

# Carnegie Mellon

## Structural Building Guidelines

Revised – July, 2008

These guidelines apply to all student construction, and especially to activities relating to special functions (e.g. Spring Carnival, Homecoming, International Festival, Theme Parties, etc.) and other educational and social activities. They are intended to control the construction of temporary structures; permanent structures shall be planned and construction managed by Campus Design and Facility Development. **These guidelines establish safety as the primary factor in the design, construction, use, and demolition of temporary structures.**

The construction or erection of any platform, booth, structure, or framework on any Carnegie Mellon University property or within any University owned building must have prior written approval of Facilities Management Services (FMS) and Environmental Health & Safety (EH&S) and meet the following general criteria. Where applicable, the Housing Services Policy covering student construction within residence buildings must also be followed.

### PLAN REVIEW

All proposed construction must be reviewed by appropriate representatives of both Facilities Management Services Operations and Environmental Health & Safety. Proposals must be submitted in writing at least one week in advance of the start of planned construction, and must include two identical sets of drawings or sketches showing structural details, assembly hardware, overall dimensions, a complete description of all **structural** and **decorative** materials (including an estimate of quantities to be used), and electrical wiring diagrams. Drawings must be on size 8 1/2" x 11" white paper, and all proposals are to be initially submitted for review to the Fire Safety Specialist, Environmental Health & Safety. Whenever construction plans are submitted, they are to be accompanied by a plan indicating the steps and methods that will be used when assembling and later, dismantling the structure.

### PLAN SUBMITTAL

An appointment is to be made to meet with the Fire Safety Specialist, at the Environmental Health & Safety offices. During this appointment a preliminary review of plans and all related information will be conducted and, if acceptable, plans will be received into the review process. Complete plan review is conducted by at least three individual persons, who examine plans for structural, electrical, and fire and general safety purposes. Plans dropped off without an appointment and preliminary meeting **will not** be accepted for review.

### START OF CONSTRUCTION

Applicants will be notified if and when their plans have been approved, and what modifications or changes, if any, may need to be made to their original plans. Only materials specifically listed, and in the quantities described on approved plans may be used. Actual construction **may not begin** until notification of approval has been received. Plan approval constitutes an authorization to begin construction.

## **TRANSPORT OF PRECONSTRUCTED MATERIALS**

Whenever it is necessary to relocate preconstructed portions of a booth, platform, framework, or structure to another location transportation of such material shall be carried out in a safe manner. Only vehicular transport, or wheeled carts capable of supporting the weight placed upon them, should be used for this purpose. While some preformed modules may be hand carried to the final site, these must be **no larger and no heavier** than can be easily handled by **no more than six (6) persons**.

## **ON SITE INSPECTION**

All construction must follow the approved plan and is **subject to on-site review and inspection**. Discrepancies noted by on-site inspection teams must be promptly addressed upon receiving notification of problems requiring corrective action. This especially applies to any issues relating to **structural integrity or safety**.

## **PERSONAL SAFETY REQUIREMENTS**

Proper clothing, footwear, and protective equipment shall be worn during all phases of construction and demolition. The following guidelines **shall be** followed at all times:

- 1) Safety glasses or face shields shall be worn when operating power tools.
- 2) Safety glasses shall be worn when hammering, hand sawing, or removing fasteners.
- 3) Proper footwear shall be worn at all times. Open toed shoes, sandals, or worn-out shoes are not permitted. Bare feet are specifically prohibited from construction sites.
- 4) Bump caps or hard hats shall be worn when working under or around overhead structures other than entrance structures or wires.
- 5) No loose clothing, jewelry, neck ties, etc. shall be worn when operating or assisting in the operation of power tools.
- 6) Proper clothing (e.g. long pants or slacks, short-sleeved shirt, or long-sleeved shirt with cuffs buttoned or rolled completely up) shall be worn at all times during construction and demolition. Clothing that extends past the hands or feet shall not be worn.
- 7) Power tools are to be kept unplugged except when in actual use.

**Safety shall be paramount at all construction and demolition sites. If and when questions, controversies, or apparent conflicts arise regarding safety, EH&S shall be contacted to evaluate the situation and provide direction. The resulting EH&S directive shall be enforced by the appropriate authorities.**

## **CONSTRUCTION MATERIALS**

All structures must be built of non-combustible materials, or they must be properly treated with a flame retardant 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 flamespread.

Only screws and bolts (no nails or staples) are to be used when connecting large pieces of a structural section, or when connecting sections of a structure. Nails or staples may be used only for attachment of lighter, non-structural material to the booth or framework. Joist hangers and similar metal mounting plates must be used for connecting support beams, stair stringer sections, and other large structural members.

