminations

Table 6

Maximum beam spans for Redwood and Western Red Cedar

Beam Size	40 lb/ft² live load – 10 lb/ft² dead load Tributary load width (ft)								
	4′	5′	6′	7′	8′	9′	10′	11′	12′
4x6	7′ 4″	6′ 7″	6′ 0″	5′ 6″	5′ 2″	4′ 11″	4′ 8″	4′ 5″	4′ 3″
4x8	9′ 8″	8′ 8″	7′ 10″	7′ 3″	6′ 10″	6′ 5″	6′ 1″	5′ 10″	5′ 7″
4x10	11′ 10″	10′ 7″	9′ 8″	8′ 11″	8′ 4″	7′ 11″	7′ 6″	7′ 2″	6′ 10″
4x12	13′ 9″	12′ 4″	11′ 3″	10′ 5″	9′ 9″	9′ 2″	8′ 8″	8′ 4″	7′ 11″
6x8	9′ 3″	8′ 3″	7′ 7″	7′ 0″	6′ 7″	6′ 2″	5′ 10″	5′ 7″	5′ 4″
6x10	13′ 2″	11′ 0″	10′ 9″	9′ 11″	9′ 5″	8′ 9″	8′ 4″	7′ 11″	7′ 7″
6x12	15′ 11″	14′ 3″	13′ 0″	12′ 0″	11′ 3″	10′ 7″	10′ 1″	9′ 7″	9′ 2″

Spans are distances in feet-inches between centers of posts or supports. Grade is No. 2 or better.

Table 7

However, there are times when a beam must sit on top of a post. In these cases there must be a positive connection between the post and the beam. Sometimes dimensional lumber secured to the side connecting the beam to the column is sufficient, but metal connectors are also available. See Figure 12 for different ways to connect beams to posts.

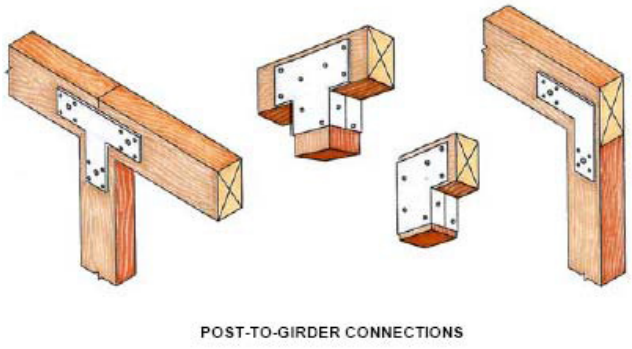

Figure 12

Note that beam spans are measured differently than joist spans. A beam span is measured from the center of support to the center of support. Also notice that a beam may only be cantilevered a maximum of 2 feet beyond the support.

If the beam is not notched into the post, then the structural performance of the connection is limited to the capacity of the bolts. In this case, the tributary area that can be safely supported by the beam is greatly reduced. This type of connection should be avoided if at all possible. Notching the beam into a 6x6 post or sitting the beam directly on top of the post allows direct wood-towood bearing, and this will always provide better support.

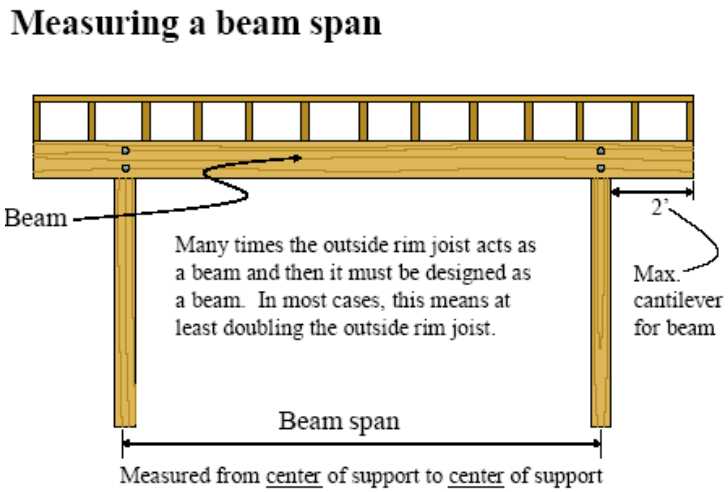

Figure 13

But since this type of connection is occasionally used, Tables 8 and 9 have provided showing the reduced area of deck that can be supported when attaching the beam to a post using only bolts to support the load. Note that the tables specify the size and number of bolts for use with various size beams and posts. The beam sizes in these tables are all based on No. 2 treated Southern Pine.

