Residential Decks

Permit and Construction Guidelines

 Builders and homeowners are required to obtain a permit prior to constructing, altering or replacing a deck.

Plan Submittals

The following information shall be submitted to the building department for their review in order to obtain a deck permit. All the information shown on the sample documents should be contained in all plan submittals. Additional information may be necessary. Plan review fees and permit fees will vary from one jurisdiction to another.

The first requirement is submission 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.

**Site Plan**

![Site Plan Diagram]

Figure 1

All the dimensions shall be shown on the Site Plan. The distance to property lines and setback requirements. The Site Plan may be drawn by the builder or the homeowner and does not have to be scaled by a design professional.
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 joints, beams, posts, decks, and connections in the beams. The information contained in this document should be considered a complete code requirement.

A variety of decking materials may be used for the flooring and railings. Please specify the type and style of material.
and the forging direction, such as 7/8 Radius Edge Decking running at a 45 degree angle to the floor joists. This is important because certain products like Radius Edge Decking have limited span capacities as shown in Table 1.

The deck must be constructed of either a naturally decay-resistant lumber or a preservative-treated lumber (AC2) and be designed to support a live load of 40 psf. All overhangs over the water must be located at least 10 feet from the dock line so that there is no horizontal play from the dock line. Safety rails are not required for the dock and lighting on the pier is required.

Columns and Piers

The size of the wood columns and concrete piers that are required to support a dock is based on the square footage of the deck by multiplying it by the column and pier. This square footage can be determined by using Figure 7 as an example. A column or pier supports an area of deck that is halfway to the next support in each direction. The distance is considered a support. In Figure 7, the interior piers support the live and dead going back to the house and half the pier supports the dead but not the live. The interior piers support 9 feet of the span in each direction. They remain the interior post and pier are carrying a total of 5 feet parallel to the pier.

**Figure 8**

A diagram illustrating the distribution of loads on the piers and columns. The loads are distributed such that the interior piers support 9 feet of the span in each direction, reducing the load on the exterior piers. This ensures the safety and stability of the dock.

**Tributary load area for posts**

We then determine the distance between posts and piers parallel to the house. Since the posts are 10 feet apart in the diagram, the interior post and pier supports 5 feet each direction for a total of 10 feet along the length of the beam. These two dimensions then give us an area of...
8 square feet of deck supported by the corner post. The perimeter posts carry half the area of the interior post supports, as well as the corner post. Now the size of the column and the pier can be determined using Tables 2 and 3.

Table 2 on the right shows the size of post that is required to support the maximum load placed on the deck. The maximum post height is measured from the top of the concrete pier to the bottom of the heads of the post supports. This same post may come in contact with or be abutted on top to provide support for the girders. The post shown is the minimum height of the maximum post height.

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 minimum height of your particular solution.

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 unservicable. To use Table 3, select the square footage of deck supported by the pier. This is the same as in the previous table. Then choose the largest pier size best suited for your application and the area of the pier required. Remember that all pier are to be a minimum of 25 inches deep or an inch below the frost line. At least 1 inch of the pier should be elevated above grade with the top sloped for drainage.

Each pier can be chosen individually, based on the square footage of deck supported by each pier. Each pier can then be sized according to a different diameter bolt. An easier way to do this is to determine the largest diameter bolts required and make all the holes that size. This method is faster, however, requires more concrete. Which ever way it is done, this information must be shown on the Creek Plans.

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. The means a column anchor must be used to attach the post to the pier. A "drill pit" simply drilled into the bottom of...
the post is not sufficient. The sample plus 10% extra, A6867 is a Post Base or equivalent is being used as a base for the post to the pole. This means to specify some type of column section on the pole. Column sections are made to fit into the post and for the pole. Some column sections are designed to be set directly in the concrete when it is poured. Others can be driven into the concrete later so they can be placed exactly in the desired position. The concrete must be placed exactly where they need to go after the concrete has set up.

