Carnegie Mellon University

Environmental Health and Safety (EHS)
Carnival Construction Standards

Revised: 11/17/2024

Construction for Spring Carnival Booth building will adhere to the following construction standards. In addition to the specific items listed throughout this document, generally accepted good practices are expected to be used in all cases.

1. Introduction

Construction for Spring Carnival will follow the International Building Code (IBC) 2009 edition (or any newer revision) occupancy group "B" (Business) with some alterations and interpretations as noted below. Specific items in this document will take precedence over the IBC where they conflict. In addition to the specific items generally accepted good construction practices are expected to be used in all cases.

2. Definitions

a. **Committee**: when used with no qualifying phrases, shall refer to the Spring Carnival Booth Committee and members of the Spring Carnival Executive Board.
b. **Midway**: shall refer to the entire carnival midway or, as appropriate, the portion of the parking lot and adjacent roadways under control of the Committee.
c. **Carnival Booth Assistant Committee**: A group of assistant booth directors (fraternity, sorority and independent) who work alongside the Carnival Booth Committee to be assigned tasks that promote the safety of Spring Carnival in relation to booth operations.

3. Roles and responsibilities

a. Carnival Booth Committee and Assistant Committee:

i. Reviews organizations booth plans prior to Build Week to approve all construction related activity
ii. Works closely with Environmental Health & Safety and Facilities Management and Campus Services
iii. Collaborates with the faculty member(s) who do the final review and approval of organization booth plans
iv. Assist in developing a safety rubric sheet for committee members and midway watch shifts to use throughout build week

b. Structural Oversight Committee (SOC):

i. The SOC is defined to be the faculty and staff representatives of the university whose responsibility is to review the Spring Carnival Booth Building Construction Standards and ensure Teardown safety.

c. Organizations:

i. Remain up to date with and adhere to carnival construction standards.
ii. Submit booth drawings and plans to the Structural Oversight Committee and update program as needed based on committee feedback.
iii. Submit updated programs when construction plans change or adjust to manage design changes.
iv. Build and tear down structures in accordance with the organization's approved plans o Adhere to safety requirements (i.e. PPE requirements, safety training, and housekeeping) when on Midway.
v. The Committee, or a subcommittee appointed for the purpose, reserves the right to

declare any condition, material, design, or activity to be unsafe at its sole discretion.

d. EHS:

i. Assist with the coordination and implementation of various safety trainings to include – Scissor lift training, forklift training, hand and power tool, student shop safety, personal protective equipment, hazard communication, fire extinguisher training, etc.
ii. Provide support to the Carnival Booth Committee in their efforts to coordinate and plan booth and carnival activities
iii. Obtain needed personal protective equipment and scissor lifts for build week
iv. Provide fire safety guidance and support, including the coordination and delivery of fire extinguishers to be placed throughout Midway.
v. Assist Carnival Booth Committee review and approve proposed booth plans
vi. Perform final fire safety checks of Booths on the morning of Carnival
vii. Provide approval of occupancy signs after successful final fire safety checks

4. Inspections

a. Organizations will be able to schedule a final inspection in the 24 hours prior to opening. Structures not passing the inspection will be given an opportunity to correct the problems and schedule another inspection.
b. As part of the final inspection process, a final fire safety inspection is required the morning of Carnival. All final booth details, including decorations, displays, powered equipment, etc, must be in place prior to this inspection. Organization representatives, including but not limited to the booth chair/ co-chair, and electoral chair must be present during the inspection. Prior to the final fire safety inspection, EHS will send organization representatives a checklist containing plan review comments and general items that will be reviewed during the inspection.
c. Structures must pass their final inspection to be permitted to open for public occupancy.
d. No structural changes may be made to a structure after it passes its inspection. If any changes are made, it must be re-inspected before reopening to the public.
e. Structures are subject to additional unscheduled inspections at any time.

5. Occupancy

a. No booth will be permitted to be occupied by more than the number of people listed for the booth type below:
   i. Blitz Booths – no more than 5 people
   ii. 1-story Booths – no more than 10 people
   iii. 1.5/2-story Booths – no more than 15 people
b. After passing the final fire safety inspection, an occupancy sign stating the occupant load must be placed at the main entrance of each booth. Organizations may create their own design for the sign. The information contained on the sign must clearly convey that EHS has approved the booth occupancy and the appropriate occupant load for the booth, as specified above.

6. Construction and Demolition

a. Construction and demolition of structures must proceed in a safe manner, both for those involved in those activities and for other nearby.
b. Construction and demolition must proceed according to the approved plans. Any Organization deviating from the approved plans will be required to stop all other work until the deviation from the plans is corrected. Alternately, an organization may submit revised plans to address the change; work may start again once the revised plans are approved.
c. No persons are to climb on or otherwise be supported by any partial structure or improvised scaffolding that is not of sufficient strength to support them. Any structural member acting in shear should not be considered of sufficient strength to support a person. Other persons bracing or holding a part of the structure will not be considered when evaluating the strength of the support. Cross bracing is required to support any walls that are not yet fully connected.
d. Unless otherwise designated by the Committee, the Midway is considered to be a construction site from the start of the move-on process until the Midway opens to the public, and then again from the start of tear-down until the Committee declares that teardown has completed.
e. A fire lane through the CFA lot must be kept unobstructed at a width of at least 20 feet throughout the construction and demolition process. The fire hydrant and fire department connection at the northwest corner of the CFA lot must always remain accessible.
f. Appropriate personal protective equipment (including hard hats and closed toed shoes) must be worn by all persons in that area while the Midway is deemed to be a construction site.
g. All persons on Midway must always wear safety glasses. When using bladed instruments, safety glasses are required. Sunglasses and prescription glasses are not a substitute for safety glasses. Gloves and long pants are recommended to be worn when appropriate.
h. Long hair must be secured and tucked in to prevent entanglement with powered rotating equipment including powered hand drills.

7. Plan Submission and Approval

All plans submitted for approval must be in PDF format with each page sized to print on $8^{1}/_{2}$x11 inch paper.

a. Plans must include:

i. Floor plans, sections, and details showing all structural elements with additional details for prefabricated components, support beams and posts, doors, windows, structural connections between walls, stairs, ramps, and railings. All elements must be fully dimensioned.
ii. Drawings of all decorative elements including fastener details.
iii. A complete description of all structural and decorative materials used that includes an estimate of the total quantities of each used.
iv. Electrical and wiring diagrams that include the locations of wires, receptacles, switches, lights, and all other electrical elements used.
v. A list of all electrical devices to be used including their power consumption.

vi. A description (with drawings, if appropriate) of how the structure will be moved to the Midway and installed there.
vii. A description (with drawings, if appropriate) of how the structure will be removed from the Midway and disposed of or stored.
viii. A description of the booth to be printed in Spring Carnival literature
ix. Environmental Judging Form

b. **Submit Plans**: Plans shall be submitted electronically to the Committee. They will be reviewed by both the Structural Oversight Committee and the Committee. The organization will be informed of the results of the review. An opportunity will be given to resubmit modified plans if the original plans are not approved as submitted. Construction of prefabricated components may commence once the plans have been approved.

