

Coastal Building Materials



FEMA



HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION FEMA 499/August 2005 Technical Fact Sheet No. 8

Purpose: To provide guidance on the selection of building materials used for coastal construction.

Key Issues

- The **durability** of a coastal home relies on the types of materials used to construct it. For more details, see the U.S. Department of Housing and Urban Development (HUD) report *Durability by Design, A Guide for Residential Builders and Designers*, available on the HUD User website at <http://www.huduser.org/publications/destech/durdesign.html>.
- Materials and construction methods should be resistant to **flood and wind damage, driving rain, corrosion, moisture, and decay**.
- All coastal buildings will require **maintenance and repairs** (more so than inland construction) — use proper materials and methods for repairs, additions, and other work following initial construction (see Fact Sheet No. 30).

Section 60.3(a)(ii) of the National Flood Insurance Program (NFIP) regulations requires that all new construction and substantial improvements in floodprone areas be constructed with materials below the Base Flood Elevation (BFE) that are resistant to flood damage. (See Fact Sheet No. 30 for a definition of “substantial improvement.”)

Flood-Resistant Materials

Flooding accounts for a large percentage of the damage caused by a coastal storm. Building materials exposed to flooding must be resilient enough to sustain a certain amount of water exposure in order to avoid the need for complete replacement after the flood.

FEMA defines a flood-resistant material as *any building material capable of withstanding direct and prolonged contact (i.e., at least 72 hours) with floodwaters without sustaining significant damage (i.e., requires more than cosmetic repair)*.

The following are examples of flood-resistant materials:

- **Lumber:** pressure-treated or naturally decay-resistant, including redwood, cedar, some oaks, and bald cypress
- **Concrete:** a sound, durable mix, and when exposed to saltwater or salt spray, made with a sulfate-resisting cement, with a 28-day compressive strength of



Select building materials that can endure periodic flooding.

5,000 psi minimum and a water-cement ratio not higher than 0.40 – consult ACI 318-02, *Building Code Requirements for Structural Concrete and Commentary*, by the American Concrete Institute International

- **Masonry:** reinforced and fully grouted
- **Structural Steel:** coated to resist corrosion
- **Insulation:** plastics, synthetics, and closed-cell foam, or other types approved by local building officials

This table lists examples of flood-resistant materials used in coastal homes.

Location of Material Use	Name of Material
Piles and posts	Round, tapered wood piles preservative-treated for ground contact, at a minimum; square-section piles or wood posts preservative-treated for marine use
Piers	Reinforced concrete or concrete masonry units (CMU) (see “Flood-Resistant Materials” above and Fact Sheet No. 14)
Foundation walls	Reinforced concrete or CMU, or wood that is preservative-treated for foundation or marine use (see Fact Sheet No. 15)
Beams	Solid sawn timbers and glue-laminated products, either naturally decay-resistant or preservative-treated for aboveground exposure; built-up members preservative-treated for ground contact
Decking	Preservative-treated or naturally decay-resistant wood, or composite wood members (e.g., manufactured of recycled sawdust and plastic)
Framing	Sawn wood or manufactured lumber (preservative-treated or naturally resistant to decay if in close proximity to the ground)
Exterior sheathing	High-capacity shearwall sheathing rated “Exterior”
Subflooring	Plywood or oriented strand board (OSB) rated “Exposure 1,” or rated “Exterior” if left permanently exposed (e.g., exposed underside of elevated house on open foundation)
Siding	Vinyl or naturally decay-resistant wood (see Fact Sheet No. 25)
Flooring	Latex or bituminous cement formed-in-place, clay, concrete tile, pre-cast concrete, epoxy formed-in-place, mastic flooring, polyurethane formed-in-place, rubber sheets, rubber tiles with chemical-set adhesives, silicone floor formed-in-place, terrazzo, vinyl sheet-goods, vinyl tile with chemical-set adhesives, pressure-treated lumber or naturally decay-resistant lumber
Walls and ceilings	Cement board, brick, metal, cast stone in waterproof mortar, slate, porcelain, glass, glass block, clay tile, concrete, CMU, pressure-treated wood, naturally decay-resistant wood, marine grade plywood or pressure-treated plywood
Doors	Hollow metal
Insulation	Foam or closed-cell
Trim	Natural or artificial stone, steel, or rubber

Many coastal jurisdictions make available a list of approved materials that can be used in coastal environments. Check for locally approved flood-resistant materials. Include all proposed construction and materials in approved plans. For guidance on testing specific materials, refer to *NES Evaluation Protocol for Determination of Flood-Resistant Properties of Building Elements* (NES, Inc. – <http://www.nateval.org>).

Wind-Resistant Materials

Homes in many coastal areas are often exposed to winds in excess of 90 mph (3-second peak gust). Choose building materials (e.g., roof shingles, siding, windows, doors, fasteners, and framing members) that are designed for use in high-wind areas.

Examples:

- shingles rated for high winds (see Fact Sheet No. 20)
- double-hemmed vinyl siding (see Fact Sheet No. 25)
- deformed-shank nails for sheathing attachments (see Fact Sheet No. 18)
- wind-resistant glazing (see Fact Sheet No. 22)
- reinforced garage doors
- tie-down connectors used throughout structure (from roof framing to foundation — see Fact Sheet Nos. 10 and 17)
- wider framing members (2x6 instead of 2x4)

Remember: A wind-resistant material is only as good as its connection. Always use recommended fasteners and connection methods.

