January 1982

MAP-23

COASTAL CONSTRUCTION PRACTICES

Edited by
Christopher P. Jones
and
Leigh Taylor Johnson

Florida Sea Grant College Program

GC
57.2
.F532
no.23

Cooperative Extension
Advisory Bulletin

Marine Research · Education · Advisory Services
A Sea Grant Program for Florida

10000

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Edited by

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Coastal Engineer
Florida Sea Grant College Program

and

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U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

Project No. A/MAP-1
Grant No. NA80AA-D-00038

Marine Advisory Bulletin MAP-23
Florida Sea Grant College Program

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Florida Sea Grant College Program
GC57.2 .F532 no.23
8276142
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INTRODUCTION

Coastal construction and development concern us all, especially in areas where development continues at a rapid pace. Between 1970 and 1980, the number of households in Florida's coastal counties increased from 1.8 million to 3.0 million. This continuing growth of coastal areas and the concentration of people near the ocean's edge indicates a need for up-to-date information on the problems and technology of building in the coastal zone.

This bulletin contains information from papers presented at a Coastal Construction Practices Seminar held at Satellite Beach, Florida, on April 12, 1980. The seminar was sponsored by the Brevard County Beach Erosion Control District, the City of Satellite Beach, the Florida Cooperative Extension Service and the Florida Sea Grant Program. Although the seminar was organized to provide a public forum for the citizens of the area to discuss coastal hazards and coastal construction, the information is applicable to other coastal areas as well.

Speakers included Dr. Val Villanyi Hausner, consulting engineer, Orlando; Byron Spangler, professor of civil engineering and Chris Jones, Florida Sea Grant coastal engineering specialist, both at the University of Florida; James Balsillie, engineering geologist, Bureau of Beaches and Shores, Florida Department of Natural Resources, Tallahassee; Jim Smith, Federal Flood Insurance Program, Federal Emergency Management Agency, Atlanta, Georgia; Ray Murray, city engineer, Cocoa Beach.

As a supplement to this bulletin, videotapes of the talks by Spangler, Jones, Balsillie and Smith are available through the Marine Advisory Program.

Leigh Taylor Johnson

Leigh Taylor Johnson

Brevard County Extension Marine Agent

PROBLEMS ENCOUNTERED BY THE BUILDING INDUSTRY IN COASTAL AREAS

During recent years various regulations have been implemented to protect Florida's coastal areas. These regulations are based in part upon studies by the U.S. Army Corps of Engineers, the Florida Department of Natural Resources, Universities, local government engineering and building officials and others.

The studies and regulations have addressed two basic problems encountered in coastal areas:

1. minimizing structural damage to new construction from wind, surge and wave forces during storms.

2. protecting existing construction against these same forces.

New construction can, for the most part, be designed to resist hurricane forces, using existing building codes, flood insurance regulations, setback line requirements and other available design guidance. Because many existing buildings were not designed with these requirements and guidance, they cannot be rendered as storm resistant as new buildings. However, shore protection structures can be used to prevent a major cause of structural damage and collapse, namely foundation failure.

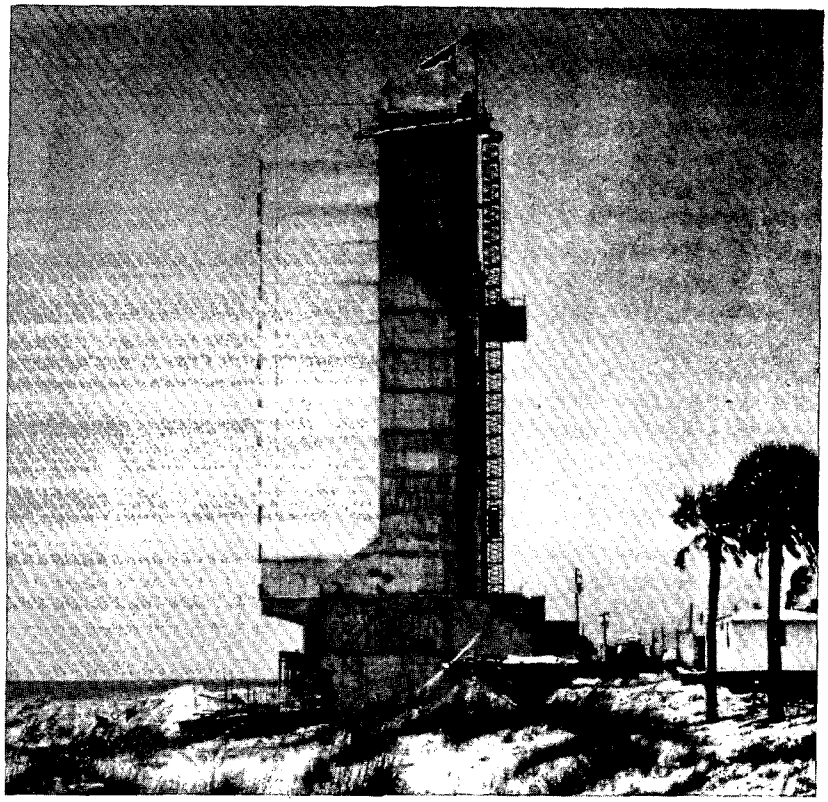
Minimizing Damage to New Construction

From a structural and construction viewpoint, any basic construction material (wood, masonry, reinforced concrete) can be used for buildings along the coast provided they are designed properly.