8. Booth Dimensions

a. Height Limits

i. No part of a booth may exceed 25 feet in height.
ii. No platform surface on which patrons will stand may be higher than 10 feet.
iii. The roof, the highest surface once can stand on during construction, may be no higher than 20 feet.
iv. Any part of the structure exceeding 19 feet in height must be drawn in exact detail and will only be approved at the discretion of the Structural Oversight Committee and the Committee.
v. Some plots may be subject to lower maximum heights because of overhead obstructions.
vi. All heights are as measured from the lowest point of the plot.

b. Exterior Decorations

i. Decorative pieces on second floor roofs must be:
    1. Firmly affixed and should be able to withstand strong winds
    2. Made of lightweight materials such as paper Mache. Use of plywood or 2 x 4" wood components should be minimal.
    3. Preassembled so that most of what needs to be done at this height is to attach the decoration.
    4. Time spent on 2nd floor roofs should be minimized and limited to attaching roofing material and/or preassembled decorative items.
    5. All elements of a booth must fall within the plot lines at all heights, with the exception of a 1' overhang allowance at least 7' above the ground. Any materials overhanging the designated plot size must not be structural or dangerous in any way. All elements falling within this exception must be fully detailed in an organization's plans and are at the discretion of the Structural Oversight Committee and Booth Committee to approve or reject.

c. Egress Distance

i. No point in the booth may be more than 50 feet from an exit, measured along the center of the path a person would walk to that exit.

ii. Exit doors to the exterior of the booth must be placed at a distance apart no less that one-half the length of the maximum overall diagonal dimension of the booth.
iii. Pathways must be at least 6 feet wide and available throughout staging area. Materials must be stacked to allow for egress around the booths.
iv. Allow for paths for the scaffolding to access the booths and to be moved around Midway.
v. Any doors in the egress path must be side hinged, and swing in the direction of egress travel. Sliding doors must not be used in the egress path.
vi. Pathways must be with lighting no less that 1 foot-candle (11 lux) at the walking surface, so persons walking through the booth can see the path.

9. Structural Design

a. Lumber Quality

i. All structural components must be #2 or better lumber with the exception that "stud" quality lumber may be used for its intended purpose as wall studs.
ii. Designs using a different structural system other that structural lumber, such as a steel stud frame or tent system, will be reviewed and evaluated at the discretion of the Head(s) of Booth, SOC and the Spring Carnival Committee.
iii. Material showing signs of deterioration, or that is past its useful life shall not be used.

b. Floor Design

i. Floor joists must be installed no farther apart than 16 inches on center. Joists are limited to the maximum spans shown here:

Nominal Size	Floor Joist Maximum Span
2x4	Up to 4'0" ONLY within 12 inches of the ground
2x6	9'0"
2x8	11'6"
2x10	14'0"
2x12	16'0"

ii. All joists and rafters must be supported from below either by a structural wall or by a header beam and posts sized appropriately to support a live load of 50 pounds per square foot in addition to the weight of other parts of the structure that will be supported. Joists are not permitted to be supported by fasteners in shear.
iii. No booth may use 2x4 nominal lumber for their floor design with exception to doghouses.
iv. Doghouses may use 2x4 lumber with a maximum span of 7'-6".

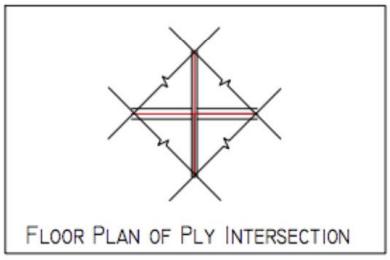
c. Flooring

i. Floors sheathing must be no less than 3/4 inch thick (nominal) plywood properly installed.
   1. If the underlying joists are installed on no more than 12 inch centers then 1/2 inch thick (nominal) plywood may be used if properly installed.
   2. Major axis of the plywood must be perpendicular to the joists.

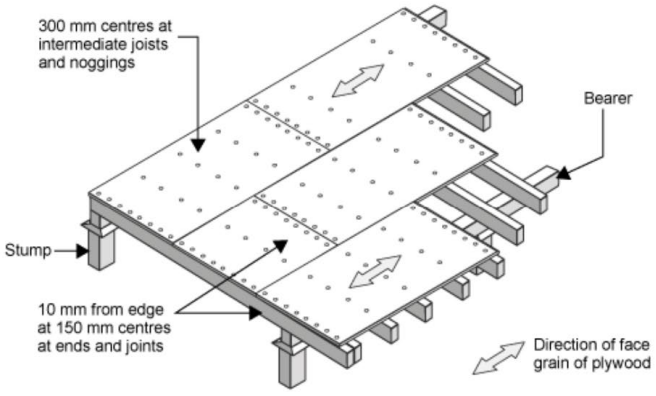
ii. Framing Details:
   1. All floor frames must have double rim joists to support exterior walls where the wall framing members are not perpendicular to the direction of the floor joist. This typically occurs on two sides of a square or rectangular frame.
   2. Where lateral restraint is provided by joist hangers or blocking between joists, their depth shall equal not less than 60% of the joist depth. See section 18 for how to find the appropriate joist hanger size.

Model No.	DF Allowable Loads					SP Allowable Loads					SPF/HF Allowable Loads				
	Uplift[1] (160)	Floor (100)	Snow (115)	Roof (125)	Wind (160)	Uplift[1] (160)	Floor (100)	Snow (115)	Roof (125)	Wind (160)	Uplift[1] (160)	Floor (100)	Snow (115)	Roof (125)	Wind (160)
SINGLE 2x SIZES															
LUS24	490	670	765	825	1045	490	725	830	895	1135	420	575	655	705	895
LUS26	1165	865	990	1070	1355	1165	940	1075	1165	1475	1005	740	845	915	1160
MUS26	1090	1295	1480	1605	1825	1090	1410	1610	1745	1825	940	1110	1265	1370	1570
HUS26	1550	2720	3095	3335	3335	1550	2950	3335	3335	3335	1335	2330	2650	2820	2865
HGUS26	1765	4360	4885	5230	5390	1765	4725	5290	5390	5390	1520	3750	4200	4500	4635
LUS28	1165	1100	1255	1360	1725	1165	1200	1365	1480	1835	1005	940	1075	1165	1475
MUS28	1555	1730	1975	2140	2645	1555	1880	2150	2330	2645	1335	1475	1690	1830	2275
HUS28	2000	3965	4120	4220	4335	2000	3790	3960	4070	4335	1720	2905	3035	3125	3435
HGUS28	3015	6745	6970	7125	7275	3015	6460	6705	6870	7275	2595	4960	5160	5290	5745
LUS210	1165	1340	1525	1650	2090	1165	1445	1660	1795	2270	1005	1145	1305	1415	1745
HUS210	3000	4255	4445	4575	5020	3000	4105	4310	4450	4930	2580	3150	3315	3425	3815

ALL PIECES OF PLYWOOD SUB-FLOOR MUST HAVE ALL EDGES SITTING ON FRAMING MEMBERS. AS SEEN IN DRAWING, THE RED LINES INDICATE THE EDGES OF THE PLY AND ALL EDGES ARE SITTING ON THE CENTER OF A JOIST. ALTERNATIVELY, THERE CAN BE 2 JOISTS NEXT TO EACH OTHER EACH ONE HOLDING AN EDGE OF PLY.