**Ladder to House Connection**

Dock ladders are usually supported on one side by a bracket attached to the house. The ladder attachment is required to ensure the deck is safely and securely supported at this point. When the ladder is attached to the house, there are very specific requirements that must be met. Follow the diagram closely for the proper attachment.

**Table 3**

<table>
<thead>
<tr>
<th>Post size based on deck area supported</th>
<th>6&quot;</th>
<th>8&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; post</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>8&quot; post</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>10&quot; post</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>12&quot; post</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>14&quot; post</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>16&quot; post</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1**

The deck ladder shall not be attached to the house. The ladder attachment shall be securely attached to the flooring of the structure and along the foundation wall. Use Table 4 to determine the proper attachment of the deck ladder to the side joint of the house.

**Required size and spacing of corrosion resistant lag screws for attaching dock ledger to house for a given joint span**

<table>
<thead>
<tr>
<th>Joint span (feet)</th>
<th>6.0 - 9.9</th>
<th>10.0 - 12.9</th>
<th>13.0 - 15.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lag size</td>
<td>3.2&quot;</td>
<td>3.2&quot;</td>
<td>3.2&quot;</td>
</tr>
<tr>
<td>Lag spacing</td>
<td>D = 4&quot;</td>
<td>D = 4&quot;</td>
<td>D = 4&quot;</td>
</tr>
</tbody>
</table>

**Table 4**

The size and spacing of the lag screws is based on their capacity. Lag screws shown are anodized in the 1/2" diameter, 1/2" for 12" lag screws and 3/8" for 3/8" lag screws. The span of the floor joists determines how much load is being transferred to the ledger and thus to the lag screws. Use Table 5 by picking a lag screw size and then find the span of the floor joists.
Under the gusset will be the required net center spacing of the lag screws. Since some lag screw spacing will coincide with the framing layout, an equal spacing is also provided that may be useful in lieu of the specified net center spacing where the gussets are being fastened.

Pilot holes shall be drilled for lag screws 1/2 inch or larger. The clearance hole for the shank shall have the same diameter as the shank. The head hole for the threaded portion shall have a diameter equal to 60% to 70% of the shank diameter. Pilot holes shall not be drilled for 5/8 inch lag screws. All holes and of the glulam shall be plugged with 1/2 inch by 1/2 inch by 1/2 inch fiber mats or 1 inch by 1 inch by 1 inch fiber mats. The fiber mats shall be placed at least 1 inch from the ends and edges of the glulam as shown in Figure 7. The use of lag screws, along with the other usual connections used to build a deck, brings us to a very important point. The use of proper locations and connections with treated lumber is critical to the overall performance of the structure. Standard carbon steel nails and fasteners will rust and corrode with time, causing weighty stress and possibly an eventual failure of the deck. Therefore, the lag screws securing the glulam and all other connections used to construct a deck must be treated wood galvanized or stainless steel. Ordinary carbon steel nails and fasteners shall not be used in deck construction. The use of stainless steel and carbon steel will cause the dehiscence and pitting of the wood. The use of treated wood galvanized or stainless steel will not.

Deck ledger attachment to house

Figure 5 describes the equivalent spacing of lag screws when units are spaced at 8" on center. The equivalent spacing described in Table 4 may be used in lieu of the 8" on center spacing needed.

Many individuals have attached ledgers directly against hardboard siding. This will fail by the eventual tearing of the siding and the ledger. Therefore, a ledger root board is required for all ledger boards which touch hardboard siding. This root board is treated and will not attract water and keep it from the ledger. The ledger root board is treated for resistance against wood decay and is fastened to the ledger.