Limitations in tributary load area for beam-to-post connections using 4x4 or 6x6 posts and 1/2-inch-diameter bolts.

Live load (lb/ft²)	Tributary load area (ft²)	
	Southern Pine	Redwood, Western Red Cedar
Two-bolt connection (2x6, 2x8)		
40	30	16
Three-bolt connection (2x10, 2x12)		
40	44	34

Table 8

Limitations in tributary load area for beam-to-post connections using 6x6 posts and 5/8-inch-diameter bolts.

Live load (lb/ft²)	Tributary load area (ft²)	
	Southern Pine	Redwood, Western Red Cedar
Two-bolt connection (2x6, 2x8)		
40	42	27
Three-bolt connection (2x10, 2x12)		
40	63	40

Table 9

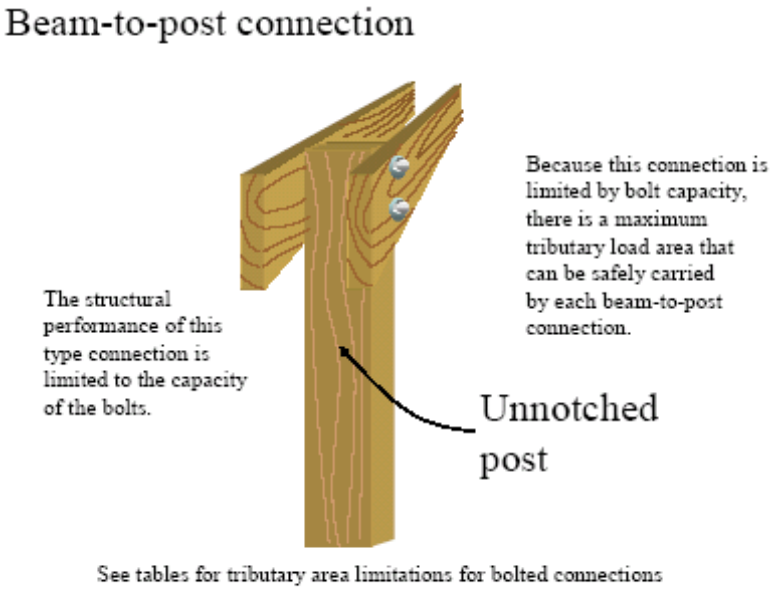

Figure 14

Part 6: *Cantilever Decks*

It is often desirable to cantilever a deck for aesthetics or for other reasons. Certain considerations must be taken into account when using a cantilever. Deck joists 2x8 and larger may be cantilevered a maximum of 2 feet beyond the supporting beam as shown in Figure 15. The back span for a cantilever must be a minimum of twice the cantilevered distance. The maximum cantilever without engineering is 2 feet.