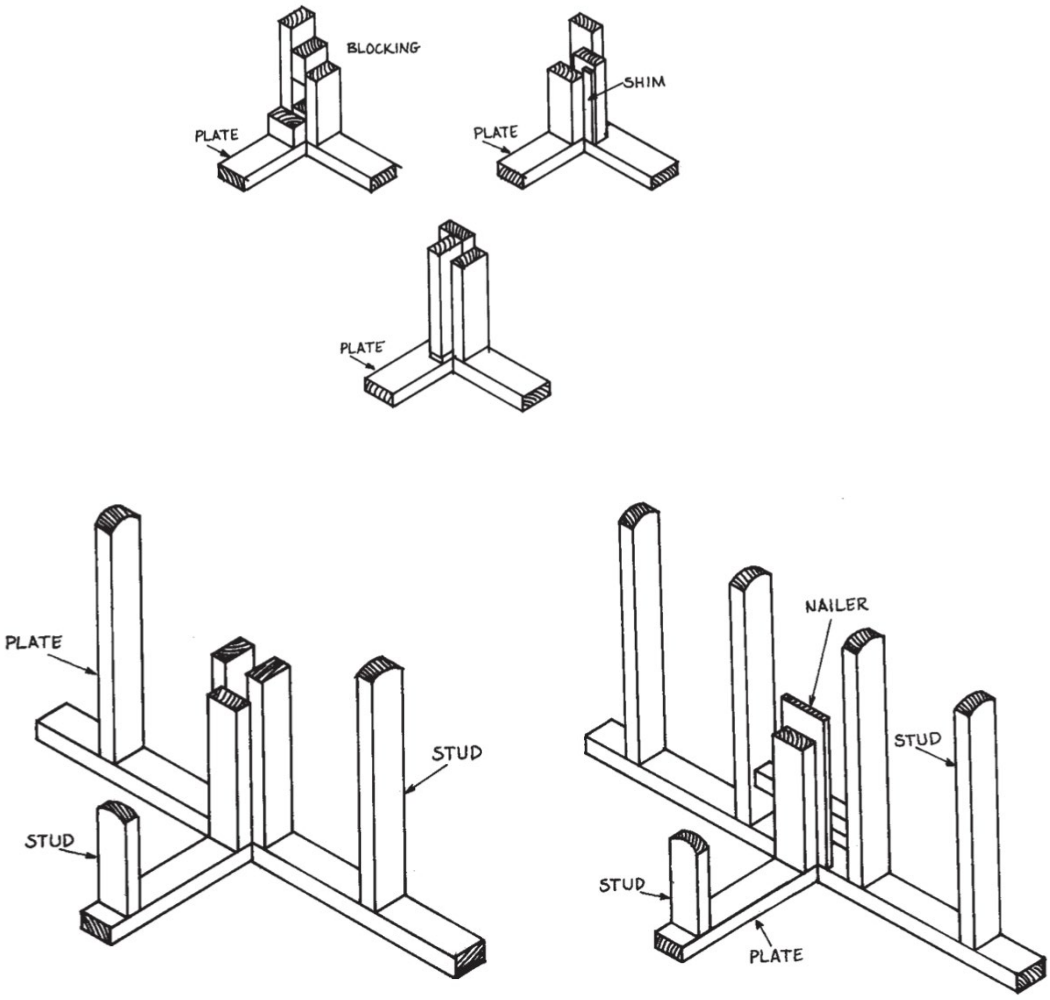
FLOOR PLAN OF PLY INTERSECTION



iii. Flooring must be plywood only - Oriented Strand Board (OSB) is not permitted for use on floors.
iv. All transverse (short direction) plywood seams must have joists below them.
v. Base of any interior post must have adequate support, i.e. transfer the load directly to the asphalt.
vi. For walls that run parallel to the floor joists above, a double joist is required for where the floor frame meets the wall in order to match minimum 1-½" bearing.
    1. If the same wall is a bearing wall for floor or roof, above minimum bearing support shall be 3-½".
vii. If the wall is parallel to the joist then a second joist must be added.
viii. Blocking/Bridging:
    1. Joists exceeding a nominal 2x12 shall be supported laterally by solid blocking, diagonal bridging (wood or metal) or a continuous 1"x3" strip attached across the bottom the bottom of joists perpendicular to joists at intervals exceeding 8'.
    2. Joists shall be supported laterally at the ends and at each support by solid blocking except where the ends of the joists are nailed to a header, band or rim joist or to an adjoining stud or by other means. Solid blocking shall not be less than 2 inches (51mm) in thickness and the full depth of the joist. Blocking must be placed no more than 8' apart. Blocking from joist to joist should be staggered between each other.
ix. Note that booth construction has no foundation for the structure, therefore all framing will have tighter constraints to ensure the booth remains stable, square, and plumb.

d. Walls

i. Structural walls must be made up of 2x4 (nominal) lumber or larger spaced no farther apart than 16 inches on center for all booth types.
ii. All structural walls must be a properly braced shear wall be covered with no less than ½" thick (nominal) plywood or oriented strand board on one side of the wall
iii. Decorative elements (non structural, but this will depend on the weight and size of the decoration) may increase the spacing to 24 inches on center.
iv. Large fabric elements such as pieces of canvas or cloth must be fully secured from blowing away in wind.
v. All structural sheathing panel edges must be completely backed by framing. Interior, non-structural partitions do not need sheathing.
vi. Double top plates are required regardless of story height to lock corners of booths together.
vii. The maximum height for an unsupported wall is 10'. Unsupported walls are walls that have no interior walls tying into the length of the exterior wall.
viii. There should be no breaks in the vertical wall framing unless a properly designed opening is conveyed. Studs must be continuous from bottom plate to top plate.



e. Headers/Beams

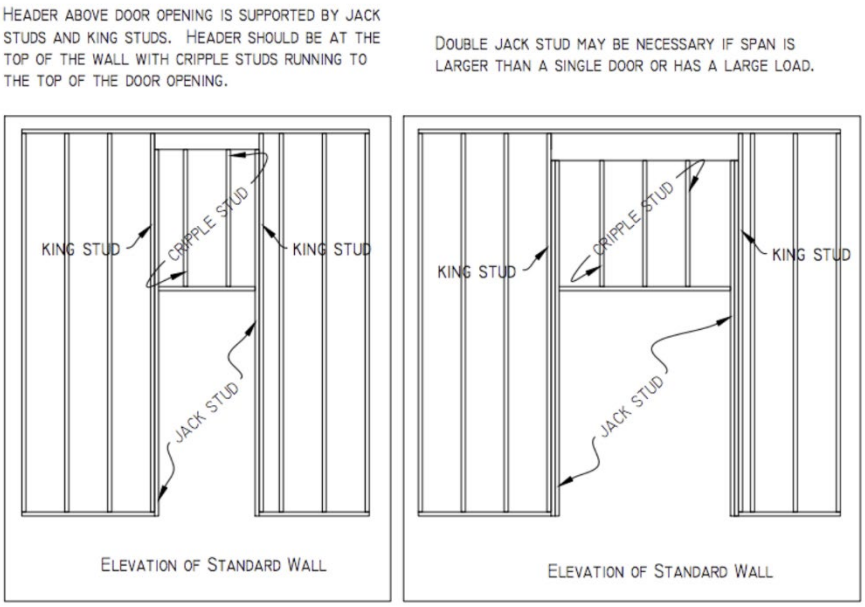
i. Any gaps in structural walls (i.e., doors or windows) must have properly supported headers.

ii. All wall openings that do not reach the floor must have a lower plate that is the same width of the wall stud to ensure equal support of framing.

iii. If the combined width of the header does not match the width of the wall frame, the appropriate spacer plate must be added to ensure that the header and wall thickness match. (i.e. 2x4 wall frame header would need a 0.5" ply spacer).

iv. Headers are limited to the maximum spans shown here:

