"ELOISE"

A SEMINAR ON BEACHES VS. HURRICANES

Edited By

Todd L. Walton, Jr. and Thomas M. Leahy

PROCEEDINGS OF A SEMINAR
HELD MARCH 4 & 5, 1976
IN GAINESVILLE, FLORIDA

Sponsored By

MARINE ADVISORY PROGRAM-SEA GRANT
COASTAL ENGINEERING LABORATORY-UNIVERSITY OF FLORIDA
COASTAL PLAINS CENTER FOR MARINE DEVELOPMENT SERVICES
FLORIDA SHORE & BEACH PRESERVATION ASSOCIATION

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SEMINAR OVERVIEW

MARINE ADVISORY PROGRAM

Todd L. Walton, Jr.
Marine Advisory Specialist

On behalf of the Marine Advisory Program and the Florida SUS Sea Grant Program I would like to welcome all of you to our Beaches vs. Hurricanes Seminar. I hope that the next two days will be very beneficial to all of you. I would like to provide you with a very brief overview of the motivations for our seminar this year.

I think we are all aware that Florida's major problems are due to rapid growth. As this figure shows, the growth trend in Florida has far exceeded that of the U.S. and that of the world in the past two decades. Three-fourth's of the people coming into Florida are moving into the coastal zone, an area long recognized as being a high hazard area. The typical coastal resident in this area is often not well informed as to the risks he is taking or the hazards to which he may be subjecting himself. We have had a somewhat apathetic attitude when building our homes in the coastal zone.

We are aware that beaches erode during storms but yet proceed to go ahead and build right on the beach without regard to what has happened in the past or what might happen in the future. As indication of what has happened elsewhere, I'd like to show some figures of a few areas in the U.S. where we have data on storm damage on beaches.

After a major Northeaster storm in N.J. in 1953 dunes over 20' high were eroded 50-100'. This figure represents an average of conditions on the beach before and after a two day Northeaster storm that raised the water level only 6 feet above normal. Before and after profiles shown of this figure represent average profile over a 40 mile section of beach. Maximum landward retreat of the profile in some areas was 120-180 feet.

A Northeaster in Virginia in 1948 caused recessions estimated in some locations to be well over 100 feet with a storm surge of approximately five feet above normal.

Hurricane Audrey struck the Louisiana-Texas coast in 1957 and completely submerged the crown of the beach ridge with a storm surge of 10 feet. The elevation of the shore was only about 5 feet above MSL (somewhat similar to the elevations we find in Florida along our lower Gulf Coast barrier islands). The whole barrier retreated on an average of 125 feet in the area at which this storm hit.

Hurricane Carla struck the Texas coast in September 1961, and caused primary dune ridges 15-20 feet in height to recede in places 150-300 feet and left wave cut cliffs 10-15 feet in height. This figure shows an estimated before and after beach profile on Mustang Island (from the work of Miles Hayes).

If these types of damage can occur elsewhere it's relevant to ask "what can happen in Florida?" In the next two days you're going to be seeing numerous slides of the effects of hurricane Eloise and hear expert opinions on how much of the damage there could have been prevented. I'm only going to subject you to one "Eloise" slide which was taken at the beach, very close to the area of maximum winds of the storm. The floor of this house prior to "Eloise" was sitting on the crest of the primary dune line. Prior to the storm there were a number of structures adjacent to it. This property owner was probably very fortunate to come through as unscathed as he did. His foresight in building on pilings saved his home. Nothing else was left of the homes adjacent to his but a pile of rubble. You'll be seeing considerably more on Eloise's effects on Florida's beaches in the next two days.

To give you a quick idea of what history has recorded in the way of storm tides in Florida I have a slide which condenses a considerable amount of data summarized in a past publication of the laboratory entitled, "Storm Tides in Florida" of which Dr. T.Y. Chiu was one of the principal authors. The underlined numbers are the recorded storm surge levels.

In South Florida where considerably more historical data exists on storm tides you can see that many of our past storm surge levels (if they occurred now) could spell disaster.

For comparison purposes this figure shows you Hurricane Camille storm surge levels along the Louisiana-Mississippi Coastlines.

Camille hit along the Louisiana-Mississippi coast in 1969. Maximum storm surges were recorded in the area of Pass Christian on the order of 25' evaluation of the storm surge based on historical data (100 years of record) shows a Camille type storm has an expected recurrence interval of 160 years. That means, on the average one time in 160 years you would expect a storm having Camille's storm tides or greater to hit along that section of coast. As you view the damage of Eloise consider what might have happened if a storm of Camille's intensity hit in the Panhandle.

Tommorrow we will be hearing about both State and Federal programs to help us protect ourselves from Mother Nature. I'd like to point out though that these programs provide coastal dwellers with minimum reasonable protection and by no means protect them from all of the inherent dangers of living on the coast or from a catastrophic event. I hope you'll keep this in mind.

As an example of what I refer to when I say minimum protection I'd like to present my last figure when addressing the subject of Risk Criteria. The information on this is from the work of Dr. Leon Borgman.

The different lines on the graph represent different return periods of an event such as a storm surge level or a wind speed, (TR = 100). The bottom scale represents the design period (or what probability people call the Encounter period) and the vertical scale represents the probability that the designated event will be equaled or exceeded in a give encounter period. As an example of how you would use this information, if you designed a home for 100 year storm tide you could find that the probability of the 100 year event being equaled or exceeded in 50 years is about 40%, (a higher risk than most of us would probably like to take!). Put another way, the chance of that home surviving undamaged for 50 years is not much better than the chance of you flipping a coin and having it come up heads. Presently most enforceable building codes use as the basis for design the event (storm tide level or wind loading) having the 100 year return period.

I promised a very brief overview of the reasons for a conference such as this and I hope I've not been too brief. I hope you will have a most enjoyable and enlightening two days and will soak up the information that the experts on our program will be presenting. Ask questions, learn, and come back next year. Thank you.

COASTAL ENGINEERING LABORATORY

Dean Morton Smutz
Director, Coastal Engineering Laboratory

It is customary on occasions of this kind for the representative of the host institution to describe ongoing activities. Because your particular interest is in beach preservation and related activities, I'll confine my remarks to our Coastal and Oceanographic Engineering Laboratory. It is a tribute to people like Per Brunn, Jim Purpura and Dean Joe Weil that such a laboratory now exists on our campus. Dr. Robert Dean, who was formerly with the Laboratory and now at the University of Delaware, also deserves much credit or the initiation of many projects that are of direct benefit to Florida.

Jacques Cousteau in his book "The Living Sea" describes the outer continental shelf as the new frontier. These words are even more appropriate since the beginning of the energy crisis. In his book, he points out that if you count all of the continental shelf areas around all of the continents and islands, the area of this new frontier is roughly that of the size of Asia.

It has been proposed that nuclear reactors be placed offshore and I will start this presentation by describing the work that we are doing related to offshore nuclear power plants. In the May 16, 1975 issue of the New Yorker magazine, there is an article about offshore nuclear reactors. Let me quote a few statements from this article:

> "Within 2,000 miles of Newark there was only one test basin large enough to contain such a design. Europeans were far ahead of Americans in such coastal engineering facilities. The Dutch, for example, could have placed a suitable piece of New Jersey's ocean in a corner of the laboratory at Delft. The one sufficient ample facility in the United States was at the University of Florida at Gainesville where a Coastal and Oceanographic Engineering Laboratory had been built to house extensive working models of Florida's bays, estuaries and beaches where erosion was worth preventing because erosion could produce concomitant erosion of the treasures of the state."

The nuclear reactor facility is to be placed three miles off the New Jersey coast in 1985. These are twin floating nuclear reactors about 400 feet long and 400 feet wide, costing $2 billion with a power cable running under the sea floor back to the shoreline. The floating reactors will be placed within a breakwater. Figure 1 shows a 1:64 scale model of the reactor facility. The breakwater consists of several thousand dollars and is designed to protect the reactors under storm conditions. In one test, the reactor facility must be able to continue to operate under the worst storm to be encountered in a hundred years. In another test, the reactor facility must be able to withstand damage in the largest storm to be anticipated in a million years. Another test involves the ramming of the breakwater by

the largest supertanker to be built in the 1980's.

We have another unique facility, an internal wave tank which accomodates the flow of two different fluids in the same direction or opposite directions and permits airflow over the surface of the upper layer. Internal waves are frequently encountered in the depths of the ocean and are now being studied by Dr. Max Sheppard and Dr. Wang. This laboratory facility permits a study of internal waves under carefully controlled conditions.

Dr. Mehta of our staff is involved in our Sea Grant Project in preparing glossaries of inlets. These compilations of information are of interest and importance to municipal and state planners who need to know the history, characteristics, and important past studies of the particular inlet. The Matanzas Inlet on the Atlantic coast is one such inlet under study and the last unimproved one in that area. We feel that it is very important to study this inlet because it shows how nature intends for an inlet to be designed.

In our wave tank, it is possible to use models of actual inlets and beaches to determine the most appropriate designs for engineering structures. It has been shown that model studies permit an engineer to try out various designs prior to the actual construction. We believe that it is better to make your design mistakes on a small scale in a test facility rather than on a large scale in the real world.

We have recently been involved in a study at Marineland, Florida, directly related to the sea satellite to be launched in 1978. This 20 ton satellite costing $20 million dollars will be put into a polar orbit and it is going to observe all of the oceans of the world in each 24 hour period. It is amazing to me that it will be able to measure the height of waves within 6" at a distance of over 500 miles from the earth. The design of the radar unit has to be selected at this time in order to be placed in the actual satellite in 1978. Our tests at Marineland last November and December were carried out with Dr. Omar Shemdin serving as principal investigator. Because Dr. Shemdin is now with the Jet Propulsion Laboratory while on leave of absence, Dr. Latif served as our local representative. This study involved the use of six satellites, three aircrafts and three naval vessels. Measurements were made on the surface of the sea at the same time there were measurements from satellite and high-flying aircraft. In spite of poor cooperation by the weatherman, the tests were completed successfully.

As most of you know, the State Department of Natural Resources is implementing Florida's very enlightened set-back-line law through contract with the University of Florida, with Jim Purpura and Dr. T. Y. Chiu heading the project. The study involves measurements in the field and the use of aerial photographs and historical data to determine the most appropriate position of the line. The citizens of each community have an opportunity to present their views in a series of hearings before the State cabinet finally establishes the exact location of the set-back line.

Dr. Partheniades of our laboratory is interested primarily in the cha-

racteristics of estuaries and in sedimentation phenomena. He has designed and built specialized laboratory equipment that will help explain the very complicated phenomena of cohesive sedimentation.

We also participate in the University of Florida Marine Advisory Program. Marine specialists are available to people throughout the state who wish to make inquiries about coastal engineering problems. This program is an integral part of the Sea Grant Program. Todd Walton serves as the Coastal Engineering Advisory Specialist for the Sea Grant Marine Advisory Program.

Our Coastal and Oceanographic Engineering Archives is also a unique facility. Lucille Lehmann, as a full-time archivist, is accumulating data about all areas of Florida and you are welcome to make use of these facilities. She may be able to help you find needed information about your own areas from maps, photographs, reports, court proceedings, etc...

We are pleased to have you meet with us at the University of Florida and we are glad to participate with the Florida Shore and Beach Preservation Association in bringing you this conference on the "Lessons of Eloise."

ACTIVITIES OF THE COASTAL PLAINS MARINE CENTER

Phil Hill
Asst. Director

The Coastal Plains Marine Center was created in 1969 by the Coastal Plains Regional Commission to promote the accelerated economic development of the Coastal Plains Region in ways that will not degrade the quality of its environment by providing free continuing technical assistance to the public agencies, academic institutions, and private enterprises engaged in managing, exploring, and developing the coastal and marine resources of North Carolina, South Carolina, and Georgia.

In 1975 the Commission boundaries, and areas served by the Center, were expanded to include eastern Virginia and northern and western Florida. The Center accomplishes its overall purpose by transferring information and by coordinating the sharing of expertise across State lines. It strives to achieve the following functional objectives:

1. To stimulate, coordinate, and financially support information exchange projects.

2. To extend the technical staff capabilities of the Commission and its member States.

3. To bring marine agencies and organizations together to facilitate communication and cooperation, and to get them working together on a Regional basis.

4. To respond to requests for technical assistance, information, or publications.

5. To identify needs for coastal and marine resource information and conduct an active information dissemination program to meet those needs.

6. To strengthen and coordinate coastal and marine research and development through information exchange.

The Center achieves these goals and objectives through various program activities, including its Cooperative Projects Program, supplementary staff work, its annual Conference on Marine Resources, responding to requests, performing advisory and consulting services, and compiling and distributing various publications.

Comparatively recently the Center initiated a Cooperative Projects Program which has been highly successful. Projects in this program are joint efforts by the Center and State coastal and marine-related agencies, and benefit not only the State, but more importantly have potential Regional economic impact. The Center contributes coordination, advisory and consulting services, and financial support. The States do that detailed planning, make necessary arrangements, and furnish the required personnel, equipment, and materials. In other words, stimulated and assisted by the Center, the States work together, sharing their available talent with each other. Examples of these projects include small meetings, workshops, and demonstrations

related to problems, new techniques, or other interests common to the State. The projects to be undertaken are determined by group composed of Center and State representatives, considering Regional needs and availability of funds.

In another program activity, the Center professional staff has extended in various ways the technical staff capabilities of the Commission and of its member States, which do not always have all of the expertise they need. They turn to the Center for assistance in these instances. For example, the Commission's Environmental Affairs Advisory Committee asked the Center to undertake a project involving assistance in submitting State applications to the NOAA Office of Coastal Zone Management for estuarine sanctuary grants under the Federal Coastal Zone Management Act of 1972. The procedures for submitting these applications require a list of protected sites, either within the estuarine sanctuary program or within other Federal, State, or private programs which are located in the same regional or biogeographical classification, the Carolinian classification, extending from Cape Hatteras to Cape Kennedy, being applicable in this case. To meet this need, the Center compiled a map indicating protected sites in this area and including information on these sites. This is an example of a case in which each of the States would have had to do this work individually for themselves, resulting in unnecessary duplication of effort and expense.

In addition to the smaller meetings in the Cooperative Projects category, the Center annually sponsors, plans, and conducts a much larger Conference on Marine Resources. The detailed planning and conduct of this Conference, as well as the compilation, publication, and distribution of the report, is handled entirely by the Center. The purpose of the Conference is to serve as a means through which Federal, State, and local government administrators, scientific researchers, and representatives from private industry, as well as private citizens, can address some of the major coastal and marine issues facing the Coastal Plains Region. Information is exchanged among leaders in marine fields both inside and outside the Region, and efforts are coordinated toward the solution of common problems. To give an idea of the broad scope of problems addressed at these Conferences, the subjects involved at the last two Conferences were: Seabed Mineral Resources; Sport Fishing; Marine-Based Recreation and Tourism; Seafood Market Development; Recent Developments in Coastal Zone Planning at the State Level; Marine Advisory and Research Capabilities; Seafood Processing: Technology and Economics; Access to Beaches and Estuarine Water; Federal State Planning for Marine Fisheries; and Offshore Impacts of OCS Development.

The Center responds to requests for assistance, information, or publications. This activity is one of the most important, as it directly affects filling the stated needs of the five States for coastal and marine resources information. While requests are received and honored from all sources, those from individuals and organizations involved in managing and using the coastal and marine resources of the Region, and particularly from State agencies and industries which influence economic betterment in coastal and marine areas, are most pertinent to the Center's overall purpose.

Another Center activity which affects filling the needs of the five States for coastal and marine resources information involves advisory and consulting services wherein the recipients of these services are unaware of the availability of information they need. In this case these needs are

identified by the Center, which conducts an active information dissemination program to keep users of Center services abreast of recent coastal and marine developments both within the Region and outside it. Information collected by the Center is reviewed and analyzed to determine those individuals and organizations with the Region who would benefit the most from it. This information is extracted, summarized, and distributed accordingly without any prior initiative by or obligation on the part of these recipients.

A final Center activity which should be mentioned is the Center's publications program. The Marine Newsletter is an 8-page bimonthly publication, whose circulation has recently increased above 7,000 and which continues to be well-received. It reports recent developmentsof value to the complete spectrum of coastal and marine interests in the five States. The Conference on Marine Resources was discussed earlier. While the Conference in itself serves as a means of information exchange, further benefits are produced by the Center in the compilation, publication, and distribution of the Report. These further benefits are derived through capturing the information and results in written form for dissemination to a much broader audience. Still another Center publication is the annual Summary of Marine Activities of the Coastal Plains Region, which includes information about coastal and marine organizations in the five States and their current interests and projects in order to enable contacts to be made. This publication informs researchers of what is being done in their particular fields of interest and where it is being done, so as to facilitate communication across State lines, prevent duplication of effort, and coordinate coastal and marine research and development programs.

