



Department of Building, Zoning & Housing  
26789 Highland Road  
Richmond Heights, Ohio 44143-1429  
216-383-6312 Fax: 216-383-6319  
[www.richmondheightsohio.org](http://www.richmondheightsohio.org)

## **RESIDENTIAL DECK REQUIREMENTS**

**Use this checklist when submitting your permit application for your deck. This will help you avoid potentially costly repairs and re-inspection fees. Please note that this list is not intended to include every possible violation but will include the most common deck violations.**

**Your Permit Application Must Include All of the Documents Listed Below**

**1.  Permit Application**

- a. A permit application must include all of the following listed below

**2.  Site Plan**

- a. Submit two copies of your site plan including the new deck

**3.  Construction Drawing Requirements**

- a. Two sets of framing plans showing the exact size of the deck
- b. Height of the deck above the final grade.
- c. Footing size and thickness / diameter
- d. Post location, lumber species, span, and spacing
- e. Decking material, size, span and direction
- f. Connection to home band board. When the deck is directly connected to a home you must include a code compliant connection detail along with a flashing detail.
- g. Beam connections: post to beam connections and beam to joist connections.
- h. A code compliant guard rail and a code compliant handrail.
- i. Stair detail

**4.  Specifications Identified On Drawings**

- a. Identify pressure treated or naturally decay resistant wood.
- b. Size and spacing of floor joist
- c. Beam size and spacing
- d. Types of hangers
- e. How high is the proposed deck from the intended final grade?
- f. A vapor barrier to control the growth of grass and weeds 6 mill covered with gravel
- g. Use only approved hot dipped galvanized or stainless steel nails, bolts or lags

**5.  Sample Plans**

- a. Deck framing plan
- b. Deck plan
- c. Detail guard rail and footing plans

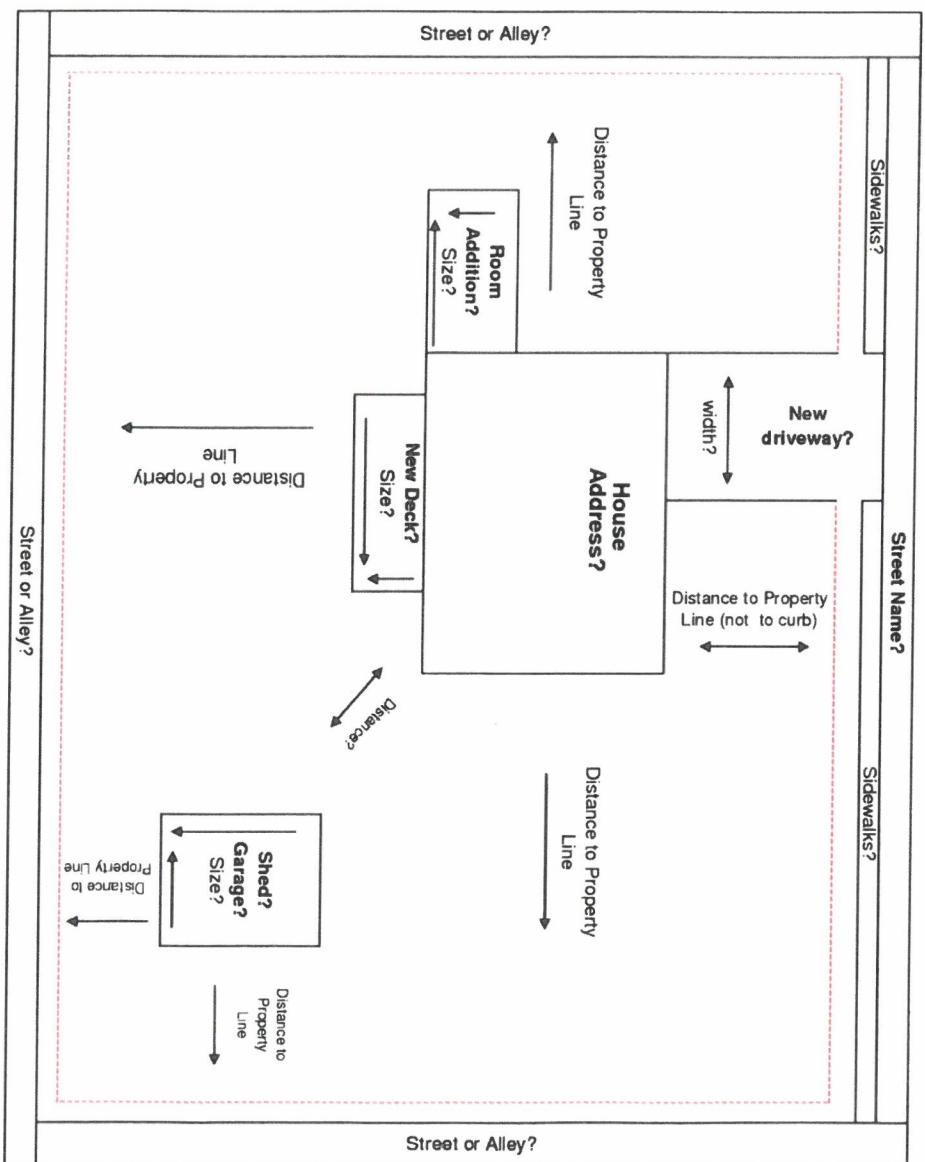
## 1. Permit Application

- Complete a permit application on-line or available at the City of Richmond Heights Building Department [www.richmondheightsohio.org](http://www.richmondheightsohio.org) . Click on the building department tab, and then click on the Residential Permit Application.

## 2. Site Plan

- Submit 2 site plans, showing all property lines, setback lines. The site plan is a bird's eye view of your property showing the location of your house, garage and other accessory structures. The site plan will show the intended improvement with dimensions.

