

# APPENDIX G

## FLOOD-RESISTANT CONSTRUCTION

(This appendix is informative and is not part of the code.)

### SECTION G101 ADMINISTRATION

**G101.1 Purpose.** The purpose of this appendix is to promote the public health, safety and general welfare and to minimize public and private losses due to *flood* conditions in specific *flood hazard* areas through the establishment of comprehensive regulations for management of *flood hazard areas* designed to:

1. Prevent unnecessary disruption of commerce, access and public service during times of *flooding*;
2. Manage the alteration of natural *flood* plains, stream channels and shorelines;
3. Manage filling, grading, dredging and other development which may increase *flood* damage or erosion potential;
4. Prevent or regulate the construction of *flood* barriers which will divert floodwaters or which can increase flood hazards; and
5. Contribute to improved construction techniques in the flood plain.

**G101.2 Objectives.** The objectives of this appendix are to protect human life, minimize the expenditure of public money for *flood* control projects, minimize the need for rescue and relief efforts associated with *flooding*, minimize prolonged business interruption, minimize damage to public facilities and utilities, help maintain a stable tax base by providing for the sound use and development of flood-prone areas, contribute to improved construction techniques in the flood plain and ensure that potential owners and occupants are notified that property is within flood hazard areas.

**G101.3 Scope.** The provisions of this appendix shall apply to all proposed development in a flood hazard area established in Section 1612 of this code, including certain building work exempt from permit under Section 105.2.

**G101.4 Violations.** Any violation of a provision of this appendix, or failure to comply with a permit or variance issued pursuant to this appendix or any requirement of this appendix, shall be handled in accordance with Section 114.

### SECTION G102 APPLICABILITY

**G102.1 General.** This appendix, in conjunction with the *International Building Code*, provides minimum requirements for development located in flood hazard areas, including the subdivision of land; installation of utilities; placement and replacement of manufactured homes; new construction and repair, reconstruction, rehabilitation or additions to new construction;

substantial improvement of existing buildings and structures, including restoration after damage, temporary structures, and temporary or permanent storage, utility and miscellaneous Group U buildings and structures, and certain building work exempt from permit under Section 105.2.

**G102.2 Establishment of flood hazard areas.** *Flood hazard areas* are established in Section 1612.3 of the *International Building Code*, adopted by the applicable governing authority on [INSERT DATE].

### SECTION G103 POWERS AND DUTIES

**G103.1 Permit applications.** The *building official* shall review all *permit* applications to determine whether proposed development sites will be reasonably safe from flooding. If a proposed development site is in a flood hazard area, all site development activities (including grading, filling, utility installation and drainage modification), all new construction and substantial improvements (including the placement of pre-fabricated buildings and manufactured homes) and certain building work exempt from *permit* under Section 105.2 shall be designed and constructed with methods, practices and materials that minimize flood damage and that are in accordance with this code and ASCE 24.

**G103.2 Other permits.** It shall be the responsibility of the *building official* to assure that approval of a proposed development shall not be given until proof that necessary permits have been granted by federal or state agencies having jurisdiction over such development.

**G103.3 Determination of design flood elevations.** If design flood elevations are not specified, the *building official* is authorized to require the applicant to:

1. Obtain, review and reasonably utilize data available from a federal, state or other source, or
2. Determine the *design flood elevation* in accordance with accepted hydrologic and hydraulic engineering techniques. Such analyses shall be performed and sealed by a *registered design professional*. Studies, analyses and computations shall be submitted in sufficient detail to allow review and approval by the *building official*. The accuracy of data submitted for such determination shall be the responsibility of the applicant.

**G103.4 Activities in riverine flood hazard areas.** In riverine *flood hazard areas* where *design flood elevations* are specified but *floodways* have not been designated, the *building official* shall not permit any new construction, substantial improvement or other development, including fill, unless the applicant demonstrates that the cumulative effect of the proposed devel-

opment, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point within the community.

**G103.5 Floodway encroachment.** Prior to issuing a *permit* for any *floodway* encroachment, including fill, new construction, substantial improvements and other development or land-disturbing activity, the *building official* shall require submission of a certification, along with supporting technical data, that demonstrates that such development will not cause any increase of the level of the base *flood*.