Figure 8

The ledger root board is attached using 7 1/2" lag screws. The lag screw is driven 3 1/2" into the ledger. In the end, the ledger is secured to the plate.
to ascertain the house rim joint and extend at least 1/2" beyond. This means this connection requires a continuous 3" 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 joint of the house. This requires very close attention and details so water cannot get to the house rim and cause structural damage to it and possibly even the end of the floor joists. Figure 6 shows an improper flashing around at least 6 inches behind the siding with the top of the flashing extending beyond the rim joint beyond the edge of the ledger. To avoid this problem, the flashing must be galvanized steel and not aluminum. Horns or flutes for the ledger should be cut to create a drip edge to prevent water from finding the main structure of the house. Caulked with a mixture of steel wool and paint around the seams of the ledger.

The house rim joint must be securely anchored to the house framing and it must be sitting on the foundation wall. Ledgers should be anchored to the house framing and then to the foundation wall. This is an important point to understand. The ledger should be cut to fit the wall side and then to the bottom. The ledger should be cut to fit the wall side and then to the bottom. The ledger should be cut to fit the wall side and then to the bottom.

Figure 5

Lodger flashing

In order to attach a deck to a cantilevered portion of a house, it is required that the rim joint be able to carry the added load of the deck in addition to the weight of the house wall which is already sitting on it. Once the rim joint is fully nailed into the deck framing, it is necessary to ensure the connection is not sufficient to support the extra load imposed on it by the deck. This is especially true with wood joists which, by their natural tendency, will try to expand and cause damage to the rim and wood beams.
The first requirement for attaching a deck to a foundation is to ensure that the beam joints must be 2 x 6's or wood joists spaced at 16 inches on center. Each 2 x 6 joint must then be sealed with an additional 1 1/2 ft N. 4 x 5 1/2 lag screws with 3/16 inch washers at 16 inches on center staggered. Wood joints must also be sealed with 10 inch long wood sufficient sealed. The wood finisher shall be lined with 1 1/2 x 1/2 inch nails every 10 inches. The finished joint and the sealed joints will each be treated by an oil-based sealer. Solid planks between the 2 x 6 joints or wood joists shall be provided over the foundation wall.

The next thing that must be done is to bond the 2 x 6 joints in the finished floor joints with Simpson G350 galvanized angles or their equivalent. These angles are designed to transfer the load imposed on the ends by the deck beam into the finished floor. The finished floor joists shall be bonded with 3/16 inch nails, six nails into the deck and the other six into the bonded joints.

The maximum deck joint space for this application is 15 feet. A total of 10 inches is required for 1 1/2 inch kickers between each deck joint. If this is not possible, 18 inches on center. Figures 7 and 8 show elevations and plan views detailing how a deck ledge shall be attached to a conditioned floor structure.

Framing around a chimney or bay window which extends beyond the exterior wall of the house may be accomplished by bonding across the chimney or bay window area with a double header attached to double trimmers. Bonding of these members is required when the header span is greater than 4 feet. The double joint and header shall be of sufficient cross section to carry the sill joist framing into the header.
The bearer shall be supported on each end by a double joint bearing where the bearer span exceeds 8 ft. Tied joists over 12 ft long shall be supported at the bearer by joint bearings. A space shall be provided between the double framing members and the bearer to allow for water drainage and air circulation.

**Joint and Beam Spans**

There are four main types of beam span capacities based on the size, grade, spacing, and grouting of the material used for the piers or beams and the loads that are imposed on them. Deck splices are required in the design for 40 piers per square mile. For framing over 40 piers per square mile, a minimum joint material and joint bearing beam is No. 4 and below, matched to match the beam. The main splices are made at the ends of the beams. There are two sets of splices for the framing beam. These are both 28 in. on the side of the beam to one. The main service capacity is the capacity of the beam for applications where the load is going to be carried by the beam, and not by the piers. This is usually determined by the piers and the beam to one. The main service capacity is the capacity of the beam for applications where the load is going to be carried by the beam to one. The main service capacity is the capacity of the beam to one. The main service capacity is the capacity of the beam to one.

