Coastal Construction Fact Sheet Series

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

Technical Fact Sheet No. G.1

Introduction

FEMA has produced a series of 37 fact sheets that provide technical guidance and recommendations concerning the construction of **coastal residential buildings**. The fact sheets present information aimed at improving the performance of buildings subject to flood and wind forces in coastal environments. The fact sheets make extensive use of photographs and drawings to illustrate National Flood Insurance Program (NFIP) regulatory requirements, the proper siting of coastal buildings, and recommended design and

construction practices, including structural connections, the building envelope, utilities, and accessory structures. In addition, many of the fact sheets include lists of additional resources that provide more information about the topics discussed.

Available Fact Sheets

The following 37 fact sheets are also available on the FEMA website (www.fema.gov) as Adobe[®] Portable Document Format (PDF) files and as plain text (.txt) files. You must have Adobe[®] Reader to view the PDF files. The latest version of Adobe Reader is recommended. Download the free Reader from www.adobe.com.

Category 1 – General



Fact Sheet No. 1.1, Coastal Building Successes and Failures – Explains how coastal construction requirements differ from those for inland construction, and discusses the characteristics that make for a successful coastal residential building. Includes

design and construction recommendations for achieving building success.



Fact Sheet No. 1.2, Summary of Coastal Construction Requirements and Recommendations for Flood Effects – Summarizes recommendations for exceeding NFIP regulatory requirements for new construction and for repairs, remodeling, and additions.

Topics include building foundations, enclosures below the Base Flood Elevation (BFE), use of nonstructural fill, use of space below the BFE, utilities, certification requirements, and repairs, remodeling, and additions. Cross-references to related fact sheets are provided.

STREAM OF STREAM





Fact Sheet No. 1.3, Using a Digital Flood Insurance Rate Map (DFIRM) – Explains the purpose of Flood Insurance Rate Maps (FIRMs) and Digital Flood Insurance Rate Maps (DFIRMs); highlights features that are important to coastal builders, including flood zones and flood elevations; and ex-

plains how to obtain FIRMs, DFIRMs, and Flood Insurance Studies (FISs).

Note: The fact sheets have been divided into 10

different categories, which represent various build-

ing components or aspects of the construction

process. Fact sheets are numbered first by the category and then followed by a number to rep-

resent the fact sheet within the category. Future

updates to the guide will include fact sheets us-

ing these categories and will allow the user to add

new fact sheets within the category without requir-

ing the entire guide to be reprinted. Revisions to

individual sheets will include a letter behind the

numbers to represent each successive update.



Fact Sheet No. 1.4, Lowest Floor Elevation – Defines "lowest floor," discusses benefits of exceeding the NFIP minimum building elevation requirements, identifies common construction practices that are violations of NFIP regulations, which result in

significantly higher flood insurance premiums; and discusses the NFIP Elevation Certificate. Also includes a copy of the certificate.



Fact Sheet No. 1.5, V Zone Design Certification – Explains the certification requirements for structural design and methods of construction in V Zones. Also includes a copy of a sample certificate and explains how to complete it.



Fact Sheet No. 1.6, Designing for Flood Levels Above the BFE – Recommends design and construction practices that reduce the likelihood of flood damage in the event that flood levels exceed the BFE. It includes illustrations of appropriate construction

practices and information on the insurance benefits of building above the BFE.



Fact Sheet No. 1.7, Coastal Building Materials – Provides guidance and best practices on the selection of building materials used for coastal construction. Flood, wind, corrosion, and decay resistance are discussed, including protection recommendations.



Fact Sheet No. 1.8, Non-Traditional Building Materials and Systems – Provides guidance on alternative building materials and techniques and their application in coastal environments. It includes discussions of Engineered Wood Products, Structural Insulated

Panels, Insulating Concrete Forms, Prefabricated Shear Walls and Moment Frames, Sprayed Closed-Cell Foam Insulation, Advanced Wall Framing, and Modular Houses.



Fact Sheet No. 1.9, Moisture Barrier Systems – Describes the moisture barrier system, explains how typical wall moisture barrier systems work, and discusses common problems associated with moisture barrier systems.

Category 2 – Planning



Fact Sheet No. 2.1, How Do Siting and Design Decisions Affect the Owner's Costs?-Discusses effects of planning, siting, and design decisions on coastal home costs. Topics include initial, operating, and long-term costs; risk determination; and the effect on

costs of meeting and exceeding code and NFIP design and construction requirements.



Fact Sheet No. 2.2, Selecting a Lot and Siting the Building– Presents guidance concerning lot selection and building siting considerations for coastal residential buildings. Topics include factors that constrain siting decisions, coastal setback lines, common siting

problems, and suggestions for builders, designers, and owners.