In summary, the Center profides free continuing technical assistance to those who manage, explore and develop the coastal and marine resources of Florida, Georgia, South Carloina, North Carolina, and Virginia; and transfers information and coordinates the sharing of expertise across State lines. This is a job which is not being done by anyone else. The Center stimulates, coordinates, and financially supports information exchange projects such as those included in its Coorperative Projects Program. It extends the technical staff capabilities of the Commission and its member States. Through such means as its annual Conference on Marine Resources it brings coastal and marine agencies and organizations together to facilitate communication and cooperation, and to get them working together on a Regional basis. In order to fill the stated needs for coastal and marine resource information, the Center responds to requests for technical assistance, information, and publications. In order to fill the unstated needs for such information, the Center identifies these needs and conducts an active dissemination program to meet them, involving advisory and consulting services. Sometimes this information is specialized and of interest to a broad spectrum of coastal and marine interests and is disseminated through Center publications such as the Newsletter, conference reports, and summaries of coastal and marine activities.

Further information regarding the Center and its services can be obtained by writing to the Coastal Plains Marine Center, 1518 Harbour Drive, Wilmington, N.C. 28401, or telephone 919/791-6432.

FLORIDA SHORE & BEACH PRESERVATION ASSOC.

Stan Tait, Executive Director
John G. Cowley, President

I want to say a few words about the Florida Shore and Beach Preservation Association and to encourage anyone here who isn't a member to join our group before this seminar is over. It may be the most important thing you do for the cause of beach preservation.

Throughout the past two days, you've all heard about various beach restoration projects underway or proposed and about the importance of erosion control in general.

In a nutshell, our job at the association is to help make sure that you get the wherewithall from the State Legislature and the Congress so that you can undertake these projects in the first place.

A very important mission of the association is to lobby the State Legislature for funding of the beach program. And I use the word "lobbying" unashamedly because it's the only way we're going to get the money we need to preserve and rebuild our beaches. Through lobbying, we "sell the case" of erosion control to our lawmakers We "educate" them about the importance of our beaches.

Some of you can perhaps recall that back in 1957 the FSBPA was formed to promote beach preservation in Florida. At that time there was no state program. Thanks to the dedicated efforts of the founding fathers of our association, the 1957 Legislature was persuaded to begin the first state erosion control program.

We've come a long way since then. But virtually every single law and dollar relating to erosion control has come as a result of our efforts.

We do a lot more than lobbying, of course. We help to educate the general public about the need for erosion control. We're the only statewide organization doing that. We reach the public through speeches and news releases and newsletters and pamphalets. We also co-sponsor meetings such as this to help bring professionals and interested citizens together to discuss and learn about beach erosion.

What I'm saying, in short, is that this association is very important to the state's erosion control program. We've got an enormous job in the coming months and years so that you'll have the funds to preserve and rebuild our beaches. To do that job, we need your help. So I urge you again -- if you're not a member of our association -- to please join and help us win that fight. I just happen to have a few spare membership application forms. Thank you.

John G. Cowley

Members of the Florida Shore & Beach Preservation Association are pleased to participate in sponsoring this seminar. Our organization was organized approximately 18 years ago with its primary objective to focus attention on the importance of Florida's beaches to all of its residents. These beaches are recognized, by information obtained from visitors themselves, to be the number one tourist attraction. Tourists paid approximately eight hundred million dollars in taxes during the past year. The long and varied coastline of the state and its beautiful beaches establishes Florida as a unique state with a tremendous economic potential from tourism. If this industry, so important to Florida, is to continue to grow and prosper, then our primary natural resouce, our beaches, must be protected and restored.

The seminar this year was especially planned to deal with problems arising from hurricanes and what can be done to minimize damages from such storms to beaches and structures in coastal area, and that I am sure that the programs planned today will be of great benefit to each of us present.

ABSTRACTS OF CONFERENCE

I. BEACHES VS. HURRICANES
ABOUT THAT HURRICANE
Dr. Neil Frank

There is a passage in the bible which says "where is the wise man." Eloise destroyed the philosophy of many of the wise men who lived in the panhandle of Florida. It had been a long time since they had a bad hurricane. As we start today I want to define some terminology. We're going to be talking about major hurricanes and major hurricanes would be a category 3, 4 or 5 on a scale of 1 to 5. We have found that it is extremely useful and meaningful to classify hurricanes on this scale rather than worry so much about the meteorological data that would define the various boundaries. A 1 would be a minimal storm. A 5 would be the worst storm you would ever expect to occur. There have only been two 5 storms hit this nation in this century, Camille in 1969, and the Labor Day storm in 1935. On this relative scale of 1 to 5 we'll be talking about a major hurricane as being a category 3, 4 or 5. Eloise was the first major storm to hit Florida in over a decade. It was the first major storm to hit the panhandle in about 40 years and during that 40 year interval we have had 6 or 7 hurricanes in the Florida panhandle. The strongest previous hurricane in 1941, was a category 2. The most recent, Agnes, in 1972 a category 1. Eloise was also the first major storm to hit the Panama City area since the turn of the century. Fifteen hurricanes have hit the panhandle since 1900 and only three of those have been of the category 3 type. We had a lot of people in the Panama City area who felt they were immune from hurricanes or at least bad hurricanes. 122,000 people lived in the Panama City - Apalachicola area and not one of them have experienced a major hurricane this century. If you count up not only the hurricanes but also the tropical storms, there have been 15 hurricanes in the panhandle this century and 17 tropical storms in this century. Only three of them would have been in the major category. It would be easy to conclude then that we get a lot of activity in the panhandle but none of it is really major. It has not always been that way.

Let's go back prior to the turn of the century in an 11 year period 1885 to 1896. There were nine storms in the Florida panhandle and even though data in that period are very limited and very sparse, we can conclude that many of these were of the major category. If we start on back into history we can see that in the Florida panhandle in 1736 Pensacola was destroyed by a hurricane. In 1842 the highest storm surge on record in the state of Florida occured at Cedar Key. We have an eye witness account there that said the water was 20 feet above normal. In 1843, Port Leon just south of St. Marks was destroyed; you don't even hear that name in our modern society. In 1844 Port St. Joe was destroyed. There is an interesting story about Port St. Joe. If you go back to that part of Florida history I understand that Apalachicola was a primary seaport during those years. Then there was some controversy over taxes. A lot of the residents of Apalachicola decided that they weren't going to pay the taxes and they just picked up and moved over to Port St. Joe. In 1841 there was a yellow fever epidemic in St. Joe which destroyed a lot of the community and then the final destruction came in a hurricane in 1844.

Let's look around the state and look at some of the other historical storms that we tend to forget about. In the Tampa area in 1848, a 15 foot surge of water occured. I was recently talking to a resident who lives south of the Tampa area and he said that down in Port Charlotte - Punta Gorda area, "I know that there was a bad storm there once because that's where my relatives come from; they were in a ship and that ship went over some of those offshore islands." In other words the water was so high that it covered the islands and this ship went across the islands and was deposited on the beach in the Punta Gorda area. In 1873 Punta Rassa was destroyed by another hurricane which brought 14 feet of water.

Down in the Florida Keys, at Key West you hear that they don't have a bad hurricane problem down there. The same kind of attitude exists in the Keys that you saw prevalent in the Florida panhandle. Yet in 1846 Key West was almost completely destroyed by a hurricane that moved across it. The water was said to have run four to five feet deep along the main street of Key West. There is only one high spot in Key West, where the ground elevation is 17 feet. People were on that point of land and fearful that waves were going to break over them. Then, of course, there is the 1935 storm that established the record for being the strongest hurricane that we've ever experienced in the Atlantic, the Carribean, and the Gulf of Mexico. Eighteen feet of water over the keys destroyed a railroad track and 400 lives were lost. Down in the southeast coast of Florida we remember the '26 storm in Miami. It would have been a category 4. In 1928 a storm hit Palm Beach and killed 2000 people around Lake Okeechobee. Recently we've come across some other pieces of literature that we think are quite interesting. In 1796 we have an account of a ship that was caught in a hurricane offshore and as it was being thrust along they threw their anchor out. The anchor didn't catch at first but when it finally caught, it lodged on something solid. When the water went down, the boat was deposited in the middle of Elliot Key. At that time they didn't have a way of getting it off the island, they had to burn the boat so they could salvage the iron.

It's a little harder to get a direct hit on the northeast coast of Florida because hurricanes tend to run parallel to the northeast coast of Florida. There we don't have any recent storms or evidence of any major storm, although in 1871 Melbourne was destroyed. In 1893 a storm moved parallel up the Florida coast and then moved up on to the Georgia coast and produced some 20 feet of storm surge at Savannah Beach and killed over 2000 residents. I was in Savannah Beach again this spring, asking the people there if they were going to leave if they got a hurricane and they told me they don't have a hurricane problem at Savannah Beach.

Let's take a look at Eloise and compare it to some other storms to put it in proper perspective. What kind of a storm was it? I told you already that it was a category 3 on the scale of 1 to 5. I would like to point out that one of the problems we have had with Eloise is that our mathematical storm surge model produced what I considered to be the first major failure during an analysis of Eloise. We've run this model for all of our historical storms, we've run it operationly now since 1969 at the

center and we have never seen a major failure of this model. Yet for some reason, and I'm not sure just why yet, there was a failure of this model for Eloise. We predicted about a 7 foot storm tide so we put out in our advisories that the water would be about eight feet. When we saw that the storm was strengthening we increased the water level in our advisories to 10 feet but we found out after the fact that that wasn't even adequate. The storm surge profile of Camille produced 25-26 feet of water compared to the 16-17 feet of water that was produced by Eloise. A category 5 type of storm, Camille certainly produced a lot higher storm surge and produced a lot more devastation than Eloise. A survivor of Camille was a gal by the name of Mary Ann Gerlock. Mary Ann and her husband stayed in their apartment because they felt it was reasonably safe. They had gone through Hurricane Dora in Jacksonville in 1964. Dora was a category 2 storm. The eye of Dora hit around St. Augustine and Jacksonville was really in the fringe of that storm. They felt Dora had been a bad storm though and they did all right in Dora so why go away from Camille? When the building began to break apart they found themselves in the water. Her husband drowned. Mary Ann was in the water 12 hours and finally was deposited here on the beach 4 1/2 miles down from where her apartment was originally located. At one time Mary Ann was so far out in the gulf that she couldn't even see land. The tide went out and she went out with it. The next tide brought her in and deposited her on the coastline.

I think you can see that there is a vast difference in the kinds of devastation that we witnessed in the Panama City area in Eloise compared with what occurred in Camille even though we consider Eloise a major hurricane. In 250 years of storm surges on the Mississippi coast (since 1700) the highest storm surge that they had experienced there was 16 feet, then Camille came along with 25 feet. The point I want to make is that we frequently forget these rare events that occur in the past and we don't consider them in our planning. I want to emphasize, too, that there are two aspects of hurricane preparedness; one is an aspect that you people are addressing yourself to in this conference and that is realistic planning, realistic cost in terms of buildings. What kind of a building do you build on the seafront when you know that the expected frequency of a storm or bad hurricane is maybe one in 100 years or one in 50 years? Maybe 50 years would be a more realistic value to consider in terms of building life. There is another aspect of hurricane preparedness that is quite different, and that aspect concerns human life. Our philosophy at the Hurricane Center is that "We don't really mind you going down and building on the beachfront and doing it very poorly if that's your desire and you're willing to take the risk and you are also willing to take the loss. Our primary concern is that you get out when we put the warnings up. Don't stay there and try to protect yourself. Our's is not an expensive program and doesn't cost lots of dollars to do. For the kinds of things we are considering here with setback lines and realistic planning and building costs and insurance programs, that's lots of dollars. There is also a lot of give and take to come to some kind of a realistic program when considering building. Preparedness for human lives is not an expensive program.

How about wind damage? Well, here are four homes in the Panama City area, as they looked prior to the arrival of that hurricane and on one of them you can see that the roof was completely blown off but the other three were reasonably well intact. Here's another picture of some damage. You can see there's some roof damage on the home to the right. On the building to the left, the roof is gone and there is major damage to that home. Here is one more you can see where the roof blew off causing some roof damage on the two roofs adjacent, although the one in the middle faired fairly well. Let's compare that with the kind of wind damage that we saw on the Mississippi coast. You can see total devastation in that community. The peak winds of Eloise were recorded on a 38 ft. tower in the Panama City area and were about 156 miles per hour. We know that the winds in Camille were probably over 200 miles per hour. Our indirect evidence would indicate that they were certainly over 200 miles per hour. O.k. there's no question then that there is a big difference in a category 5 type hurricane such as Camille and a category 3 such as Eloise and I think it's well that we take note of that as we view the Panhandle. We have to be very careful that we don't begin to assume that that's the worse that we could ever expect to see up there.

Now in the final few minutes that I have here today, I want to highlight a problem that Todd Walton already mentioned, and that's about our increasing coastal population. A recent report out of the University of Colorado at the Dept. of Behavioral Sciences had a figure that really astounded me. It shows the increase in population over the decade of the 60's and at the top of the graph you can see that we've had a 13 percent increase in the number of people in the United States alone. At the bottom of the graph there's been a 43 percent increase in our beachfront developments. We began to ask ourselves some questions about this. What impact does that have on the hurricane problem? Now we're living in good times and people are looking for new lifestyles and in search for those lifestyles they are turning to the beachfronts. Many of them are turning to the beachfronts in Florida. But, with this tremendous influx of new people into the state we're finding we have some problems with overcrowding. I don't know how we're going to deal with this increase in population in these coastal areas. Historically, If you lived on the beachfront and a major storm was approaching you'd get in your car and get out. I'm not sure we can evacuate everybody from our coastal areas. For example, down in the Florida Keys there are 60,000 people in the Florida Keys today and I understand that maybe 20,000 of these may live in mobile homes. Beachfront living is a fine way of life, mobile home living is also a fine way of life but it's not a place of refuge during a hurricane. These people have to get out. These and others that would have to evacuate. This is what their evacuation route looks like. (slide) A two-laned road with 60 major bridges and many of those bridges are in need of major repair. If you were in the Keys this summer you would have found you didn't have a two-laned road. You essentially had a one-laned road because at least a half a dozen of those bridges were being repaired.

Now the Keys aren't the only place. How about Marco Island on the southwest Florida coast? How about places like Key Biscayne off of Flo-

rida? The population there is 6000 and is kind of under control but there is a lot of building going on on Key Biscayne.

Now real briefly take a quick look at some of the other places over the nation so that you realize that this increase in population is not only confined to Florida. How about Key Alegro off of the Texas coast, this community is a dredge and fill operation, a beautiful development about 30 miles south of Lubock where Carla in 1961 produced 18 feet of water. I was down there trying to buy some property a year ago and I asked the salesman, "Do you have a hurricane problem?" "Absolutely not," he said, "you see Mustang Island out there, that's going to protect us. We've been here 12 years and never seen water in the streets." This is a national problem. It's more severe in Florida though, than it is in other parts of the nation because more people have come here. Our last major storm was in 1950, the coastal population at that time was 2 million. Today it's 5 1/2 million people in Florida.

The problem I want to pursue now is what is the level of hurricane experience of our coastal residents. In order to pursue that point, I want to make sure that we have an understanding here that there's a vast difference in the devastation that takes place in the inner core of that hurricane and what takes place in the outer fringes. A hurricane has an inner area what we call the eye, where winds are relatively calm. This may be 25 to 30 miles across. Surrounding that is a doughnut of extreme winds and that's where most of the action takes place. Seldom does the area of extreme devastation cover a section of the coastline more than 50 miles wide, and yet the overall diameter of the storm may be 300 to 400 miles. I estimate that maybe 80 percent of the people who go through a hurricane actually go through the fringes. Fringe experiences can be deadly, I've already relayed to you about Mary Ann Gerlock and her husband who decided to stay because they'd been through the fringe of Dora. Fringe experiences can lead to false impressions and false impressions can lead to very poor hurricane planning. Let's take a look at the population in several key areas of the state. Along the southeast Florida coast we've got nearly 2 million people. If you go back to the 1950 storm there were about 600,000 people there at that time. Seventy percent of our people along the Southeast Florida coast are in an inexperienced category. Conditions on the west coast are even worse. Over at St. Petersburg in 1970 half a million people were there. The population today is about three quarters of a million people. The last major storm direct hit there by category 3 or greater was in 1921 when the population was less than 20,000. If you look around the Tampa Bay area, there are over a million people there today while only 100,000 were there in 1921. Ninety percent of the people in the Florida west coast are in this "no experience" category. Up on the Georgia and Northeast coast of Florida which includes Jacksonville, 1.3 million people haven't seen a bad storm this century. If you look over the entire state of Florida we've got five and a half million people in our coastal counties. That's not state population, that's coastal counties, and of that group 43% are totally inexperienced. Eighty percent of the residents of the most hurricane prone state in the nation are in a low ex-

perience category and as we know many of these people are living out in very vulnerable places. The thing that makes this problem even worse is that the increase in population has come in the State of Florida during a low period of hurricane activity. We know that hurricanes tend to occur in cycles. By that I mean a hurricane would tend to affect one area of our coastline then the cycle changes and hurricanes go someplace else. The decade of the 60's and so far the 70's (and Eloise hasn't broken this trend) for major hurricanes is in the Gulf of Mexico. We had seven major hurricanes during that period (eight with Eloise) and all of them were in the Gulf of Mexico. The decade of the 50's we had the major hurricanes on the East coast of the United States. Then you have to go back 25 years to the decade of the 40's when major hurricanes occured in Florida. The last 25 years we've only had 2 major hurricanes (three with Eloise) which hit the State of Florida, and Betsy and Donna were both primarily in the Florida Keys. In the six year period, 1944 to 1950, we had seven major hurricanes in the State of Florida. Many of those, the '49 storm at Palm Beach, the '44 storm on the west coast, the '45 storm and the '47 storm were very damaging hurricanes. I don't know when we're going to go back to that pattern again, but I can tell you that some day we're going to have major hurricanes return to the State of Florida.