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Splice Type</th>
<th>Capacity</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td>28 in.</td>
<td>40 piers</td>
<td>No. 4</td>
</tr>
<tr>
<td>No. 2</td>
<td>28 in.</td>
<td>40 piers</td>
<td>No. 4</td>
</tr>
<tr>
<td>No. 3</td>
<td>28 in.</td>
<td>40 piers</td>
<td>No. 4</td>
</tr>
<tr>
<td>No. 4</td>
<td>28 in.</td>
<td>40 piers</td>
<td>No. 4</td>
</tr>
</tbody>
</table>

**Joint Span Measurement and Beam to Pier Connection**

![Joint Span Measurement](image)

Figure 10

Remember that the ends of the joints will need to be properly supported. If they are running between the ledger and a beam, they will need joint bearings on both sides.
Measuring a beam span

Diagram showing measurement of beam span with a tape measure.

Note that beam spans are measured differently than joint spans. A beam span is measured from the center of support to the center of support. Also note that a beam must only be loaded to half of its span beyond the support. If the beam is not loaded into the joint from the structural performance of the connection is limited in the capacity of the joint. The beam span should be designed to be no more than 2 feet beyond the support.

But, since this type of connection is generally used,Tabber (not to be!)

Beams-to-purlin connection

Diagram showing beam connection to purlin with bolts.

If you select the correct size bolts the load can be carried.
Cantilevered Decks

It is often desirable to cantilever a deck for esthetical or functional reasons. Certain considerations must be taken into account when using a cantilever. Cantilevered decks must be designed and constructed to resist the additional bending stresses and shear forces that are present.

Cantilevered decks must be designed and constructed to resist the additional bending stresses and shear forces that are present. The cantilevered portion of the deck must be a minimum of twice the cantilever distance.

Cantilevered Connections

A concentrated load at the end of the deck has the effect of producing uplift on the joint at the cantilevered portion of the deck. When a deck is cantilevered, the connections to the exterior wall of the house or other framing member such as a beam shall be designed and constructed to resist the additional forces. Where cantilevered portion of the deck is supported on the cantilevered portion of the beam, one way of resisting these loads is with a steel flared block at each end to prevent uplift.

The beams in Figures 15 and 16 are notched into adjacent sides of a bolt post. Due to the separation of the two members this makes up the beam, solid blocking must be placed.
Guardrails

The common safety measures, guardrails are required when the deck floor is over 10 inches above another floor or the ground below. The guardrail shall not be less than 30 inches in height, measured vertically from the crest of the tread.

The guardrail support posts can be incorporated into the railing of the deck. The posts extend from the flooring to the top red cap. Guardrails are mandated to have extensions that do not allow a 4-inch diameter sphere to pass through any opening 6-in between the posts. These behaviors in combination with the cap of the extension reduce the hands in the joints. In order to do this, the tops of the guardrail support posts should be capped approximately 6-in apart. The advantage of this design is that the fall length of the post restricts the red cap.

Guardrails and handrails shall be designed to support a single 300-pound concentrated load applied in any direction at any point along the top. They are to be semi-fixed at the support and securely fastened in the foundation. The span of a straight run shall be no greater than 8'.

Figure 9. The guardrail is 6-in components which consist of the following: 1/2 inch rebar, 3' long, and 1 1/2' high. The handrail shall be designed to withstand a horizontally applied load of 300 pounds distributed over a 1 square foot area.

When guardrail posts are not a continuous part of the support post system, they must be attached to the guardrail and the handrail itself. Frame the deck love at a minimum of 1 1/2' high. The post will be fixed to the beam at the bottom and will rotate at the top. This post is the most critical of the system. The post shall be fixed to the beam at the bottom and the handrail shall rotate into the joint when the code permitted load is applied.

Figure 9.