### Sample Site Plan

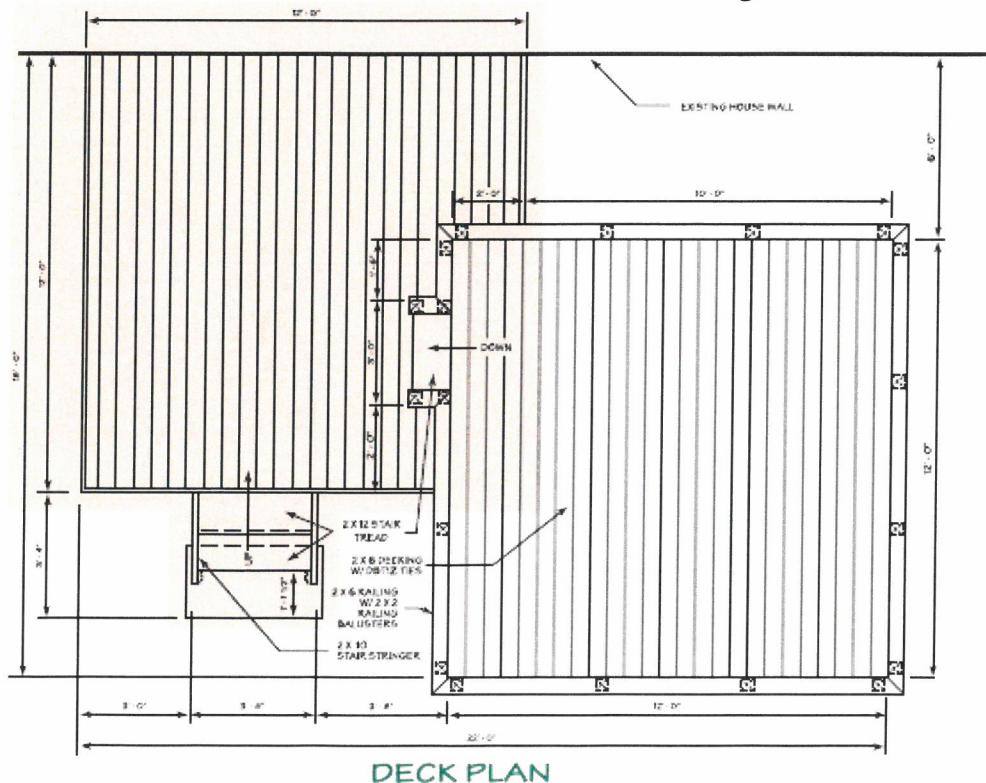


## How to Draw a Basic Site Plan

### 3. Construction Drawings

- a. **R106.3.1:** Two or more copies of the construction drawings. Construction drawing should be clearly written and complete to indicate the location, nature and extent of the work proposed.
- b. **R106.3.1: Framing Plan**, showing the joist and beam layout, the location of the ledger board (See Page 7, figure 14), posts, and footings, and the type, size, and spacing of the ledger board fasteners. *for an example of a typical deck framing plan.*
- c. **R312.1: Height of the deck from grade** Show the height of the deck from the surrounding grade. This will determine whether or not a handrail is required for the stairs. This will also determine if a guard rail is required for the deck.
- d. **R312.1: Example-1**, A deck with a height greater than or equal to 30" will require a guard rail. A code compliant guard rail detail should be on the construction drawings.  
**See Pages 8 & 9**
- e. **R311.7.7: Example-2**, Stairs leading to the deck with 4 or more risers are required to have a handrail on least one side of the stairs. A code compliant handrail detail should be on the construction drawings.  
**See Pages 8 & 9**

**Figure 5**



#### 4. Deck Joist Spacing and Beam Spacing

- Deck and joist beam spans shall comply with table 2 below; these are the maximum allowable spans for deck beams.
- Clearly indicate all joist and beam sizes

**Example:** A 4"x6" beam size, less than or equal to a 8ft in length would have a maximum allowable span of 5ft-6" (See Table 2 Deck Beam Spans)

**Table 2. Deck Beam Spans (L<sub>b</sub>)<sup>1</sup>**

Species	Size <sup>4</sup>	Joist Spans (L <sub>j</sub> ) Less Than or Equal to:						
		6'	8'	10'	12'	14'	16'	18'
Douglas Fir-Larch <sup>2</sup> , Hem-Fir <sup>2</sup> , SPF <sup>2</sup> , Redwood, Western Cedars, Ponderosa Pine <sup>3</sup> , Red Pine <sup>3</sup>	3x6 or 2-2x6	5'-5"	4'-8"	4'-2"	3'-10"	3'-6"	3'-1	2'-9"
	3x8 or 2-2x8	6'-10"	5'-11"	5'-4"	4'-10"	4'-6"	4'-1"	3'-8"
	3x10 or 2-2x10	8'-4"	7'-3"	6'-6"	5'-11"	5'-6"	5'-1"	4'-8"
	3x12 or 2-2x12	9'-8"	8'-5"	7'-6"	6'-10"	6'-4"	5'-11"	5'-7"
	4x6	6'-5"	5'-6"	4'-11"	4'-6"	4'-2"	3'-11"	3'-8"
	4x8	8'-5"	7'-3"	6'-6"	5'-11"	5'-6"	5'-2"	4'
	4x10	9'-11"	8'-7"	7'-8"	7'-0"	6'-6"	6'-1"	
	4x12	11'-5"	9'-11"	8'-10"	8'-1"	7'-6"	7'-0"	
	3-2x6	7'-4"	6'-8"	6'-0"	5'-6"	5'-1"	4'-9"	
	3-2x8	9'-8"	8'-6"	7'-7"	6'-11"	6'-5"	6'-0"	
	3-2x10	12'-0"	10'-5"	9'-4"	8'-6"	7'-10"	7'-4"	6'-11"
	3-2x12	13'-11"	12'-1"	10'-9"	9'-10"	9'-1"	8'-6"	8'-1"

1. Assumes 40 psf live load, 10 psf dead load, L/360 simple span beam deflection limit, L/180 cantilever deflection limit, No. 2 grade, and wet service conditions.

2. Incising assumed for refractory species including Douglas fir-larch, hem-fir, and spruce-pine-fir.

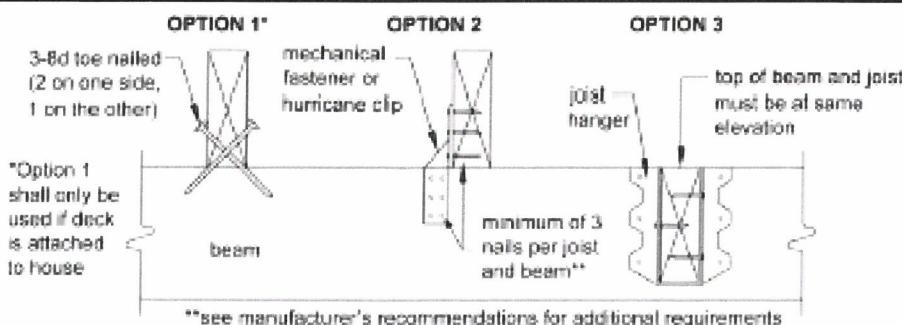
3. Design values based on northern species with no incising assumed.

4. Beam depth must be equal to or greater than joist depth if joist hangers are used (see Figure 6, Option 3).

#### JOIST-TO BEAM CONNECTIONS

Each joist shall be attached to the beam as shown in Figure 6. Joists may bear on and overhang past the beam a maximum of L/4. Use Option 1 or Option 2 to attach the joist to the beam. Option 1 shall only be used if the deck is attached to the house with a ledger.

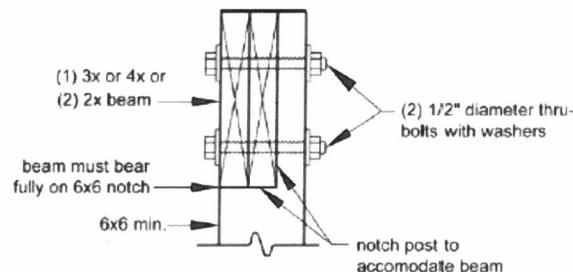
**Figure 6: Joist-to-Beam Detail**



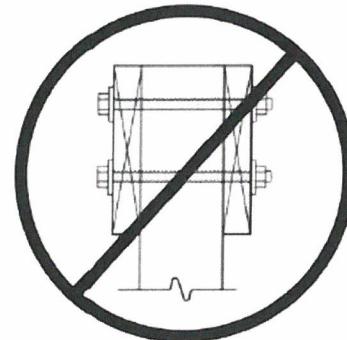
## 5. Bearing of Beams and Joists

- a. **R502.6 Bearing:** The ends of each joist, beam or girder shall have not less than 1.5 inches of bearing on wood or metal and not less than 3 inches on masonry or concrete except where supported on a 1-inch-by-4-inch ribbon strip and nailed to the adjacent stud or by the use of approved
- b. See the details below, for the most common approved post to beam connections and one beam connection that is not approved.

