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TECHNICAL COMMUNICATION

Summary of Beach Replenishment on the U.S. Gulf of Mexico Shoreline

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INTRODUCTION

Beach replenishment is an increasingly popular coastal management option in the United States. The national experience in artificial beach construction, however, is largely undocumented. Following the PILKEY and CLAYTON (1989) data summary of beach replenishment on U.S. Atlantic coast barrier islands, this paper summarizes beach replenishment on the U.S. coast along the Gulf of Mexico. The Pacific coast has been examined also (CLAYTON, 1989). The study is approaching a stage from which the beach replenishment alternative can be evaluated on a national scale (LEONARD *et al.*, 1989, LEONARD *et al.* (in press [a]).

Principles of replenished beach design, the success of design parameters, and predictions for the Gulf of Mexico beaches are discussed by DIXON and PILKEY (1989). Atlantic coast beach replenishment principles have been discussed by PILKEY (1988), LEONARD *et al.* (1988), LEONARD *et al.* (in press [b]). LEONARD *et al.* (1989) and LEONARD *et al.* (in press [a]) compare beach replenishment on the U.S. Atlantic, Gulf of Mexico, and Pacific coasts.

As in PILKEY and CLAYTON (1989), this paper lists projects through 1987 (with two exceptions) with date, volume, length, and cost of each emplacement project, as well as funding source (Table 1). Durability of individual project beaches in terms of beach lifetime categories (less than two years, two to five years, and greater than five years) is included as possible. Beach lifetime is considered to be the amount of time in years to lose 50% of the fill material from the project area. Fifty percent is generally a conservative measure, since most beaches had lost over 50% of fill material during the time indicated by the lifetime category. Furthermore, 50% serves as a point from which comparison can be made among different projects; little to no data is available for quantitative analysis of project performance.

Approximately 35 replenished beaches were identified along the U.S. Gulf of Mexico coast, including over 100 federal-, state-, and locally-funded individual pumping operations. Twenty-nine of the 35 projects are located on the central and south portions of Florida's west coast. The amount, type, and accuracy of data for individual projects is quite variable. In some cases, the documented record of a project may be no more than a mention in the literature.

The data set presented establishes a relatively complete picture of the extent of use of the beach replenishment on the Gulf coast. Several projects may have been missed, especially

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Table 1. *List of beach replenishment projects on the U.S. Gulf of Mexico shoreline. "Type" refers to funding categories as follows (see explanation in text): (1) federal: beach erosion control; (2) federal: navigation; (3) federal: emergency shore protection; (4) state and local; and (5) private.*

Beach	Year	Type	Volume	Length	Density	Cost	Durability	References
			(cubic yards)	(miles)		($)	(years)	
Corpus Christi, TX	1978	1,6	850,000	1.4	607,143	$3,000,000	> 5	9, 10, 11
	1985					$4,415,000		10
Galveston, TX	1985	5	15,079	0.3	53,854	$21,000	2–5	12
Grand Isle, LA	1954-1955	4	1,150,000	1.4	821,429	$188,000	2–5	13, 14, 15
	1957	3	140,000	4.5	31,111	$76,000		13
	1961-1962	4	350,000	1.4	246,479	$115,000		13
	1966	3	550,000			$447,000		13
	1976	3						16
	1983-1984	1	2,800,000	7.5	373,333	$8,640,000	< 2	13,16,17
Isles Dernieres, LA	1985							18
Harrison County, MS	1952-1953	1,6	7,004,000	26.0	269,385	$3,001,800	> 5	19,20,21,22,23,24,25
	1964	1	200,000					24,25
	1972-1973	1	1,923,443	26.0	73,979		> 5	19,21,22,23,24
City of Bay St. Louis, MS	1941							26
	1967	3.4		6.1				26
Perdido Key, FL	1985	2	2,433,000	1.0	2,339,423		< 2	27
Santa Rosa Island, FL	1961	6	75,300					30
Panama City Beach, FL	1982	2	347,000	1.0	365,263			28
	1984	2	320,000	1.0	336,842			28
	1986	2	221,000	1.0	232,632			28
St. Joseph Spit, FL	1980	2	332,000	0.6	553,333			28
	1985-1986	2	500,000	0.6	833,333	$80,000		28
Okaloosa County, FL	1986	2	182,000					28
	1987	2	126,000					28
Mexico Beach, FL	1965-1970	4	101,250	0.7	155,769	$41,000		31,32
	1971-1975	4	100,000	0.6	181,818			31,32
Clearwater Beach Island, FL	1950		150,000					33
	1981	2	180,000	0.6	321,429			33
Clearwater Beach, FL	1977	2	185,750					33,34
	1981	2	750,000	2.0	378,788			33
Indian Rocks Beach, FL	1969	3	100,000	1.1	90,909	$290,000	< 2	24,33,35
	1973	1	400,000	4.5	88,889	$1,711,000	> 5	21,24,35,36