In World War II we began to get involved in tropical weather problems in the Pacific. So, interest in hurricane typhoons began to be recreated again and there was a lot of emphasis on understanding the hurricane problem. Then in the 1950's we had all these storms go up the east coast of the United States and the National Hurricane Research Laboratory was established in Palm Beach. It later then moved to Miami. NHRL bought a number of aircrafts, a couple of DC6's and put all kinds of instruments on board these planes. These planes went out to collect data. Our understanding since World War II has increased tremendously, but unfortunately we have not been able to take that understanding and place it directly into our forecasting ability. Even though we've had a slight increase in our forecasting ability or our forecasting accuracy, we don't have nearly the forecasting accuracy that we need. At the same time our coastal population is just speculating to the point now where the demands that are being placed on the warning system by our coastal population far exceed our capability to give proper warnings. The thing we really fear is well illustrated on this side. On the left hand side you see the dollar damage on hurricanes by five year periods since the turn of the century and it comes as no suprise that we're seeing a tremendous increase in dollar damage. At the same time, though, over here on the right hand side, we've been extremely pleased to see that there has been a steady decrease in the number of lives that have been lost in a hurricane since the Galveston disaster in 1900 that claimed 6000 lives. The thing we fear now is that some time in the near future we're going to have another spike on our death curve over here that's going to be equal or even surpass that Galveston disaster unless we do something and do something rather quickly. It's my opinion that unless we as responsible people in the coastal areas, those of us involved in the warning, those of us involved in the planning, those of us involved in advising, those who are responsible for making the plans, and those of us who are responsible for education, do something in the near future to bring an awareness or inform those coastal residents who have moved to our coastlines and beachfronts, Mother Nature is

going to impose her own educational program. Her educational program is swift and deadly. Thank you, I appreciate the opportunity of coming up here and sharing these thoughts with you.

Questions & Answers

Q. Do some areas of the coast get higher storm tides?
A. Where you have shallow water you're going to get a higher storm surge, where you have deep water you're going to get a lower storm surge. The good news to those of us who live along the Southeast Florida coast is that we have the Gulf Stream offshore, the water is very deep. The bad news for those of you on the Florida west coast is that it's very shallow and you potentially have a greater storm surge problem in terms of surge height.

Q. Aren't hurricanes warnings somewhat misleading at times and on short notice?
A. Yes sir, you're absolutely right. That's one of the problems we're faced with, we know we're going to have to give you a warning. My average forecast error in 24 hours is 100 miles. If we try to give you lead time beyond that, our warnings become impossible. Let me translate what that means in terms of warning. We are going to try to give you 12, 18 hours, maybe 24 hours of warning, maybe 12 or 18 for evacuation. I know that an area of the coastline that needs to be evacuated will never probably be more than 50 miles, but in order to consider my error for 12 hours I increase it 50 miles to the right, 50 miles to the left, so we've got 2/3 of our people already over warned if we try to give 12 hours lead time in our warnings. If we go to 24 hours then I have to go 100 miles to the left and 100 miles to the right. Now my warning is over an area 250 to 300 miles and you've got most of the people 75 to 80 percent who now have been overwarned. That's a very difficult problem for us and this increase in population just escalates it for us. Because what that requires is greater lead time, but my accuracy isn't getting any better.

Q. Aren't hurricane surges heights hard to predict and much different in different areas?
A. Absolutely. Now if we take our storm surge models (and prior to Eloise I had tremendous confidence in it) and run it on the Southeast Florida coast it gives us results of about 12 feet for a storm like Camille. If you run a Camille on the west coast, the Tampa Bay area, you get 24 feet for exactly the same storm with the same meteorological parameters. The only difference is the depth of the water offshore.

Q. Aren't you concerned about the way people build on the coast?
A. I want to qualify that, I don't care if you go to the coastline and build if you're willing to take your own loss. Don't come to me and ask for my insurance agency to pay for your loss if you've gone down and built on the coastline. What I was really trying to do was make an impact that my primary responsibility is lives. I have a lot more personal feeling about building and what are realistic building codes along the coastline than that statement implied. In a sense I'm not trying to tell people that they shouldn't go on the coastline and build. If I had the money to go there and live, that's where I'd live. My constraint is notmoney, not the knowledge

that hurricanes can occur. My predecessor, Dr. Robert Simpson, has a home on the bayfront and a nice boat parked at the back of his home. He was right on a canal and he knew that someday that home was going to be wiped out, but he is willing to go down and take the gamble. He knew what the probability of a hurricane was there but he said, "I'm willing to go down there and enjoy the many good years of life that I think I have a reasonably good chance to live before we get that major hurricane." Now if he had gotten wiped out that first year he realized that that was a gamble he was taking. So, I don't think it's realistic to present a viewpoint that nobody should build on the beachfront. That's an unrealistic position to take. What is the most effective way to build is what you people are addressing yourself to here today.

Q. What are some of the high water levels of hurricanes in Southeast Florida?
A. The Florida East coast, for example in the '26 storm down in Miami, had 12-12 1/2 feet in Fort Lauderdale. The '28 storm in Palm Beach was on the order of 10 feet. The '49 storm was something on the order of 10 to 12 feet. These were big storms and this gets back to the point that I think our model has given us realistic results down there. I don't know why the failure of Eloise happened. People that are in the business tell me, that it was because the waves were breaking right on the beachfront rather than breaking offshore where they normally would.

THE ECONOMIC VALUE OF FLORIDA'S BEACHES

Dean Gaiser

My presentation will certainly be a departure from the highly technical, sophisticated, scientific presentations that you have been hearing this morning and will continue to hear through the rest of today and tommorrow. Let me identify to you first of all the size of tourism in our state. In 1975 27.1 million tourists visited our state. Their expenditures were 8.8 billion dollars. They provided employment for about 480,000 of our citizens. Probably even more important they contributed well over 500 million dollars in state tax revenue. One of the reasons that tourists and their expenditures and their contribution to state tax revenue are so important to us is that we get to keep all that money that they spend in revenue and we get to use it for our own programs. We have to provide none of the social programs and the welfare programs, the protection programs and medical and educational programs for them. They simply leave that tax money with us and go back to Ohio, Pennsylvania, Iowa, and New York and so forth. Last year our visitors indicated that well over half of them came to our state simply because of our beaches. So beaches are an important part of our total tourism contribution. Each tourist has an average stay of a little over 12 days. It's obvious they don't spend that whole time at the beach. Indeed they go to the beaches and they use the beach resort area as their point of departure for other considerations in our state. While they're here each tourist is going to spend about $374.00. The beaches contribute almost half of the total expenditures of our visitors. (We have over 1200 miles of shoreline in Florida) A great deal of it is beaches people can use now. Sunseekers and Florida beaches go together like love and marriage or mustard and hot dogs. Of all the many attractions Florida holds for winter visitors, the thousand plus miles of beach is the greatest.

The beaches are an integral, important part of our total tourism picture. We can't do without them, we have to have them. They ensure the quality of the visit and their visit insures the economy of Florida.

WHAT'S BEING DONE BY THE FEDS?

Colonel Drake Wilson

I have been asked to talk about the Federal government's response to Hurricane Eloise.

We have two authorities for assistance in flood or coastal storm emergencies. The first one is Public Law 84-99, which was really written for inland floods rather than for coastal storms. It is applicable for damage to Federal works, if any, and there were none affected by Eloise, (although we did survey harbors, channels, and basins to determine that) and to conditions of immediate urgency, one of which I will get back to later.

The main law we operate under is PL 93-288, the Disaster Relief Act of 1974. We provide the principal engineering support to the Federal Disaster Assistance Administration (FDAA) under the Act. Our services include damage investigations, wreckage and debris removal, emergency repair and temporary replacement of public facilities, protective work essential to the preservation of life and property, and other technical assistance. I will discuss the things we did after Eloise further on in my talk.

During the hurricane season, from 1 June through 30 November, the Mobile District stays on a General Alert status. As a hurricane approaches the District, sequential phases of our Hurricane Plan are initiated. Each phase triggers certain conditions of preparation and readiness. For Hurricane Eloise, Phase I, which includes plotting the storm's path, locating all floating plant and checking emergency equipment, went into affect on September 17th.

Early on the morning of September 22nd, advisories indicated Eloise would most probably go inland somewhere in the District. At 7:15 a.m. Phase II and III of the Hurricane Plan were placed in effect, and at 7:30 a.m. the Emergency Operations Center was actuated. At this point in the plan we have continuous communication with all floating plant, all floating plant are either in safe harbor or moving to one, and all emergency power supplies are checked.

At 7:00 a.m. on September 23rd, the NOAA National Hurricane Center reported that Hurricane Eloise was striking the Florida panhandle. We have an arrangement with the U.S. Coast Guard base at Mobile for reconnaissance service to survey damaged areas. I was on the first flight out and we were able to view some of the areas that morning. Pictures were taken about 10:00 a.m. by a newspaper photographer who was also on that flight. The surf was still high and the eroded dune and damaged buildings showed clearly in those photos.

Eloise moved rapidly inland and at 11:00 a.m. NOAA discontinued the coastal warnings. Our first damage survey teams were dispatched from the Mobile and Panama City area offices and we began to receive reports of heavy damage in the Panama City area.

Our survey teams cover the area as rapidly as possible to produce what we call "windshield" estimates. (We dress our people in red jackets so we can show the flag a bit.) Their first mission is to come up with a quick estimate of the magnitude of destruction and the capabilities of local interests.

Other teams were moving inland along the storm's track, and we began receiving reports of substantial, wide-spread damage well up into southeastern Alabama.

The early reports indicated severe dune erosion in the Panama City beaches area, a matter of some concern to us as we were working on a study for beach erosion control and hurricane protection for that area. We learned that the University of Florida survey teams were already measuring dune erosion throughout that region, so we did not duplicate their work. I understant their findings will be discussed later on in the program.

Almost immediately after the storm, special survey teams from our Hydraulic Data Section entered the area to run elevations on high water marks, wave runup marks, and other data pertinent to the storm surge. This data will be used in a report to published soon.

Well, I said I would get back to that condition of extreme emergency. A lot of commercial chicken sheds were damaged around DeFuniak Springs and we had a call from Congressman Sikes' office, asking what we were going to do about it. We can act to supply emergency drinking water under PL 84-99. Now, these chicken houses have a big device at one end that meters food and water down to the chickens. The problem was that they were without power for these devices. We scrounged around Mobile and some other places and came up with 35 portable generators that we could move into that area. We credit ourselves with saving 2½ million chickens.

One of the first emergency work approvals we got from the Federal Disaster Assistance Administration was for emergency dredging at Mexico Beach. A small boat channel providing access to the Gulf was closed by Eloise, and we put a small contract dredge in there to open up the inlet.

The next big activity we got into was the debris removal mission assigned by FDAA. We did this all the way along the Panama City beaches. Debris removal has some difficulties. We want to get on out there as quickly as possible and do what is necessary, and, at the same time, do it by contract with preference for local contractors.

We have to make a survey of debris quantity, and then advertise a contract and award it competively in the space of about a week. That is awfully fast contracting action, much more rapid than we normally use, but its still a delay of over a week. To get by that delay we rounded up trucks and forklifts from our projects to provide the first work until the contracts could get underway.

Our next major mission -- in fact the last increment is still on -- was demolition of buildings that were so badly damaged that they could not be rebuild. FDAA authorized us to contract out the demolition of these

dangerous structures. There were some complications, so demolition was delayed until recently. We closed down our emergency field office after debris removal was completed, and the demolition contracts are being administered out of our Panama City Area Office.

The last, and perhaps most interesting, operation is the beach restortion. The FDAA has authority to provide emergency protection against additional damage from subsequent storms when a major disaster has destroyed the existing protection, in this case the beach and dunes. This work is limited to "the minimum essential measure" to protect against the 5-year storm. At FDAA's request, we determined that a 5-year storm surge, plus runup, would reach elevation 6 feet mean sea level. Figure 1 shows a typical section of the proposed emergency restoration. We have determined that a berm like this is required at 25 locations along the beach. Figure 1 also slows the beach and dune profile we are recommending for beach restoration and storm protection for this same area in a study we have recently completed. That work will require Congressional approval. The emergency work would probably be done by pumping sand out of the entrance channel to Panama City Harbor, stockpiling it where trucks could get at it, and then hauling it into the selected locations where it would be build up into the profile.

That concludes my presentation. I have Walter Burdin, one of your recent graduates, with me here and if you have any questions now, we'd be happy to give you any information we can.

Q. What did you say the elevation of the emergency berm would be?

A. Six feet, mean sea level. That's the elevation of the 5-year storm surge plus wave runup. We have surveyed and located the 25 places where the beach fronting a structure is less than that elevation and that's where the sand will go. The total quantity in the emergency proposal only runs around 250,000 cubic yards and the quantities we're talking about in the total beach restoration proposal run around 8 million cubic yards. You can see that there is a considerable difference between the emergency and full scale restorations.

Q. Do you think this beach restoration will actually be done?

A. Well, as far as the emergency work under FDAA, yes. There is some internal problem at FDAA that has delayed their decisions. Still, I expect they'll go ahead and do it, but we don't have a directive yet.

Q. Doesn't it seem kind of sad that you can get Federal money after the damage is done, but you can't get it for those people who want to protect themselves in advance?

A. Well, the Federal government, in [illegible]ings of this sort, is frankly rather ponderous. It takes us about 10 years to move one of our projects through the whole process from conception through construction. They have tight rules on how it is done - both on regular Corps projects and disaster work. I guess they think it would be abused if they gave private individuals funds to do it themselves. Futhermore, if you do it in bits and pieces you don't have anything very lasting. If you just protect a little isolated bit of property it's going to be flanked on either side.

Q. Is the beach really eroding in that region?

A. Yes, we think so. Of course, it depends on what frame you look at. There were periods in the past when that beach was accreting, but the net change is one of loss or erosion.

Q. Are your proposing any groins in your full restoration project?

A. No. The only thing we're proposing in the large project is the re-establishment of the beach, establishment of a hurricane protection dune, and then periodic nourishment.

Q. Is this Federal money alone or is there local money involved in that project?

A. The large project will cost shared in accordance with the law - about 60 percent Federal funds and 40 percent local funds.

Q. Will the State of Florida contribute towards the local share?

A. This is still being worked out. The State of Florida has passed a law where they can put up a considerable share of the local funds, and it's our information that they intend to do that. I don't know if they have their funds in hand yet, but then, we don't have either. We have a valid agreement with Bay County about their share of the local cooperation and they have a means of financing it. They haven't gotten to the point of having dollars in the bank yet.

Q. Who pays for a damaged house that is torn down under your demolition contract?

A. I don't really know the answer to that. We send our real estate people over to get a release from the owner so we can come on his property and tear the house down. The FDAA pays us the cost of the demolition. Of course, that person doesn't have his house anymore so I assume his loss is covered by insurance. But the cost of demolishing and removing the damaged structure is covered by the Federal government.

Q. Is there any attempt to coordinate the maintenance of the harbor entrance with the beach nourishment project?

A. Yes, we're doing that at Panama City. In our study we have recommended additional Federal cost sharing for a reach about 2 miles downdrift from the entrance channel as mitigation for the channel effect. In addition, we plan to deposit sand from future maintenance dredging in that reach. We are also planning to do this at the Mobile Harbor entrance. We will try to discharge, with a pump-out hopper dredge, on the east end of Sand Island with the idea that it will move on to Dauphin Island downdrift from there.

LESSONS LEARNED IN BUILDING DESIGN IN THE COASTAL ZONE

Dr. Byron Spangler

Investigations of damages resulting from natural disasters such as hurricanes, tornadoes and earthquakes reveal many surprising things and many lessons in design and construction are learned.

Proper site selection is one of the important factors to be considered in design, even though it is not often considered as such. Residential and commercial structures properly sited can prevent much costly damage and can save design and construction costs.