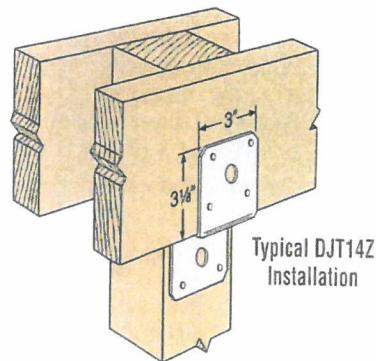
**Figure 8. Post-to-Beam Attachment Requirements**



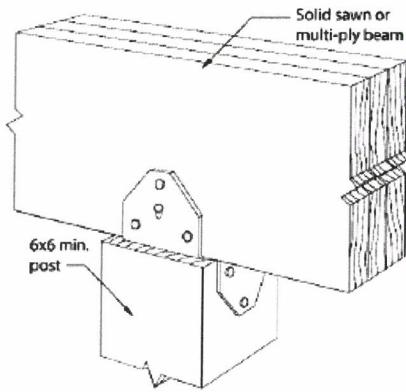
**Figure 9. Prohibited Post-to-Beam Attachment Condition**



**Simpson DJT14: Connects beams at the side of the post**



**Figure 10. Alternate Approved Post-to-Beam Post Cap Attachment**



## 6. Footing Size Thickness / Diameter

- f. **Typical Footings:** a detail drawing of the required footing shall be on the construction drawings; this is done by using a separate detail drawing of the footings.
- g. **Figure 10** shows a typical drawing of a deck footing.
- h. **R403.5 Exterior Deck Footings:** To calculate your footing sizes use Table 404.5 to determine the minimum footer size based the tributary area the footing would support.

**Example:** If your footings would support a tributary area of 35 square feet a 13x13 square footing is required or 14 inch diameter footer would be required.

TABLE 4

Minimum footing size for deck footings without roof loads		
EXTERIOR DECK AND PORCH FOOTING SIZE IN INCHES <sup>a,b</sup>		
Diameter	Square	Maximum Tributary Area Per Post (square feet)
8	8 x 8	14
10	9 x 9	22
12	11 x 11	31.6
14	13 x 13	42.8
16	15 x 15	56
18	16 x 16	70.8
20	18 x 18	87.2

**RECOMMENDED POST SIZES REGARDLESS OF THE TRIBUTARY AREA**

Diagonal bracing is recommended for all decks that are 24 inches or greater above grade

4x4 post shall not exceed 48 inches above grade

4x6 post shall be used for deck heights from 48 inches to 72" above grade.

6x6 post shall be used for deck heights from 72" to 96" above grade.

Post sizes for decks above 96 inches in height require and engineers design.

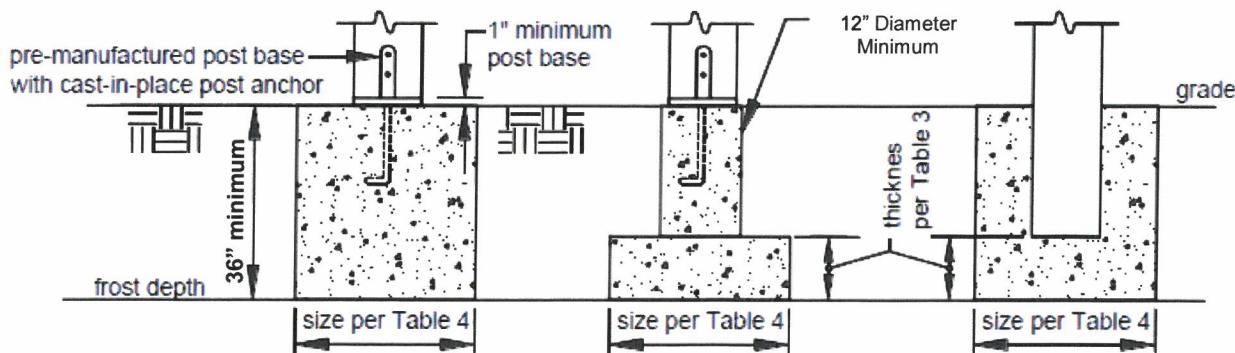


FIGURE 10: FOOTINGS

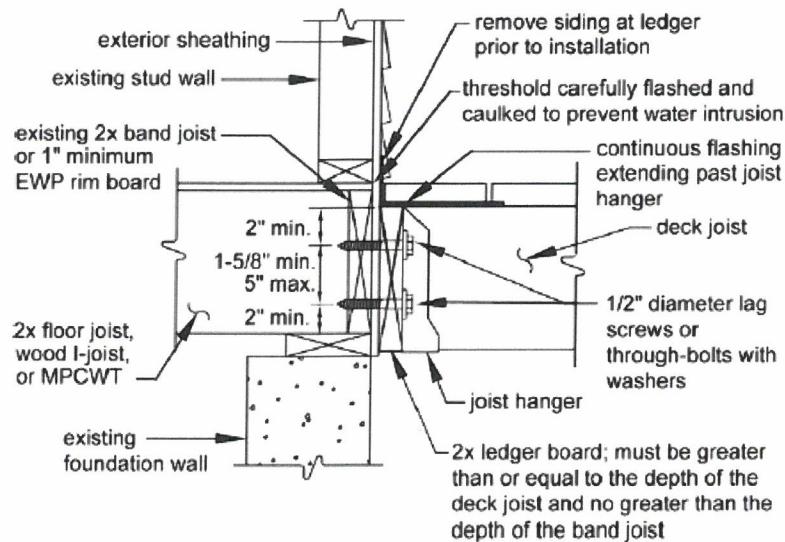
7. **Connection To The Home ledger Board Detail (See Figure 14 General Attachment of Ledger)**

- a. **R502.2.2.1: Deck Ledger Connection to Band Joist:** a detail drawing of the connection to the home is required on the construction drawings. ( See Figure 14)
- b. **R502.2.2.1.1: Placement of lag screws or bolts in deck ledgers:** The lag screw or bolts shall be placed 2 inches in from the bottom or top of the deck ledgers and between 2 and 5" in from the ends. The lag bolts shall be staggered from the top to the bottom along the horizontal run of the deck ledger.

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**Figure 14. General Attachment of Ledger Board to Band Joist or Rim Board**

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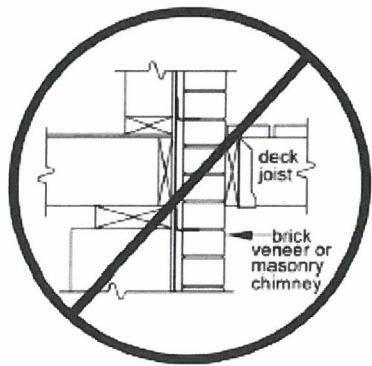


**Prohibited Ledger Attachment's**

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**Figure 17: No Attachment to or Through Exterior Veneers (Brick, Masonry, Stone)**

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**Figure 18: No Attachment to House Overhang**

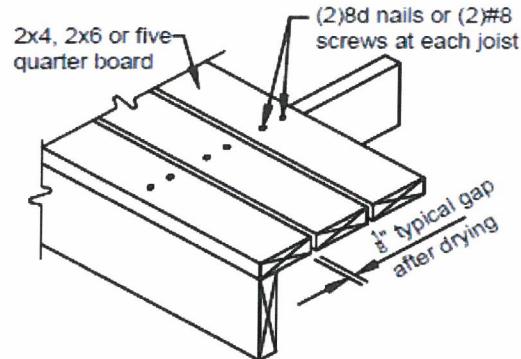
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## 8. Decking Material Size

**Approved Material:** Wood or wood-plastic composite decking shall be installed in accordance with the requirement below.

