Carnegie Mellon University

Environmental Health and Safety (EHS)
Carnival Construction Standards

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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.

3. 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. Structures must pass their final inspection to be permitted to open for public occupancy.
c. 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.
d. Structures are subject to additional unscheduled inspections at any time.

4. Occupancy

No booth will be permitted to be occupied by more than 50 persons at any time.

5. 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. 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. All persons on Midway must wear safety glasses at all times. 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.
f. Long hair must be secured and tucked in to prevent entanglement with powered rotating equipment including powered hand drills.

6. 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.

7. 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. Pathways must be at least 6 feet wide and available throughout staging area. Materials must be stacked to allow for egress around the booths.
iii. Allow for paths for the scaffolding to access the booths and to be moved around Midway.

8. 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. 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.

c. Flooring

i. Floors 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. Flooring must be plywood only - Oriented Strand Board (OSB) is not permitted for use on floors.

iii. All plywood seams must have joists below them.

iv. Base of any interior post must have adequate support, i.e. transfer the load directly to the asphalt.

d. Walls

i. Structural walls must be made up of 2x4 (nominal) lumber or larger spaced no farther apart than 16 inches on center, with the exception that walls supporting only a roof or decorative elements may increase the spacing to 24 inches on center.

ii. At least one side of each structural wall must be covered with no less than 3/8 inch thick (nominal) plywood or oriented strand board (OSB) properly installed.
   1. All structural sheathing panel edges must be completely backed by framing. Interior, non-structural partitions do not need sheathing.

e. Headers/Beams

Any gaps in structural walls (i.e., doors or windows) must have properly supported headers. 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. Doors or doorways must have at least 32 inches wide and 6'8" inches high clear space when the door is open.

ii. Doors may not have locks or latches. Any closing doors must open in the direction of egress.

g. **Headroom**

i. 7 foot 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.

ii. 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.

9. Stairs

a. Design Dimension Limits

i. 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.

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

iii. Stairways must be at least 36 inches wide.

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

v. 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.

vi. 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 considered to be individual steps.

vii. 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.
viii. 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.

b. Tread Thickness

i. Stair treads may either be either:
   1. 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
   2. A single piece of 3/4 inch thick plywood that does not span more than 16 inches and has no unsupported edges.

c. Stair Strength

i. Stair carriages must be supported from below. Stair carriages should have no more than 1 foot of span for every 1 inch of carriage waist.
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.

d. Stair Lighting

i. Stairways that are enclosed on more than one side must be illuminated with lighting no less than 1 foot-candle (11 lux) at the walking surface level.

10. Ramps

a. Ramps are permitted so long as they have no more than a 1 in 8 slope.

11. Stair and Rand 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 300 pound force in any direction at any point.

12. 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.

13. 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.

14. 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”

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.

15. 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.

16. Plumb

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

17. Fasteners

a. Appropriate fasteners including bolts, construction screws or nails, must be used for all structural construction.
b. Drywall screws are not permitted for use on structural elements. Structural elements may not be supported by fasteners in shear.

18. 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.

19. Fire Protection

a. All structures must be built of non-combustible materials, or they must be properly treated with a flame retardant material approved by Environmental Health & Safety. Application of flame retardant treatments must occur prior to painting or coating any combustible material to assure for more complete protection against flame spread. Flame retardant material shall be applied in multiple thin coatings rather than a single thin coat.
b. No smoking or open flames shall be permitted on the Midway at any time.
c. No flammable gases 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.
d. Straw, hay, dry grass, or similar materials that cannot be flame-proofed are not permitted.
e. Foam may only be used under the following conditions:
    i. All foam must be pre-soaked (not merely sprayed) in approved flame retardant.
    ii. The maximum dimensions of any single piece of foam used cannot exceed 24x24x2 inches.
    iii. Total thicknesses of foam applied to any structure cannot be greater than 4 inches.
    iv. Urethane foam and foam designated as flammable or combustible shall not be used for any reason.
f. 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 removed when the inclement weather ends.
g. Fog machines or other devices that can produce the appearance of smoke are not permitted on the Spring Carnival Midway.
h. Each booth must have at all times a smoke detector. Each organization will obtain it from the Committee and must return it on the day of tear-down.

20. 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.

21. Paint

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

22. 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.

23. 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.
b. Organizations shall comply with all instructions given as a result.
c. Where feasible, reasonable opportunities will be given to correct the problem or problems before the structure is closed permanently.
d. No person may have any part of his/her body under or on any component that is not structurally supported.

24. 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

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**