**G103.5.1 Floodway revisions.** A *floodway* encroachment that increases the level of the base *flood* is authorized if the applicant has applied for a conditional Flood Insurance Rate Map (FIRM) revision and has received the approval of the Federal Emergency Management Agency (FEMA).

**G103.6 Watercourse alteration.** Prior to issuing a permit for any alteration or relocation of any watercourse, the *building official* shall require the applicant to provide notification of the proposal to the appropriate authorities of all affected adjacent government jurisdictions, as well as appropriate state agencies. A copy of the notification shall be maintained in the permit records and submitted to FEMA.

**G103.6.1 Engineering analysis.** The *building official* shall require submission of an engineering analysis which demonstrates that the flood-carrying capacity of the altered or relocated portion of the watercourse will not be decreased. Such watercourses shall be maintained in a manner which preserves the channel's flood-carrying capacity.

**G103.7 Alterations in coastal areas.** Prior to issuing a permit for any alteration of sand dunes and mangrove stands in flood hazard areas subject to high velocity wave action, the *building official* shall require submission of an engineering analysis which demonstrates that the proposed alteration will not increase the potential for flood damage.

**G103.8 Records.** The *building official* shall maintain a permanent record of all *permits* issued in *flood hazard areas*, including copies of inspection reports and certifications required in Section 1612.

## SECTION G104 PERMITS

**G104.1 Required.** Any person, owner or authorized agent who intends to conduct any development in a flood hazard area shall first make application to the *building official* and shall obtain the required *permit*.

**G104.2 Application for permit.** The applicant shall file an application in writing on a form furnished by the *building official*. Such application shall:

1. Identify and describe the development to be covered by the permit.
2. Describe the land on which the proposed development is to be conducted by legal description, street address or

similar description that will readily identify and definitely locate the site.

3. Include a site plan showing the delineation of flood hazard areas, floodway boundaries, flood zones, design flood elevations, ground elevations, proposed fill and excavation and drainage patterns and facilities.
4. Indicate the use and occupancy for which the proposed development is intended.
5. Be accompanied by construction documents, grading and filling plans and other information deemed appropriate by the building official.
6. State the valuation of the proposed work.
7. Be signed by the applicant or the applicant's authorized agent.

**G104.3 Validity of permit.** The issuance of a *permit* under this appendix shall not be construed to be a permit for, or approval of, any violation of this appendix or any other ordinance of the jurisdiction. The issuance of a *permit* based on submitted documents and information shall not prevent the *building official* from requiring the correction of errors. The *building official* is authorized to prevent occupancy or use of a structure or site which is in violation of this appendix or other ordinances of this jurisdiction.

**G104.4 Expiration.** A *permit* shall become invalid if the proposed development is not commenced within 180 days after its issuance, or if the work authorized is suspended or abandoned for a period of 180 days after the work commences. Extensions shall be requested in writing and justifiable cause demonstrated. The *building official* is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each.

**G104.5 Suspension or revocation.** The building official is authorized to suspend or revoke a *permit* issued under this appendix wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or code of this jurisdiction.

## SECTION G105 VARIANCES

**G105.1 General.** The *board of appeals* established pursuant to Section 112 shall hear and decide requests for variances. The *board of appeals* shall base its determination on technical justifications, and has the right to attach such conditions to variances as it deems necessary to further the purposes and objectives of this appendix and Section 1612.

**G105.2 Records.** The building official shall maintain a permanent record of all variance actions, including justification for their issuance.

**G105.3 Historic structures.** A variance is authorized to be issued for the repair or rehabilitation of a historic structure upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a his-

toric structure, and the variance is the minimum necessary to preserve the historic character and design of the structure.

**Exception:** Within *flood hazard areas, historic structures* that are not:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places; or
2. Determined by the Secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district; or
3. Designated as *historic* under a state or local historic preservation program that is approved by the Department of Interior.