Structures that are located in a coastal zone are particularly susceptable to damage if proper use is not made of natural barriers for protection. In order to discuss the lessons learned from Hurricane Eloise and to illustrate the site selection aspect, I would like to show a few slides of damage that occurred as a result of Hurricane Camille. This storm, as you know, struck the coast of Alabama, Mississippi, and Louisiana, with much damage being done in the area of Gulfport, Pass Christian and Mobile. In this area there is little dune protection. In face there is no dune in this particular area of Mobile. Here we see that the water damage, and the majority of this water damage, occurred for some considerable distance inland, the equivalent of two or three blocks. You can see that there is some wind damage where the roofs have been destroyed but the majority was wave damage. Structures did not have any protection from the waves other than the building themselves. Here you can see that the elevation at which the structures were built was only 6 to 8 feet above mean high water. The wind damage was great also because in Pass Christian it was estimated that the wind velocity approached 200 miles per hour. It was not that high in the Panama City area however.

We can design structures to resist wind and wave forces if we can provide the money. Monumental type structures are usually designed with adequate engineering design principles and will withstand high winds. This church, for example, took the brunt of the storm and remains structurally sound. There are many other monumental type structures which resisted the wind and wave forces. You can see the results of the inadequately designed structures in the surrounding area.

This is an aerial view of the Panama City Beach area, which Dr. Self and I were asked to investigate and report on the structural damage. These slides were made a few days after the storm. They're not as revealing in terms of the water level as the Corps of Engineers' slides. However, they do show the effects of the storm. The setback line lies just in the rear of some of these buildings in this slide and you can see all through the slides that follow that hurricane Eloise was a good test of the setback line. I feel, from what I have seen, that it bore up very well as far as location because many of the structures forward of the setback line were severely damaged and those in back of the setback line were, for the most part, in fairly good shape. I am not sure this is true in the area to the

west because our investigation included only the area of Panama City Beach. A question was asked about the drainage of the storm water. Here you see a headwall for one of the drainage pipes and you can see the loss of material and the erosion of the beaches. There are a number of these drainage channels along the beach and they do create some localized erosion. Inland there was very little damage. Not only did the dunes tend to protect the inland structures but the compactness of the construction along the coast tended to do the same thing. This helped to attenuate the wave forces. The Corps of Engineers' values on the water height was approximately 15 feet plus about a 3 foot topping wave, a total of approximately 18-19 feet. You can see the water was attenuated to a considerable extent and very little damage was done to the structures inland. There was considerable damage and erosion around isolated structures. Any barriers that were provided to protect structures from the movement of the water created considerable turbulence and generated a great amount of beach erosion. You'll notice here that there was a seawall in front of this structure and there is much erosion around the edges of the building and seawall.

This building shows more evidence of wind damage than most of the other structures. This is the same structure that was shown in Colonel Wisdom's slide just a few minutes ago and the way you can tell there was wind damage is that the upper portion of the structure was severely damaged, while the intermediate portions of the structure here were not greatly damaged. This is a close-up of the structure. Notice that the building is on high ground and well supported. The problem of a building of this type, of course, is that unless you reinforce the walls and provide adequate ties or adequate horizontal bracing members to resist the wind forces damage is apt to occur. The lesson learned in any wind damage study is that if you don't tie the structure together adequately it may not stay there. This is a typical example. We can reinforce masonry walls adequately to resist wind damages and we should do so in areas subject to high wind forces.

Return of the end walls of this seawall towards the highway or rear of the building was inadequate and the water eddying around the corners and edges of these walls eroded the sand and breached the end of the wall. Once this happened the water began to flow rapidly between the swimming pool and the building and seawall and washed the sand support away from the swimming pool. Erosion of the sand behind the seawall weakened its support. The steel tie-backs cannot take compressive forces and may buckle, break loose or wash out, permitting failure of the seawall as a result of battering by the waves. Jim Purpura, I'm sure, is going to tell you something about the erosion at the bottom of walls which undermines the wall and decreases the resistance to earth or wave forces. We find that in almost every case where there was a swimming pool there was considerable erosion. We are not sure, but we feel that possibly leakage from the pool through poorly jointed walls permitted severe loss of sand beneath the walkways around the pool prior to the storm. This created a channel for the water to flow through and wash out more sand during the storm, thus removing the support of the swimming pool by the surrounding sand. In almost every instance where there is a swimming pool we found this condition existing. The swimming pool, after the surrounding slabs have dropped a bit, caused an increase in the velocity of water between the pool and adjacent structures and rapidly destroyed the support of the sand around the structure creating

the condition as shown here.

Wherever there is a considerable amount of grassy growth there is something to hold the sand in place and there is less chance of erosion. This is not structural but it may affect erosion around structures.

Slabs on grade should not be used in an area of wave or water influence because the wave action may wash out the sand underneath the slab and leave no support. Here again is a seawall with short end returns and a condition that should be avoided. This setback between these two walls results in eddying at corners resulting in wash out of the sand in these areas. Support around the wall will be lost. This structure had a first floor slab on grade. The second floor and the roof are structural slabs. Note that when sand eroded from beneath these slabs they failed because of lack of support.

The storm revealed many things that may occur in areas where rapid construction occurs and where contractors possibly graduated to large structure construction from moderate residential construction without learning true structural concepts. Notice what a waste of wire mesh we have here. It served absolutely no purpose because when the contractor placed it he left it directly on the sand. Therefore the mesh is not serving the purpose for which it was intended. This was typical of most of the slabs on grade in the area.

This is an example of improper support of roof structure. It was too far out on the beach in this particular case. Notice that there is a section of the pre-stressed double-tee roof missing. There it is at the base of the building. It was not adequately fastened to resist the forces of the waves as they splashed against the top of the structure. Wind forces would not be enough to break it loose because of its weight, but the wave forces in combination with the wind broke it loose. If it had been adequately fastened it would probably still be there. It is not known whether or not these structures were adequately designed, they look as if they grew like Topsy in many instances.

There was a seawall back here, that is pretty much intact. One of the panels was broken from the end and the water rushed through, washing out the sand behind the wall undermining this footing and the interior of the structure collapsed. The structure had very good support for the part nearest the Gulf but inadequate support on the shore side.

This is the motel in which we stayed while we were at Panama City Beach. There was a double seawall. Notice where the sand line was prior to the storm. The structure has very little sand support as it is on piles. If the piling had been used under the inner walls they propably would still be there. The sand is washed out around the ends of the walls, water rushed down in this area between the two walls and in back of the shoreward wall and washed out the swimming pool on the east side of this building. Everywhere there was a swimming pool that created a restricted area for the water to flow, there was erosion of the sand. Also, wherever there was a short end return there was a breach of the wall.

Reinforced concrete seawalls do not stand up very well in this sort of environment. An amazing thing about this particular structure is shown by a palm tree on the front side. There were only 6 inches between the palm tree and the roof. With the exception of a slight scratch in back of one of those trees, the force of the water and the wind did not cause enough sway to damage the eave of that structure. Palm trees are fairly rigid structures even with their deceivingly sparse root system.

This is an example of what happens when half of a building is supported on piling and the other half isn't. The seawall portion was on spread footings on the sand. The sand was eroded from beneath the spread footings causing collapse of the structure. This is one of the reinforced concrete walls and you'll notice that there was considerable spawling of the concrete. Large chunks of concrete fell off and the reinforcement lost its bond strength. Any slight battering will destroy a wall like this. Prestressed concrete piling is a much better type of material to use. Again, in the same example, in the front portion of the structure, the beam across here which supported the prestressed concrete members was supported on piling. The inner portion of the structure was supported on a spread footing resting directly on the sand. There was not enough support when wave action eroded the sand from beneath the footing.

This structure was placed directly on the sand. The only support for the walls was a thickened slab that you can see here. There was a small block sea wall which did not have enough return to prevent the water from breaching the end and sand was eroded around this structure and it collapsed. This is one of the better constructed slabs. You'll notice that there is mesh in the concrete in this case, but there wasn't any to support it after the sand eroded away. It is good construction if you can keep the sand there but it isn't very good in an area which may be subjected to wave or tidal action.

All of the furniture in this building was washed out to the shoreward side of the structure. The waves came through and literally wiped everything out of these buildings. The receptacle covers were torn away and it's just as though somebody came in and bulldozed everything out and then swept it clean.

This was a rather unusual type structure, again an example of something not to do. Walls are not supposed to support footings. Here is a pile cap back of the front wall. The front wall rests on a spread footing, there's no piling under it. The shear between the walls perpendicular to the beach and the front wall furnishes the only support. Here you can see what happens when it loses that sheer strength. There was much poor construction there. You'll notice here that the steel footing mesh was placed directly on the sand and if any concrete got around it, it was purely accidental. If you're going to do this you might as well leave the mesh out. Apparently the mat in this case placed directly on top of the piling and the sand was very close to the top of the piling.

Here again eddying occurred around a discontinuous wall, washing out the top of the sheet pile wall causing it to collapse. The water eroded the sand and left no support for the swimming pool.

This is another common mistake which may be a construction or a design fault. This was a cantilevered slab with steel in the bottom. Notice where it's placed here in the bottom of the slab. It's amazing that it did not fail under normal loads. The steel in this case should be in the top of the slab, not the bottom. If design is for both gravity loads and the possibility of upward wave forces the slab should be reinforced both the top and bottom. Damage such as occurred during Eloise reveals some of the things we fail to design if we don't use our imagination.

This is an interesting structure. It was only very slightly damaged. The railing up here was slightly damaged. Apparently this section of seawall was knocked out by battering, possibly by debris. When this happened there was much eddying behind the wall beneath the building. This is what the underside of the building looked like. We don't know how much farther down into the sand the piling extended but the structures seen to be in reasonably good shape. There is a distance of approximately thirty feet from the panel that was knocked out to the east. It had been washed clear of sand. There was another opening at the east end of the building. The water came in, eddyed, washed the sand out through this small opening and out the east end. Look how this beam was placed, and look at the stirrups in that beam. The reinforcing cage was assembled, set into form, directly on the sand and the concrete placed. Now, as most of you are designers you know that there should be at least 3 inches of clear cover on any steel in footings which are exposed to earth. We design it that way, but it isn't going to act that way unless it's built that way. There's another interesting thing here. These beams were placed in this direction about every 8 feet except here. Notice this steel extending out here. Apparently there was supposed to be a beam in there and it was left out. Many omissions can be covered up with sand. These are not design errors, there was supposed to be a beam there, otherwise there is no reason for having the steel there.

There are many wood pilings and all appear to be in excellent shape. Even in the older buildings there is no evidence of decay.

This is an example of some wind damage. The reason this damage occurred was that the ties between the backup wall and the veneer were not adequately placed. There was a relatively wide opening between the concrete and the brick. When wind blows across a flat surface, that flat surface acts like an air foil and there is considerable negative pressure or suction on this wall. With the sparse locations of the ties, the wall brick was literally pulled away and this negative pressure plus the pressure between the two walls stripped the brick away. The other end of the building was even worse. Design error or construction error? We don't know.

This is the newer section of the Holiday Inn. An error was made in surveying or placement of pilings. Notice the pile cap here and the location of the bearing wall. This extra concrete apparently was an afterthought and was put in there to support the brick veneer wall. Again, we see slab on grade construction. The slabs did not fail in this case, and for the most part, remained in place. In the repair, blocking is being placed between the pile caps to support the slabs. This is the same building, the mesh in this slab is exposed. It was placed directly on the sand and not supported to the correct elevation or pulled up into the concrete as concrete was placed.

This is an example of another slab on grade. When the slab dropped down 2 1/2 to 3 inches, further failure was prevented by support provided by the pile cap. One of the causes of damage in this area was the wave action literally picking up these slabs and turned them back into the interior of the building. There were three or four slabs in this structure in which that happened. If there had been a structural slab this probably wouldn't have happened.

This structure extended farther out on the beach than all others. The sand erosion around the pile supports is about 18 in. to 24 inches. This part of the structure is still in good shape, the piling was driven deep enough that the structure was not damaged. I personally feel that construction should not be permitted to encroach on the beach like this but if it is permitted this is a good method of construction. There was one thing that was not done very well, however. On the opposite side of this stairwell the upper stories are cantilevered over the beach. A structural slab spanned between the supporting cantilevered beams. They acted as a trap for the waves as they rushed against the building and splashed upward. The confined pressure cracked the slab at the beam supports as the reinforcement was placed for gravity loads rather than upward loads.

Let me summarize a few things here that we might say or some lessons that we learned. 1. If we're going to use a seawall and we're not going to continue it all the length of the beach and are going to use end returns, we should return them far enough that the ends will not be breached due to the wave action, eddying and the wash-out of the sand at the ends of the wall. 2. We should design for forces on the seawalls in all directions. Don't depend on the sand remaining behind them to resist the forces of the waves. Too many of the walls are designed only as retaining walls and not as walls to resist forces from a wave action as well. We should design all of our structures and build them so that when we put the steel in them they are going to have enough concrete cover that corrosion is minimized, reducing expansion and spawling. 3. I mentioned very briefly the possibility of leakage of sand through the improperly filled joints in the sea walls. Many of the joints were filled to the beach surface. Below that point, in many cases, there was no grout. This permits rainwater, wave splash-over or leakage from pools to wash the sand out through the openings that exist below beach level and support is lost from the back of the retaining wall. The joints between wall sections should be adequately grouted. 4. For buildings, do not use slab on grade. This is one of the biggest lessons we should learn. Design them as structural systems rather than as slabs on grade.

5. The water damage for the most part occurred in the first floor level of all the structures. Anything above the first floor was in good shape except for water damage from leakage due to the wind stripping the roofing off of the structures. We might think about designing breakaway walls. This is something that some of us have talked about and I understand that the government is concerned with this too. We should establish standards for breakaway walls.

6. Finally, our survey of the damage further indicated that we must have adequate inspection during construction.

Q. How much inspection did you find out they have?

I can't answer that question. We didn't see any plans and we didn't talk to any designers so we don't know how much inspection was done, but I suspect from what we saw that there was not very much. Maybe a visit to the site once a week.

Q. How is adequate compaction to be assured beneath floor slabs?

Well, I asked this question of a number of people over there and they weren't able to tell me. They are back filling but they had no answer as to how they were going to get adequate compaction.

Q. What type ties should be used for seawalls?

I would recommend reinforced concrete ties rather than steel ties for two reasons (1) they will take compressive forces without buckling if the sand does wash out and (2) they don't wash out if properly placed.

II. PROGRAMS TO PROTECT US FROM THE WRATH OF MOTHER NATURE THE FEDERAL FLOOD INSURANCE PROGRAM

Richard W. Krimm
Assistant Administrator for Flood Insurance

Events of the past five years have shattered the popular myth of unlimited plenty in America. Through the personal inconvienience of the energy shortages of 1973 and 1974 and the recent spectre of massive unemployment, the general public is slowly beginning to recognize the interdependencies of the Nation's production systems and economic health upon a delicate and finite natural environment.

Previous to this growing, painful awareness were years of unprecedented economic growth in which immediate production needs had been indulged and immediate consumer demands gratified, in many cases, to the peril of the environment and at the expense of the economy.

In a very real sense, consuming and industrial America had stayed too long at the fair and only now are many citizens beginning to realize what had long been recognized in technical and scholarly circles; namely, that production and growth must conform as far as practicable to the cycles of nature and the limitations of the ecosystem.

What had been true of large production and consumer trends over the past two generations was true as well of housing production in the flood plains and coastal zones of the Nation.

Despite the good faith efforts of the home building industry as a whole to provide safe, quality housing for the Nation, the flood hazard has historically been unknown or underestimated in the planning and land use decisions of many local governments. To compound the problem, people have moved at an alarming rate in recent years to areas once avoided because of the flood hazard. Increased population densities in coastal and riverine areas have aggravated the existing flood hazard and increased the exposure of property and lives to the perils of floods and flood-related erosion.

In short, the truism that floods are the work of nature, flood disasters the work of man has been borne out by the losses of life and property resulting from encroachment upon the flood plains and coastal zones of the Nation. In this century along, over 10,000 Americans have lost their lives in floods. Average annual flood losses are currently extimated at $1.5 billion and are continuing to increase. The Water Resources Council estimates that by the year 2020 A.D., losses in the Nation could escalate to $5 billion annually, unless commitment to prudent flood plain and coastal zone management is realized.

The Eloise disaster by itself underscores the urgent need for sustained inter-governmental commitment toward reducing flood losses. In the disaster, approximately $230 million in structure and contents losses occurred. In Florida, the total amount of damages to both coastal and inland properties amounted to $20 million. This figure does not include the damage to shore protection devices, replacement costs for lost or displaced sand supplies,

items which are uninsurable under the National Flood Insurance Program. In the Panama City Beach and Fort Walton Beach areas approximately $3.2 million in flood insurance claims were paid to Florida property owners for the Eloise disaster.