## **USE OF STYROFOAM**

Styrofoam is merely an insulation material, providing no structural strength to any construction on which it is used. While it can be easily shaped for purposes of decorating temporary structures such as booths or similar frameworks, its use shall be limited as follows for both environmental and firesafety reasons:

- a) all styrofoam must be **presoaked** (not merely sprayed) in approved flame retardant. It must, therefore, be of a size that will fit in an open tray or similar type of container in order that presoaking may be properly carried out.
- b) the maximum dimensions of any single piece of styrofoam used cannot exceed **24"x24"x2"**. Any styrofoam pieces larger than this must be cut down to at least this size before construction or use has begun, or before material is placed in storage.
- c) thicknesses of styrofoam applied to any structure cannot be greater than twice (2 ply) the maximum thickness allowed for any single piece, or four inches.
- d) these rules also apply to other types of expanded or extruded foam. Urethane foam and styrofoam designated as "COMBUSTIBLE" **shall not** be used in temporary structures for any reason.

## **STRUCTURES IN OR NEAR BUILDINGS**

Structures cannot be attached to any building or projection, nor can any portion of a building or projection be used for their support. If a structure is designed to be placed within, or in the vicinity of an existing building, its placement cannot obstruct or reduce in size any means of emergency egress from that building. **(All exterior doors and direct paths to corridors, stairwells, and exterior doors are means of emergency egress).**

## **STRUCTURAL HEIGHT AND ACCESS**

No structure can be built containing stairs, ramps, ledges, landings, or platforms providing access or permitting any person to stand on any portion thereof at a height greater than 8 feet above its base. Ladders **will not** be permitted to be a part of the overall structure, and portable ladders shall not be kept at the site of the structure after construction has been completed.

## **STAIRS**

If stairs are planned as a part of a structure, they must comply with the following requirements:

- a) Minimum width - 36"
  - b) Tread depth (minimum) - 11"
  - c) Riser height (maximum) - 7"
- Note: When constructed, no variation exceeding 3/16" in depth of adjacent treads or in height of adjacent risers will be permitted.

Measurements of individual riser height and tread depth must equal 18", i.e., if risers are 6" in height treads must be 12" deep. Tolerance between the largest and smallest tread or the largest and smallest riser in any stairway shall not exceed 3/8".

## **JOISTS AND SUPPORT BEAMS**

All elevated walking surfaces, load bearing ceilings, and similar structural members shall be appropriately supported by beams or joists no less than 2" x 6" in size, with the edge (2") of the joist or beam touching the surface it is supporting. Smaller pieces of lumber, such as 2" x 4"s shall not be used for this purpose.

## **RAMPS**

Walking ramps used as a part of, or in connection with a structure may not have slopes greater than 1" of vertical rise for each 8" of horizontal run (1:8). They must have slip resistant walking surfaces and be equipped with appropriate hand rails. Wheelchair ramps may not have slopes greater than 1" of vertical rise for each 12" of horizontal run (1:12). They must have landings that are 5 feet square and they must be equipped with appropriate hand rails.

## **HAND RAILINGS**

Hand rails are required for ramps and stairways. They shall not be less than 34" or more than 38" in height, when measured vertically from the top surfaces of treads, landings, or walking surfaces.. Hand rails may be attached to the wall of the structure or may be mounted on vertical support posts. Tops of hand rails should be rounded to conform with the grip of the human hand. All openings located directly beneath hand rails must be protected by balusters constructed of solid material placed close enough together so as to reduce the size of the openings to no more than 4" in width.

## **GUARD RAILS**

Guard rails at least 42" in height must be provided along any elevated walking or standing surface. Hand rails that form a part of a guard rail shall not exceed 42" in height. Openings located directly beneath guard rails must be protected by balusters constructed of solid material placed close enough together so as to reduce the size of the openings to no more than 4" in width

## **DOORS AND DOORWAYS**

All doors and doorways included as part of a structure must have a minimum height of 6'8" and a minimum width of 32". Doors **shall not** be equipped with locks or latches.

## **OVERHEAD CLEARANCE**

Clear head room of at least 6'8" must be provided throughout the interior of any booth or structure that persons are expected to enter, and along the top of any open or partially open structure at which persons may stand while participating in any activity. Minimum clearance of 6'8" must be maintained below lighting or any other objects suspended overhead. **If stairs run through a doorway or covered passage** a minimum of 6'8" must be maintained between the bottom of the lintel or ceiling and the top(s) of the stair tread(s) located directly below.