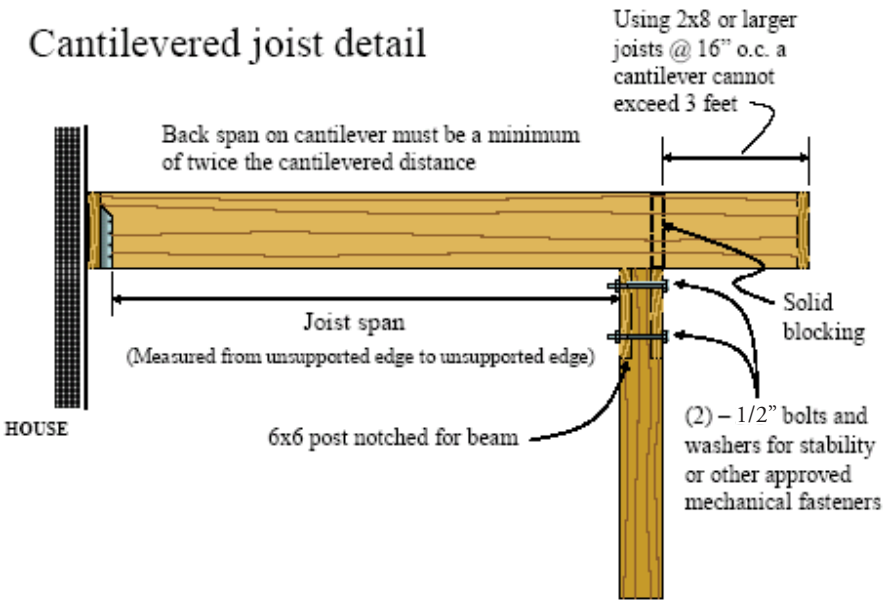

Figure 15

A concentrated load on the end of the cantilever has the effect of producing uplift on the joists at the first interior beam support or at the attachment to the house. When a deck is cantilevered, the connection to the exterior wall of the house or other framing members such as a beam shall be designed and constructed to resist uplift resulting from the full live load acting on the cantilevered portion of the deck. One way of resisting these loads is with a steel twist strap at each end to prevent uplift.

The beams in Figures 15 and 16 are notched into opposite sides of a 6x6 post. Due to the separation of the two members that make up this beam, solid blocking needs to be placed between the two beam members every 4 feet so they may be securely nailed together in order for them to act as one unit.

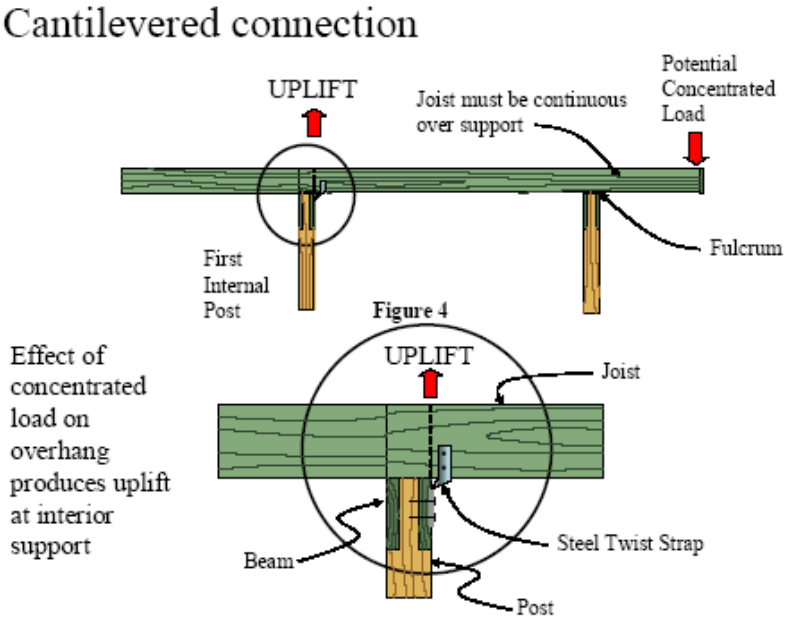

Figure 16

Part 7: *Stairs*

Stairways shall have a minimum width of 36 inches. The maximum riser height shall be 7-3/4 inches and the minimum tread depth shall be 10 inches as measured in Figure 21. ***Open risers are permitted provided the opening between the treads does not allow the passage of a 4-inch diameter sphere.*** The opening between adjacent treads is not limited on stairs with a total rise of 30 inches or less. The greatest riser height and tread depth within any flight of stairs shall not exceed the smallest by more than 3/8-inch.

There shall be a minimum of two stringers where the spacing between them is 24 inches. This requires the treads to overhang 5 inches beyond each stringer. Three stringers may be used where the outside members are placed 36 inches apart and a third is centered in between. Now the treads are supported on the ends and in the center. This gives us a stronger set of stairs and allows us to meet the concentrated load requirements.