**G105.4 Functionally dependent facilities.** A variance is authorized to be issued for the construction or substantial improvement of a functionally dependent facility provided the criteria in Section 1612.1 are met and the variance is the minimum necessary to allow the construction or substantial improvement, and that all due consideration has been given to methods and materials that minimize flood damages during the design flood and create no additional threats to public safety.

**G105.5 Restrictions.** The *board of appeals* shall not issue a variance for any proposed development in a floodway if any increase in flood levels would result during the base flood discharge.

**G105.6 Considerations.** In reviewing applications for variances, the *board of appeals* shall consider all technical evaluations, all relevant factors, all other portions of this appendix and the following:

1. The danger that materials and debris may be swept onto other lands resulting in further injury or damage;
2. The danger to life and property due to flooding or erosion damage;
3. The susceptibility of the proposed development, including contents, to flood damage and the effect of such damage on current and future owners;
4. The importance of the services provided by the proposed development to the community;
5. The availability of alternate locations for the proposed development that are not subject to flooding or erosion;
6. The compatibility of the proposed development with existing and anticipated development;
7. The relationship of the proposed development to the comprehensive plan and flood plain management program for that area;
8. The safety of access to the property in times of flood for ordinary and emergency vehicles;
9. The expected heights, velocity, duration, rate of rise and debris and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site; and
10. The costs of providing governmental services during and after flood conditions including maintenance and

repair of public utilities and facilities such as sewer, gas, electrical and water systems, streets and bridges.

**G105.7 Conditions for issuance.** Variances shall only be issued by the *board of appeals* upon:

1. A technical showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site renders the elevation standards inappropriate;
2. A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable;
3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, nor create nuisances, cause fraud on or victimization of the public or conflict with existing local laws or ordinances;
4. A determination that the variance is the minimum necessary, considering the flood hazard, to afford relief; and
5. Notification to the applicant in writing over the signature of the building official that the issuance of a variance to construct a structure below the base flood level will result in increased premium rates for flood insurance up to amounts as high as \$25 for \$100 of insurance coverage, and that such construction below the base flood level increases risks to life and property.

## SECTION G201 DEFINITIONS

**G201.1 General.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

### G201.2 Definitions.

**DEVELOPMENT.** Any manmade change to improved or unimproved real estate, including but not limited to, buildings or other structures, temporary structures, temporary or permanent storage of materials, mining, dredging, filling, grading, paving, excavations, operations and other land-disturbing activities.

**FUNCTIONALLY DEPENDENT FACILITY.** A facility which cannot be used for its intended purpose unless it is located or carried out in close proximity to water, such as a docking or port facility necessary for the loading or unloading of cargo or passengers, shipbuilding or ship repair. The term does not include long-term storage, manufacture, sales or service facilities.

**MANUFACTURED HOME.** A structure that is transportable in one or more sections, built on a permanent chassis, designed for use with or without a permanent foundation when attached to the required utilities, and constructed to the Federal Mobile Home Construction and Safety Standards and rules and regulations promulgated by the U.S. Department of Housing and Urban Development. The term also includes mobile homes, park trailers, travel trailers and similar transportable structures that are placed on a site for 180 consecutive days or longer.

**MANUFACTURED HOME PARK OR SUBDIVISION.** A parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

**RECREATIONAL VEHICLE.** A vehicle that is built on a single chassis, 400 square feet (37.16 m<sup>2</sup>) or less when measured at the largest horizontal projection, designed to be self-propelled or permanently towable by a light-duty truck, and designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel or seasonal use. A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect-type utilities and security devices and has no permanently attached additions.

**VARIANCE.** A grant of relief from the requirements of this section which permits construction in a manner otherwise prohibited by this section where specific enforcement would result in unnecessary hardship.

**VIOLATION.** A development that is not fully compliant with this appendix or Section 1612, as applicable.

### SECTION G301 SUBDIVISIONS

**G301.1 General.** Any subdivision proposal, including proposals for manufactured home parks and subdivisions, or other proposed new development in a flood hazard area shall be reviewed to assure that:

1. All such proposals are consistent with the need to minimize flood damage;
2. All public utilities and facilities, such as sewer, gas, electric and water systems are located and constructed to minimize or eliminate flood damage; and
3. Adequate drainage is provided to reduce exposure to flood hazards.