North Redington Beach, FL	1981-1983	4	19,144	0.3	63,813	$369,000		31,32
Madeira Beach, FL	1961	4	30,000	2.0	15,000	$300,000		33
Treasure Island, FL	1964		10,000			$6,500		33
	1966							38
	1969	1,3	820,000	1.7	471,264	$525,000	2–5	24,25,33,34,39,40,41
	1971	1	75,000	0.3	250,000	$216,000	2–5	24,34,39,42
	1972	1	150,000	0.4	394,737	$185,700		24,33,39,43,44
	1976	1	380,000	1.5	253,333	$1,149,000	2–5	33,44
	1978	1	50,000	0.4	131,579	$224,000	2–5	44
	1981	2	70,000					44
	1983	1	220,000	0.8	275,000		2–5	44
	1986	3	555,000	1.7	318,966	$3,500,000		43
Upham Beach, FL	1968	4	30,000					44,45
	1975-1976	4	80,000	0.5	170,213	$230,000	< 2	24,31,32
	1979		254,000	0.5	479,245		< 2	31,32,34
	1980	1	243,000	0.5	458,491		< 2	44
	1986	1	175,000				< 2	36,43
St. Petersburg Beach, FL	1971-1975	4	25,000	0.5	50,000	$683,000		31,32,46
Mullet Key, FL	1964	4	140,000	0.8	179,487	$236,000		24,47
	1972-1973	1	505,000	1.3	394,531	$597,000		24,34,47
	1977	6						38,43
Anna Maria Key, FL	1963							48
	1977-1978	2	206,000					44
	1985	2						49
Longboat Key, FL	1977-1978	2	101,480					44
	1982	2						34
Lido Key, FL	1964	2	123,000			$69,000		41,50
	1970	1,2	350,000	1.2	291,667	$333,000	2–5	12,50,51
	1974	1,2	250,000	1.2	208,333	$458,000	2–5	41,52,53
	1977	1	350,000	1.2	291,667	$610,000		31,41,50
	1980	2	185,000					34
	1982	2	92,000					34
	1985	2	239,000			$886,000		50
Venice Beach, FL	1963	2	19,000					50
	1971-1975	4	25,000	0.2	147,059	$50,000		31,32
	1979-1980	3						50
Port Charlotte Beach, FL	1980	2	49,700	1.1	43,596		< 2	41,54,55
Gasparilla Island, FL	1981	2	264,000					56
Captiva Island, FL	1961		110,000			$38,000		57
	1962	3	7,000					58
	1962-1963		57,000	0.9	67,059			59
	1963		50,000					58
	1964-1967		80,000			$100,000		58,60
	1965		12,000			$12,000		58,60

Table 1. *Continued.*

Beach	Year	Type	Volume	Length	Density	Cost	Durability	References
South Seas								
Plantation, FL	1981	5	655,500	1.9	346,825	$3,600,000		59
	1985	3	3,300	0.9	3,667		> 5	55,61,62,63,64,65
Fort Myers Beach, FL	1961-1987	2	767,000					56
Bonita Beach, FL	1976							56
Vanderbilt Beach, FL	1983	5	48,000					66
Keewaydin Island, FL	1963	2	524,000					66
	1964	2	10,000					66
	1968	2	8,800					66
	1970	2	140,000					66
	1980	2	235,000					66
	1985	2	120,000					66

those which are small and locally-funded. The data compilation provides an information base for and indicates information sources available to coastal zone managers for the formulation of national, state, and local policies toward beach replenishment as the "solution" to erosion.

NATURE OF THE DATA

Information concerning beach replenishment on the U.S. Gulf of Mexico coast is difficult to obtain. No one source exists; therefore, data must be gathered piecemeal from a variety of sources. In many instances, information is neither found nor available. In some cases, records from the same project differ. Although over 100 Gulf coast pumping operations were identified, cost data is known for 26 projects, volume data for 75 projects, length data for 43 projects, and durability for 22 projects.

Information on federal projects came from such sources as U.S. Army Corps of Engineers annual reports and district publications, Congressional documents, and miscellaneous federal agency reports. Information on state and local projects came primarily from state and local government records. Consultants' reports provided the principle source of information on private beach replenishment projects. Much information on all types of projects—federal, state, local, private—was gleaned from conference proceedings, scientific papers, and news media reports, as well as through personal communications with government employees at all levels and informed people working in the private sector.

CATEGORIES OF REPLENISHED BEACHES

Gulf of Mexico beach replenishment falls into five broad funding categories. Several beaches fall into more than one category, having been funded by a variety of sources throughout their history (*e.g.* Grand Isle, Louisiana).

(1) Federal: Beach Erosion Control (BEC). The standard federal beach replenishment project consists of a major initial restoration project followed by periodic nourishments. The purpose of the federal BEC project is to provide erosion control and storm protection for coastal property.

(2) Federal: Navigation. The purpose of a federal navigation project is channel maintenance. If the dredge material is of beach quality and beach disposal is economically feasible, beaches may be replenished under the federal navigation project category.

(3) Federal: Emergency Shore Protection. Federal emergency shore protection projects usually are carried out following a coastal storm which has left coastal property dangerously exposed to the forces of winds and waves. Most beaches which fell in this category were scheduled for replenishment before the storm.

(4) State and local. Although a portion of most federal BEC projects are funded by state and local monies, several Gulf beaches have been replenished through state and local support without federal assistance.

(5) Private. Several Gulf beaches have been replenished through funding provided by private property owners. In these few cases, no public funds—federal, state, or local—were used. One of these privately funded beaches (South Seas Plantation, Florida) is perhaps the most durable (longest-lived) artificial beach on the open-ocean Gulf coast.

Some projects fall into a separate category based on physical setting rather than funding as they are bayshore and not open Gulf. Two of the projects, Corpus Christi, Texas, and Harrison County, Mississippi, are among the largest and most durable Gulf projects.

DATA SUMMARY

The beaches in Table 1 are listed in geographic order from west to east and north to south. The study area from which the table is derived extends from Corpus Christi, Texas, to Keewaydin Island, Florida. Several bayshore projects are included.

With few exceptions, beach replenishment along the Gulf shoreline has been sporadic in both application and maintenance. The time gap between subsequent replenishment operations often is a function of politics and finances rather than the physical state of the beach. For information on actual beach performance, the reader should refer to the original sources in the list of references and to DIXON and PILKEY (1989).

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