Fact

Sheet

Foundations in Coastal Areas-

Explains foundation design

criteria and describes foun-

dation types suitable for

coastal environments. Also

addresses foundations for

high-elevation coastal areas

Fact Sheet No. 3.2. Pile Design

(e.g., bluff areas).

No.

3.1.

Category 3 – Foundations







and Installation– Presents basic information about pile design and installation, including pile types, sizes and lengths, layout, installation methods, bracing, field cutting, connections, and verifying capacities.

Beam Connections – Illustrates typical wood-pile-to-beam connections; presents basic construction guidance for various connection methods, including connections for misaligned piles; and illustrates pile bracing connection

G.1: COASTAL CONSTRUCTION FACT SHEET SERIES

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

techniques.

GUIDE

2 of 6



Fact Sheet No. 3.4, Reinforced Masonry Pier Construction– Provides an alternative to piles in V Zones and A Zones in coastal areas where soil properties preclude pile installation, but the need for an "open foundation system" still exists. Includes

recommendations for good masonry practices in coastal environments.



Fact Sheet No. 3.5, Foundation Walls– Discusses and illustrates the use of foundation walls in coastal buildings. Topics include footing embedment, wall height, materials and workmanship, lateral support, flood openings and ventilation requirements, and interior grade elevations

for crawlspaces.

Category 4 – Load Paths



Fact Sheet No. 4.1, Load Paths– Illustrates the concept of load paths and highlights important connections in a typical wind uplift load path.



Fact Sheet No. 4.2, Masonry Details – Illustrates important roof-to-wall and wall-to-foundation connection details for masonry construction in coastal areas. Topics include load paths, building materials, and reinforcement.



Fact Sheet No. 4.3, Use of Connectors and Brackets– Illustrates important building connections and the proper use of connection hardware throughout a building.

Category 5 – Wall Systems









Fact Sheet No. 5.1, Housewrap- Explains the function of housewrap, examines its attributes, and addresses common problems associated with its use. Topics include housewrap vs. building paper and housewrap installation.

Fact Sheet No. 5.2, Roof-to-Wall and Deck-to-Wall Flashing— Emphasizes the importance of proper roof and deck flashing, and presents typical and enhanced flashing techniques for coastal homes.

Fact Sheet No. 5.3, Siding Installation in High-Wind Regions— Provides basic design and installation tips for various types of siding for high-wind regions, including vinyl, wood, and fiber cement and discusses sustainable design issues.

Fact Sheet No. 5.4, Attachment of Brick Veneer in High-Wind Regions- Provides recommended practices for installing brick veneer that will enhance wind resistance in high wind regions. Examples of proper installations and brick veneer tie spacings are provided.

Category 6 - Openings



Fact Sheet No. 6.1, Window and Door Installation– Presents flashing detail concepts for window and door openings that provide adequate resistance to water intrusion in coastal environments, do not depend solely on sealants, are integral with secondary weath-

er barriers (e.g., housewrap), and are adequately attached to the wall. Topics include the American Society for Testing and Materials (ASTM) Standard E 2112 and specific considerations concerning pan flashings, Exterior Insulation Finishing Systems, frame anchoring, shutters, and weatherstripping.



Fact Sheet No. 6.2, Protection of Openings – Shutters and Glazing– Presents information about the selection and installation of storm shutters and impact-resistant glazing and other types of opening protection in windborne debris regions. Shutter types

addressed include temporary plywood panels; temporary manufactured panels; permanent, manual closing; and permanent, motor-driven.

Category 7 - Roofing



Fact Sheet No. 7.1, Roof Sheathing Installation– Presents information about proper roof sheathing installation and its importance in coastal construction; also discusses fastening methods that will enhance the durability of a building in a high-wind

area. Topics include sheathing types and layout methods for gable-end and hip roofs, fastener selection and spacing, the treatment of ridge vents and ladder framing, and common sheathing attachment mistakes.



Fact Sheet No. 7.2, Roof Underlayment for Asphalt Shingle Roofs- Presents recommended practices for the use of roofing underlayment as an enhanced secondary water barrier in coastal environments. Optional installation methods are illustrated.



Fact Sheet No. 7.3, Asphalt Shingle Roofing for High-Wind Regions— Recommends practices for installing asphalt roof shingles that will enhance the wind resistance of roof coverings in high-wind, coastal regions. Issues include installation at hips, eaves, and

ridges; shingle characteristics; weathering and durability; and wind resistance.