**G301.2 Subdivision requirements.** The following requirements shall apply in the case of any proposed subdivision, including proposals for manufactured home parks and subdivisions, any portion of which lies within a flood hazard area:

1. The flood hazard area, including floodways and areas subject to high velocity wave action, as appropriate, shall be delineated on tentative and final subdivision plats;
2. Design flood elevations shall be shown on tentative and final subdivision plats;
3. Residential building lots shall be provided with adequate buildable area outside the floodway; and
4. The design criteria for utilities and facilities set forth in this appendix and appropriate *International Codes* shall be met.

### SECTION G401 SITE IMPROVEMENT

**G401.1 Development in floodways.** Development or land disturbing activity shall not be authorized in the *floodway* unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering prac-

tice that the proposed encroachment will not result in any increase in the level of the base *flood*.

**G401.2 Flood hazard areas subject to high-velocity wave action.** In *flood hazard areas* subject to high-velocity wave action:

1. New buildings and buildings that are substantially improved shall only be authorized landward of the reach of mean high tide.
2. The use of fill for structural support of buildings is prohibited.

**G401.3 Sewer facilities.** All new or replaced sanitary sewer facilities, private sewage treatment plants (including all pumping stations and collector systems) and on-site waste disposal systems shall be designed in accordance with Chapter 7, ASCE 24, to minimize or eliminate infiltration of floodwaters into the facilities and discharge from the facilities into floodwaters, or impairment of the facilities and systems.

**G401.4 Water facilities.** All new or replacement water facilities shall be designed in accordance with the provisions of Chapter 7, ASCE 24, to minimize or eliminate infiltration of floodwaters into the systems.

**G401.5 Storm drainage.** Storm drainage shall be designed to convey the flow of surface waters to minimize or eliminate damage to persons or property.

**G401.6 Streets and sidewalks.** Streets and sidewalks shall be designed to minimize potential for increasing or aggravating flood levels.

### SECTION G501 MANUFACTURED HOMES

**G501.1 Elevation.** All new and replacement manufactured homes to be placed or substantially improved in a *flood hazard area* shall be elevated such that the lowest floor of the manufactured home is elevated to or above the design flood elevation.

**G501.2 Foundations.** All new and replacement manufactured homes, including substantial improvement of existing manufactured homes, shall be placed on a permanent, reinforced foundation that is designed in accordance with Section 1612.

**G501.3 Anchoring.** All new and replacement manufactured homes to be placed or substantially improved in a *flood hazard area* shall be installed using methods and practices which minimize flood damage. Manufactured homes shall be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement. Methods of anchoring are authorized to include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting wind forces.

### SECTION G601 RECREATIONAL VEHICLES

**G601.1 Placement prohibited.** The placement of recreational vehicles shall not be authorized in *flood hazard areas* subject to high velocity wave action and in *floodways*.

**G601.2 Temporary placement.** Recreational vehicles in *flood hazard areas* shall be fully licensed and ready for highway use, and shall be placed on a site for less than 180 consecutive days.

**G601.3 Permanent placement.** Recreational vehicles that are not fully licensed and ready for highway use, or that are to be placed on a site for more than 180 consecutive days, shall meet the requirements of Section G501 for manufactured homes.

## SECTION G701 TANKS

**G701.1 Underground tanks.** Underground tanks in *flood hazard areas* shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design *flood*.

**G701.2 Above-ground tanks.** Above-ground tanks in flood hazard areas shall be elevated to or above the design *flood* elevation or shall be anchored or otherwise designed and constructed to prevent flotation, collapse or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, during conditions of the design *flood*.

**G701.3 Tank inlets and vents.** In *flood hazard areas*, tank inlets, fill openings, outlets and vents shall be:

1. At or above the design flood elevation or fitted with covers designed to prevent the inflow of floodwater or outflow of the contents of the tanks during conditions of the design *flood*.
2. Anchored to prevent lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, during conditions of the design *flood*.