Material	Supporting Any Floor	Supporting Only a Roof	Notes
Double 2x4	2'8"	3'6"	
Double 2x6	3'11"	5'5"	
Double 2x8	5'0"	6'10"	
Double 2x10	6'1"	8'5"	Requires doubled jack studs at each end
Double 2x12	7'1"	9'9"	Requires doubled jack studs at each end

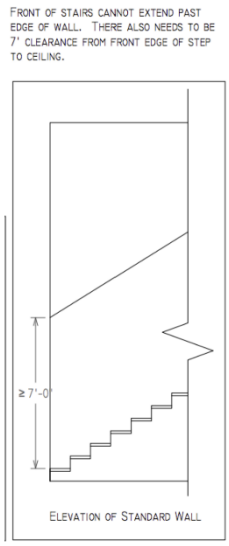


f. Door Openings

i. A minimum of two exterior exit doors or doorways must be provided. The main entry door or doorway for the booth will count as one of the required exterior exits.
ii. Interior doors or doorways must be at least 32" wide.
iii. Exterior doors or doorways must be at least 36" wide.
iv. Doors or doorways must have 6'-8" inches high clear space when the door is open.
v. Doors may not have locks or latches. Any closing doors must open in the direction of egress.

g. Headroom

i. 7'-6" (90 inches) minimum headroom must be maintained at all times not otherwise specified.
   1. Nose of stairs should not extend past end of wall, i.e. step up should allow 7 foot minimum headroom (see figure below).



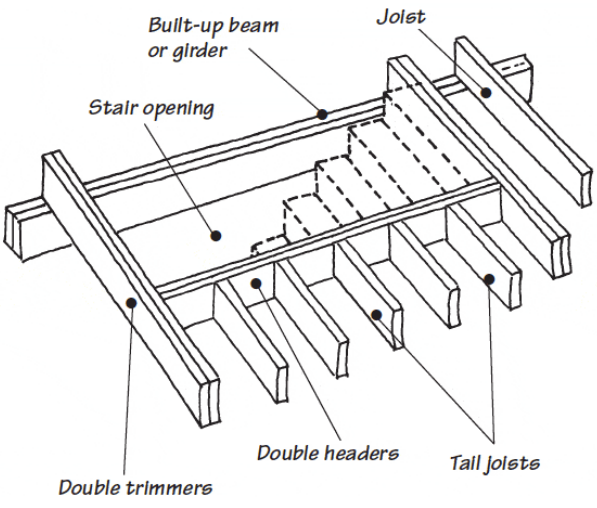
i. Objects may hang down below that height but no lower than 6’8" at any point and over no more than 50% of the ceiling.

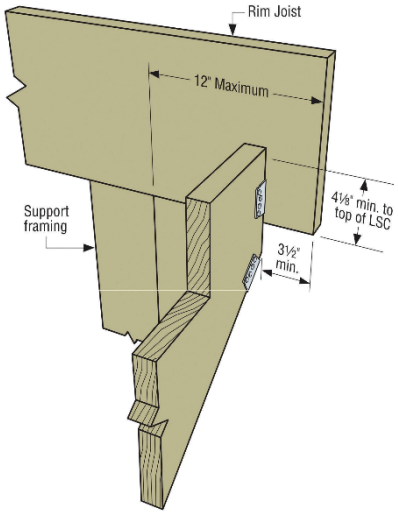
h. Floor Opening

i. Two-story booths must stagger joists in plywood flooring.

ii. Openings in floor framing shall be framed with header and trimmer joists. Where the header joist span does not exceed 4 feet, the header joist shall be a single member the same size as the floor joist. Single trimmer joists shall be used to carry a single header joist that is located within 3 feet of the trimmer joist bearing. Where the header joist span exceeds 4 feet, the trimmer joists and the header joist shall be double and of sufficient cross section to support the floor joists framing into the header.

iii. Double trimmers will be required at all stair support joists regardless of span. This is shown in the detail below.





10. Stairs

a. Design Dimension Limits

i. Where stairs are used for 1.5 and 2-story booths, a minimum of two separate stairways must be provided.

ii. Stairs may not have a run (horizontal projection per step or tread) less than 11 inches and must have a rise (vertical difference between adjacent steps or rise) of at least 4 inches and no more than 7 inches. The variability between the largest and smallest riser height and the largest and smallest tread length may not exceed 3/8 inch in any flight of stairs.

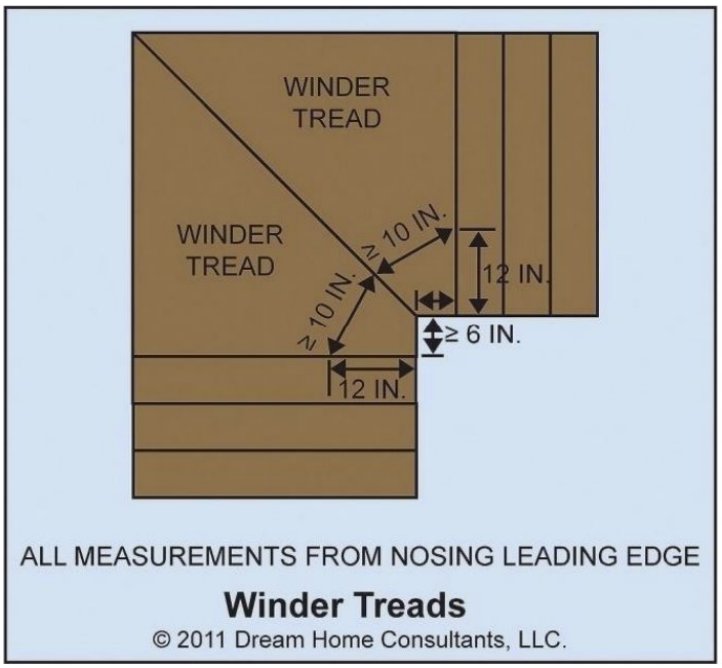
iii. Riser heights and tread depths must total 18 inches.

iv. Stairways must be at least 36 inches wide from the inner edges of each handrail.

v. Headroom over steps must be at least 80 inches measured vertically from a line that connects the front edges of each step.

vi. There shall be a landing at the top and bottom of each flight of stairs that is at least as long as the flight of stairs is wide. It is permissible to use the pavement outside of the structure as the lower landing as long as the height from the pavement to the first step is within 1 inch of the riser height of the rest of the flight of stairs across the entire width of the first step.

vii. Please note that the flight of stairs encompasses the entire run of the stairs from start to finish, regardless of if it changes direction.