- a. Decking shall be wood 2x4, 2x6, or five-quarter board (span rated) decking and wood-plastic composite sizes per manufacturer
- b. Wood decking may be placed at an angle of 45 to 90 degrees to the joists and attached per FIGURE 1. If wet, place decking with no gap so after drying a 1/8-inch gap is created
- c. Each wood decking member shall bear upon a minimum of three joists or intermediate blocking between joists.
- d. Wood-plastic composite's label and installation instructions must be made available to the inspector.

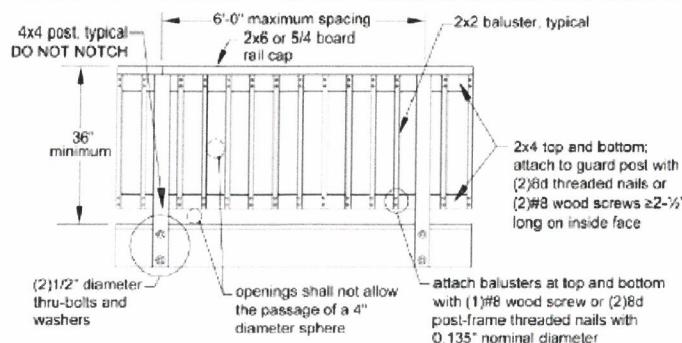


**FIGURE 1: TYPICAL DECKING**

## 9. A Code Compliant Guard Rail

- a. **R312.1:** All decks greater than 30 inches above grade are required to have an approved guard installed.
- b. **R312.2:** The height of the guard should not be less than 36 inches in height measured vertically from the top of the deck to the floor or final grade.
- c. **R301.7: Deflection.** To meet the minamum requirements of deflection in the Ohio Building Code, hold down anchors should be installed haveing a minimum allowable tension load of 1800 pounds for a 36 inch maximum guard rail height. **(See Guard Post to Outside Joist Example)**
- d. **R312.2:** Openings shall not allow the passage of a 4 inch diameter sphere to pass through the openings between the balusters.

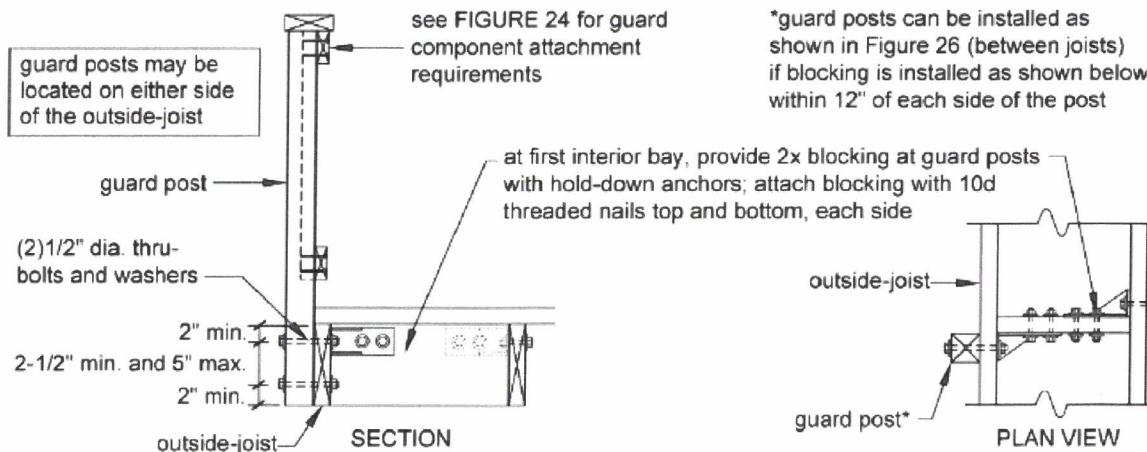
**Figure 24. Example Guard Detail**



## 10. Guard Post Attachments

- a. The most commonly used deck guard posts are minimum 4x4(nominal)
- b. **R301.7: Deflection:** To meet the minamum requirements of deflection in the Ohio Building Code, hold down anchors should be installed haveing a minimum allowable tension load of 1800 pounds for a 36 inch maximum guard rail height. **(See Guard Post to Outside Joist Example)**
- c. **R312.2:** Guard rail height shall be installed at a height of not less than 36" tall measured vertically above the adjacent walking surface, adjacent fixed seating or or the line connecting the leading edges of the treads.
- d. **R312.3 Opening Limitations:** Spaces between balasters shall be less than **4 inches.**
- e. **R312.3 Opening Limitations:** the triangular openings at the open side of a stair, formed by the riser, tread and bottom rail of a guard, shall not allow passage of a sphere **6 inches** in diameter

Figure 25. Guard Post to Outside Joist Example



# Tested Guardrail Post Connections for Residential Decks

Joseph R. Loferski, Dustin Albright, and Frank E. Woeste, P.E.

Table 1.—Summary of guardrail post-to-deck-connection testing results for four residential rail-post-assemblies involving PPT 2 by 8 No. 2 southern pine joists and 4 by 4 No. 2 southern pine posts.

Guardrail post-to-deck connection assembly	Average test load (lb)	Average deflection at 200 lb (in.)	Average test load <sup>a</sup> as percent of 500 lb (%)	Meet building code test criteria?
1/2-inch lag screws	178	na	35	No
1/2-inch bolts	237	4.4	47	No
HD2A anchor (4 by 4 post inside band)	645	2.0	129	Yes
HD2A anchor (4 by 4 post outside band)	686	1.9	137	Yes

<sup>a</sup> The average test load for an assembly as a percent of the 500-pound test load requirement must be greater than 100% to be considered a "test proven assembly" by the authority having jurisdiction for an actual construction.

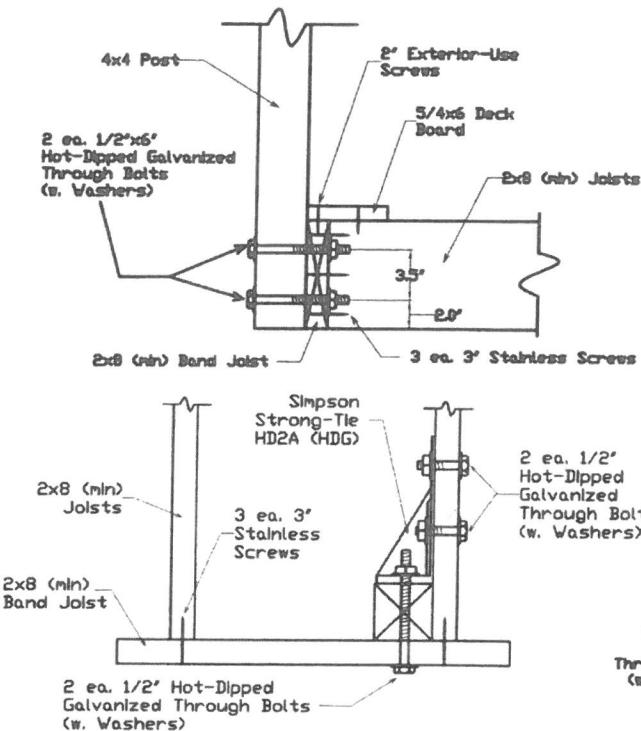


Figure 2.—This guardrail post detail "looks" very strong as it utilizes two 1/2- by 6-inch bolts, yet in a series of tests, the average failure load was only 47% of the test load requirement for a code-conforming design.