Wood can be an excellent material for lowrise (one and two story) buildings as long as it is pressure treated. But the most important requirement for wood frame construction is that its connections, anchorages and fasteners be analyzed and designed by a structural engineer to withstand lateral and uplift wind forces; plywood or wood plank sheeting should cover the stud walls to withstand racking forces due to wind pressure. The wood structure itself should be securely anchored to the foundation.

Masonry construction enables engineers to safely design low to midrise buildings (eight story maximum). The block walls are reinforced with horizontal and vertical steel bars spaced at required intervals in concrete filled block cells. When constructed properly, these buildings will resist vertical gravity loads and wind loads. Problems do arise, however, when the quality of construction is substandard. There have been numerous instances where the steel bars were left out or where the block cells were not filled with concrete, thus pointing out the need for effective construction inspection.

Reinforced concrete and protected steel buildings can be constructed to very tall heights and still resist hurricane forces. These are generally constructed with shear walls (thick, reinforced concrete walls designed to withstand hurricane wind forces) that are placed strategically throughout the buildings. These buildings are generally supported on pilings or other erosion resistant foundations.



Regardless of the construction materials used, there are special considerations involved when building along the coast. The importance of an adequate foundation and strong connections between structural elements have already been mentioned. Another important consideration is the specification of hurricane resistant door frames, window frames and storm shutters. Failure of exterior windows and doors due to wind pressure, suction or projectiles can lead to other damages.

Protection of Existing Construction

In many cases buildings have been located too close to the shoreline and are now threatened by erosion. While beach restoration or relocation of the buildings may be desireable from a geological point of view, these alternatives may not be feasible or acceptable to the property owners. The only remaining way to protect existing buildings is with shore protection structures such as seawalls and revetments.

Many seawalls are really sheet pile bulkheads that serve only as retaining walls. They can protect against some storms, but numerous failures have been observed during severe storms. For this reason the term seawall will be used to describe heavy, structural walls resting on deep foundations, such as the bayshore seawall protecting the City of Tampa. These walls are very expensive, frequently costing $400 to $600 or more per linear foot of shoreline.

Riprap revetments are the next best solution and are more affordable, although they do not provide the same degree of protection. They consist of one or more layers of natural stone or boulders, concrete rubble or bags filled with sand-cement grout, placed on a gentle slope. Revetments can be constructed in front of existing sheet pile walls (to improve wall stability) or by themselves.

The size of the riprap units is determined by the height of the storm waves expected and the vertical dimensions of the revetment are determined by the expected storm surge water level. Design guidance is available in the U.S. Army, Corps of Engineers Shore Protection Manual.

Dr. Val Villanyi Hausner, consulting engineer, Orlando.

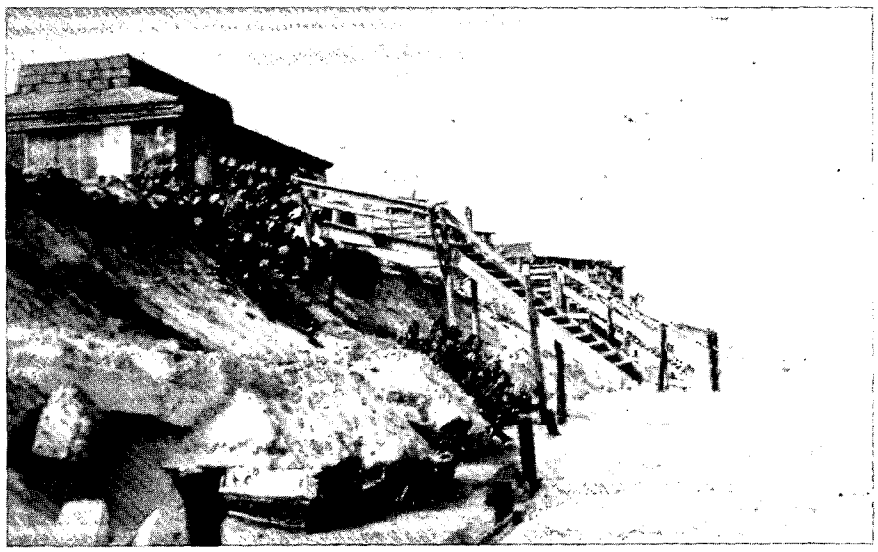
BUILDING IN COASTAL AREAS: SITING, DESIGN AND CONSTRUCTION PRACTICES

When discussing coastal structures, three topics should be addressed: siting, design, and construction practices. All three are important in coastal areas because of the threat of storms and the damage they cause.