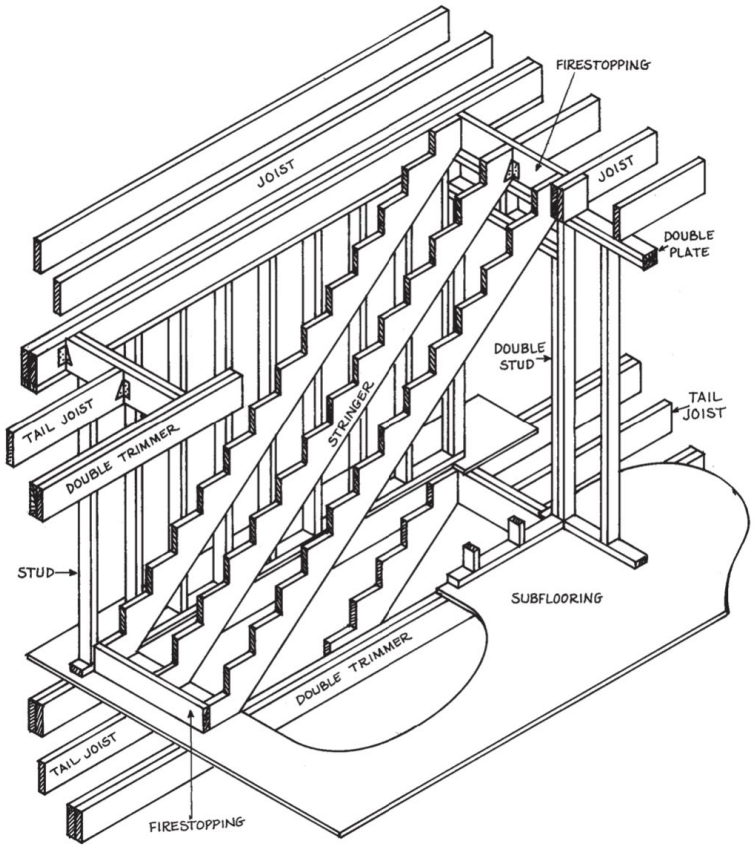
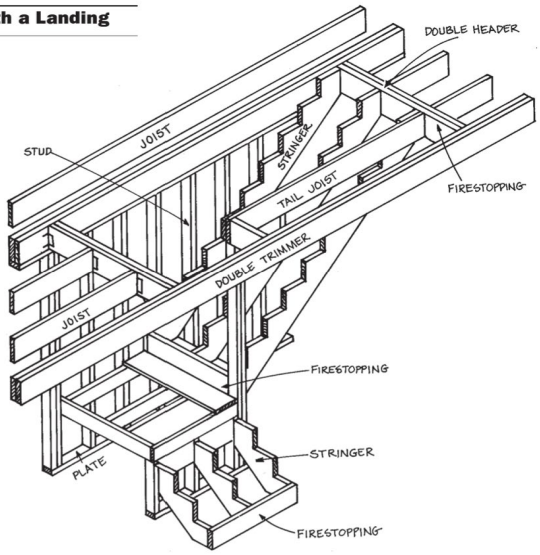


Figure 32. Stairway With a Landing



viii. Any time there is a change in platform elevation the change must meet the requirements of a step. Changes in elevation more than 36 inches apart horizontally shall be individual steps.

ix. Curved stairways are permissible when they meet the above requirements for width and headroom (measured in the center of the nosing of the stair tread) as well as meeting the requirements for a means of egress in the IBC.

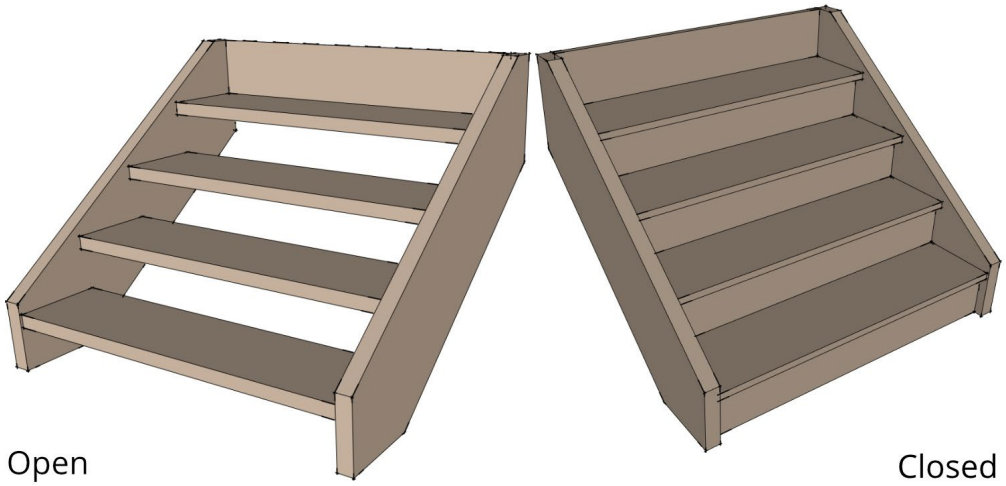
x. An additional step or platform may be placed outside of a plot in the case where leveling creates the need for an extra step or platform to make stairs conform to code.

xi. 2x12 members are the minimum requirement for stair stringers, however larger members may be needed based on the respective rise and run. The throat of the stringer (the dimension between where the stair is cut and the bottom of the stringer) must be no less than 3.5" at any given point. The suggested throat dimension is 5".

b. Tread Thickness

i. Stair treads must be:

1. A single piece of 3/4 inch thick plywood that does not span more than 16 inches and has no unsupported edges.
2. No open risers are permitted. All organizations must build closed risers.



Open Closed

c. Stair Strength

i. Stair stringers must be supported from below. Stair stringers should have no more than 1 foot of span for every 1 inch of stringer. Reference above stringer throat requirements for the required thickness of the stringer.

ii. Stairs must withstand a vertically downward single point load of 250 pounds per step applied at any point on any step. (For example, a flight of 10 stairs must withstand a 2500-pound load)

iii. Stairs must have adequate lateral bracing to withstand a 500-pound side load applied at any point.

iv. A single piece of nominal 2x12 lumber that is no more than 36 inches between supports and no more than 6 inches overhung beyond the outer support.
v. Stringers should be no more than 17" OC. All two-story and 1.5 story booths will have at least 3 stringers.

d. Stair Lighting

i. Interior stairways shall be provided with an artificial light source to illuminate the landings and treads. The light source shall be capable of illuminating treads and landings to levels of not less than 1 footcandles (11 lux) as measured at the center of treads and landings. There shall be a wall switch at each floor level to control the light source where the stairway has six or more risers.
ii. Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway.
iii. There is an exception of switches if there is a remote, central, or automatic control of lighting.

11. Ramps

a. Ramps shall have a maximum slope of 1 unit vertical and 8 units horizontal (12.5%).
b. There is a maximum vertical height limitation of 30".
c. There shall be a floor or landing at the top and bottom of each ramp, where entrances/exits open onto ramps and where ramps change directions.
d. The width of the landing perpendicular to the ramp slope shall not be less than 36 inches.

12. Handrails

a. Handrails are required anywhere there are 2 or more risers or on any ramp.
b. Handrails are required in addition to a guard railing on steps and must be continuous along at least one side of any flight of stairs.
c. Handrails must be 34 to 38 inches high measured vertically from the tips of the stair nosings or from the ramp surface. The height of the handrail must not vary more than 3/8 inch over the length of the handrail.
d. Handrails must have a rounded profile on top, no smaller than 1-1/4 inch in diameter and no larger than 2 inches in diameter.
e. A minimum clearance of 1-1/2 inches must be maintained between a handrail and an adjacent wall or guard railing.
f. Handrails must withstand a 200-pound force in any direction at any point.
g. Handrails shall be provided on all stairs with four or more risers.
h. Handrails must have a smooth contact surface with no nails, splinters or any other hazardous protrusions exposed.
i. Handrails must be fastened strongly to the wall. It is highly recommended that when/if using PVC pipes as handrails they must be strong enough to not be flexed or ripped off the wall due to screws in plastic only.

j. Handrails shall be continuous to the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest rise of the flight. Handrail ends shall be returned toward a wall, guard walking surface continuous to itself, or terminate to a post.
k. Required handrails shall be one of the following types or provide equivalent graspability:
    i. Type 1: Handrails with a circular cross section shall have an outside diameter of not less than 1 ¼ inches and not greater than 2 inches. If the handrail is not circular, it shall have a perimeter of not less than 4 inches and not greater than 6 ¼ inches and a cross section of not more than 2 ¼ inches. Edges shall have a radius of not less than 0.01 inches.
    ii. Type II: Handrails with a perimeter greater than 6 ¼ inches shall have a graspable finger recess area on both sides of the profile. The finger recess shall begin with ¾ inch measure vertically from the tallest portion of the profile and have a depth of not less than 5/16 inch within ⅞ inch below the widest portion of the profile. This required depth shall continue for not less than ⅜ inch to a level that is not less than 1 ¾ inches below the tallest portion of the profile. The width of the handrail above the recess shall be not less than 1 ¼ inches and not more than 2 ¾ inches. Edges shall have a radius of not less than 001 inches.