## **PROJECTIONS AND JUTTING MATERIAL**

There may be no projections at heights which persons may physically strike accidentally. All bolts, nails, etc. must be arranged so as not to protrude from the outside of any structure, and interior projections must be covered for safety.

## **STRUCTURES AND PRACTICES THAT ARE NOT PERMITTED**

The **construction or use** of holding tanks, swimming pools, slides, or similar amusement/activity type structures is **strictly prohibited**. This does not include the use of leased "dunking pools", or decorative fountains or waterfalls that recycle water from a tank having a depth of no more than 10" and a total capacity for holding no more than 50 gallons at the Spring Carnival Midway only. (Example: A rectangular shaped tank measuring 10" deep by 26" wide by 45" long). Back flow prevention devices and/or siphon breaks shall be used on all plumbing connections to the municipal water distribution system.

Gasoline or other flammable liquid or compressed gas powered equipment **shall not be used** within any residence building or at the Spring Carnival Midway area.

The use of **cut** live trees, plants, or shrubbery for decorative or other purposes **is not permitted**.

Also, the use of straw, hay, dried grass, excelsior, or similar materials which may not accept flame retardant treatments is **prohibited**.

The use of fog machines or similar devices which can create the appearance of smoke **are not permitted** to be used on the Spring Carnival Midway. Such devices are also **not permitted to be used indoors** in areas where they may cause false activations of fire alarm system smoke detection.

The use of plastic tarpaulins or black plastic sheeting is **not permitted**, since these are flammable and cannot be treated with approved flame retardant. For temporary weather protection, clear plastic sheeting or industrial visqueen may be used.

Open flame activities, such as lighting bonfires or tiki torches, are **municipally prohibited**. Such activities require special permits issued by both the city and the county.

## **ACTIVITIES**

Games involving one-on-one interactive contact, those involving activities that present an obvious risk of personal injury, or that require any person to act as a target for thrown or projected objects, or those which permit projectiles or similar items to be fired or thrown outside of or beyond the target area **are not permitted**. Plan submittals **are to include** an accurate description of any game or activity that is to be applied in connection with the use of the structure.

## **RECYCLED CONSTRUCTION MATERIALS**

While recycling of construction materials is encouraged, the following rules **shall** apply:

- 1) **No** fasteners showing signs of stress or corrosion shall be re-used.
- 2) Lengthening lumber for purposes of providing support is permitted **only** if the pieces to be joined are of the same cross-sectional dimensions, are connected with gusset plates of the same cross-sectional dimensions extending along each piece as far as the largest dimension, and fastened with five (5) threaded bolts or screws on each side of the joint: one in the center and one near each of the four corners.
- 3) Lumber or building material that cannot retain fasteners **shall not** be re-used.
- 4) All material to be recycled shall be inspected for signs of deterioration that may have occurred during storage. Material showing any signs of deterioration (e.g. rotting, insect damage, delamination, etc.) **shall not** be used.

## **TENTS**

All tents are designated "**NO SMOKING**" structures and are to be properly posted. Signs for this purpose will be provided by Environmental Health & Safety. Before approval can be given for the use of any tent, proof of flame retardance must be furnished. **Tents covering an area of 120 square feet or more require a special city permit** in addition to approval by FMS/EH&S. A permit fee is charged by the City of Pittsburgh, and must be paid by the organization planning to use the tent. Environmental Health & Safety will help apply for the required city permit when supplied with a check or money order made payable to the Treasurer, City of Pittsburgh, in the amount of the permit fee, a site plan showing the proposed location and overall size of the tent, and a certificate of flameproofing furnished by the company providing the tent. Application for the permit must be submitted at least one week prior to tent erection.

## **DISMANTLING STRUCTURES AFTER USE**

When dismantling any structure, the following safety precautions **are to be observed in addition to the Personal Safety Requirements:**

- 1) Demolition is to be carried out by starting at the top of the structure and working downward to its base. Each section removed must be of a size and weight that can easily be carried by one person. If this is not possible, sufficient people must be on hand to safely move all dismantled segments of the structure.
- 2) A container, or "nail bucket" is to be kept at each organization's demolition site. All nails, bolts, screws, etc. are to be deposited in this container as they are removed. This will help ensure against injuries that can occur when people step on such objects.
- 3) If separate structures are immediately adjacent to one another, such as occurs at the Spring Carnival Midway, a predetermined schedule for dismantling alternating structures is to be established and followed. This means that every other structure that is located side by side or back to back must first be totally removed before any dismantling work is begun on the remaining structures.
- 4) The same personal safety equipment, i.e., eye protection, head protection, etc., shall be used during demolition as is required during construction.