In the face of these coastal losses and in light of the exposure of properties in Florida to severe flood and flood-related erosion hazards, we can be encouraged by the initiatives and complementary efforts of State and Federal levels of government to reduce these losses that continue to plague the Nation and the State of Florida.

In this connection, the State of Florida's set-back laws of 1970 and 1971 represent landmark legislation at the State level to preserve the coastal environment while protecting new properties from flood and flood-related erosion damages.

The State of Florida's efforts to date in determining the degree of compatibility of housing production with Florida's coastal environment have resulted in the completion of detailed set-back studies for 21 coastal counties having sandy beaches.

As a complement to and in support of the State's efforts, the Federal Insurance Administration has arranged priorities for the next 3 years to accelerate flood insurance rate studies for coastal communities with optimum development potential. FIA's flood risk zone and elevation studies will produce the necessary technical data so that actuarially sound premium rates may be applied to new construction and communities may adopt comprehensive flood plain management measures to further protect properties from flood and flood-related erosion. The base flood data we shall furnish to Florida's coastal communities should dovetail with existing set back requirements to ensure genuinely comprehensive coastal zone management measures. All of Florida's sandy beach counties have either been surveyed to determine these base flood elevations or will be studied over the next three fiscal years in accordance with the priorities submitted by the State of Florida's Department of Community Affairs appointed by the Governor to coordinate the flood insurance program in the State.

Recent advances in the state of the art, most notably the tidal surge models refined by Tetratech Inc., of California and the National Oceanic and Atmospheric Administration (NOAA) have been invaluable to redetermine inland base flood elevations resulting from tidal, coastal surge. It is my understanding that the base flood data reevaluated by NOAA on behalf of FIA for Sarasota, Lee, Charlotte, Collier, and Manatee Counties has assisted the Florida State Department of Natural Resources and Coastal Engineering Laboratory during the course of set-back studies for these counties. As a result of the State's efforts, final set-back limits have been proposed in these counties and public hearings are underway in these communities to establish a set-back limit for the purposes of coastal zone management. Concurrent with these State proceedings are FIA's appeals' proceeding to arrive at final base flood elevations for sections of Sarasota, Lee, Manatee, and Charlotte counties.

In addition, final set-back regulations were in effect, as of February 20, for eight of the remaining 17 counties for which State set-back studies have been completed.

To a certain extent then there has been a cross fertilization of our mutual study efforts. Through open lines of communication, among the Department of Natural Resources, Department of Community Affairs, the Coastal Engineering Laboratory, and FIA's Regional Flood Insurance Specialists, I am confident that we can assist each other's specialized efforts to achieve mutual loss mitigation goals. Unquestionably the research efforts of the State of Florida to establish safe set-back parameters for coastal communities can be of mutual benefit to our endeavors to increase public safety in the coastal zones of Florida. Since the mission of the statutes that guide the State's research activities and the efforts of the Federal Insurance Administration are identical, lines of communication must remain open to avoid a duplication of individual efforts or a fragmentation of mutual goals.

On a related issue, FIA will soon elicit recommendations from the Great Lakes Basin Commission to determine the feasibility of studying riparian erosion in greater depth in order to determine the best means of identifying erosion prone areas as well as the feasibility of establishing set-back limits for properties fronting the Great Lakes. I shall be pleased to keep you informed of all developments in this regard.

While the dynamics of littoral and riparian erosion are distinct phenomena whatever data or conclusions we reach regarding the Great Lakes' problem may possibly increase our knowledge of the coastal erosion hazard. Based on the data and recommendations we shall soon receive from representatives of the Great Lakes Basin Commission, the recommendations from those in attendance at this seminar, and counsel concerning the constitutionality of Federal regulations prohibiting construction in coastal zone areas, we shall consider the feasibility of refining and/or amplifying the set-back regulation under Section 1910.5 we published for proposed rule making in the Federal Register on March 26, 1975.

My remarks thus far have focused on ongoing study efforts that we hope will be on benefit to the State of Florida in implementing its 1970 and 1971 Set-Back Laws. I would underscore the fact that the Federal Insurance Administration's present flood plain management requirements for communities with coastal hazard areas represent a significant step toward reducing the exposure of new construction in these areas to flood losses. Under Section 1910.3 (e) of FIA's existing flood plain management regulations the following requirements apply to communities that have been provided with detailed coastal surge data:

(1) Must provide that all new construction and substantial improvements within the designated coastal high hazard area be elevated on adequately anchored piles (including basement) at or above the 100-year flood level and securely anchored to such piles or columns;

(2) Must provide that all new construction and substantial improvements within the designated coastal high hazard area have the space below the lowest floor free of obstructions or are constructed with "breakaway walls" intended to collapse under stress without jeopardizing the structural support of the building so that the impact on the building of abnormally high tides or wind-driven water is minimized. Such temporarily enclosed space shall not be used for human habitation;

(3) Must prohibit, within the designated coastal high hazard area, the use of fill for structural support;

To date, 62 communities in Florida have adopted these measures to protect whatever new construction may be permitted in coastal high hazard areas. Of course, more stringent State or local standards when they should apply take precedence over FIA's standards which safeguard avoids a potential conflict between State and Federal requirements.

In order to reduce the hazard of flood-related erosion to new construction, FIA published erosion mitigation standards for proposed rulemaking in the March 26, 1975, issue of the Federal Register. Included among these standards was a set-back requirement "for all new development from the ocean, lake or riverfront, to create a safety buffer consisting of a natural vegetation or contour strip. This buffer will be disignated by the Administrator according to the flood-related erosion hazard and erosion rate, in conjunction with the anticipated "useful life" of structures, and depending upon the geologic, hydrologic, topographic and climatic characteristics of the community's land. The buffer may be used for suitable open space purposes, such as for agricultural, forestry, and wildlife habitat areas, and for other activities using temporary and portable structures only."

Our decision to publish such a regulation as a final rule depends, however, upon a variety of factors:

(1) The ability to identify erosion-prone areas

(2) determining what constitutes "abnormal erosion beyond anticipated cyclical levels" --language by which we are guided in the Flood Disaster Protection Act of 1973 for insurance underwriting purposes,

(3) determining a sound actuarial premium rate for properties subject to flood-related erosion.

When we have received and weighed all pertinent data, we shall come to a decision as to whether the proposed set-back regulation under 1910.5 should be adopted in final form.

In closing, I would add that while the focus of our energies at FIA is directed toward helping communities reduce the exposure of whatever new construction they may wish to permit from flood and flood-related erosion we recognize that compatibility of housing production with the ecosystem is essential if our goals are to be achieved. Thus, we shall make every effort to keep all available lines of communitication open to assist the State of Florida and local governments in their efforts to preserve the natural environment of coastal areas.

PARALLELS
Between National Flood Insurance Program
and State Set-Back Law

1) Both contain "grandfather" provisions for existing construction.

2) Both require public input: NFIP thru appeals' procedure; State SBL thru Public Hearings before study determinations become final.

3) Both require detailed studies - Section 1360 of 1968 Act for all flood-prone communities and SSBL for set-back studies for all Florida's coastal counties with sandy beaches.

4) Both permit variances.

   a) State variances handled by DNR
   b) Our variances handled at local level

5) Both establish penalties:

   State - Fines ($500 - $1,000)
   NFIP - Suspension of the benefit of subsidized insurance and application of sanctions.

CLAIMS
FROM ELOISE:

1) Bay County area claims, including Panama City, Panama City Beach, Mexico Beach, (Lynnhavan included although not a coastal community),

   total $3.2 million paid
   281 claims

2) Ft. Walton Beach area claims, including Ft. Walton Beach, Niceville, Valparaiso, Okaloosa Beach Islands,

   total $1.5 million paid
   95 claims

Total Claims 611
376 Paid
177 Closed w/o payment
58 Pending

State Set-Back Studies Completed for:		Status in NFIP	FIA Study or Appeals' Status
Nassau Co.		EP	77-78-79 Priority List
Santa Rosa Co.		EP	do.
Escambria Co.		EP	do.
Okaloosa Co.		EP	do.
Walton Co.		EP	do.
Bay Co.		EP	T&S estimate submitted
Gulf Co.		EP	77-78-79 Priority List
Franklin Co.		EP	do.
Duval Co.	*	Not Participating	----------
St. John's Co.	*	RP	77-78-79 Priority List
Flagler Co.	*	EP	do.
Volusia Co.	*	RP	----------
Brevard Co.	*	RP	77-78-79 Priority List
Indian River Co.	*	EP	----------
St. Lucie	*	EP	T&C (U.S.G.S.)
Martin Co.	*	EP	77-78-79 Priority List
Manatee Co.	**	RP	Appeals Proceedings
Charlotte Co.	**	RP	do.
Sarasota Co.	**	RP	do.
Lee Co.	**	EP	do.
Collier	**	EP	----------

Partially completed studies: Palm Beach Co. (EP), Broward (RP) Co., Pinellas Co. (RP);

Not Yet Underway -- Dade Co. (RP)

* State Set-Back Studies Completed with public hearings underway.
** State Set-Back Regulations in Effect.

LAND PLANNING, COASTAL RISK - A FUNCTION OF COASTAL PROCESSES

Christopher C. Mathewson

INTRODUCTION

The coast is the most active and dynamic environment into which man is extending himself, often with disasterous economic and human results. Coastal processes, both long term and short term, have a direct influence upon the risks that man's development of this environment face.

As long as land is privately owned and as long as development is not specifically prohibited by legal or institutional regulation, land will continue to be sold for development. If the consumer is to be provided adequate protection from coastal hazards, two basic options are available to society: (1.) prohibit construction in all hazardous areas (which could halt most coastal development in some areas), or (2.) set structural and environmental standards (which would increase the cost of construction). It is a combination of both options that I believe offers the consumer both the protection and the coastal homesite. Coastal construction setback lines only identify extremely hazardous areas, and therefore, must be combined with structural and environmental requirements, and most importantly, with a continuous education program.

"IT ISN'T NICE TO FOOL WITH MOTHER NATURE"

We have all heard the statement "it isn't nice to fool with Mother Nature," but fool we must if we are to develop the fullest potential of our coastal lands. Development, not only for commercial or residential housing but recreational and asthetic uses as well, requires some modification, alteration, and change in this environment where the land and sea meet.

In many areas around the United States, one can produce evidence where fooling with Mother Nature resulted in disaster - either economic or in lives. Many of these disasters were brought upon man by man's own actions. In fact, man is his own worst enemy. He tends to believe in a stable coastal environment because he doesn't see daily changes: "Why those dunes have been there forever!". In addition, our mobile society continuously brings neophtes into the coastal area, who often look upon hurricane stories as "sea stories" embellished for any and all listeners.

This general lack of awareness of coastal processes, both short term and long term, is coupled with a faith in engineering structures and their ability to protect man. A seawall, groin field, setback line, or breakwater is only able to provide protection against storms and processes, having an intensity equal to or less than the design event. That is to say, a 100 year seawall is intended to resist events that have a statistical probability of occurring at least once in 100 years. This seawall has a yearly risk of 1% that it will be overtopped, and thus, fail to provide the required protection.

The occurrence of a hurricane or severe storm, that results in disasterous economic and human losses, is perceived by the coastal resident as an "Act-of-God". To quote Norwood R. Hanson:

> "Hurricanes, of course, are things over which human begins have no control at all. They are often referred to as acts of God, something "caused by" God. God tends to be an important figure is discussions of causality. He is credited with being the cause of everything man cannot explain, or everything insurance companies can escape paying for, or everything theologians think will lend strength and force to their arguments."

The "Act-of-God syndrome" is probably one of the most difficult human responses to deal with in land planning. This is particularly true with geologic processes because the long term, daily processes cause imperceptible change, and the short term processes are irregular intermittent events, thus, "Act-of-God".

THE COASTAL ENVIRONMENT

The coastal environment, unlike either the socio-economic or biological environments, is often considered by man to be static and stable; when in fact, this environment is highly dynamic. The land we have today along our coast was produced through a continuous process of erosion and sedimentation. These processes are still active and are even capable of significantly changing the coast during a person's life span.

The Florida coastal environment can be divided into two basic coasts: (1.) a straight barrier coast along the Atlantic, and (2.) a coast of alternating white beaches, swamp, and barrier islands along the Gulf of Mexico. Florida sits on a large "geologically stable" block of Cretaceous and Early Tertiary limestone. Most of the exposed rocks in the state are younger limestones. In essence, Florida is a topographic high on the "stable" carbonate block that protrudes above sea level. The edges of this carbonate high have been modified throughout recent geologic time to produce the present coastal environment.

Long and thin barrier islands have formed along the Atlantic Coast of Florida. Behind these islands, shallow lagoons and marshes exist. This series of narrow barrier islands is broken only near Cape Kennedy and is terminated near Miami where the supply of quartz sand appears to end. South of Miami, wide lagoons are protected by coral reefs that eventually end near Marquesas Key. Along the Gulf of Mexico shore, Florida is characterized by irregular swampy coasts and long, nearly straight, sand beaches, many of which are part of a barrier island.

The coast of Florida is, therefore, made up of loose deposits of sand, shell, clay, and silt with occasional hard coral keys, resting on limestone bedrock. These loose deposits are part of the dynamic coastal environment and are continuously moved around by the active geologic processes.

COASTAL PROCESSES

Wind is the primary force that builds the coastal dunes and moves collections of dunes (dune fields) across an island. Wave forces and tidal changes act on the beachfront to transport sediment along the coast. Storms, and especially, hurricanes are irregular, intermittent events that make drastic changes in only hours. The dunes, which are the first line of defense against storm waves, and beaches are eroded, large portions of the island and mainland are flooded, and occasionally, new passes or channels will be cut completely through a barrier island.

Acts of man along the coast, and even far inland, are felt by the coastal environment in numerous ways: water resource projects may dam the rivers which supply sediment; groins and jetties block the transport of sediment along the coast; and coastal developers may remove dunes, cut channels, and construct seawalls. All of these forces interact as coastal processes attempt to reach a level of dynamic equilibrium.

Irregular, Intermittent Events: Hurricanes are irregular, intermittent events; they are irregular is size, type, and intensity, and they do not arrive on any fixed schedule. As a result, they are hard to predict and are an annual threat to coastal residents. Each year that we do not have a hurricane increases the probability that we will have one the following year.

Hurricanes are simply large storms having winds of 74 miles per hour or greater and can be described by three basic processes: storm surge and wave attack, rainfall, and wind. Since 1961, one of each of these irregular, intermittent events has landed in Texas, for example, with the related loss of life and property. Carla (1961), packing winds of more than 160 miles per hour, did her damage by saltwater flooding (storm surge). The storm surge or rise in sea level caused by Carla reached 21 feet in places and flooded lands as far as 10 miles inland. Beulah (1967), packing winds over 120 miles per hour and spawning at least 49 tornadoes, some as far inland as Austin, did her damage by freshwater flooding (rainfall). As much as 27 to 30 inches of rain were recorded along her path of destruction. Celia (1970) packed winds of more than 162 miles per hour and simply blew things apart (wind).

Hurricanes have a broad impact on large areas of our coast and cause a basic set of changes in the coastal processes. Sea level rises as the surge of seawater pushed by the hurricane winds contacts the landmass. Saltwater floods into the bays and lagoons, flooding low-lying land. The increased sea level also allows the storm waves to attack the beach and dunes. In the case of a hurricane, the storm surge and wave attack often breaches the dunes and erodes a channel across the island. Once the storm passes, the seas recede, and a wider and flatter beach appears. If sufficient sediment, usually sand, is available, the action of the normal waves and winds will rebuild the beach to the original profile.

As the hurricane makes its landfall, storm surge reaches its maximum, and the wind direction south of the storm's eye, if the storm is on a

westward course, changes. High winds and extensive saltwater flooding exist under these conditions. After the storm moves inland, the coastal areas are still not out of danger because hurricanes often cause extensive rainfall and tornadoes. The escape for the rainwater is down the rivers which empty into the already flooded bays; the result is extensive freshwater flooding.

Hurricane damages are not simply the result of either tidal surge, wind or rain-induced flooding, but numerous interactions of these three. To list the potential hazards related to each of these three basic hurricane processes required just imagination. Tidal surge carries with it: flooding, storm wave activity, the battering ram effect of floating objects, and undercutting when sediment is eroded. Wind causes flying objects, including mobile homes and even homes on stilts, to become bombs, crushing and smashing anything that get in the way. Of course, freshwater flooding from a rainstorm hurricane does the same damage as saltwater flooding.

Regular, Continuous Processes: The long term, daily processes causes imperceptible changes in the coastal environment that can only be viewed by studying historical data. These processes are the continuous erosion and deposition of sediments in response to changes in the wind and wave conditions and the actions of man.