A special concern of government officials is the apathy demonstrated by many coastal citizens. For instance, although people were evacuated during Hurricane David in 1979, the storm caused little damage. Next time, those people may not evaucate. But it is important for them to realize that not all storms will be like David -- a minimal storm whose track was parallel to the coastline. In the past, severe hurricanes have come ashore and have caused extensive damage. It can happen again.

Design maps show that the wind speed corresponding to the 50-year recurrence interval is approximately 110 miles per hour for most of Florida. The wind speed corresponding to the 100-year interval is approximately 120 miles per hour. Two 100-year storms have occurred in the vicinity of Florida since 1934; many storms have exceeded the 50-year design wind speed in that same period. Thus, severe storms can strike frequently, unlike recent years where storm activity has been mild.

This becomes important when locating structures along the coastlines. The relatively mild conditions that have prevailed recently are not always the case. People who knock down sand dunes in order to build very close to the beach destroy nature's protective barrier and often replace it with another type of barrier which is not nearly as resistant to a storm's forces. These forces include not only wind, but the more serious storm surge and wave attack.



All of these forces must be considered when designing a structure for coastal areas. Examples of poor design practices, unfortunately, become apparent only after a storm -- when the damage has already been done. Hurricanes Camille (Mississippi, 1969), Eloise (Florida, 1975), and Frederic (Alabama-Florida, 1979) revealed the following examples of poor design: inadequate ties between walls and brick veneers; inadequate fastening of roofs to structures; insufficient concrete cover over reinforcing steel which allows the steel to corrode and the structure to be weakened; short wing walls which allow material to be washed out from behind seawalls; and the use of spread footing foundations in areas where scour and erosion are expected.

Construction practices are frequently no better. In numerous instances, reinforcing steel and mesh are not pulled up into the concrete when slabs are cast. In one case, a support beam was left out when a slab was cast. One of the most serious deficiencies was uncovered by Hurricane Eloise at a 14-story condominium under construction at the time of the storm. Approximately one-third of the pilings beneath the building were exposed by the storm and had no concrete between the tops of the piles and the bottoms of the grade beams. The building was resting on the reinforcing steel, which had corroded and lost up to one-half its cross-section. Another building, through surveying or construction error, was built so that the bearing walls and pilings were misaligned by six to twelve inches.

In summary, three specific things need to be considered when building in coastal areas. (1) Siting. Buildings should be placed so that they will be safe during storms. Knocking down sand dunes in order to construct near the beach is certainly not good practice. (2) Design. Many times designers come from inland locations where storm surge and wave forces need not be considered. Not only should these be taken into account, but building code requirements should be reviewed for often these are inadequate. (3) Finally, construction must follow designs precisely. Too often short cuts are taken that lead to the failure of a structure during a storm. Better inspection during construction is a must.

Byron Spangler, professor of Civil engineering, University of Florida.

PROTECTING UPLAND PROPERTY AND STRUCTURES

Methods of protecting upland property and structures can be divided into three categories:

I. Management Techniques
II. Non-Structural Techniques
III. Structural Techniques

The first category, Management Techniques, includes such methods as coastal construction control lines, coastal construction codes, flood insurance regulations, etc. These are all aimed at regulating both the location and types of construction in the coastal zone; hence, they are most effective in undeveloped areas.

The Non-Structural Techniques include methods whereby the natural beach and dune system are preserved, enhanced or extended. These techniques include the beach restoration projects and dune vegetation and stabilization programs. Structural Techniques include the construction of revetments, seawalls and other erosion control structures.

Management Techniques

Coastal construction control lines are established to separate those portions of the beach and dune system that are susceptible to erosion and other fluctuations based upon a 100-year storm surge, from those portions that are not. The state must review any construction seaward of the line but has no authority to regulate construction behind the line.

Coastal construction codes have been established in Lee and Pinellas Counties in lieu of control line. The coastal area is divided into zones, each of which has minimum design standards for construction. The standards are increasingly stringent as you get closer to the beach, since the potential for damage increases in the same sense. One advantage of the establishment of codes (as opposed to a control line) is that the program can be administered locally.

Flood insurance regulations ensure that coastal communities enact flood plain management guidelines and that construction in flood prone areas meets minimum requirements (elevation of first habitable floor, structural support, etc.).

Non-Structural Techniques

Beach restoration projects involve the dredging of suitable sandy materials from offshore borrow areas or tidal inlets for placement on adjacent

beaches. The projects usually extend thousands of feet along the shoreline, and are expensive. As an example, the cities of Hollywood and Hallandale restored over five miles of beach in 1979, using approximately 2 million cubic yards of material, at a cost of over $7 million.

Dune vegetation and stabilization programs can be carried out on a much smaller scale than restoration projects. Basically, the programs involve the planting of vegetation as a means of stabilizing dunes and sand areas. While the presence of beach and dune vegetation will not halt erosion, it can accelerate the growth of dunes and stablize them. This not only prevents the loss of windblown sand to inland areas, but acts as a means of protecting the uplands during storms.