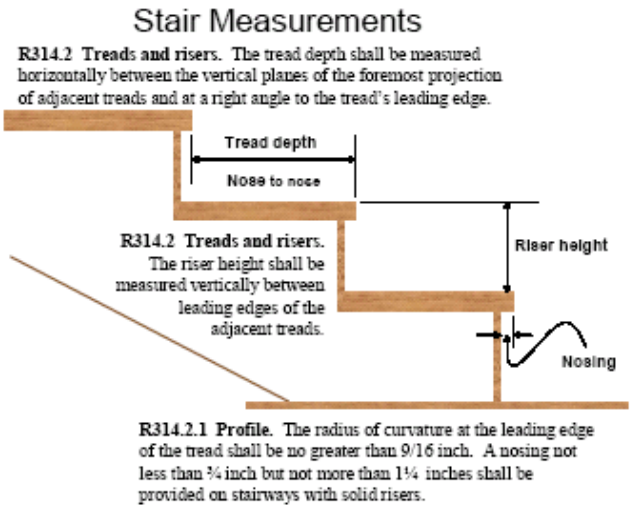

Figure 21

The stair stringers shall be 2x12, #2 treated Southern Pine or equal. They must not be over-notched when cutting in the rise and run. The cuts in these notches must end at the inside corners and not extend beyond that corner or the stringers will be weakened.

The top of each stringer shall be positively attached ***(THIS REQUIRES LAG BOLTS, CARRIAGE BOLTS, OR BRACKETS DESIGNED FOR THAT PURPOSE)*** to a backer or rim joist and then supported by Simpson LS70 gusset brackets or their equivalent on one side of each stringer. An alternate method would be to use sloped hangers.

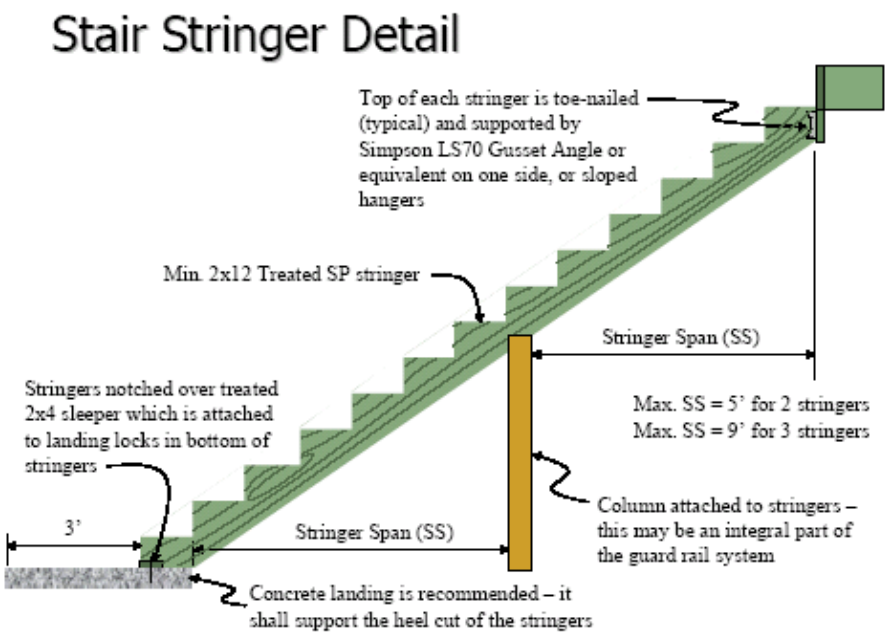

Figure 22

The bottom of these stringers shall rest on a landing. The landing must be concrete. The bottom of the stringers shall be solidly attached to the concrete by attaching a sleeper, direct attachment to the landing, or using metal angle brackets.

The stringers also have a certain span capability. When using 2 stringers to support the stairway, the maximum span for the stringers is 5 feet. When using 3 stringers, the maximum span is increased to 9 feet. The span is measured horizontally from point of support to point of support. See Figure 22.

Spacing the stringers in either manner meets the 300 pound concentrated load requirement on the treads. If the same material that is being used for the decking is going to be used for the stair treads, see Table 1 for span capabilities.

Part 8: *Guards*

For safety reasons, guardrails are required when the deck floor is more than 30 inches above another floor or the grade below. The guardrail shall not be less than 36 inches in height. Open sides of stairs with a total rise of more than 30 inches above the floor or grade below shall have guards not less than 34 inches in height measured vertically from the nosing of the treads.