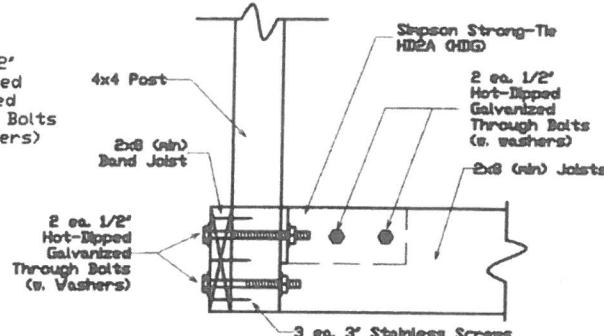


Figure 4.—Guardrail post test assembly details for 4 by 4 southern pine posts inside of band joist.

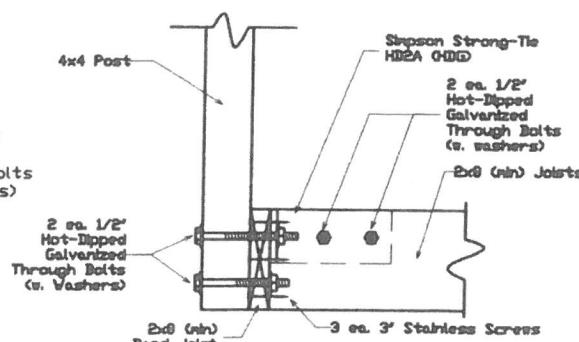
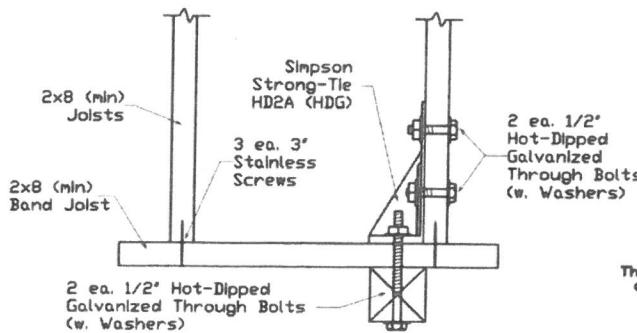


Figure 5.—Guardrail post test assembly details for 4 by 4 southern pine posts outside of band joist.

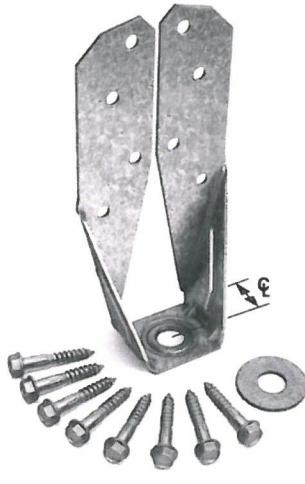
## TECHNICAL BULLETIN

### CODE-COMPLIANT GUARDRAIL POST CONNECTIONS

SIMPSON

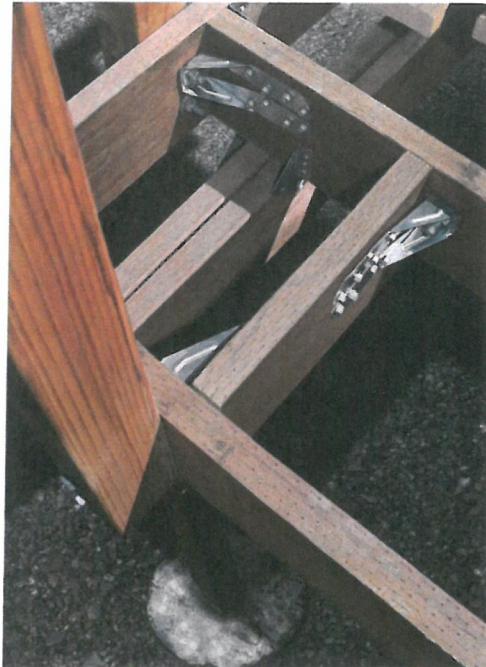
Strong-Tie

The railing connection is a crucial deck connection, and it is often inadequately constructed. In order to provide the required load resistance at the hand rail, the post must not only be fastened to the rim joist, but also be tied back into the joist framing. Machine bolts or lag screws through the post and rim joist alone do not typically meet the performance requirements of the building code.



DTT2Z  
(DTT2SS similar)

The details on page 2 show various methods by which the guardrail post connection can be made using either the Simpson Strong-Tie® DTT2 deck tension tie or HD2AHDG holdown. These details allow for a connection to the deck framing at the joists or blocking. All details meet the IRC code-required load at a maximum guardrail height of 36" above the deck surface in an outward direction.



The DTT2 deck tension tie was designed to satisfy code requirements for guardrail-post connections in wood decks. Versatile and cost-effective, the DTT2 installs using Simpson Strong-Tie® Strong-Drive® SDS screws which install with no pre-drilling and are included with each connector.

**Material / Finish:** DTT2Z – 14 ga. carbon steel with ZMAX® galvanized coating

DTT2SS- 14 ga. type 316 stainless steel

**Fasteners (Included):** DTT2Z – (8) Strong-Drive SDS screws, double-barrier coating

DTT2SS – (8) Strong-Drive SDS screws, type 316 stainless steel

#### Installation:

- Use all specified fasteners, refer to the General Notes in the current *Wood Construction Connectors* catalog for additional important information.
- The supplied cut washer must be installed between the nut and the seat
- SDS screws install best with a low-speed, high-torque drill with a  $\frac{3}{8}$ " hex driver

 This product is available with additional corrosion protection.

Model No.	$\frac{C}{4}$ (in)	Anchor Diameter (in)	Fasteners
DTT2 <sup>1</sup>	$1\frac{3}{16}$	$\frac{1}{2}$	8-SDS $\frac{1}{4}'' \times 1\frac{1}{2}''$

1. The information shown in this table is applicable to both the DTT2Z and DTT2SS.

The HD2AHDG has also been tested as a lateral anchor for the guardrail post and installs using  $\frac{5}{8}$ " diameter machine bolts.

**Finish:** Hot-dip galvanized

#### Installation:

- Use all specified fasteners, refer to the General Notes in the current *Wood Construction Connectors* catalog for additional important information.
- Bolt holes shall be a minimum of  $\frac{1}{32}$ " to a maximum of  $\frac{1}{16}$ " larger than the bolt diameter (per NDS section 11.1.2)
- A washer is not required between the base plate of the holdown and the anchor nut

Model No.	$\frac{C}{4}$ (in)	Anchor Diameter (in)	Machine Bolts
HD2AHDG	$1\frac{1}{8}$	$\frac{5}{8}$	2 $\frac{1}{8}$ " dia.