Structural Techniques

Structural techniques of protecting upland property and structures consist mainly of the construction of revetments and seawalls. Their basic functions are to protect against wave attack and to stabilize the position of the shoreline. Unless properly designed, however, they will not function as intended, and can have a detrimental effect on the beach, both in front of and adjacent to the structure.

Revetment and seawall design require an understanding of the following topics:

1. shoreline dynamics
2. construction materials and structural analysis
3. soil mechanics
4. wave-structure-soil interactions
5. modes of failure

This understanding is necessary to prevent detrimental effects to adjacent areas and to design the protective structures in a cost-effective manner.

Seawalls

A seawall is usually a vertical wall built of concrete, timber or steel, which acts as a retaining wall, holding the material behind it in place, while resisting wave forces and erosion. Even if a wall remains standing after a storm, but has failed to prevent the loss of material from behind the wall, then it has not served its purpose. If the wall itself suffers structural damage and material is lost, then it has failed.

Seawall failures can generally be divided into five categories, although a wall may fail in more than one way during storm conditions. Each of these is discussed below (refer to Figure 1).

1. Loss of Backfill: Material behind a seawall can be lost in several ways. If joints between the seawall slabs are not tight and if a filter is not present behind the joints, then the fill can wash through the joints. If the penetration of the wall into the ground is not

adequate the material can be washed out beneath the wall. Finally, if the return walls (walls extending landward from the ends of the seawall) are not long enough, then material can be lost around the ends of the return walls during storm conditions.

2. Rotation of Wall/Cap: If a seawall is not designed and constructed to resist the outward-acting forces of the fill behind the wall, then the top of the wall will rotate (lean outward).
3. Anchor Failure: If the dead-man or dead-pile anchors behind a wall fail, the wall will be susceptible to rotation, as discussed above. Anchors can fail in a number of ways, including: corrosion of the tie back rod; insufficient development length of the rod into the cap, in which case it will pull out; if the dead-man is placed at too shallow a depth, then it can be pulled through the soil as the wall rotates.
4. Insufficient Toe Penetration: If the bottom of the wall does not have adequate penetration into the ground, then it cannot develop the resistance necessary to keep the outward-acting forces of the fill behind the wall from forcing the bottom of the wall outward.
5. Poor Materials, Construction or Design: Deficiencies in materials, construction techniques or inadequate design can lead to those types of seawall failures listed above. For example, porous concrete or insufficient concrete cover over reinforcing steel can lead to corrosion and spalling, thus reducing the strength of the wall and increasing the possibility of failure.