13. Clear Width

a. All walkways, stairways, and ramps must have a clear width of 36 inches or more.
b. Handrails are allowed to project up to 4-1/2 inches into this clear space and still be in compliance with this requirement.
c. No sharp or otherwise dangerous projections are permitted from any wall or hanging object below a height of 7 feet from the closest walking surface.

14. Guard Railings

a. Guard railings are required anywhere that there is a change in elevation of more than 7 inches.
b. Guard railings must have a height no less than 42 inches from the height of the raised platforms or from the nosings of the steps if along a flight of stairs.
c. Guard railings must be constructed in a manner that prevents children from climbing them and so that a 4-inch diameter sphere cannot pass through them at any point from the platform to the top of the railing (with the exception that the bottom of a guard railing along a flight of stairs cannot pass a 6-inch diameter sphere between the stairs and the bottom of the railing structure).
d. Guard railings must withstand a 300-pound force in any direction at any point.
e. Temporary guardrails must surround and walking surface with a height greater than 4 feet, unless the walls are being erected in a timely manner.

15. Stair Balusters

a. Like guard railings, stair balusters must be constructed in a manner that prevents children from going through the balusters. Any gap must be created so that a 4-inch diameter sphere cannot pass through.
b. Stair balusters must withstand a 300-pound force in any direction at any point.

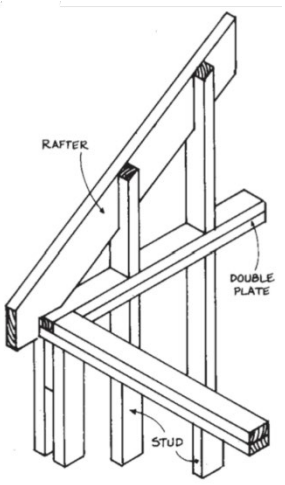
16. Roof Design

a. Roof rafters must be installed no farther apart than 24 inches on center and limited to the spans shown here:

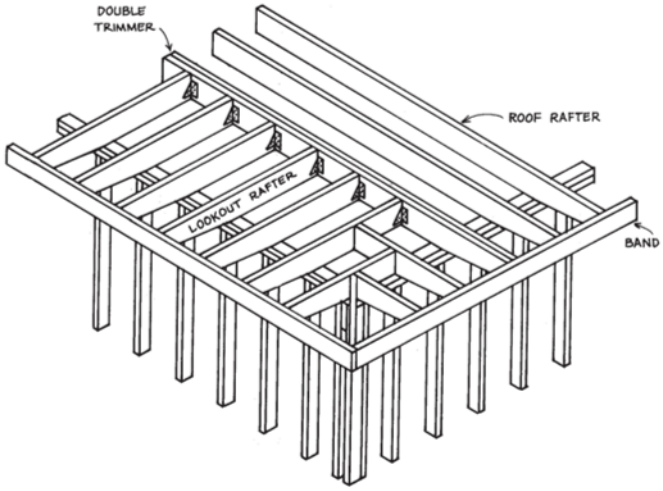
Nominal Size	Roof Rafter Maximum Span
2x4	7’5”
2x6	9’6”
2x8	12’0”
2x10	15’0”
2x12	18’0”

Ridge Beam Sizing

Roof Load	Wood	Beam Span	Total Rafter Span on Both Sides of Beam				
			16 feet	20 feet	24 feet	28 feet	36 feet
1.15 LD 10psf DL 40psf SL	#1 Southern Pine	10 feet	(2)2x10	(2)2x12	(2)2x12	(3)2x10	(3)2x12
		12 feet	(2)2x12	(3)2x10	(3)2x12	(3)2x12	(4)2x12
		14 feet	(3)2x12	(3)2x12	(4)2x12	(4)2x12	3-1/2x11-7/8
		16 feet	(3)2x12	(4)2x12	3-1/2x11-7/8	3-1/2x11-7/8	3-1/2x14
		18 feet	(4)2x12	3-1/2x11-7/8	3-1/2x14	3-1/2x14	5-1/2x14
		20 feet	3-1/2x14	3-1/2x14	3-1/2x14	3-1/2x16	5-1/2x14
		22 feet	3-1/2x14	3-1/2x16	3-1/2x16	3-1/2x16	5-1/2x16
		24 feet	3-1/2x16	3-1/2x16	3-1/2x18	5-1/2x16	5-1/2x18
		Span	16 feet	20 feet	24 feet	28 feet	36 feet
1.15 LD 10psf DL 70psf SL	#1 Southern Pine	10 feet	(3)2x10	(3)2x12	(3)2x12	(4)2x12	(4)2x12
		12 feet	(3)2x12	(4)2x12	(4)2x12	3-1/2x11-1/4	5-1/2x11-7/8
		14 feet	(4)2x12	3-1/2x11-1/4	3-1/2x11-7/8	3-1/2x14	5-1/2x14
		16 feet	3-1/2x11-7/8	3-1/2x14	3-1/2x14	5-1/2x14	5-1/2x16
		18 feet	3-1/2x14	3-1/2x14	5-1/2x14	5-1/2x14	5-1/2x18
		20 feet	3-1/2x16	3-1/2x16	5-1/2x16	5-1/2x16	5-1/2x19-1/4
		22 feet	3-1/2x16	5-1/2x16	5-1/2x16	5-1/2x18	5-1/2x22
		24 feet	3-1/2x18	5-1/2x16	5-1/2x18	5-1/2x19-1/4	5-1/2x23-3/8



b. All rafters must be supported from below either by a structural wall or by a header beam and posts sized appropriately to support a live load of 50 pounds per square foot in addition to the weight of other parts of the structure that will be supported. Rafters are not permitted to be supported by fasteners in shear.
c. Roofs must be no less than 3/8-inch thick (nominal) plywood or oriented strand board (OSB) properly installed.



Flat Roof Framing

17. Level

a. Any platform more than 12 inches from the lowest point of the ground underneath must be level.
b. No variation of more than 1/2 inch between any two points of the platform or 1/4 inch between any two points less than 12 inches apart is permitted.

18. Plumb

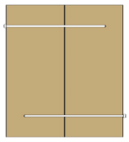
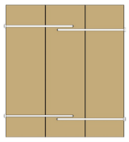
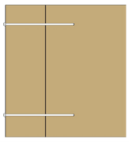
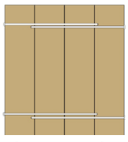
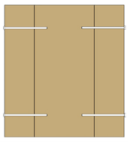
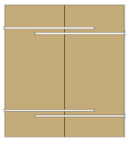
a. Structural walls supporting other elements must be plumb to within 1/4 inch in 10 feet.

19. Joist Hangers and Fasteners

a. Joist Hangers
   i. Joist hangers must be used where the bearing length is less than 1.5”
   ii. Where lateral restraint is provided by joist hangers or blocking between joists, their depth shall equal not less than 60% of the joist depth. See the chart below for how to find appropriate joist hanger sizes.