Coastal erosion is a long term, gradual process that slowly removes land from the state, resulting in shoreline recession. Numerous processes act together to cause this recession. One is the gradual rise in sea level as the earth warms up, and glacial and polar ice caps melt; another is the natural reduction in river sediment discharge as the climate of North America has become drier since the last Ice Age. In addition, the construction of seawalls, groins, and jetties interrupts the longshore transport of sediment, and therefore, further starves parts of the coast of the necessary sediment. For example, a study of the historical recession of Sargent Beach, Texas, shows that almost 2,000 feet of recession has ocurred since 1852. Some of this recession, about 15 feet per year (in 1973) can be attributed to the actions of man himself.

The construction of seawalls or other "permanent" coastal protective structures often enhances shoreline erosion at other sites. There are two significant problems related to seawalls: (1.) they reflect wave energy back offshore and often cause extensive beach erosion which frequently does not rebuild, and (2.) they protect ONLY the land directly behind the wall, and therefore, are often detrimental to neighboring property owners.

Urbanization is an accepted practice of converting undeveloped land into higher and better used, i.e., buildings, streets, and parking lots. This activity, however, has generally not been associated with the cause of a flood disaster.

The effect of urbanization is to change the character of the land surface and to therefore change the amount of rainwater runoff. On undeveloped land, the rainwater is removed by evaporation back into the atmosphere, infiltration into the soil, and by surface runoff in streams.

The land surface is grass-covered and drains slowly. As a result, flood peaks are low and extend for long periods of time. Urbanization, however, changes this pattern - evaporation may be increased slightly, infiltration is drastically reduced, and runoff is sharply increased. Drainage improvements, storm sewers, and gutters efficiently remove the rain water, increasing the intensity of the flood peak and reducing the drainage period. The flash flood watch that the National Weather Service posts is the result of urbanized runoff.

Wind driven processes, aeolian transport, are the mechanisms that build the coastal dunes and carry sediment inland. These processes play a significant role in semi-arid climates where vegetative protection of the dunes can be easily killed and removed. For example, in the coastal bend area of Texas along Mustang and Padre Island, high coastal dunes and large fields of shifting sands cover large areas of the islands. The nearly continuous (prevailing), southeasterly winds pick up sand from the beach and blow it shoreward through breaks in the dune wall. Once behind the dune wall, the sand is blown across the island and into Laguna Madre. These wind processes remove beach sand, transport and sand across the island, and erode the dunes if the stabilizing vegetation on the dune wall is disturbed.

LAND PLANNING FOR THE COASTAL ENVIRONMENT

When man considers developing the land, he generally thinks in terms of single and multi-family housing, hotels, and commercial or industrial structures. All of these improvements are rigid structures, that once constructed, are not designed to be moved. The coastal lands as we have discussed are not static, but dynamic and therefore moving. Thus, the beginning of a conflict - man's rigid structures requiring a static environment against an environment that is inherently dynamic.

In an effort to stabilize this dynamic environment and to protect man's immovable structures, coastal protective devices are designed and built. However, coastal protection is expensive, so a certain degree of risk is incorporated or allowed in order to keep the costs within reasonable economic limits. Alternatively, coastal setback lines are established based on an evaluation of the environment. The Florida setback requirements, for example, are based on at least these seven considerations:

1.) Ground elevation in relation to historical storm and hurricane tides,

2.) Predicted maximum wave uprush,

3.) Beach and offshore ground contours,

4.) The vegetation line,

5.) Erosion trends,

6.) The dune or bluff line, and

7.) Existing upland development.

Storm and great hurricanes are the primary cause for short term,

often violent, and drastic changes. As a result, coastal management practices are based on these events. Unfortunately, these events are irregular and intermittent, making them hard to predict. For example, thirty storms, with winds in excess of 40 miles per hour, have landed in the Houston-Galveston area of Texas between 1886 and 1970. Seven of these storms were hurricanes having winds of from 74 to 125 mph, and only three were hurricanes with winds greater than 125 mph. Great hurricanes hit this area about every 28 years on the average and are often forgotten before the next one arrives. The intermittent nature of the major storm has two adverse affects: (1.) they are often larger than the design storm used for coastal protective structures and coastal development structures, and (2.) their real power is often masked by human nature: "I made it through the last hurricane, so I'm not worried about this one." Another factor that may support the lack of concern shown for hurricane hazards by many coastal residents is the value or cost of coastal housing; afterall, a $50,000 to $70,000 beachfront house should be hurricane proof, especially if it sits behind a seawall designed for the 100 year storm.

The Planned Disaster: The planned disaster is planned ignorance. Fear that the truth about hurricane risks will reduce property values or development potential, and faith in the coastal protective structures and in the idea that a hurricane is a rare event is ignorance that removes any respect for this natural process. As a result, the planned disaster is not only an economic reality, but a social reality.

Considering the dynamic nature of the coastal lands and the irregular, intermittent nature of hurricanes, we are faced with two coastal development choices. We can either bend with these natural processes or design brute force structures to withstand them. The bend-with-the-storm structures are tents, designed to be flexible, easily moved, low cost structures, which do not provide any security against storms. The brute force structures are concrete monoliths, designed to withstand the direct attack of the greatest hurricane. Of course, tents are uncomfortable for permanent housing and commercial uses, and the concrete monolith is economically impossible. As a result, we are trapped between two extremes, the tent on one end and the economically impossible structure on the other. We are today living in the middle ground of the planned disaster.

As any developer knows, it is economically unreasonable to build a coastal home that is hurricane proof. This knowledge, unfortunately, is not passed on to the buyer, who too often believes that a protective structure will protect him from all storms and hurricanes. It is this bit of human faith that can generate the planned disaster. Consider this planned disaster: assume that a beautifully planned community has been built on a barrier island; that this community is connected to the mainland by a causeway; that it is protected by a 100 year seawall; each homesite is elevated above the 100 year flood; and each structure is behind the setback line. Now, let a few hurricanes pass, with little or no damage, and the planned disaster is ready.

A hurricane is predicted, but "then haven't we lived through 10 years

with hurricanes?" Few people evacuate the community, many have "hurricane parties" and prepare to enjoy the storm. Unfortunately, the intensity of the storm is greater than predicted. On the night of August 17, 1969, Camille leveled a 92 unit brick apartment building as the storm surge, plus storm waves, rose to flood the second floor of the building, and one (1) person of 24 survived a hurricane party.

What made the Camille, or Carla or Beulah or Celia or Eloise, disasters possible? - the high value placed on the "good life" along the coast and on the belief that hurricanes are rare "Acts-of-God" and not guaranteed natural processes. The risk of a catastrophic fire that destroys a home is about 1 in 10,000, and fire insurance is usually required in any mortgage. However, the risk that a hurricane will destroy a home is 1 in 100, or 100 TIMES greater risk than a fire; but, this natural process is often never considered or discussed, and insurance is not required.

What else contributed to the disaster? The regular, continuous, coastal processes may very well have played a significant role in enhancing the storm's impact. Shoreline erosion since the previous hurricane moved the ocean 10 feet closer to the setback line and undermined the seawalls. Land subsidence could have lowered the land elevation (fortunately this is a minor problem in Florida). A drought may weaken the vegetation on the dunes, or "dune buggies" may have destroyed it, such that aeolian processes were removing the dune sand. Dredging of a new channel may have increased the flooding in the estuary. The possibilities are endless.

COASTAL MANAGEMENT ALTERNATIVES

Since tents are generally unsuitable, hurricane proofing is economically impossible, and the great hurricane will return, we will have made a significant step toward reducing the disaster as soon as we recognize and admit to the planned disaster. Our actions now are to make the coastal lands hurricane resistant and strive to be prepared to reduce damages and losses. Two basic coastal management alternatives are (1.) to prohibit development (Thou shall not!), or (2.) to set building and protection standards (Thou Shall!). The first case is the most commonly used method and is the basic concept behind the Florida coastal setback line law. In essence, this law prohibits coastal construction on the shoreward side of a line set by the Department of Natural Resources without a specific variance from the Department. In the second case, any construction, regardless of its location relative to the shore, must meet specific building standards, and any protective device must provide for the continuation of the coastal processes. These requirements have been met by such engineering and maintenance projects as sediment bypass systems; but are often severely lacking in home construction where the structure is placed on stilts for flood protection but without adequate design for wind forces.

"Thou Shall!" Coastal Management: A basic problem with "Thou shall not!" coastal management lies in the human perception of just how much protection is provided behind a setback line, seawall, breakwater, or by a minimum floor elevation. This protection is designed for a specified risk, but the risk often appears to be extremely low, and therefore, the proba-

bility of loss appears low. A false sense of security is provided that may result in the planned disaster.

In addition, should losses occur, the injured parties may feet justified in filing a claim against the state or persons who established the "safety zone". The concept behind a "thou shall!" coastal management program is to shift the responsibility for improper land uses from the government back to private industry; where I feel the responsibility lies because as long as land is privately owned and as long as development is not specifically prohibited by legal or institutional regulation (open beaches laws), land will continue to be sold for development by private industry.

Herein lies the problem: Coastal processes represent a primary source of threat to both the economic and human safety along the coast of the United States. The combination of the short term, irregular, intermittent events and the long term, regular, continuous processes forms the most dynamic environment for man and his activities. Often man himself brings about undesired changes in the complex system. The hurricane is a significant process simply due to its magnitude, but the continuous processes may in fact cause the greatest loss. For example, the formation of large active dune fields on central Padre Island, Texas, are initiated by hurricane processes; but, these dune fields represent a more severe problem to land development because they can simply bury the development in millions of cubic yards of sand.

Land planning for coastal management, based upon the risks of economic and human loss, is directly related to active coastal processes - processes, that place modern development within the middle ground of the planning disaster because either solution to the problem is not acceptable to society. The low cost, flexible land use is uncomfortable, and the low risk structure and protection is economically unreasonable. As a result, coastal land planning must recognize this complexity and develop management programs that consider the entire system of coastal processes. The Florida coastal construction setback line law is a good start, because those lands hazardous to development due to the coastal processes, are identified for the coastal resident and developer. However, as Purpura and Sensabaugh emphasize "... compliance with no construction seaward of the recommended setback line does not imply that structures can be built without giving detailed consideration to the problem associated with ocean front development."

The responsibility to complete the project, well started, lies with everyone associated with coastal land planning and coastal management. Some projects and programs suggested to meet this responsibility are:

1. Buyer and renter awareness - a large sign stating the "the structure is not hurricane proof and that the occupant should evacuate when so instructed" should be required on the door of all rental or sale property.
2. Local hurricane shelters - selected high-rise structures should be specifically designed to be hurricane resistant and available

to local residents in the event of an unexpected change in the storm. This is particularly applicable for such areas as the Florida Keys where a large population is separated from high ground by a long, narrow, low-lying road, thus, making evacuation time-consuming, difficult, and hazardous.

3. Light structure tiedown - structures that are easily moved by hurricane processes (mobile homes, fish shanties, pre-fab food service structures, for example) should be securely anchored or even prohibited when in the vicinity of fixed structures to reduce damages due to floating and/or flying structures.

4. Hurricane resistance construction - building codes, designed for hurricane conditions, should be written to limit the surface area of unsupported glass or provide special supports for the glass; to require storm shutters and adequate foundations; and to require that the structure is fixed to the foundation to prevent it from blowing away, in order to reduce the economic losses due to structural damage. The damages brought about by Eloise should be evaluated and used as a "classroom" to improve design, construction, and inspection procedures, which would lead to a reduction in future hurricane losses.

5. Public education - every effort should be made to educate the public about the existence of the planned disaster and to remind them that the hurricane is an irregular, intermittent event, and therefore, "IT WILL RETURN".

PENINSULAR FLORIDA'S EROSION PROBLEMS AND SOLUTIONS

Colonel Donald A. Wisdom
District Engineer, Jacksonville District

Good afternoon, Ladies and Gentlemen. I am indeed very pleased to have this opportunity to talk with you on the Corps of Engineers' involvement in Florida's beach erosion problems and solutions. I hope to provide an insight into the day-to-day unheralded efforts by the Corps in trying to provide protection to meet head-on such acts of nature.

Today, I will cover how the laws involving the Federal Government in local beach erosion control projects have evolved over the years, the authority under which the Army Corps of Engineers supervises this Federal involvement, my responsibilities as District Engineer in representing the Federal Government in erosion control studies and projects, the erosion problems we've experienced in Florida, and the solutions to some of these problems.

Involvement of the Corps of Engineers in coastal problems began in 1922 when the State of New Jersey formed an Engineering Advisory Board to study shore erosion. The Corps assisted that Board in developing the first substantive report on shore processes and beach erosion.

In 1930, Congress gave the Federal Government specific responsibility for shore protection by authorizing the Corps to study erosion problems at the request of, and in cooperation with, State and local governments -- and to recommend corrective measures. The study costs were then to be equally shared by Federal and non-Federal interests.

The role of the Corps under this authority was confined only to the conduct of studies until 1946 when congressional legislation expanded the use of Federal funds. Under the new legislation, the Federal Government could contribute up to one-third of the construction costs for beach erosion control projects for the protection of publicly owned shores. In 1956, Congress expanded the authority to include privately owned shores where substantial public benefits would result. Finally in 1962, it increased the Federal share of project costs to its present level, with all study costs to be borne by the Federal Government.

Today, the Federal share of construction costs for beach erosion control projects may be as high as 70 percent for public parks and conservation areas, and 50 percent for other public shores. The Federal Government will bear up to 70 percent of the costs of providing hurricane flood protection for Federally authorized projects. Each beach erosion control study is 100 percent Federally funded, and is specifically authorized by Congress. Studies authorized for peninsular Florida, Puerto Rico, and U.S. Virgin Islands are assigned through the Chief of Engineers to the Jacksonville District.

Once a beach erosion control study is completed, the District Engineer's recommendations as to the Federal participation in the project itself are

reviewed by the Chief of Engineers and the Board of Engineers for Rivers and Harbors prior to submittal to Congress. Favorable recommendations generally result in authorization of a Federal project. However, I would emphasize that favorable recommendations result only for publicly owned shoreline or shores for which Federal assistance results in public benefits.

The magnitude of the erosion problems in peninsula Florida is apparent from the number of Federal projects authorized and studies underway. As you are aware, these projects and studies represent only a part of the effort throughout the State to control erosion and the loss of one of Florida's most valuable natural resources, its sandy beaches.

Counties having authorized projects are Duval, Brevard, St. Lucie, Palm Beach, Broward, Dade, Key West, Lee, Manatee, and Pinellas. Counties with studies underway include Nassau, St. Johns, Volusia, Indian River, Martin, Monroe, Charlotte, and Sarasota.

Federal projects that have been completed are Cape Canaveral Beach, Ft. Pierce Beach, Palm Beach Harbor, Delray Beach, Pompano Beach, Bal Harbour, Virginia Key, Key Biscayne, Cape Florida State Park, Lido Key, Mullet Key, and Treasure Island.

Projects for which advanced engineering and design have been completed are Duval and Dade Counties. We are ready to proceed with these projects as soon as Congress provides construction funds.

Projects authorized but not being initiated due to lack of local sponsorship include the counties of Palm Beach, Broward, Lee, Manatee, and Pinellas.

Studies currently underway that may lead to authorized projects are the counties of Nassau, St. Johns, Volusia, Indian River, Monroe, and Charlotte.

Based on our experience in areas where we now have authorized projects, we generally find:

(1) Public apathy for support and sponsorship for comprehensive beach erosion control measures until the problem becomes critical and economic loss has occurred.

(2) That in many cases much effort from the private sector and monies have been expended on a piecemeal approach to the problem such as the construction of groins and seawalls which have, in many instances, a domino effect in creating new localized erosion which, in turn, encourages a continuing fragmentary corrective effort.

(3) That the protection of natural dunes would, of course, have provided the protection desired. However, the loss of these dunes are generally a prerequisite to Corps involvement. Under the current Corps program, authority to study and recommend erosion control projects is provided after the fact where the erosion problem has become critically severe and attracts Congressional interest.

(4) That the solution will, in almost all cases, require construction of beach fills that require a source of suitable sand. This need for a source of sand has, in the past, created problems in effecting a solution to the erosion problem. Solutions to the erosion problem other than beach fills - or beach nourishment as it is referred to - in some cases arrest the erosion but result in the loss of the sandy beach.

A protective structure of emergency revetment provided by the Corps, and additional rubble furnished by local interests was in Nassau County on the upper east coast of Florida.

An emergency revetment was placed at Jacksonville in the early 1960's, and we now have a Federal project authorized to rebuild a sandy shoreline.

Another type of protection, a waffle slab revetment, was used by Delray Beach which is on the lower Florida east coast. As a result of a major storm, part of the waffle revetment failed, and beachfill was used as the ultimate solution.

Private groin construction was the result of individual efforts to protect sand beaches at Miami Beach.

Beach fill construction was the ultimate solution to the erosion problem at Bal Harbour. We are now ready to proceed with construction on the remainder of this project when funds are received from Congress.

Loss of the protective beach has occurred along much of the developed areas along Florida's lower west coast. The effective solution to the erosion problems generally involves partially restoring the protective sandy beaches. At Ft. Pierce, beachfill was provided and has proven to be the best solution.