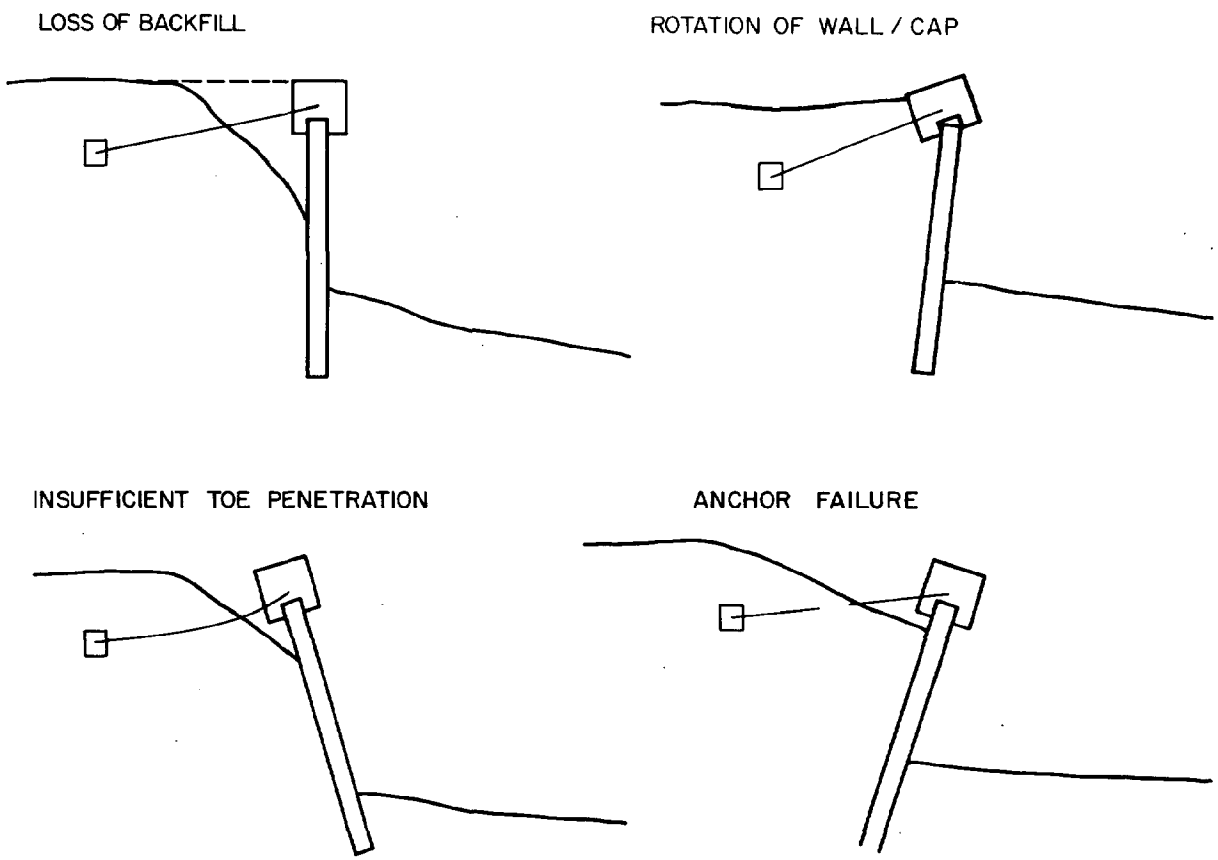


Figure 1: Seawall Failures

Proper design and construction of seawalls can ensure that those failures mentioned above do not take place. Some general design guidelines for concrete sheet pile seawalls are mentioned below (refer to Figure 2):

1. Have the seawall designed by a professional engineer.
2. Ensure that construction inspection is provided.
3. Check the design to see that it provides: adequate concrete cover over all reinforcing steel in the wall and cap; adequate embedment of the wall into the cap; adequate penetration of the wall into the ground; protection of the tie back rod against corrosion; adequate development length of the tie back rod into the cap; anchors that develop enough resistance to keep the wall in place.

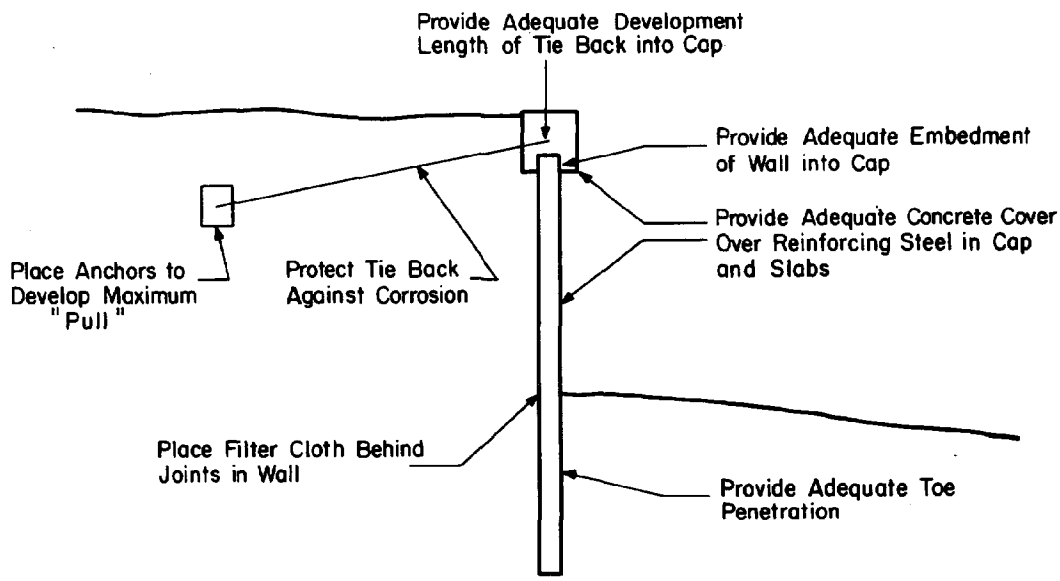


Figure 2: Seawall Design Considerations - anchored concrete sheet pile seawall

Revetments

Revetments are gradually sloping structures built of stone, interlocking blocks and other materials, that are designed to dissipate wave energy and stabilize the shoreline. They are most effective on low energy coasts and bay shorelines where wave heights are not large.

Revetment failures can be divided into three categories:

1. Loss of Supporting Material: Revetments depend upon the underlying material for support. When that material is lost the revetment will settle and it's effectiveness will be diminished or destroyed.

2. Stones too Small: In the case of a rubble or stone revetment, failures will occur if the stones are too small and are dislodged by attacking waves. The size of the stones needed increases roughly with the cube of the wave height.
3. Revetment Not Low, High Enough: If the bottom of the revetment is too high, then waves can attack the soil in front of the revetment, leading to its collapse. If the top of the revetment is too low, then waves can overtop it easily and erode the soil behind the revetment.

Proper design of revetments includes the following considerations (refer to Figure 3):

1. Have the revetment designed by a professional engineer.
2. Provide construction inspection.
3. Check the design to ensure that the slope of the revetment is not too steep, that a filter cloth is placed below the stones, that the stones are of adequate size and weight, and that the vertical dimensions of the revetment will protect the uplands.