Fact Sheet No. 7.4, Tile Roofing for High-Wind Areas– Presents design and construction guidance for tile roofing attachment methods. Topics include uplift loads, uplift resistance, special considerations concerning tile attachment at hips and ridges, tile installation on critical and essential buildings, and quality control.

High Wi		
1 HgH- **1	nd Regions	
NOWE BOLEOF & CODE TO ESHIETHE SOME	R0C706 Recrete Fact Sear Bo. 7.5	
WINN Is describe position for minimizing on solution decays and assid proofs in high and will good design wind speed?"	ater intensite Trough and well updates that can bear regions (i.e., gender that Wonley per boar (eg))	
in particular and the second se	The Brownied Sills	
Bur teruge anti- unitation approximate, the a compating while entry travailles and possi- tionals, while case and to man possible and abare seen. As the catingse of voltage,	The most supervise approxit is previ- ing annuales was from overing the atte in the annuale atte annuales, and prevent in the are conferenced. Official: attend to be	1
Allo wellafan oan be portied is a norder o somen, mei it with fans best storred to a	the Court offsets are real, presented affirs may not comproved to an indian and a real to a first set.	8
Ex outer officially prior perior approach and some of which have been stranged to blow of Trans design in fight.	Manural, they unarther arise are alread in the bulling code or tests compliance is not at fease.	
 Settions Between 	the state and the second second and	
 Collect and reads 	alle wij te jenant anothen te fan anteng	
 Galler mark setting Sufficiency 		
Abagate wellber of affire is prevery a subscription of reality of and totales memory are memory of reality of and totales	Ar barler mets to full their 5.3.500 protot- dice in Nighting Region for economications reporting with an behavio	
Also excludes can releas the temperature of and complex, while all grands, principles of and the total control, measure, cold posterior and more of an impact on each control (interaction that the stream) of unitarian that is or to to product.	whence he change to an arrested with configu- ntian back to be case and configure with the solution of changes had have the mark to no back a submitted with the back to no back a submitted within the back to no back a submitted within the back to no	
At amothed all the set in all officing way it proves were resource and the lage of all of	Unwided affit: may be to will the water's for the software.	
provide or the second particular design of the second programming, transmiss, she animothy activities of the second programming that the second second particular second s	The response properties are not dealer to the set when the solution of the share of the solution of the solution is an analysis, will be sharepointed at the program of galax states with a statement of the program of galax state with, at other the hearty of sharepoint	
Partition and base a detailed with the second	have and senared unce the state theory is play as	

Fact Sheet No. 7.5, Minimizing Water Intrusion through Roof Vents in High-Wind Regions- Describes practices for minimizing water intrusion through roof vent systems, which can lead to interior damage and mold growth in high-wind regions. Topics in-

clude soffit vents, ridge vents, gable end vents, off-ridge vents, gable rake vents, and turbines.

NUMBER OF TAXABLE PARTY OF TAXABLE PARTY OF TAXABLE PARTY OF TAXABLE PARTY.	THE INCOME IN CASE AND ADDRESS OF
Property To be of a second sec	the sold of other held stress shi
mahanon'a high aited opiers (Le, genoir Par Min	also, no how population (per study) with pony."
Eq. bases before large a planes have automatic that uses before using a planes have automatic planes, to serve contemp in which (plane to the server automatic and planes of a dark a which () determine the server and a plane approximation () and server instant and planes and a dark a which () a server and planes and a dark a which () a server and planes and a server and () a server and planes and a server and () and a server and a server and a server and a server and the server a server approximation to a straining contemporarily the server asserved approximation of server and the server asserved approximation of the server asserved approximation.	
 Aman Adar the manufacture's installation in structures and here facilities under transmission. 	
 Consultation waters are then used associating in account denses with ASEX 7 or the band building areas, it is the extension depicts care with the area proceedings in order to the highest bank. 	Agen 1 The descinal deciding second system access Manison Addes White will do seen by Many and the decide will be a set of the second feature and the second second second second second feature and the second seco
 See See See See See See See See See See	 Re-inductional sends with second-left data, the entropy is a result of a parameter of the transmers of a second-left data of the parameters between entropy of the data of the parameters of the anti-transmers of the data of the parameters of the anti-transmers of the data of the da
for Anesters (to not their builder.) For Scrapholeteral contrast and general book of the second sec	 Repairs dealers quested Repairs data desenancia, año la Organizar la deale data data da sectadar de na lenge ar catal denan des forunasi tierinas (RE NINO);
the first sector of the sector	

Fact Sheet No. 7.6, Metal Roof Systems in High-Wind Regions- Presents design and installation guidance for metal roofing systems that will enhance wind-resistance in high-wind regions. Discussions on sustainable design options are included.