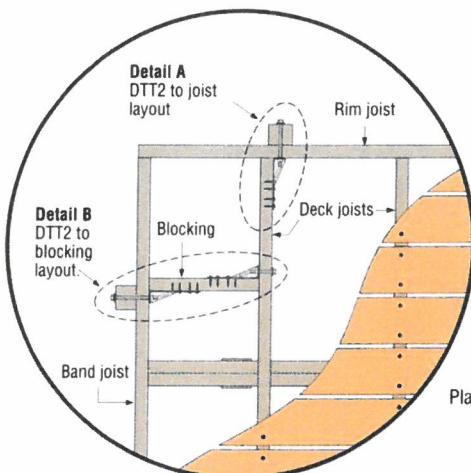
HD2AHDG

## TECHNICAL BULLETIN

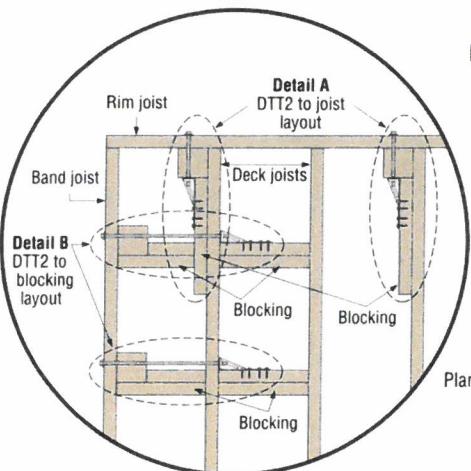
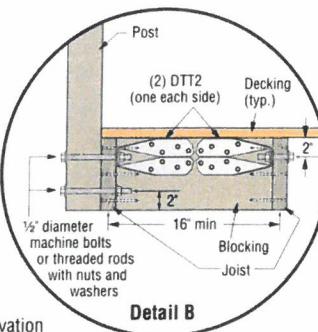
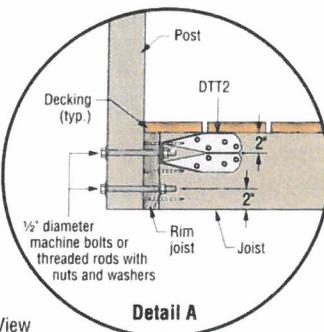
### CODE-COMPLIANT GUARDRAIL POST CONNECTIONS

SIMPSON

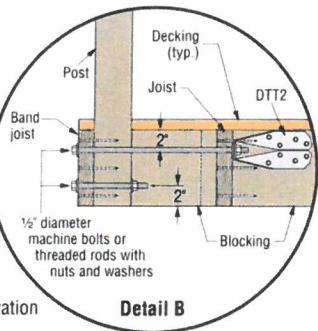
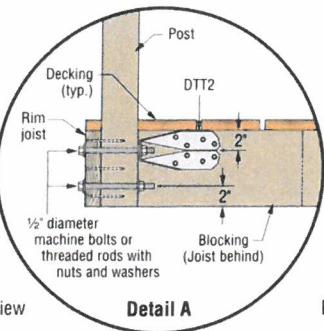
Strong-Tie



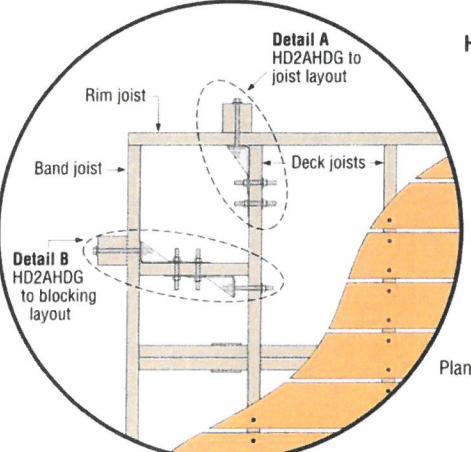
#### DTT2 Attachment of Guardrail Post *Outside Rim/Joist*



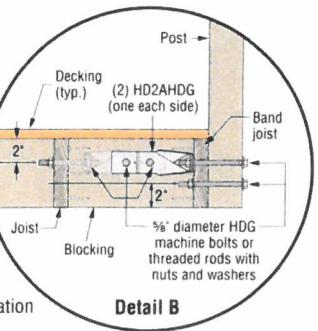
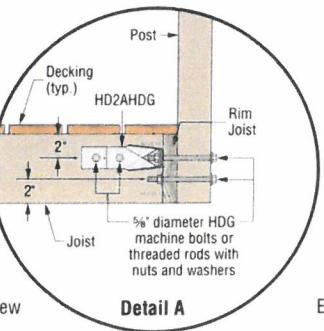
#### DTT2 Attachment of Guardrail Post *Inside Rim/Joist*



**Detail A:** Fasten blocking to joist with (24) 10d common nails (0.148" x 3")  
**Detail B:** Fasten blocking together with (12) 10d common nails (0.148" x 3")



#### HD2AHDG Attachment of Guardrail Post *Outside Rim/Joist*



When using ZMAX® or hot-dip galvanized connectors, use hot-dip galvanized fasteners that meet the specifications of ASTM A153. Simpson Strong-Tie® stainless-steel connectors are manufactured from type 316 stainless steel and therefore require type 316 stainless-steel fasteners.

All details assume the following:

- Maximum 36" guardrail height
- Minimum nominal 2x8 rim joist, joists and blocking
- Minimum nominal 4x4 guardrail post
- DF or SP framing lumber

## TECHNICAL BULLETIN

# CODE-COMPLIANT GUARDRAIL POST CONNECTIONS

**SIMPSON**  
**Strong-Tie**<sup>®</sup>

### Guards: What the Codes Require

The 2009 International Residential Code (IRC) and 2009 International Building Code (IBC) each have specific requirements for the design, construction, and use of guards. Some of these requirements are shown below.

### When is a guard required?

"Guards shall be located along open-sided walking surfaces, including stairs, ramps, and landings, that are located more than 30 inches measured vertically to the floor or grade below..."

*IRC 2009, Section R312.1*

"Guards shall be located along open-sided walking surfaces... that are located more than 30 inches measured vertically to the floor or grade below..."

*IBC 2009, Section 1013.1*

### If a guard is not required because the deck or porch is 30 inches or less above the floor or grade, does the guard have to be code compliant?

All guards must be designed and constructed in accordance with the governing building code, including guards that are not required. The general public expects all guards to perform and falls resulting from guard failures can cause serious injury regardless of the fall height.

### What is the guard height requirement?

In the IRC, "guards at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches high..."

*IRC 2009, Section R312.2*

In the IBC, "required guards shall be not less than 42 inches high..."

*IBC 2009, Section 1013.2*

### How much force must a guard be capable of resisting?

For one- and two- family dwellings, both the IRC and IBC require guards be designed to resist a single concentrated load of 200 lbs. applied in any direction at any point along the top.

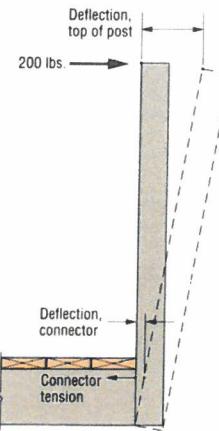
*IRC 2009, Table R301.5; IBC 2009, Section 1607.7*

### What is the allowable deflection of a fully loaded guard post?

The building codes do not contain deflection limits for guards however the *International Code Council Evaluation Service Acceptance Criteria 273 for Handrails and Guards* (AC273) places reasonable limits on tested assemblies. The maximum permissible deflection in AC273 for 36"-high guards is 3".

### How does load or deflection at the top of a guard post relate to a connector at the base of a guard post?

As a result of the large leverage arm of a guard post, the tension force in the post-to-deck connector will be much larger than the force at the top of the post. Similarly, any deflection at the post-to-deck connector will result in amplified deflection at the top of the post. For a 36" post connected to a 2x8 deck joist, a 200 lb. force at the top will result in about an 1,800 lb. force in a connector located 2" from the top of the joist. A 1/4" of deflection in this connector will result in over 2" of deflection at the top of the post.



### Do the Simpson Strong-Tie details address load applied in all directions?

The details in this technical bulletin address an outward force on the guardrail. An additional connector can be installed on the lower bolt to resist an inward force.

### Why have the code requirements changed?

The 200 lb. point load requirement in the code is not new. However there has been an increased focus on this requirement in recent years. Research and testing conducted at Virginia Tech on post-to-rim-joist connections indicated common bolted or lag screwed connections to a rim joist alone did not meet the load requirements in the code.