Figure 10.
Figure 19 shows a side view of the connection details for attaching the railing posts to the riser and to the deck posts. Two lag screws in the deck frame block on each side of the post are necessary to prevent the post from rotating unless the post is blocked in from below and lagged in a joint perpendicular to the riser joint. Use 12-inch diameter bolts when attaching hook plates to the deck frame block. The bolts work loose over time. This is especially true when the posts are being attached to the outside edge of the rim.

The triangular opening formed by the floor, rim, and backrest of the guard at the bottom of the post should be at least 0.75 inch wide at the bottom of each side so that 0.75-inch diameter spacers cannot pass through.

Stairs

Stairs shall be a minimum width of 36 inches. The maximum run height shall be 7.54 inches and the minimum tread depth shall be 18 inches as measured in Figure 21. Open stairs are permitted between the levels of the building, but tread areas shall allow the passage of a 4-inch diameter sphere. The spacing between adjacent treads is not limited as long as a 3-inch diameter sphere cannot pass within any flight of stairs shall not exceed the smaller by more than 3 inches.

Figure 21

There shall be a minimum of two handrails where the opening between them is 20 inches. This requires the handrail to overlap 1 inch beyond each opening. These handrails may be used in combination with the handrail guard. Stairs shall be at least 36 inches wide with a minimum of 18 inches of open space between the levels of the building. New treads are suggested on the ends and in the center. This provides a stronger set of stairs and allows us to meet the concentrated load requirements.
The stair stringers shall be 2x12, No. 3, treated southern pine. They must not be over nailed when nailing to the riser and run. The nail in these connections must be in the middle; common nails and split rivets will weaken the stringers. The top of each stringer shall be toenailed to a header or core joint and then supported by Simpson 1917C joist hanger nailed diagonally to one side of each stringer. An alternate method would be to use clipped hangers.

The bottoms of these stringers shall rest on a landing. It is recommended that the landing be concrete. The bottoms of the stringers shall be spaced over a turned 2x4 sleeper which shall be attached to the landing or the stringers could be nailed or they would be held in by the concrete landing itself. Either way effectively holds the stringers in place so they remain stable.

The stringers also have a certain span capability. When using 2 stringers to support the overhead, 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 the point of support to points of support, see the diagram on the left.

Spacing the stringers in either manner means the 300 pound concentrated load requirement on the header. If the same material of heavy grade steel is being used for the header it is going to be used for the stair tread, see Table 1 for span capabilities.

Handrails

Handrails are required on stairs with four or more runs. The handrail shall be continuous for the full length of the stairs and shall start at a level directly above the top step of the flight and continue to extend directly above the second floor where recommended. The handrail shall be returned to the points of the top and bottom of the stairs.

Handrail geometry
The handrail shall be between 34 inches and 38 inches above the center of the treads and shall be provided on at least one side of the outlet. There shall be a minimum clearance of 1/2 inch between the handrail and adjacent framing. Two 1/4-inch diameter holes for the handrail shall be provided at a vertical distance not greater than 2 inches from the floor. If the handrail is not circular, it shall have a minimum diameter of at least 1-1/4 inches and not greater than 1-1/4 inches with a minimum cross-section of 1-1/4 inches. This means that handrail with round edges will meet the requirements of the code.

Inspections

Inspections are another part of the process. These inspections are done as a service to the homeowner and are required for all permits. Inspections should take place when various phases of the construction are completed. Where a dock is close to the ground to verify the connection between the dock and the house at the time of the inspection, then the dock shall be self-supporting.

Footing or pier base inspections may be required before the concrete is poured. Remember that the concrete is not expected to react with the soil. The concrete must be self-supporting before it is poured. The inspector must ensure that the concrete is poured properly and to meet code.

A separate footing (rough-cast) inspection may be required if the deck floor framing and connections cannot be easily inspected during the final inspection. A final inspection is required after all the work is complete.

When scheduling an inspection, try to allow 24 hours in advance to set up times for the inspector to make his visits. The builder or homeowner is not required to be present for the inspections but they are welcomed to be there if they would like to be.