The perimeter support posts can be incorporated into the railing of the deck. The posts extend from the footings to the top rail cap. The triangular opening formed by the riser, tread and bottom rail of the guard at the open sides of a stairway is permitted to be of such a size that a 6 inch sphere cannot pass through. Balusters or ornamental closures that do not allow a 4-inch diameter sphere to pass through are used to fill in between the posts. These balusters in combination with the cap rail and bottom rail transfer the loads to the posts. In order to do this successfully, the main railing posts should be spaced approximately 6 feet apart. The advantage of this design is that the full length of the post resists the rail load.

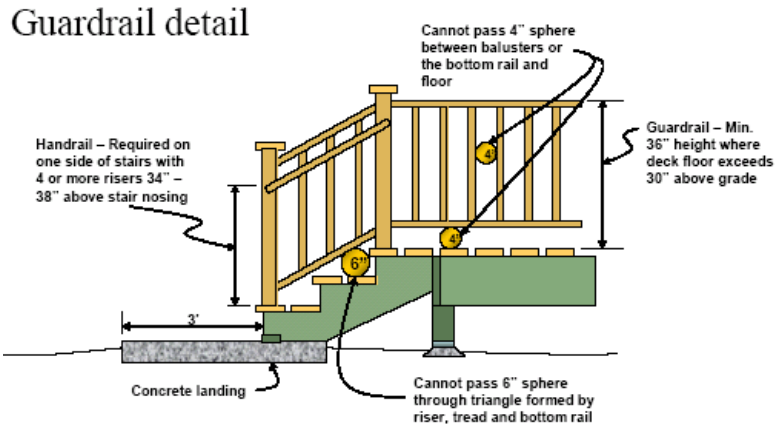

Figure 17

Guardrails and handrails shall be designed to support a single 200-pound concentrated load applied in any direction at any point along the top. This is to resist the loads of people leaning on or running into it.

The guardrail in-fill components, which consist of the balusters or panel fillers, shall be designed to withstand a horizontally applied load of 50 pounds distributed over a 1 square foot area.

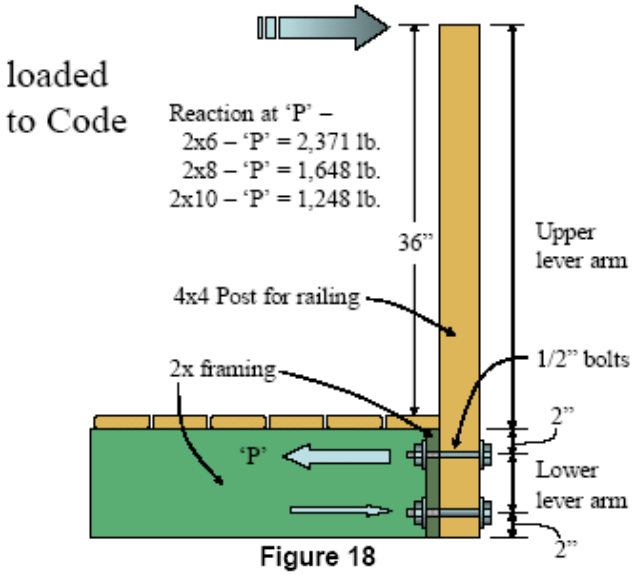

Figure 18

When the guardrail posts are not part the support post system, they must be attached so they can withstand the prescribed loads without twisting the rim joist. It is therefore necessary to be sure the rim joist is blocked so it cannot rotate. Lag screws into the ends of the perpendicular joists or blocking are the proper connectors for this purpose. Nails into the end grain of the framing lumber will simply withdraw allowing the rim joist to twist. Figure 18 shows the reaction load that is imposed on the top bolt in various size rim joists when the code prescribed load is applied.

Figure 19 shows a plan view of the connection details for attaching the railing posts to the rim joist and the rim joist to the deck joists. Two lag screws in the deck joists or blocks on each side of the post are necessary to prevent the rim from rotating unless the post is blocked from behind and lagged to a joist perpendicular to the rim joist. Use 1/2-inch diameter bolts when attaching 4x4 railing posts to the rim joist so it cannot work loose over time. This is especially true when the posts are being attached to the outside edge of the rim.