### Why the Simpson Strong-Tie® solution?

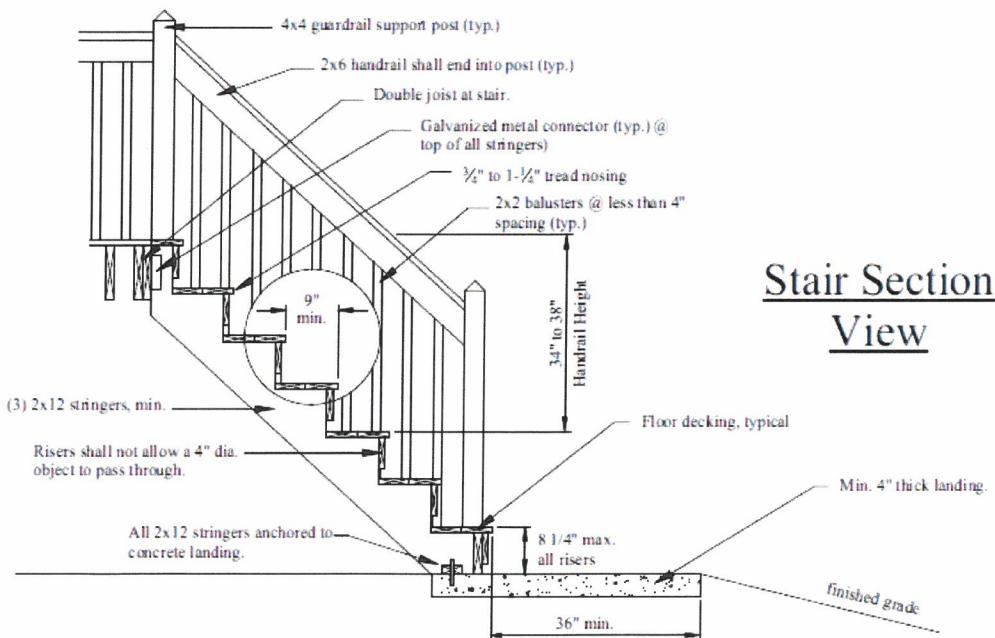
The connection details shown have been designed to meet the requirements in the building code. Simpson Strong-Tie also performed testing on several full scale assemblies. Some of this testing is summarized in the table below.

Connector	Post-Fastening Assembly	Average Test Ultimate <sup>1</sup>	Average Deflection at 200 lbs. <sup>1</sup>
DTT2	Outside rim joist, fastened to joist	635 lbs.	2.6 in.
	Outside rim joist, fastened to blocking	650 lbs.	1.6 in.
HD2AHG	Outside rim joist, fastened to joist	790 lbs.	1.5 in.
	Outside rim joist, fastened to blocking	655 lbs.	1.5 in.

1. Applied load and measured deflection shown are at top of post.

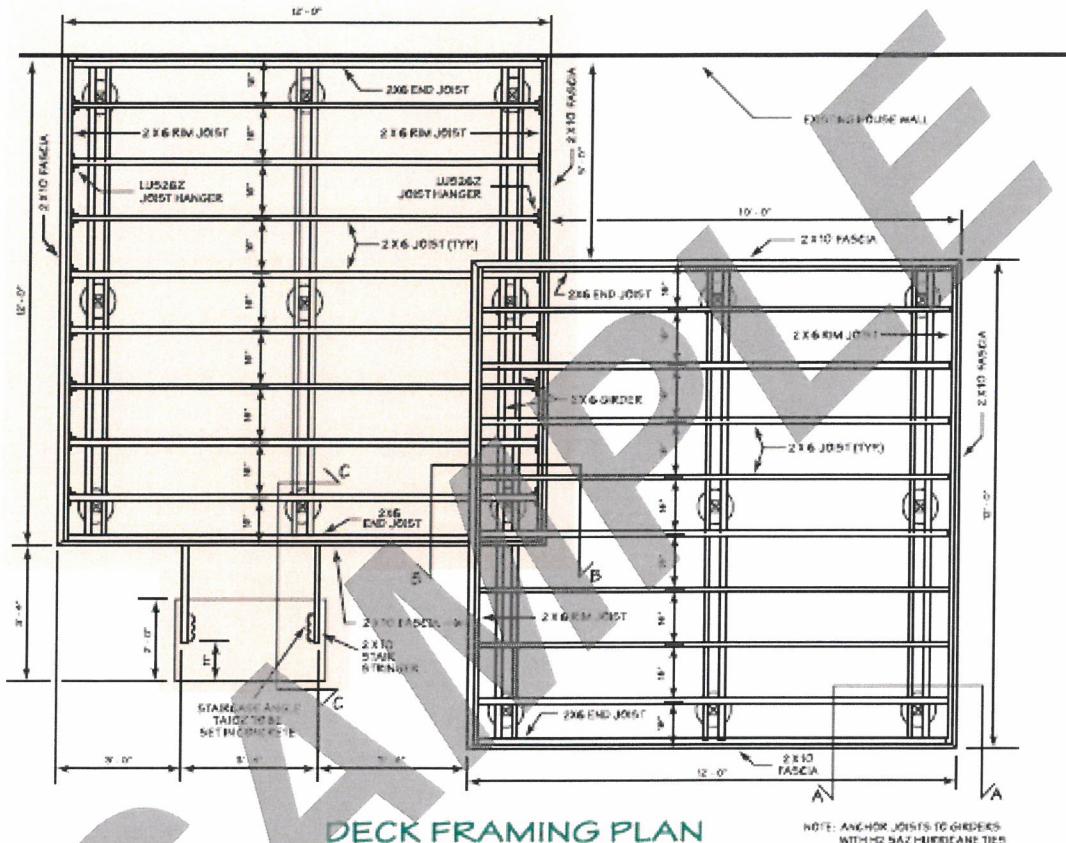
## 11. Stairs & Handrail Requirements

- a. **R311.8.3 Handrails required:** Handrails are required on at least one side of each continuous run of treads with four or more risers
- b. **R311.8.3.1 Height:** The height of the handrail measured vertically for the tread nosing or finish surfact of the tread shall not be less than 34 inches and not more than 38 inches in height.
- c. **R311.8.3.3 Continuity:** Handrails for stairs shall be continuous for the full run of stairs.
- d. **R311.7.4.1:** The maximum riser height shall be 8  $\frac{3}{4}$ "
- e. **R311.7.4.2:** The maximum tread depth shall be 10"
- f. **R301.5:** Handrails shall resist a 200lb single concentrated load.
- g. **R312.3:** Spaces between balusters shall be less than 4 3/8 inches.
- h. **R301.7: Deflection:** To meet the minimum requirements of deflection in the Ohio Building Code, hold down anchors should be installed having a minimum allowable tension load of 1800 pounds for a 36 inch maximum hand rail height. (See Guard Post to Outside Joist Example)