Category 8 - Attachments



Fact Sheet No. 8.1, Enclosures and Breakaway Walls– Discusses requirements and recommendations for enclosures and breakaway walls for their use below the BFE. It includes a diagram of a compliant wall system and examples of systems that have either resulted in increased damages

or increased flood insurance premiums.



Fact Sheet No. 8.2, Decks, Pools, and Accessory Structures- Summarizes NFIP requirements, general guidelines, and recommendations concerning the construction and installation of decks, access stairs and elevators, swimming pools, and acces-

sory buildings under or near coastal residential buildings.



Fact Sheet No. 8.3, Protecting Utilities- Identifies the special considerations that must be made when installing utility equipment, such as fuel, sewage, and water/sewage lines in a coastal home, and presents recommendations for utility protection.

G

Category 9 - Repairs



Fact Sheet No. 9.1, Repairs, Remodeling, Additions, and Retrofitting - Flood– Outlines NFIP requirements for repairs, remodeling, and additions, and discusses opportunities for retrofitting in coastal flood hazard areas. Also presents recommendations for exceed-

ing the minimum NFIP requirements. Definitions of "substantial damage" and "substantial improvement" are included.



Fact Sheet No. 9.2, Repairs, Remodeling, Additions, and Retrofitting - Wind- Outlines requirements and makes "best practice" recommendations for repairs, remodeling, and additions, and discusses opportunities for retrofitting in coastal high wind areas.

Category G - Guide



Fact Sheet No. G.1– Technical Fact Sheet Guide

<text>

Fact Sheet No. G.2, References and Resources– Lists references that provide information relevant to topics covered by the Home Builder's Guide to Coastal Construction technical fact sheets.

FEMA P-499 Home Builder's Guide to Coastal Construction-2005 to 2010 Crosswalk

Category	Category Code	Sheet	Title	2005 Edition Fact Sheet No.
Guide	G	1	Technical Fact Sheet Guide	
General	1	1	Coastal Building Success and Failures	1
General	1	2	Summary of Coastal Construction Requirements and Recommendations for Flood Effects	2
General	1	3	Using a Digital Flood Insurance Rate Map (DFIRM)	3
General	1	4	Lowest Floor Elevation	4
General	1	5	V Zone Design Certification	5
General	1	6	Designing for Flood Levels Above the BFE	New
General	1	7	Coastal Building Materials	8
General	1	8	Non-Traditional Building Materials and Systems	New
General	1	9	Moisture Barrier Systems	9
Planning	2	1	How Do Siting and Design Decisions Affect the Owner's Costs?	6
Planning	2	2	Selecting a Lot and Siting the Building	7
Foundations	3	1	Foundations in Coastal Areas	11
Foundations	3	2	Pile Design and Installation	12
Foundations	3	3	Wood Pile-to-Beam Connections	13
Foundations	3	4	Reinforced Masonry Pier Construction	14
Foundations	3	5	Foundation Walls	15

G.1: COASTAL CONSTRUCTION FACT SHEET SERIES

Category	Category Code	Sheet	Title	2005 Edition Fact Sheet No.
Load Paths	4	1	Load Paths	10
Load Paths	4	2	Masonry Details	16
Load Paths	4	3	Use of Connectors and Brackets	17
Wall Systems	5	1	Housewrap	23
Wall Systems	5	2	Roof-to-Wall and Deck-to-Wall Flashing	24
Wall Systems	5	3	Siding Installation in High-Wind Regions	25
Wall Systems	5	4	Attachment of Brick Veneer in High-Wind Regions	New
Openings	6	1	Window and Door Installation	22
Openings	6	2	Protection of Openings - Shutters and Glazing	26
Roofing	7	1	Roof Sheathing Installation	18
Roofing	7	2	Roof Underlayment for Asphalt Shingle Roofs	19
Roofing	7	3	Asphalt Shingle Roofing for High-Wind Regions	20
Roofing	7	4	Tile Roofing for High-Wind Areas	21
Roofing	7	5	Minimizing Water Intrusion through Roof Vents in High-Wind Regions	New
Roofing	7	6	Metal Roof Systems in High-Wind Regions	New
Attachments	8	1	Enclosures and Breakaway Walls	27
Attachments	8	2	Decks, Pools, and Accessory Structures	28
Attachments	8	3	Protecting Utilities	29
Repairs	9	1	Repairs, Remodeling, Additions and Retrofitting - Flood	30
Repairs	9	2	Repairs, Remodeling, Additions and Retrofitting - Wind	30
Guide	G	2	References and Resources	31



Developed in association with the National Association of Home Builders Research Center