The state of knowledge in the use of sand to protect against the onslaught of the sea has been developed to a point where dune and beach dimensions can be designed to protect against storms of any given intensity. In some cases, hard structures must be provided to protect dunes, to maintain a specific beach shape, or to reduce nourishment requirements, but in each case the costs of such works must be weighed against the added benefits they would provide.

One of the problems inhibiting the construction of beachfills in the past was locating a suitable source of sand within economical pumping or hauling distance of the project site.

In 1965, the studies completed or underway on the east coast of Florida showed that if the Federal or local governments were to come to grips with their erosion problems, a comprehensive program was needed to locate sand deposits offshore in the Atlantic Ocean. The Corps of Engineers uses a jackup barge commonly referred to as the "Sea Horse" to obtain subsurface sand samples.

In that same year, the Corps of Engineers' Coastal Engineering Research

Center initiated studies leading to a program of mapping sand deposits offshore in the Atlantic Ocean from Miami to New Jersey that would be suitable for beach restoration. The results of that program, known as the Inner Continental Shelf Sediment and Structure Program, have formed the basis for more detailed geologic investigations such as this that have identified sources of sand for beach construction from Jacksonville south to Miami. Once these studies confirmed the existence of suitable sand in sufficient quantities offshore in the Atlantic, we have moved in a positive manner to exploit this source of sand in combating some of Florida's erosion problems.

The source of sand for improving Duval County reaches is about three and five miles offshore within economical pumping distance.

The source of sand offshore of the Dade County Beach project varies in distance about one to two miles. The offshore sand deposits are located in valleys between buried sandstone and coral reefs. We have located sources of sand for the Florida east coast projects off the east coast of Florida, and have the preliminary data and engineering capability to develop other sources as needed.

Although studies on the lower west coast of Florida have not been as extensive as the CERC study, we are developing a knowledge and inventory of sand offshore in the Gulf of Mexico.

New methods and equipment for locating sand offshore are being used by the Corps, such as the jackup barge which allows detailed subsurface investigations offshore in most wave climates.

The Corps is also moving toward development of new methods of beach nourishment such as the Corps' Hopper Dredge "Goethals", which has been modified to allow its load of sand to be pumped ashore for beach nourishment. This dredge placed 400,000 cubic yards of sand on the Hanna Public Park Beach in April 1974. In a trial run, the dredge picked up sand from as far as five miles offshore and placed it on the beach. The Jacksonville District is now in the process of converting its hopper dredges to have this pump-out capability.

The Corps of Engineers does not have a philosophy per se on "Beach Nourishment Projects." Beach nourishment projects have evolved as a reaction to the affluence of man that has allowed 50 percent of our nation's population to live within the coastal counties bordering the oceans and Great Lakes. The need for shore protection projects began when man entered into the narrow strip of land bordering these bodies of waters, intending to remain there and participate in the battle of man against the sea.

When the first oceans were formed on this planet in the ancient past, long before the dawn of history, a never-ending struggle between the land and the sea began. The conflict, once started, has gone on and continues with unabated vigor today. Beach structures have been found to have a place in this battle when properly used, but research has shown that the best protection is afforded by using methods as similar as possible to natural ones. In other words, a greater degree of effectiveness is obtained by the type of protection provided by nature, which permits the natural pro-

cesses to continue unhampered. To simulate natural protection, dune and beaches are rebuilt artificially by placing sand on the shore, generally from sources offshore, such as was done at Bal Harbour.

The trend toward the use of beach fills for erosion protection and recreation use is a departure from the classical structural classification in that it enhances as well as protects. Such a project covers the mistakes of the past such as revetments, seawalls, and groins and provides an aesthetic appearance compatible with a natural beach. It provides continually changing natural physical forms as the artificial lines created during construction and erased by wind and wave. Most importantly, it creates public recreation beaches in areas that have heretofore not been available for public use.

In addition to the Federal beach erosion control projects authorized under the Civil Works Program, I have just touched on, I would like to point out that the Corps, whenever possible, nourishes Florida's beaches with sand from other Federal projects. In 1972 and 1974, a total of 2 million cubic yards of sand were placed on Jacksonville's north beach from the maintenance operations in Jacksonville Harbor.

In 1974 and 1975, 2.7 million cubic yards of sand were placed on the city of Canaveral Beach during construction of the Navy Trident Submarine Basin. Although these are the two major cooperative efforts to be completed, we have and continue to duplicate this on a smaller scale throughout the State when funds and authority are available.

I would like to summarize by saying that the Corps is involved in your beach erosion problems in Florida; that we are continually studying the problem and increasing our knowledge of the causes of the erosion problems; we are seeking more economical solutions and that we have developed the capability to assist in any phase of beach erosion control desired by the State or local governments.

Questions and Answers

To Professor Collier
Q. I understand there is information about the development of a statewide code for building structures in the high energy zone.
A. We're coming along in the study. We're working with Mr. Bill Sensebaugh, we write a lot of stuff and we give it to Bill and he bounces it back to us. We're to a stage now where we send out our first draft. We are going to get some feedback from it soon.

To Mr. Dixon
Q. You made a comment about the possibility of obtaining some financing for the erosion control programs and I gathered you were talking about some sort of tax.
A. The gist of what I was trying to get across to you was that you have a special tax although limitations say that only a small part goes to beaches. No one this year wants to talk about taxes. Yet as a reality if we're going to finance some of the beaches in the state with the existing revenue we have at the present time, there are just not enough dollars and general revenue to do it. There are many programs we need to fund other than beach erosion. I would highly recommend that this association give consideration to some type of special plan and I'm not really pushing this, there could be a tax on soft drinks or such which you could take and put in erosion control account for the beaches. There is no such existing tax specifically for this purpose.

To Colonel Wisdom
Q. (1) Is there any program that will bring you into an area before the dune is gone?
(2) Is there any program planting for the dunes to protect the vegetation?
A. Yes sir. The reason that I indicated on the slide that the Corps did not come in until after the dune line had been violated was because that's only when the local sponsor realizes he doesn't have any beach left. It's not a policy of the Corps to wait until after the dune line has been destroyed. We welcome the opportunity from any sponsor to get in to a beach restoration prior to the erosion of the dune line.

Our Waterway Experiment Station is doing considerable amount of work in the area of stabilization for secondary dune lines.

Q. Well I think really the problem we're trying to point out is law enforcement and in that regard we've got a problem. The present law calls for a minimum of $1000 fine and no judge in his right mind is going to fine a person $1000 for a first offense for driving on the vegetation. So we have a bill introduced to the legislature to correct this.
A. To give the judges a little discretion. A man has been driving his beach buggy on the beach for years to go fishing, we come along and pass a setback line. You can't find that setback line on the ground, it's not

painted there so he does it again and the officer comes along and hauls him into court. He needs to be aware of the problem, he needs to be convinced that he shouldn't do it again but he doesn't need to be fined a $1000.

Q. You mentioned the 200 variances. Is that the number granted?
A. That's the number that we processed. That's the high number on our last file. This year we are already at about number 60, that's one application a day. Got to work that out for us.

Q. You mentioned that a community has requested that you come back and re-determine the setback in that area. What does the law say in this regard?
A. The law requires that the department review the setback line at five year intervals. It also provides that a local community or local government may request that the department review the line at any time and Martin County has requested that we come in and review the line, and work is underway on that project.

Q. Brevard's county construction setback line was passed about 15 months ago. It was unconditionally specified that a study be made of Cape Canaveral presently has a setback of about 750 feet and it was done on the basis that there would be a review in about 15 months and 15 months is up this month. Can you tell me what actions are being taken?
A. I know the study is underway and the field crew have been in the area on several occasions collecting data. As far as the details of just how far along on the opposite analysis, no, I don't know exactly where it is.

"EROSION PROBLEMS,
BEACH RESTORATIONS AND HURRICANE PROTECTION,
AND FINANCING ASPECTS OF BEACH PROJECTS"

Moderator - William T. Carlton

We will be discussing beach nourishment, hurricane protection projects and the financing of these projects. After the panel has made an individual presentation to you, I'm going to ask those speakers who have already given their presentation to be on hand for a question and answer session. I have a feeling there are many questions that have not been asked and I think it's important that if someone has a question they should ask it and try to get an answer before they go home. The first speaker this afternoon is a long time friend of the Florida Shore and Beach Preservation Association, the Coastal Engineering Laboratory at the University of Florida and the Bureau of Beaches and Shores in the Department of Natural Resources, Representative Earl Dixon is from Jacksonville. He's been in the legislature a long time and has always favored us with his support of our programs. We are extremely appreciative of this. I think there are not too many people in the legislature as familiar with our programs and our problems as Representative Dixon is. Generally, in any organization there are few people that stand out, I think it's no different in the legislature. We have probably 140 or 150 members of the legislature, maybe a few more, I'm not real sure, and as usual 15 or 20% of those people who are the leaders and it just so happens that Representative Dixon comes in that category. He is one of the top leaders in the Florida legislature and it gives me a great deal of pleasure at this time to introduce to you Representative Dixon, who will have a few remarks for us.

The Honorable Earl Dixon

Thank you very much Bill and it's good to be with each of you today. I'd like to speak just a moment with you and tell you some of my feelings about beach erosion. It's been my pleasure to work with Mr. Carlton and others in his department over the eight years that I've been in the legislature. We have some problems in our funding and I'd like to discuss that a little bit with you. First of all, I feel that Florida's beaches have been neglected for far too long. Since the state first assumed the responsibility for the preservation of beaches back in 1957, our state funds expended for this purpose have amounted to 15 million dollars. This cannot even be considered a token effort. Frankly over the years our beaches have been placed in the lowest possible priorities in the budget process and at the same time they have been placed in the highest possible priority for their benefits to Florida. All of this can mean only one thing. Citizens of Florida do not have sufficient interest in our beaches to demand that local officials, the legislature, and the Congress place them in a higher priority. The citizens are not interested because they do not know the problem or they do not seem to understand the solutions. They must be in-

formed. Apparently this is the responsibility of the Florida Beach and Shore Preservation Association. For the first time this organization has professional guidance and I commend the organization for it. They are doing a great job, a better job involving our people in this important program. They must do more, however, and I would urge everyone to support this organization and their programs. When the association reaches the people, the local officials, the Legislature and the Congress, we'll have to get the message and these priorities will have to change.

At the same time, we need to take a serious look at the manner in which beach restoration programs are funded. State funds according to law are used to assist local interest in implementing the projects. State funds are not needed until local funds and federal funds are on hand. If we're going to continue this type program, we need to take a look at the local funding programs, because along with all others they are having financial problems. They always have and they always will. Consequently the priorities must change and these priorities must change based on increased public demand or new sources of revenue must be found for local funds and possible state funds. (I challenge the FSBPA to give special attention to this problem and come up with an acceptable and sure way to fund the nonfederal cost of beach restoration and beach erosion control projects).

You are all aware of the problems of erosion as is just about everyone in the state. Until we can get help from you and support from the local level to tune my colleagues in, I'm afraid that we're just not going to be able to succeed. As a suggestion to you we could let the tourist help pay the bill. We've been doing this but our tourist dollar have been spent somewhere else. We have 800 million a year from the tourist. This is the revenue that's coming in from them. Of this we're getting 400 million directly into sales tax which goes into our general revenue fund. I'm not advocating a tax in this respect because it's something that will have to be discussed and brought up with the legislation in order to enact it, but somewhere, somehow, and someplace, we've got to do something about our funding problem. I would ask you to work with me to convince my colleagues and also those in our local government that we need a system in our funding program. I'll be around this afternoon and I'll be happy to answer any questions.

We have a serious problem in our funding this year, as all of you are aware of and it's frankly not a good year to try to get funds but we're doing all we can to do with the existing revenue. I serve as vice chairman of the house appropriation committee and I know the problems that we're faced with in our funding. All of us together can do something about it, but we have to have more assistance for our colleagues. Thank you.

Bill Carlton

I think there's a law somewhere in Florida that if commercial advertisements advertise something for sale they have to have some on hand. I couldn't help but notice that the Times Union said the state is putting more money in a tourist advertising program and I wonder if we're going to stand

around and wait until we don't have any of the beaches that we're advertising and might be taken to court about it. It's something to think about. We're taking in all of this money because of our beaches and we're not spending any of it back on our beaches to get them back into the shape they should be in. We're going to hear now from Art Strock and Art has had considerable experience in beach restoration programs and he's going to discuss some of the problems associated in getting one of these projects on the beach, getting it constructed. I assure you it is a job and there is no end to the headaches involved. Art is now going to discuss the Broward County story with you.

Art Strock

There are a number of things we can discuss with regards to Broward County, having to do with finances, having to do with erosion control line, having to do with materials, construction and so on. The question was asked specifically; "does beach restoration really work?" Well to answer that question we probably ought to define the term "really work". What do we mean? This of course depends on many things and it would depend in part upon your point of view. What is it you're looking for, what is it you want to accomplish by beach restoration. The reason I point specifically to beach restoration is that I've been involved with it quite a bit in Broward County and in a number of other beaches, Palm Beach, Jupiter Island and others. We need to determine is the beach successful, and successful compared to what. We've looked at a lot of different kinds of construction and the lack of direction concerning the construction in this seminar. In each case we need to determine the measure of success and again we need yardstick by which to measure.

I was talking to Gordon Lamont with regards to Jupiter Island job which we worked with him on two years ago and someone happened to be with us and was saying, "Look at the amount of beach we've lost since that job was pumped up", but Gordon's response was this, "what would we have lost if we didn't have that beach." Just prior to going into that job at Jupiter Island there was an estimate made as to what would be the effect without that job. Their estimate based upon the prior history was probably in excess of 100 million dollars lost in properties or damages or protection from storms if they did not restore that beach.

There are other examples similar to this such as Delray. Many of you may know the type of construction Delray entered into, it was built once and then rebuilt twice again. There again, successful compared to what! To determine what it is successful should require an economic comparison. Any project that's entered into needs an economic evaluation. There, of course are always alternatives as to how we can do the job. There are the alternatives of groins, breakwaters, restoration and always there is the alternative of doing nothing. What are the comparisons, what are the dollar costs of doing these things or doing nothing?

There is also one other thing I want to bring out and want to make sure this is stressed upon you ;that's the availability of material. We will be

talking to you concerning beach restoration and surely one of the things that we're involved with at this time is beach restoration. You might get the tenor of my presentation is that I'm pro beach restoration and you are right in that respect. However, let us not forget that there are problems with regards to availability of materials. We had a very happy occurence in Jupiter Island area in which we searched an area in excess of 8000 feet offshore and basically there was no end to the quantity of material. We've also done some work in the Bay County area, Panama City Beach and again there was virtually no end in the materials offshore available for use for beach restoration. Not so in other areas though. In an area of Broward County we searched an area from the shoreline to at least 8000 feet offshore and from Port Everglades south for two to three miles and found really no commercially dredgeable material. In some areas there were some pockets maybe a couple of feet deep nothing really commercially dredgeable. We had to actually go to another area which increased the cost of the job tremendously. Many times we look at the ocean and the ocean floor as a sink of material which is inexhaustible. It is not.

In our reference to types of work let us also look at this availability of materials because you're going to hear more of it in the future. Let's look very briefly at what's happened with regard to some of the beaches. You can go very quickly on some of the beaches that have been restored. At Virginia Key, the Corps of Engineers built a beach and later had to go back and rebuild it and put in groins. Going up the coast you have Bal Harbour. It was only finished last year but it's operating very successfully. Going a little further north we have Hallandale which is about a mile long. This is a beach that has been losing probably in the magnitude of 15% to 18% of the beach material placed on it in a year. This is a pretty expensive loss, most of the other beaches have been far more favorable than that. Going on up is Pompano Beach which is about three miles in length. They have a loss rate of probably less than five percent. In the town of Hillsboro Beach which is about a mile long, their loss rate is somewhere between five and eight percent. In Palm Beach County, Delray Beach, their loss is probably less than eight percent. In Jupiter Island, I don't have the exact figure on that, but their beach performed very well. There is Ft. Pierce and the Cape and a number of projects on the West Coast that we could name. All these are beach restoration projects of some magnitude and all have some degree of success, but again success compared to what? Compared to the cost comparison? It must be compared to the cost comparison otherwise why not go ahead and build structures.