Model No.	DF Allowable Loads					SP Allowable Loads					SPF/HF Allowable Loads				
	Uplift[1] (160)	Floor (100)	Snow (115)	Roof (125)	Wind (160)	Uplift[1] (160)	Floor (100)	Snow (115)	Roof (125)	Wind (160)	Uplift[1] (160)	Floor (100)	Snow (115)	Roof (125)	Wind (160)
SINGLE 2x SIZES															
LUS24	490	670	765	825	1045	490	725	830	895	1135	420	575	655	705	895
LUS26	1165	865	990	1070	1355	1165	940	1075	1165	1475	1005	740	845	915	1160
MUS26	1090	1295	1480	1605	1825	1090	1410	1610	1745	1825	940	1110	1265	1370	1570
HUS26	1550	2720	3095	3335	3335	1550	2950	3335	3335	3335	1335	2330	2650	2820	2865
HGUS26	1765	4360	4885	5230	5390	1765	4725	5290	5390	5390	1520	3750	4200	4500	4635
LUS28	1165	1100	1255	1360	1725	1165	1200	1365	1480	1835	1005	940	1075	1165	1475
MUS28	1555	1730	1975	2140	2645	1555	1880	2150	2330	2645	1335	1475	1690	1830	2275
HUS28	2000	3965	4120	4220	4335	2000	3790	3960	4070	4335	1720	2905	3035	3125	3435
HGUS28	3015	6745	6970	7125	7275	3015	6460	6705	6870	7275	2595	4960	5160	5290	5745
LUS210	1165	1340	1525	1650	2090	1165	1445	1660	1795	2270	1005	1145	1305	1415	1745
HUS210	3000	4255	4445	4575	5020	3000	4105	4310	4450	4930	2580	3150	3315	3425	3815

b. Fasteners
   i. Appropriate fasteners including bolts, construction screws or nails, must be used for all structural construction. **Drywall screws are not permitted for use on structural elements that include any framing member, sheathing, flooring, railing, guard rails, balusters.** Structural elements may not be supported by fasteners in shear.
   ii. See below for the minimum fastener requirements for structural members and sheathing.

Minimum Fastening Requirements for Top- and Side-Loaded Members		3½" Wide	5¼" Wide		7" Wide		
							
Fastener Type	**LVL Depth**	**2-ply, 1¾"**	**3-ply, 1¾"**	**1¾" + 3½"**	**4-ply, 1¾"**	**2-ply, 1¾" + 3½"**	**2-ply, 3½"**
10d (0.128" x 3") Nails	7¼"≤ d < 14"	3 rows @ 12" o.c.	3 rows @ 12" o.c. (ES)	3 rows @ 12" o.c.	-	3 rows @ 12" o.c. (ES)	-
	d ≥ 14"	4 rows @ 12" o.c.	4 rows @ 12" o.c. (ES)	4 rows @ 12" o.c.	-	4 rows @ 12" o.c. (ES)	-
16d (0.162" x 3½") Nails	7¼"≤ d < 14"	2 rows @ 12" o.c.	2 rows @ 12" o.c. (ES)	2 rows @ 12" o.c.	-	2 rows @ 12" o.c. (ES)	-
	d ≥ 14"	3 rows @ 12" o.c.	3 rows @ 12" o.c. (ES)	3 rows @ 12" o.c.	-	3 rows @ 12" o.c. (ES)	-
½" Through Bolts	d ≥ 7¼"	2 rows @ 24" o.c.	2 rows @ 24" o.c.		2 rows @ 24" o.c.		
SDS ¼" x 3½", WS35 3⅜" TrussLok		2 rows @ 24" o.c.	2 rows @ 24" o.c. (ES)	2 rows @ 24" o.c.	-	2 rows @ 24" o.c. (ES)	-
SDS ¼ x 6", WS6		-	-		2 rows @ 24" o.c. (ES)		
5" TrussLok		-	2 rows @ 24" o.c.		-		
6¾" TrussLok		-	-		2 rows @ 24" o.c.		

20. Electrical

a. Booths needing electricity will be provided a 20 ampere, 120 volt service terminated in a NEMA 5-20R receptacle (common household "Edison" type). The normal operating amperage for a full- size booth is not to be more than 16 amperes. Blitz booths may not draw more than 8 amperes each under normal operating conditions.
b. All electrical work in or on a booth must comply with the requirements for single-family residential construction in the National Electrical Code (NFPA 70), 2008 or newer edition. Additionally, all switches and receptacles, including the initial plug used to tie into the receptacle provided, must be rated for 20 amperes. This is unless a 15 ampere circuit breaker in a proper enclosure is installed or with the approval of the Spring Carnival Electrical Chairperson. Electrical work must be carried out in a neat and workmanlike manner. All cabling must be rated appropriately for its amperage and weather exposure, as well as have sufficient jacketing free of nicks or signs of inappropriate wear. Cable must be secured to the structure with appropriate hardware at a minimum of every 4', as well as within 6" of entry to any electrical boxes. Where necessary, cable should be protected from accidental physical damage. Any holes bored to allow cables to pass through joists, rafters, or wood members should be centered between the two nearest edges.
c. Electrical boxes housing splices, receptacles, switches, or lighting fixtures must be securely fasted to the structure. Boxes must provide sufficient strain relief to all wires entering them. A minimum of 6" of wire is required between the entry to the box and the components to which the wire is attached. Wire must be tightly and appropriately terminated using screws or wire

nuts, and no termination or splice may occur outside of an electrical box. Electrical boxes must be covered, and all metal components housing an electrical system must be grounded. All electrical components exposed to the elements must be appropriately rated.

d. **All electrical wiring runs and connections must be inspected and approved by the Spring Carnival Electrical Chairperson or his/her representative before being closed or covered.**

21. Fire Safety

Not allowed	Minimize	Required
• Open flames; • Smoking; • Smoke or fog machines; • Flammable liquids (paint thinner, oil base paints, gasoline); • Straw, hay, dry grass, or similar materials; • Plastic sheeting or tarps; • Halogen lamps; • No plastic or sheeting permitted as a permanent part of the structure; • Space heaters or other heating appliances.	• Plastic should be used at a minimum.	• Smoke detector; • Fire extinguisher (provided).

a. No smoking or open flames shall be permitted on the Midway at any time.
b. No flammable gasses or liquids may be used in the construction of the structure or as a part of the structure itself. This includes oil-based paints or paint thinners and gasoline.
c.
d. ABC dry chemical fire extinguishers, provided by EHS, will be placed throughout Midway and must remain accessible at all times. An additional Class K fire extinguisher will be provided for the approved concession booth(s).
e. Combustible interior furnishings, decorations, and props must have a fire-retardant coating applied to them, where feasible. All instructions and limitations of the fire-retardant must be adhered to.
f. Combustible coverings shall not be placed on or near electrical outlets and appliances.
g. Straw, hay, dry grass, or similar materials are not permitted.
h. Foam, including styrofoam, may ONLY be used in the construction of a free-standing prop or

decoration. Foam shall not be applied to walls, floors, or ceilings.

i. No plastic sheeting or tarps are permitted as a permanent part of the structure. They may be used during inclement weather as a temporary cover only when Midway is not open and as long as they are secured properly while in use and removed when the inclement weather ends.
j. Fog machines or other devices that can produce the appearance of smoke are not permitted on the Spring Carnival Midway.
k. The expiration date on the back of each smoke detector shall be adhered to. Smoke detectors must be replaced every 10 years. New batteries must be installed prior to installation of the smoke detector. Exception: units with a sealed (non-replaceable) battery.
l. There must be a minimum of one smoke detector per floor. However, additional smoke detectors may be required based on the layout of the booth, at the discretion of EHS.
m. The maximum egress distance of each booth must be no more than 50'.