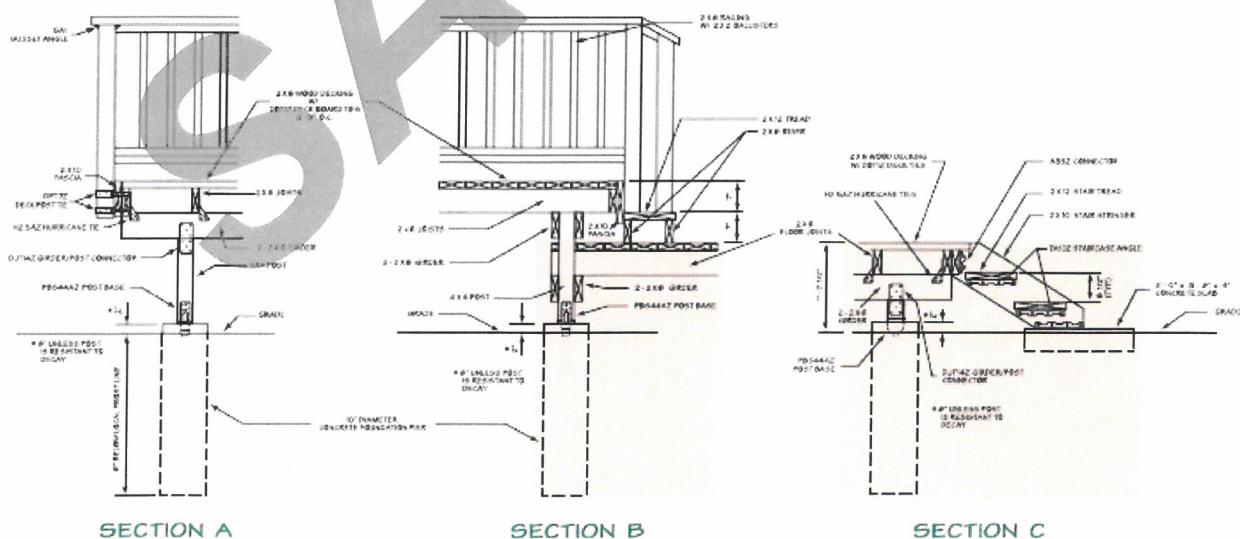
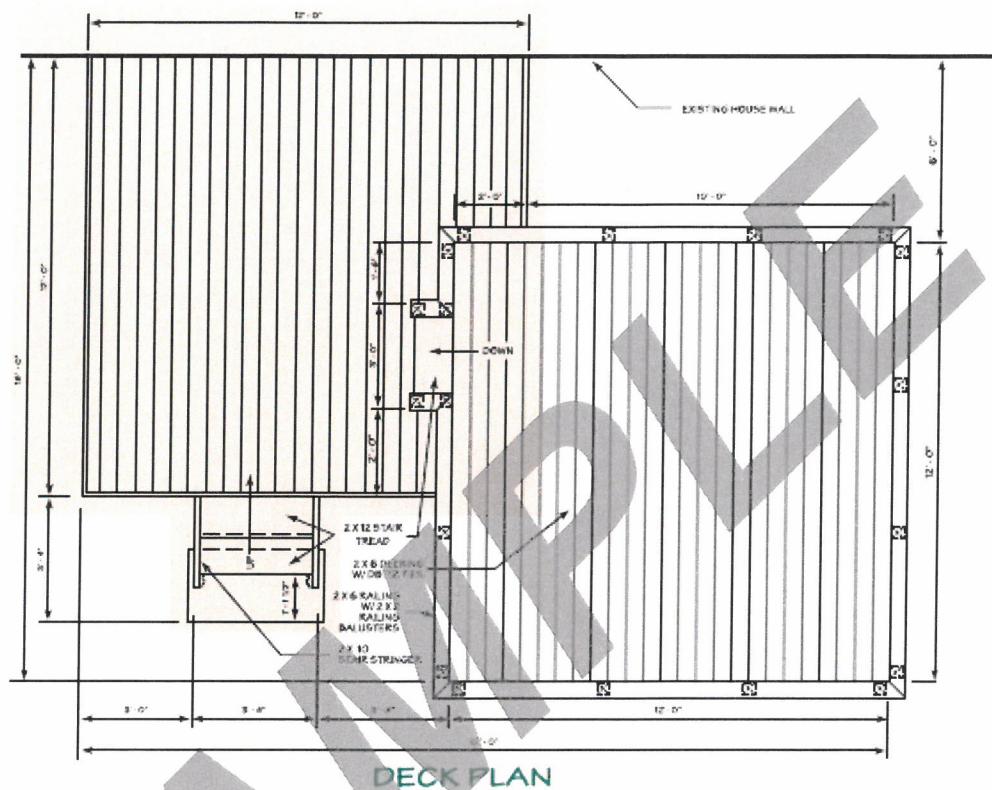
## Sample Plans Drawings

- To build the split-level deck, use complete plans.
- To build the single level deck only, use the plan sections highlighted in the light tan color.



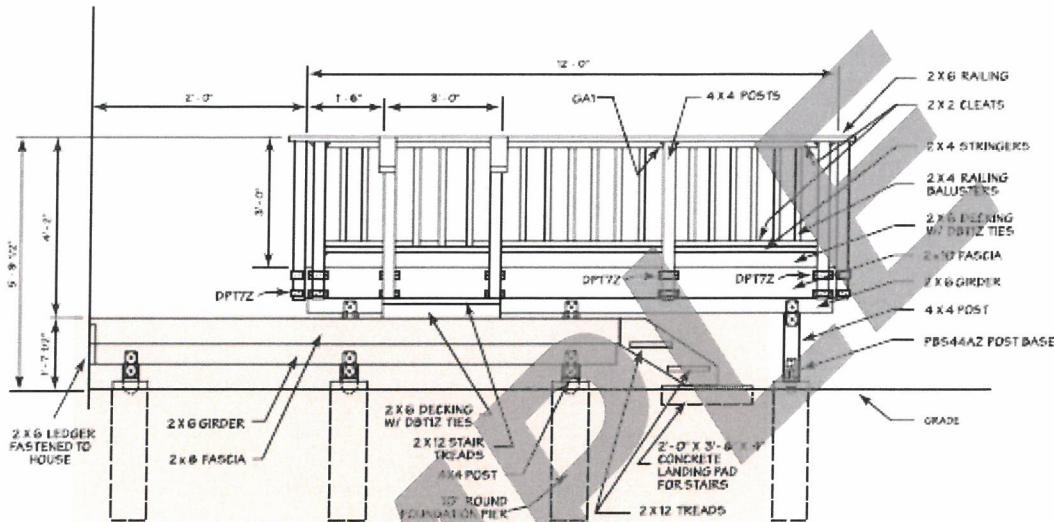
## **Sample Plans Drawings**

- To build the split-level deck, use complete plans.
- To build the single level deck only, use the plan sections highlighted in the light tan color.

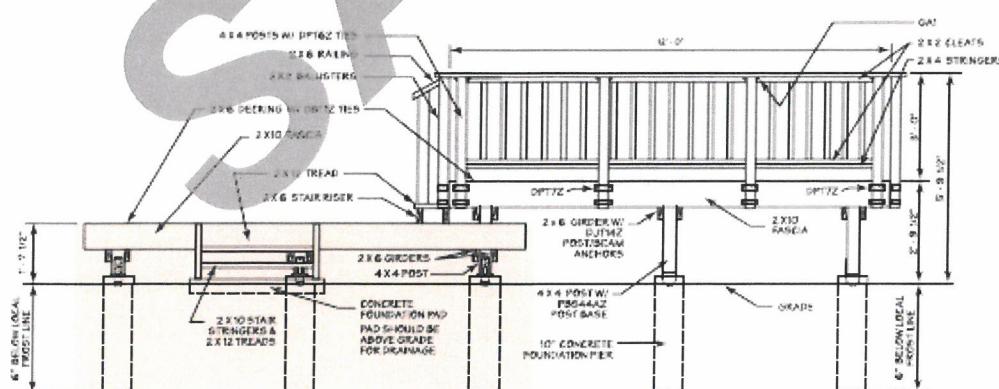


## **Sample Plans Drawing**

- To build the split-level deck, use complete plans.
- To build the single level deck only, use the plan sections highlighted in the light tan color.



### LEFT SIDE ELEVATION



## FRONT ELEVATION