There are a number of areas with structures and we can go through and name a few of them because there are perhaps some of your alternatives. Your alternatives again being doing nothing. You can perhaps wind up with ocean fronting seawalls, such as in Miami Beach, Jacksonville, and a portion of Hillsboro Beach. The city of Hollywood has the standard American groin, the wood groin, sheet steel pile, adjustable groins and dog bone groin. This is in one locality of about four miles. All of which have not seen any major degree of success with regards to groins alone. We could probably name the number of kinds on all our fingers and toes. We can refer to revetments, we can refer to breakwaters. All of these have a place. Let me

assure you, I'm not saying that groins or any structures do not have a place, they have a very necessary place with our evaluation with regards to erosion control, but like beach restoration each one of these must be measured and must be balanced against what it will cost us now and what it will cost us in the future. We now have the ability to look to the broader scope. We can be in a position of looking for instance at Deerfield Beach which has a particular type of construction of groins. It has a unique situation in that the groins protect Deerfield Beach but what does it do as far as its neighbor is concerned. I don't mean to say Deerfield is taking from anybody else, but all of us on the beach are living in one equal system and that system depends upon the general continual movement of material. If we decide in one area we are not going to permit that material to move again then we have taken something out of the system and even though Deerfield has been well protected by its system, it has done that, it has taken itself out of the entire system. Theoretically, if you've got the material moving in you have got it moving out. Hopefully, there is a balanced equation there. We know because of our erosion situation we don't have that balanced equation so by the introduction of beach restoration we're trying to create that balanced equation. The question I started with, "does beach restoration really work," let me tell you, you bet it does!

Bill Carlton

I failed to tell you that Arthur was the long time administrator of the Broward County Erosion District which is a county wide district. I don't know if you noticed in one of Stan Tate's publications recently he compared the situation in Panama City Beach with what it could have been had we been able to construct the pending beach restoration project. Over a period of about 18 2/3 miles in the city the Corps has a project recommended that's going to cost in the neighborhood of 12 to 14 million dollars. The damages to upland structures have been variously estimated to about 150 million dollars. Just assuming that this beach restoration project had been on the ground prior to the hurricane and assuming that the storm took all of it out, look at the amount of money you could have saved in the damages to the upland structure. I agree with Art that artificial restoration does work and we favor it. Now I'm going to ask Oscar Rawls from Jacksonville who is the city engineer for the consolidated city of Jacksonville to come up here and discuss some of the problems that they have had getting the Jacksonville Beach project to a point where it's ready for construction but for some reason they are not pumping material yet. Oscar will tell you about it.

Oscar Rawls

Thank you, Bill. The role of a local sponsor for a federal beach erosion control project is not one for those who are easily discouraged nor faint hearted. It takes enthusiasm, planning, energy and real personal attention to details that go into this. I feel I should know something about this because the city of Jacksonville is the local sponsor for such a beach erosion control project and as city engineer the duties of carrying out that role fall to me and my engineering division.

Our project really started when the Corps of Engineers produced a favorable report for our Duval County beaches in November, 1964. This led to a federal project which was adopted by Congress in Oct., 1965. So here we are more than a full decade later and construction still hasn't begun, here's where the patience comes in. Colonel Wilson mentioned that it takes about 10 years to go through this process of federal projects, from approval to beginning of construction. Well, it's takes us about 11, but surely his figure must work sometimes if all the chips fall in their place nicely.

I would be very much amiss if I said to you that nothing has been done in those 11 years, quite the contrary. The Corps of Engineers and the Office of Emergency Planning of the Federal Government responded to our emergency needs in Duval County after the November-December, 1962 severe northeast storm which produced considerable damage over our most populated shoreline beaches They put in some 7000 linear feet of granite rip rap revetment and added about 20,000 cubic yards of sand. Again, when hurricane Dora struck us a couple of years later, September, 1964, the Corps and the OEP responded with granite revetment this time for over some five miles of shoreline and this cost about 1.7 million dollars. In addition the Corps has placed some 3 million cubic yards of sand on the beach concentrated in the two mile reach just south of the jetty. The reason for that of course is that the most northerly reach of our beach is the frontage of the Mayport Naval Station and federal ownership. Immediately south of that is our park which is a bonafide beach park with all of the attendant facilities, bathhouses, parking areas, nature trails, overnight parking and camping, all of the things that make it a good example of a beach park. So in those two miles they placed some 3 million cubic yards of sand over the past 12 years. Of course this was more than was needed for just that two mile reach but it was put there with the full knowledge that it would migrate southward with the littoral processes, which of course it has. It's benefited the beaches southward or downdrift. Most of this 3 million yards was dredged from the Mayport Naval Station property and for the most part it came from the maintenance of the adjacent navigation channel in St. John's River. I mentioned this as an example contrary to what they're sometimes accused of. The Corps does put this material on the beaches nearby when it's reasonably possible to do so. I perhaps say this out of loyalty for having been about five years in the Corps of Engineers myself. I was Chief of Planning which included beach erosion control projects among several other things. So, I guess I mentioned this out of latent loyalty. If Colonel Wisdom was here, why it wouldn't hurt me to get a few brownie points with him either because I'm not past the point yet where I don't need to be nice to him. We haven't gotten our project started yet.

Meanwhile, the Bureau of Shores and Beaches has been extremely active on our behalf. The whole Department of Natural Resources, for that matter. They've promoted our progress with Congress and the Legislature and certainly our friend, Earl Dixon has helped us a great deal with the legislative processes. They've given us advice and assistance to the city in performing local sponsor duties. They have helped work out the problems whereby the state is enabled to contribute up to 75% of the non-federal

share of the construction cost and they have budgeted and obtained funds in their budgets by legislative action so far to be on schedule with the state contributions. The state has already delivered $577,000 roughly to the city last year as part of the state share and they have another $228,000 or a little more than that available for this year which is in the process of being delivered to the city now. This makes a total of more than $805,000 in state funds which we already have on hand. The budget for the coming two years has been something over $1,200,000 for next year and a little over a million for the following year with the restraints and so on that have been mentioned to you earlier. Those figures may be somewhat high, I certainly hope not.

Our city council decided about seven years ago to start accumulating this fund so they started putting $200,000 aside in a piggy bank each year so whenever called on they would have it. Now, they stopped doing this the past two years, not because they became disenchanted with the project or anything but because with a million dollars on hand, the remaining city contributions would not be great enough to be a traumatic experience even if it had to be produced rather quickly. We know it can't be that traumatic because the first contract for the first part of the project will take probably a year or more to complete. We have enough time at our former rate of accumulation of $200,000 a year to put this total amount together without it really killing us. So we just stop putting it, in so to speak We already have more than enough for the first year's construction and fully intend to have all that's needed when the Corps calls on us in future years. Of course we still need the state's help to keep going with this because we're depending on them to take care of 75% of our non-federal share. This is a very simple way to save up to fund a project but you do have to anticipate your needs and start putting it away in a piggy bank on a systematic basis early enough to have what you need when you need it.

Our project calls for beach replenishment for a 10 mile reach from the St. John's river jetty south to the St. John's county line. This will require about 3 1/2 million cubic yards of sand and will cost about 14 million to do. The source of that sand is an ancient river mouth some 3 1/2 miles offshore. The sand is of excellent quality, very deep and so on, but it is 3 1/2 miles offshore which means that the small and medium size contractors aren't even going to be able to think of this. It's going to be the really big boys who can operate in open ocean and can put a booster in this pipeline somewhere in the middle and finally get it to the beach. Of this 14 million dollar cost the federal share is 58.4%, the non-federal share is 41.6%. We trust that the state will continue with it's 75% of the non-federal share, meaning 75% of 41.6% is 31.2% for the state to pay of the total cost, leaving the city with 10.4% to pay. But even so, the city will need to have some million and a half dollars at present day prices to pay for its share of the cost. While this is not such a huge amount for a big county, it can be completely beyond the means of a small county. In fact many small counties have to say thanks but no thanks, we just can't afford to take your help and it's really a fact of life with them.

This was the case some 11 years ago about the time that Duval county got its project authorized. St. John's county had a similar project by the Corps about the same time and it came out just as favorably as ours for Duval county but St. John's had to say thank you but we just can't afford it and they couldn't. Now with the state's, I hope, more generous attitude of being able to go up to 75% on these things, why the Corps has agreed to bring this study of St. John's county up to date again and see how St. John's county could afford it.

Getting the money together is not the only role of the local sponsor. First you have to make detailed surveys. They have to be made by the local sponsors to establish the erosion control line which is required by the state and which delinates the private upland ownership from the beach public ownership. My own forces in the engineering division surveyed ours. Of course it can be done by consultants but it has to do with running 10 miles of traverse and tying it all in, and referring it in proper monumentation so you can find all these points. It's somewhat easier in our case because most of our frontage is fronted by some sort of revetment or wall and this has to be plotted just as you do a record plat for a subdivision. The traverse has to close, everything has to be in order, you have to show such things as mean high water line, the dunes where the seawall doesn't exist, where it does, vegetation line, and seaward limits of construction need to be shown. The final product is submitted to the Department of Natural Resources and when that staff approves the line, the local sponsor must run three ads in the paper announcing that a public hearing is going to be held. All arrangements for this hearing are made by the local sponsor and their spokesman finds himself in the role of the chief actor of the public hearing. He has to tell people there assembled that everything is wonderful and describe the project to them.

We finally have our erosion control line approved. It's been adopted by the government and cabinet. The local sponsor has another chore that sounds rather terrible. He has to get the consent of more than half of the frontage ownership to agree to the establishment of this erosion control line. You have to have this all signed up and on paper before the state will even consider the establishment of such a line. In our case this involves some 500 separate property owners. We obtain 70% to 80% approval simply by writing them a letter, enclosing a form that describes their block number and whats going to be done, shows them a little profile, how about signing up. We got 70-80% response which was much better than the 50% we needed. Then comes the permits. You have to get those from a good many sources. One would think that with the Corps doing the planning and the construction and the state endorsing their efforts and putting several million dollars into the project, that really permits would be no problems. Not so. The process of getting state permits is slow and requires maticulous presentation on the part of the local sponsor. I think it's particularly slow in our case because we were doing this at the time when the reorganization of the state government, particularly as it relates to these matters, was in something of a change condition. I think for a while noone was quite sure where their responsibility ended and the other's began,

but it should be working fine now. I don't mean to say that this is a long, long process. If you were in an awful hurry it probably would be. We as local sponsors have applied for and now have permits from the DNR for the Corps to take this sand from the ancient river mouth out at sea and to place it on our beaches. We also have a separate permit for the modification of some 30 odd storm drains which now drain from a narrow strip of the beach through the seawall and dump out on the beach. When the nourishment project of the Corps comes along these are going to be filled with sand and covered up so they will no longer function. So I prevailed upon the municipalities involved to have a suitable type of French drain arrangement designed and they're in the process of putting in this French drain arrangement at Jacksonville Beach which has all except three of these outfalls. Jacksonville is putting their own forces to work on this labor intensive project to build these things. The local sponsors do not have to neccessarily design and build these things but they certainly have to see that they're doing it unless you can con the local community into it. You have to do it yourself or have it done. In addition to this it's been well over four months since we as local sponsors ask the State Department of Environmental Regulation to give us a water quality permit to do the work. I received a call just last week after being there for four months asking for more data on which to base their hydrographic and water quality studies and this is despite the fact that every grain of sand that's on the beach is coming out of the same ocean and has been there quite a long time. They wanted logs of offshore drilling. Fortunately, the Corps had done this in the smaller areas and it was not difficult to get it, but it could be very difficult and expensive if you didn't happen to have it. Now that most of the local sponsor's work is done and most of the state's work is done we still cannot start constructing the project. The Corps is already to go with the plans and specs. They could award a contract in very short order. The only problem is that no federal funds are available to permit an official construction start of this as a new project. Somebody might say, well you have $1,800,000, why don't you give it to the Corps and let them go ahead and start? We'd be real tickled to do this. But $1,800,000 won't do it. The mobilization cost of starting is so big that it is impractical to bite it off in smaller bites, half of it at a time. So we're talking about 7 million dollars. The House and the Senate appropriations committee chairmen both assured us that their committees "unintentionally and inadvertably failed to include money in their budget considerations for a construction start early this part of the year due to a clerical error." We were supposed to get money and we didn't. Now, we usually blame tht sort of thing on the computer but as far as I know they haven't done that yet. We do have promises, however, form our congressman in whose district this lies that he will try his best to get us an official start authorized in a now pending supplemental appropriations bill which he says will be acted on before the Easter recess. This really may get us started this year after all. He really thinks that it will work and he thinks that we should be optimistic. The President did not include our project or any other new starts in this year's budget. The actions of the House and Senate committee may be able to override that.

In summary it takes a lot of patience and hard work to perform as a lo-

cal sponsor, it also takes money. I remember going to seminars at Lehigh University one time and I went to the book store and there was a big post-card that read "It takes more than ordinary skill, intelligence and ability to succeed at Lehigh, it also takes money. You must, as I said earlier anticipate your needs early enough and start achieving them. We, in Jacksonville are a fully consolidated city--county government and have been for some eight years. The City of Jacksonville is really 844 square miles; sometimes I think it's even bigger. We've been consolidated since 1968 and it's working quite well. This consolidation gives us a special advantage in beach erosion planning. I've seen beach front munincipalities in Florida where the county could not spend a dime within the corporate limits of any of the various towns and cities that made up its coastline. They weren't allowed to do so by their charter. Likewise, there were several corporate cities along this coastline and none of them could get together well enough to get their project off the ground or even devise a way whereby they would have a local sponsor which could probably speak for all of them. So the counties could not act, the cities couldn't act, couldn't do anything beyond their own corporate limits and nothing much happened. We don't have this trouble. Why our charter of consolidation gave the city of Jacksonville the authority to act on matters of this sort for the entire county even though three of our beachfront communities have their own separate autonomies or semi-autonomies. They have their mayors and their city councils and so on but the consolidated charter gave us the authority to act for them on matters of beach erosion so this has been a big help. We have at least one thing that has made the role of local sponsor easier. I guess I would recommend consolidated government to any of you for this reason and also a good many other ones because it is working well. So I'd say being a sponsor is a kind of tough role but it can be done with patience and effort, at least I think it can.

PROGRAM

"ELOISE"

A SEMINAR ON BEACHES VS. HURRICANES

Thursday, March 4, 1976

8:00 - 10:00 a.m.	Registration & Coffee
10:00 -	Welcome & Seminar Overview Coastal Engineering Laboratory-Dean Morton Smutz Florida Shore & Beach Preservation-Stan Tait & John G. Cowley Marine Advisory Program-Todd L. Walton, Jr. Coastal Plains Center-Philip G. Hill
11:00 -	Presentation of Special State Service Award by Dean Wayne H. Chen
11:15 -	"About That Hurricane" - Dr. Neil Frank
12:15 - 1:45 p.m.	Lunch - Dutch Treat
1:45 -	"The Economic Value of Florida's Beaches" - Dean Gaiser
2:00 -	"What's Being Done by the Feds" - Col. Drake Wilson
2:45 -	"A Lesson Learned in Building Design in the Coastal Zone" - Dr. Byron Spangler
3:30 -	Coffee
4:00 -	"Effect of Eloise on Florida's Beaches" - Prof. James A. Purpura & Dr. T. Y. Chiu

Friday, March 5, 1976

Programs to Protect Us From the Wrath of Mother Nature

8:30 a.m. -	"The Federal Flood Insurance Program" - Mr. Richard Krimm
9:30 -	"The State Setback Line Program and Variance Procedures" - Mr. William Sensabaugh
10:30 -	Coffee
11:00 -	"Land Planning, Coastal Risk - A Function of Coastal Processes" - Dr. Christopher Mathewson
12:00 - 1:30 p.m.	Lunch - Dutch Treat

PROGRAM CONTINUED

1:30 -	"Peninsular Florida Erosion Problems and Solutions" - Col. D.A. Wisdom
2:15 -	Panel Discussion - "Erosion Problems, Beach Restorations and Hurricane Protection, and Financing Aspects of Beach Projects" Moderator - William T. Carlton

Earl Dixon — Arthur V. Strock
Oscar Rawls — Col. D.A. Wisdom

3:30 - 4:00 p.m.	Coffee
4:00 - 5:00 p.m.	Panel Discussion continued

SPEAKERS

MR. WILLIAM T. CARLTON, Chief Bureau of Beaches and Shores, Department of Natural Resources, Tallahassee, Florida.

DEAN WAYNE H. CHEN, Dean, College of Engineering, U.F.

DR. NEIL FRANK, Director, National Hurricane Center, NOAA, Miami, Florida.

MR. PHILIP G. HILL, Asst. Director, Coastal Plains Center for Marine Development Services, Wilmington, N.C.

MR. RICHARD W. KRIMM, Asst. Administrator for Flood Insurance, Dept. HUD, Federal Insurance Admin., Washington, D.C.

DR. CHRISTOPHER MATHEWSON, Professor, Dept. of Geology, Texas A&M Univ., College Station, Texas.

MR. ROBERT MURKSHE, Chairman, Brevard County Erosion Control District Advisory Committee, Cocoa Beach, Florida.

PROF. JAMES A. PURPURA, Professor, Coastal and Oceanographic Engineering Laboratory, U.F.

MR. OSCAR RAWLS, City Engineer, Jacksonville, Florida.

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MR. WILLIAM STEVENS, County Commissioner, Broward County, Florida.

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MR. STAN TAIT, Executive Director, Florida Shore and Beach Preservation Association.

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