22. Water

a. No container holding more than 50 gallons of water may be used.
b. The depth of the water in any open container larger than 4 inches across at its narrowest dimension may not exceed 10 inches at the deepest point.
c. Exceptions may be granted for a dunking booth or similar attraction at the discretion of the Committee.
d. All water used in booths must be continuously recycling and non-stagnating.

23. Paint

a. Organization must use tarps for canvas while painting. No paint should be able to get on sidewalks or the parking lot.

24. Transportation of Materials and Parts

a. No part of a structure may be carried onto the Midway that cannot be safely handled by a maximum of 6 people.
b. No item may be rolled onto Midway that cannot be safely handled by a maximum of 3 people.
c. Larger items may be delivered by a closed box truck, or any truck approved by the members of Spring Carnival Executive Board, so long as they can safely be loaded, moved, and unloaded.
d. Forklifts, or other heavy machinery, may only be operated by those who have received proper training to become a qualified operator, and have been given permission by the Head of Booth and the rest of the Committee.

25. Fall Prevention

a. Organizations should do their best to adhere to the following safe work practices. Safety practices will be evaluated by SCC and EHS, and other relevant parties throughout build week and may contribute to penalties as well as awards as determined.

b. Stairs should be completed before construction on second floor walls begin to provide a safe way of travel between levels of construction.
c. Ladders should be of adequate height to reach roofs, floors and work surfaces. The top step and top cap of ladders should not be used for working or reaching heights.
d. Ladders must be supported by members when in use.
e. No more that the minimum number of people required to work should be on the roof at any time.

26. Other Unsafe Conditions

a. The Committee, or a subcommittee appointed for the purpose, reserves the right to declare any condition, material, design or activity to be unsafe at its sole discretion with support of the whole committee. The Unsafe Conditions Committee will also review elements brought to their attention that are unsafe. Organizations shall comply with all instructions given as a result.
b. Any member of the committee listed below can curtail and stop any unsafe conditions while the committee discusses. Where feasible, reasonable opportunities will be given to correct the problem or problems before the structure is closed permanently. No person may have any part of his/her body under or on any component that is not structurally supported. The committee will be comprised of the following people:
    i. Advisor of Spring Carnival Committee
    ii. Chair(s) of Spring Carnival Committee
    iii. Assistant Chair(s) of Spring Carnival Committee
    iv. Head(s) of Booth for Spring Carnival Committee
    v. Structural Oversight Faculty Member
    vi. Fire Safety Manager, Environmental Health & Safety
    vii. Director or Designee from Environmental Health & Safety

27. Revisions

Date	Documented Changes	Initials
11/11/2015		
6/28/2021	Updated Format and Accessibility Update	MAS
9/12/2023	Reviewed and Updated Format	RC/MAS
9/18/2024	Reviewed and no updates required	RC
11/17/2024	Reviewed and updated by the Spring Carnival Committee	RC/SCC

Appendix A

Plan Review Checklist

Organization:

Review Number:

Reviewed By:

Date:

Plans

	Floor plans, sections, and details showing all structural elements with additional details for prefabricated components, support beams and posts, doors, windows, structural connections between walls, stairs, ramps, and railings. All elements must be fully dimensioned.
	Drawings of all decorative elements including fastener details.
	A complete description of all structural and decorative materials used that includes an estimate of the total quantities of each used.
	Electrical and wiring diagrams that include the locations of wires, receptacles, switches, lights, and all other electrical elements used.
	A list of all electrical devices to be used including their power consumption.
	A description (with drawings, if appropriate) of how the structure will be moved to the Midway and installed there.
	A description (with drawings, if appropriate) of how the structure will be removed from the Midway and disposed of or stored.
	A description of the booth to be printed in Spring Carnival literature
	Environmental Judging Form

Comments:

1st Floor

Floors

	Floor joists are < 16” on center
	Floor joist max. span meets construction standards
	Flooring specified to be plywood (>= ¾”) (Unless floor joists are no less than 12 inches on center, then ½” may be used)
	All plywood seams are supported by joists

Comments:

Walls

	Structural walls made of 2x4 (or >) lumber
	Wall studs spaced < 16” on center
	At least one side of each structural wall is covered by (>⅜”) plywood or OSB
	Sheathing edges are backed by framing
	Walls are supported from below by floor frame joists
	Double top plate is used or strong tie bracket quantities are listed

Comments:

Headers

	Header span meets construction standards

Comments:

Stairs

	Stairs' run and rise total approx. 18 inches
	Stairs' run is over 11 inches
	Stairs' rise is between 4 and 7 inches
	Stairway at least 36 inches wide
	Headroom is at least 80 inches
	Landing at the bottom and top is at least as long as the stairway is wide
	Treads are of sufficient thickness (see construction standards)
	Carriage waist is at least 1 inch for every 1 foot of carriage length
	Stairs are supported from below by floor frame joists

Comments:

Handrails

	Handrails are 34 to 38 inches high
	Handrails have a rounded profile on top
	Clearance between handrail and adjacent wall is at least 1-½ inches

Comments:

2nd Floor

Floors

	Floor joists are < 16” on center
	Floor joist max. span meets construction standards
	Flooring specified to be plywood (>= ¾”)
	All plywood seams are supported by joists
	All joists are supported by a structural wall or a header beam

Comments:

Walls

	Structural walls made of 2x4 (or >) lumber
	Wall studs spaced < 16” on center
	At least one side of each structural wall is covered by (>⅜”) plywood or OSB
	Sheathing edges are backed by framing
	Walls are supported from below by floor frame joists
	Double top plate is used or strong tie bracket quantities are listed

Comments:

Headers

	Header span meets construction standards

Comments:

Guardrails

	Present at anywhere there is a change in elevation of more than 7 inches
	Guardrails are at least 42 inches in height
	Any spacing is less than 4 inches

Comments:

Roof

	Roof rafters meet the construction standards
	All rafters are supported from below by either a structural wall or header
	Roofing is no less than ⅜ inch thick plywood or OSB (other materials allowed with approval)

Comments:

Overall Comments:

Appendix B

Structural Oversite Committee: Plan Review

Organization:

Review Number:

Date:

FMCS Electrician review will include: Electrical and wiring diagrams that includes the locations of wires, receptacles, switches, lights, and all other electrical elements used. As well as the list of all electrical devices to be used including their power consumption.

Reviewer Name:

Comments:

Approved **Rejected**

Architecture review will include: Structural design of Floor plans, sections, and details showing all structural elements with additional details for prefabricated components, support beams and posts, doors, windows, structural connections between walls, stairs, ramps, and railings. Applicable building codes may be referenced.

Reviewer Name:

Comments:

Approved **Rejected**

Engineering review will include: Structural design of Floor plans, sections, and details showing all structural elements with additional details for prefabricated components, support beams and posts,

doors, windows, structural connections between walls, stairs, ramps, and railings. Applicable building codes may be referenced.

Reviewer Name:

Comments:

Approved **Rejected**

Fire Safety review will include: Fire extinguisher and smoke detector placement, lighting levels (lux), egress paths, decoration flammability and fire risks. Applicable fire codes may be referenced.

Reviewer Name:

Comments:

Approved **Rejected**