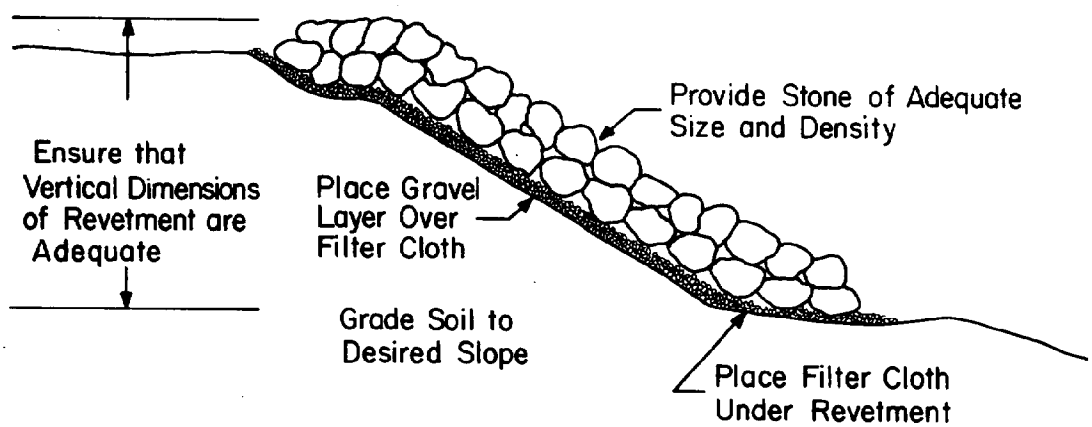


Figure 3: Revetment Design Considerations - Rubble Revetment

Christopher P. Jones, Sea Grant coastal engineering specialist, University of Florida.

TECHNICAL ASPECTS OF DESIGN AS RELATED TO THE COASTAL CONSTRUCTION CONTROL LINE

In 1970 the Florida Legislature recognized the need to regulate coastal construction, both for the protection of that construction and for the protection of the beach and adjacent property. It enacted section 161.052 of the Beach and Shore Preservation Act and by doing so prohibited construction closer than 50 ft. to the line of mean high water. Because of problems in the enforcement of section 161.052 (due to the difficulties in delineating the line of mean high water) the legislature enacted 161.053 in 1971, establishing a coastal construction setback line (CCSBL) on a county by county basis. Once the line was established all construction and excavation seaward of the line was prohibited.

In 1978, the setback line program was changed to the Coastal Construction Control Line (CCCL) program, whereby those beach and dune areas subject to severe fluctuations based upon a 100-year storm surge, or other predictable weather conditions, were identified. In those areas subject to fluctuation it was recognized that special structural and design considerations must be applied before construction or excavation could be allowed. Hence, the CCCL program does not prohibit construction seaward of the control line, but instead, ensures that such construction can withstand the forces acting in that region, and ensures that such construction will not adversely affect the beach or adjacent property.

In order to properly design structures for those areas seaward of the control line it is instructive to look at the existing design guidance (available in the form of books, reports and technical memoranda) and at the design event, with its associated design forces.

Currently, books and reports exist providing design guidance for navigation structures (jetties), shore protection structures (groins, seawalls and revetments), beach nourishment and revegetation projects, and for non-protective coastal structures (dune walk-overs, piers, etc.). An example of a report giving the design information for many of those items mentioned above is the U. S. Army, Corps of Engineers, Shore Protection Manual.

Unfortunately, there are no comprehensive sources of design guidance for homes, condominiums and other habitable structures when they are located on the shoreline. It is hoped that guidelines can be developed in the future through the Bureau of Beaches and Shores, and be distributed in the form of technical memoranda.

The design event commonly used is the 100-year storm, that is, the storm that will produce a storm surge that will be exceeded, on the average, once every 100 years. Identifying the forces associated with this event are difficult; however, once they are identified the engineering and design work to be done are relatively straightforward. The forces to be reckoned with include wind, surge and wave forces.

Wind Force

With regard to the wind forces, the Bureau of Beaches and Shores, Technical Report No. 78-1, "Design Hurricane Generated Winds," recommends using a minimum sustained wind of 140 mph for the design of habitable shorefront construction. A study in Texas indicated that this would increase the cost of construction from only 0 to 3 percent.

Storm Surge

When a storm approaches the shoreline across shoaling water it experiences a rise in nearshore water levels due to wind stresses. This departure from the normal water level is termed the storm surge still water level, or simply, the storm surge. This rise in water level can lead to flood damage due to inundation and hydrostatic pressures. Currents occurring within the storm surge water column can also produce significant hydrodynamic pressures on structures and result in scour, leading to structural damage. The storm surge is also very important, since it is the superelevated surface across which the unusually high storm-generated waves propagate.