Corrosion and Decay Resistance

Coastal environments are conducive to metal corrosion and moisture- and termite-related decay of other building materials. Metal corrosion is most pronounced on coastal homes (within 3,000 feet of the ocean), but moisture- and termite-related decay are prevalent throughout coastal areas.

Corrosion-Resistant Metals

Most jurisdictions require metal building hardware to be hot-dipped galvanized or stainless steel. Some local codes require protective coatings that are thicker than “off-the-shelf” products typically have. For example, a G90 zinc coating (0.75 mil on each face) may be required, which is thicker than the common G60 (0.5 mil on each face) coating.

Recommendations

- Use hot-dipped galvanized or stainless steel hardware. Reinforcing steel should be protected from corrosion by sound materials (masonry, mortar, grout, concrete) and good workmanship (see Fact Sheet No. 16). Use



Select building materials that are suitable for the expected wind forces.

The term "corrosion-resistant" is widely used but, by itself, is of little help to those specifying or evaluating materials for use in a coastal home. Every material resists corrosion to some extent, or conversely, every material corrodes.

The real issue is *how long will a given material serve its intended purpose at a given home?* The answer depends on the following:

- the material
- where it is used in the home
- whether installation techniques (e.g., drilling, cutting, bending) will compromise its resistance
- its degree of exposure to salt air, moisture, and corrosive agents
- whether maintenance required of the homeowner is performed

The bottom line: **do not blindly specify or accept a product just because it is labeled corrosion-resistant.** Evaluate the nature of the material, its coating type and thickness (if applicable), and its performance in similar environments before determining whether it is suitable for a particular application.

For guidance on the selection of metal hardware for use in coastal environments, consult an engineer with experience in corrosion protection. For more information about corrosion in coastal environments, see FEMA Technical Bulletin 8-96, *Corrosion Protection for Metal Connectors in Coastal Areas for Structures Located in Special Flood Hazard Areas* (see the Additional Resources section of this fact sheet).

galvanized or epoxy-coated reinforcing steel in situations where the potential for corrosion is high (see Fact Sheet No. 14).

- Avoid joining dissimilar metals, especially those with high galvanic potential (e.g., copper and steel).
- Some wood preservatives should not be used in direct contact with galvanized metal. Verify that wood treatment is suitable for use with galvanized metal, or use stainless steel.
- Metal-plate-connected trusses should not be exposed to the elements. Truss joints near vent openings are more susceptible to corrosion and may require increased corrosion protection.

Moisture Resistance

Materials resistant to moisture can greatly reduce maintenance and extend the life of a coastal home (however, by themselves, such materials cannot prevent all moisture damage. Proper design and installation of moisture barriers (see Fact Sheet No. 9) is also required).

Recommendations

- Control wood decay by separating wood from moisture, using preservative-treated wood, using naturally decay-resistant wood, and applying protective wood finishes.
- Use proper detailing of wood joints and construction to eliminate standing water and reduce moisture absorption by the wood (e.g., avoid exposure of end grain cuts, which absorb moisture up to 30 times faster than the sides of a wood member).
- Do not use untreated wood in ground contact or high-moisture situations. Do not use untreated wood in direct contact with concrete.
- Field-treat any cuts or drill holes that offer paths for moisture to enter wood members.
- For structural uses, employ concrete that is sound, dense, and durable; control cracks with welded wire fabric and/or reinforcing, as appropriate.
- Use masonry, mortar, and grout that conform with the latest building codes.

Termite Resistance

Termite damage to wood construction occurs in many coastal areas (attack is most frequent and severe along the southeastern Atlantic and Gulf of Mexico shorelines, in California, and in Hawaii and other tropical areas). Termites can be controlled by soil treatment, termite shields, and the use of termite-resistant materials.



Metals corrode at a much faster rate near the ocean. Always use well-protected hardware, such as this connector with thick galvanizing. (For information about pile-to-beam connections, see Fact Sheet No. 13).



Wood decay at the base of a wood post supported by concrete.

Recommendations

- Incorporate termite control methods into design in conformance with requirements of the authority having jurisdiction.
- Where a masonry foundation is used and anchorage to the foundation is required for uplift resistance, the upper block cores must usually be completely filled with grout, which may eliminate the requirement for termite shields (see Fact Sheet No. 14).
- Use preservative-treated wood for foundations, sills, above-foundation elements, and floor framing.

Additional Resources

FEMA. NFIP Technical Bulletin 2-93, *Flood-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*. (<http://www.fema.gov/fima/techbul.shtm>)

FEMA. NFIP Technical Bulletin 8-96, *Corrosion Protection for Metal Connectors in Coastal Areas for Structures Located in Special Flood Hazard Areas*. (<http://www.fema.gov/fima/techbul.shtm>)

American Concrete Institute International. (<http://www.aci-int.org/general/home.asp>)

American Wood-Preservers' Association. (<http://www.awpa.com>)

International Code Council Evaluation Service, Inc. Protocol for Testing the Flood Resistance of Materials. (<http://www.icc-es.org/index.shtml>)