## SECTION G801 OTHER BUILDING WORK

**G801.1 Detached accessory structures.** Detached accessory structures shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design *flood*. Fully enclosed accessory structures shall have flood openings to allow for the automatic entry and exit of *flood* waters.

**G801.2 Fences.** Fences in floodways that may block the passage of floodwaters, such as stockade fences and wire mesh fences, shall meet the requirement of Section G103.5.

**G801.3 Oil derricks.** Oil derricks located in *flood hazard areas* shall be designed in conformance with the flood loads in Sections 1603.1.7 and 1612.

**G801.4 Retaining walls, sidewalks and driveways.** Retaining walls, sidewalks and driveways shall meet the requirements of Section 1803.4.

**G801.5 Prefabricated swimming pools.** Prefabricated swimming pools in *floodways* shall meet the requirements of Section G103.5.

## SECTION G901 TEMPORARY STRUCTURES AND TEMPORARY STORAGE

**G901.1 Temporary structures.** Temporary structures shall be erected for a period of less than 180 days. Temporary structures shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design *flood*. Fully enclosed temporary structures shall have flood openings to allow for the automatic entry and exit of floodwaters.

**G901.2 Temporary storage.** Temporary storage includes storage of goods and materials for a period of less than 180 days. Stored materials shall not include hazardous materials.

**G901.3 Floodway encroachment.** Temporary structures and temporary storage in floodways shall meet the requirements of G103.5.

## SECTION G1001 UTILITY AND MISCELLANEOUS GROUP U

**G1001.1 Utility and miscellaneous Group U.** Utility and miscellaneous Group U includes buildings that are accessory in character and miscellaneous structures not classified in any specific occupancy in the *International Building Code*, including, but not limited to, agricultural buildings, aircraft hangars (accessory to a one- or two-family residence), barns, carports, fences more than 6 feet (1829 mm) high, grain silos (accessory to a residential occupancy), greenhouses, livestock shelters, private garages, retaining walls, sheds, stables and towers.

**G1001.2 Flood loads.** Utility and miscellaneous Group U buildings and structures, including substantial improvement of such buildings and structures, shall be anchored to prevent flotation, collapse or lateral movement resulting from flood loads, including the effects of buoyancy, during conditions of the design *flood*.

**G1001.3 Elevation.** Utility and miscellaneous Group U buildings and structures, including substantial improvement of such buildings and structures, shall be elevated such that the lowest floor, including basement, is elevated to or above the design *flood* elevation in accordance with Section 1612 of the *International Building Code*.

**G1001.4 Enclosures below design flood elevation.** Fully enclosed areas below the design flood elevation shall be at or above grade on all sides and conform to the following:

1. In *flood hazard areas* not subject to high-velocity wave action, enclosed areas shall have flood openings to allow for the automatic inflow and outflow of floodwaters.
2. In *flood hazard areas* subject to high-velocity wave action, enclosed areas shall have walls below the design flood elevation that are designed to break away or collapse from a water load less than that which would occur during the design flood, without causing collapse, displacement or other structural damage to the building or structure.

**G1001.5 Flood-damage-resistant materials.** Flood-damage-resistant materials shall be used below the design *flood* elevation.

**G1001.6 Protection of mechanical, plumbing and electrical systems.** Mechanical, plumbing and electrical systems, including plumbing fixtures, shall be elevated to or above the design *flood* elevation.

**Exception:** Electrical systems, equipment and components, and heating, ventilating, air conditioning, and plumbing appliances, plumbing fixtures, duct systems and other service equipment shall be permitted to be located below the design *flood* elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood-resistant construction requirements of this code. Electrical wiring systems shall be permitted to be located below the design flood elevation provided they conform to the provisions of NFPA 70.

**SECTION G1101  
REFERENCED STANDARDS**

ASCE 24-05	Flood Resistance Design and Construction	G103.1, G401.3, G401.4
HUD 24 CFR Part 3280 (1994)	Manufactured Home Construction and Safety Standards	G201
IBC-06	International Building Code	G102.2
NFPA 70-08	National Electrical Code	G1001.6