Wave Forces

Wave forces are difficult to measure or estimate analytically because of the complex nature of the water surface and the flow field beneath the waves, especially during storm conditions. However, it is known that breaking wave forces are much greater than those forces from non-breaking or broken waves. When breaking waves impact directly on a structure the horizontal force can be approximated by

$$F = 450\ H_b$$

where F is the horizontal impact force (lbs/ft^2) and H_b is the wave height at breaking (ft). As you can see, these forces can easily reach thousands of pounds per square foot. Waves can also exert tremendous uplift forces when they "peak up" just before breaking beneath a structure. Thus, it is necessary to elevate structures to reduce both the horizontal and vertical forces.

Other effects of waves and surge include the scour of material from around and beneath structures, horizontal recession of the beach profile (when the profile is not completely inundated) and vertical recession of the profile (when it is inundated).

Jim Balsillie, engineering geologist, Bureau of Beaches and Shores, Florida Department of Natural Resources.

THE FEDERAL FLOOD INSURANCE PROGRAM

Despite early efforts at flood control programs, the amount of federal disaster assistance for flood damages continued to rise during the 1940's, 1950's and 1960's. In 1968 Congress enacted the National Flood Insurance Program and has modified the program several times since then. As the program stands now, local communities are required to enact flood plain management guidelines, and any federally regulated lending institution must require that those persons borrowing money from that institution for construction in flood prone areas obtain flood insurance.

Flood insurance may be written by any licensed insurance agent, but all policies are serviced by Electronic Data Systems in Maryland, who act as a subcontractor to the Flood Insurance Program. Approximately $40 billion in flood insurance is written in Florida, representing about 30 percent of the nationwide total.

Once insurance rates are established for an area, they cannot be increased unless the entire program rate structure is increased (this has occurred only once in the history of the program). If the base flood elevation for a particular area is raised, the rates cannot be raised for that area alone.

Those areas susceptible to flooding are divided into zones, with a division between "A" zones and "V" zones. "A" zones are those areas in inland or riverine regions where flooding can occur but where high velocity waters from waves or currents are not expected. "V" zones, or velocity zones, are those areas where waves and current occur.

Some "V" zone regulations:

1. All new construction must be landward of the line of mean high water.
2. As of 1976, fill cannot be used for structural support in a velocity zone.
3. The lowest supporting member of the first habitable floor must be at or above the 100-year flood elevation; the area below that must be either open or enclosed by breakaway-type walls.
4. Man-made alternation of dunes and mangrove stand in the "V" zones are prohibited if such alterations can increase potential flood damages.
5. All new construction must be on adequately anchored piles or columns, with the structure fastened to those piles such that the lowest supporting member is at or above the flood elevation. In addition, the adequacy of the structure must be certified by a licensed architect or engineer.
6. Flood Insurance regulations, effective October 1981, require that wave height be added to the static surge level to determine the base flood elevation.

Jim Smith, Federal Flood Insurance Program, Federal Emergency Management Agency, Atlanta, Georgia.

Editor's Note:

Since the talk by Mr. Smith, there have been some important changes in the Flood Insurance Program. Two changes to "V" zone regulations, effective October 1, 1981, are:

(1) All new construction of substantial improvements will receive cheaper insurance rates if the area below the first habitable floor either remains completely open or is enclosed by a light, see-through wooden lattice rather than being enclosed by solid breakaway walls. This is to discourage past practices of converting the space enclosed by breakaway walls into habitable space.

(2) Wave height is being added to the static surge level to determine the elevation of the first habitable floor.

Another change to the program will occur in October 1983, after which no new flood insurance will be written for undeveloped barrier islands.

HOW THE CITY OF COCOA BEACH MANAGES ITS SHORELINE

The city of Cocoa Beach is located on a barrier island, with about six miles of oceanfront, between Cape Canaveral and Patrick Air Force Base. The population increases from 12,000 to 22,000 during the tourist season.

The city has taken advantage of rules and regulations provided and practiced by other communities in developing ordinances regulating coastal construction. Examples of ordinances taken from others, and those formulated by the city are discussed below.

1. In 1975, the city of Cocoa Beach established a building setback line co-terminus with the State Coastal Construction Setback Line. Language in the city ordinance allows for the automatic adoption of any changes in the state's line. Maps showing the setback line are available for use at the city building department.
2. All structures in the velocity zone must be constructed on adequately designed piles, with the design certified by a registered architect or engineer. All piles must penetrate to at least -4 ft. msl.
3. The density of multi-family developments along the coast was reduced from 40 units per acre to 15 units per acre.
4. In 1978, an ordinance was adopted requiring all new multi-family construction of three or more units to construct dune walkover structures. A three-year grace period was given to existing multi-family units for their construction of walkovers.
5. The city participates in the National Flood Insurance Program. The elevation of the first habitable floor must be at the elevation designated by the flood insurance program, or one foot above the elevation of the access road leading to the structure, whichever is higher. The city engineer may grant a variance to the one-foot rule mentioned above, but only for flood management purposes.
6. The city adopted a dune preservation ordinance requiring the replacement and revegetation of any dunes damaged during construction on adjacent upland property.