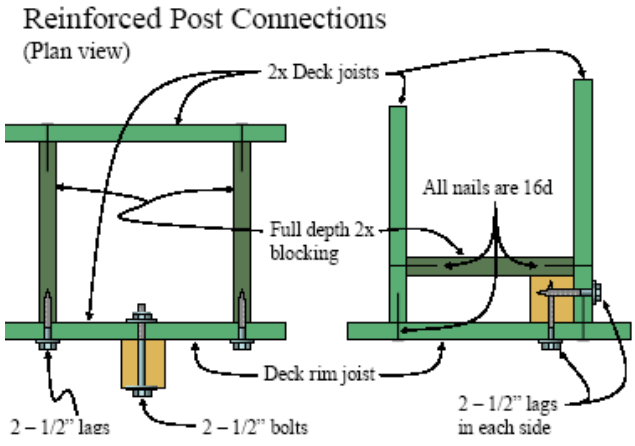

Figure 19

Part 9: *Handrails*

Handrails are required on stairs with four or more risers. The handrail shall be continuous the full length of the stairs and shall start at a point directly above the top riser of the flight and continue to a point directly above the lowest riser in the flight. The ends of the handrail shall be returned to the posts at the top and bottom of the stairs.

The handrail shall be between 34 and 38 inches above the nosing of the treads and shall be provided on at least one side of the stairway. There shall be a minimum clearance of 1-½ inches between the handrail and adjacent framing. Type I handrails shall have a circular cross-section with an outside diameter of at least 1-1/4 inches but not greater than 2 inches. If the handrail is not circular it shall have a perimeter diameter of at least 4 inches and not greater than 6-1/4 inches with a maximum cross section of 2-1/4 inches. This means 2x2 lumber with eased edges will meet the requirements of the code.

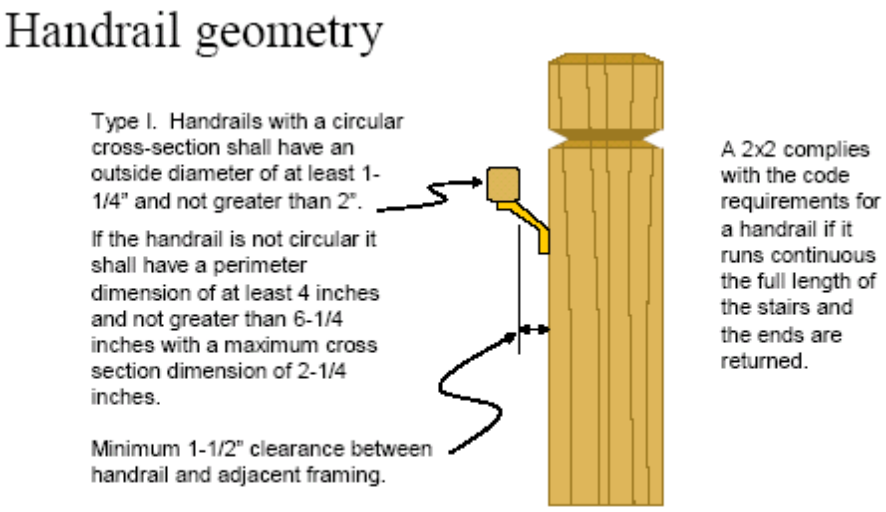

Figure 23

Handrails must be sanded and finished to prevent splinters. A 2x6 may be used for a handrail if grooves are routed out on both sides and the graspable portion forms a comfortable and usable handrail.

Part 10: *Inspections*

Inspections are an important part of the process. These inspections are performed as a service to the homeowner and are required for all decks. Inspections take place as various phases of construction progress.

Footing or pier inspections are required before the concrete is placed. ***Remember that concrete manufacturers do not approve dry set concrete.*** The concrete needs to be properly mixed with the prescribed amount of water prior to placing in order for it to work properly and to meet code.

A framing (rough-in) inspection is required if the under-floor framing and connections cannot be easily inspected during the final inspection. A final inspection is required after all the work is complete.

When an inspection is needed, call 24 hours in advance to schedule a time for the inspector to inspect the project. Someone is required to be present for the inspection. You can call the Building Code Division if you have additional questions. The contact information follows:

City of Maryland Heights
11911 Dorsett Road
Maryland Heights, MO 63043
Telephone: 314.291.6550

Part 11:
Plot Plan

Plan