With regard to enforcement of these ordinances all new construction must be approved by a site plan review process. Plans must be submitted for comments by the city and the public (during city planning commission meetings), and all work must be certified in compliance with plans, specifications and local ordinances before a certificate of occupancy will be issued.

The area seaward of the setback (control) line is to be handled by the State of Florida; however, if city inspectors note violations seaward of the line, the state will be notified.

The city has 40 public beach access points, approximately half of which have dune walkover structures. Some of these access points are equipped with viewing decks and handicap ramps.

The city requested and received funding from the state (a two-year grant totalling $110,000) for the construction of additional walkovers, revegetation, etc. Spanish bayonets are usually planted near the walkovers as a means of controlling pedestrian traffic.

Ray Murray, city engineer, Cocoa Beach, Florida.

FOR MORE INFORMATION

For Information On	Contact
Local Ordinances	City or County Building and Zoning Departments
Florida's Coastal Construction Control Line Program and Permits for Erosion Control	Bureau of Beaches and Shores Florida Department of Natural Resources 3900 Commonwealth Blvd. Tallahassee, FL 32303 (904) 488-3180
Dredge and Fill; Construction Seaward of the Mean High Waterline	Florida Department of Environmental Regulation 2600 Blair Stone Road Tallahassee, FL 32301 (904) 488-0130 and U.S. Army Corps of Engineers P.O. Box 4970 Jacksonville, FL 32232 (904) 791-3697
Flood Insurance	Local Building Department or Federal Emergency Management Agency Insurance and Mitigation Division Suite 778 1375 Peachtree Street, N.E. Atlanta, GA 30309 (404) 881-2391
Corps of Engineers Publications (request a list)	U.S. Corps of Engineers Coastal Engineering Research Center Kingman Bldg. Ft. Belvoir, VA 22060

For Information On	Contact
Florida Sea Grant Publications (See list page 18) and Assistance	Local Marine Extension Agent or Florida Sea Grant Bldg. 803, Room 5 University of Florida Gainesville, FL 32611 (904) 392-5870 or Christopher Jones Coastal Engineering Specialist 336 Weil Hall University of Florida Gainesville, FL 32611 (904) 392-2460; 392-1436

Florida Sea Grant Marine Advisory Publications

Copies still in print may be obtained free of charge on a single copy basis from your local marine extension agent or from:

Marine Advisory Program
G022 McCarty Hall
University of Florida
Gainesville, FL 32611

Fact Sheets

Building Construction on Shoreline Property. Construction guidelines and considerations for owners, designers and builders of shore area buildings.

Stabilizing Beaches and Dunes with Vegetation in Florida. MAFS-1. Provides information on the use of vegetation to stabilize beaches and dunes. Extracted from Sea Grant Report No. 7, Stabilization of Beaches and Dunes by Vegetation in Florida, by John H. Davis, Jr.

Florida Coastal and Environmental Information. MAFS-8. Lists sources of coastal and environmental information including Coastal Engineering Archives, Environmental Data Index, Oceanic and Atmospheric Scientific Information Center, University of Florida computer searches, etc.

Bulletins

Hurricane-Resistant Construction for Homes. MAP-16 (Formerly SUSF-SG-76-005). 31 pp. Discusses hurricane winds and the implication of probability concepts on home design in hazardous areas. Federal and local guidelines are reviewed including the National Flood Insurance Program, the Florida Coastal Construction Setback Line, and county building codes.

Beach Dune Walkover Structures. MAP-18 (Formerly SUSF-SG-76-006). 13 pp. Information and instructions for building walkover structures in areas where sand dunes are threatened by human traffic.

Reports

Seawall and Revetment Effectiveness, Cost and Construction. Report No. 6. 52 pp. Explains the types of shore protection structures commonly available and the relative merits and costs of each.

Stabilization of Beaches and Dunes by Vegetation in Florida. Report No. 7. 52 pp. Provides coastal strand property owners and managers with guidelines for use of vegetation in the protection and restoration of Florida beaches.

Seawall Design on the Open Coast. Report No. 29. 24 pp. Provides insight into effects which seawalls have on the beach system, and proper design considerations for seawall construction on the open coast.

Florida Sea Grant College is supported by award of the Office of Sea Grant, National Oceanic and Atmospheric Administration, U. S. Department of Commerce, grant number NA80AA-D-00038, under provisions of the National Sea Grant College and Programs Act of 1966. This information is published by the Marine Advisory Program which functions as a component of the University of Florida Cooperative Extension Service, John T. Woeste, dean, in conducting Cooperative Extension work in Agriculture, Home Economics, and Marine Sciences, State of Florida, U.S. Department of Agriculture, U.S. Department of Commerce, and Boards of County Commissioners, cooperating. Printed and distributed in furtherance of the Acts of Congress of May 8 and June 14, 1914. The Florida Sea Grant College is an Equal Employment Opportunity-Affirmative Action employer authorized to provide research, educational information and other services only to individuals and institutions that function without regard to race, color, sex, or national origina.

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