CHAPTER 38

PROBLEMS WITH SMALL CRAFT HARBORS

H. Morgan Noble
Orange County Harbor Engineer
Newport Harbor, California

Administration of a small craft harbor includes, among its problems, those of finance, law, public relations, policing, and engineering. This paper will relate experiences in all of these categories, but as it is written for Coastal Engineers, it will cover the engineering category most completely.

PROBLEMS OF FINANCE

Problems of this type vary considerably from harbor to harbor, as there are at least four different types of harbors which can be classified by the main service rendered.

HARBORS OF REFUGE

This class of harbor is very likely to be located in a remote section of the coastline and therefore the tax base and revenue from which finances may be derived is nill, or very small. Consequently, finances are very limited and these badly needed harbors are not constructed as much as needed. Harbors not used primarily for refuge are not included in this classification. Harbors of refuge serve the transient sailor. It is unlikely that any local government will accept the financing responsibility. This is more suited for State supported funds.

MARINAS

This type of harbor is suited to the use of harbor revenues for means of construction and operating finances. Most of the protected water area is devoted to boat slips and other revenue producing business. The main problem is to insure that harbor space demand is great enough to justify the necessary expenditures.

RESIDENTIAL HARBORS

Here is a type of harbor where people, other than boat owners or operators, are benefited. Homes along the waterfront and immediate harbor area are high in value and owners profit without using the harbor. People living within easy driving distance will come to the harbor, providing they have access to view it, to swim, or to enjoy it in any manner possible. All this benefits the property owner within the district of the harbor. Here is a case where a tax on property within this district is a logical means of raising necessary finances.

RECREATIONAL HARBORS

Every small craft harbor could be classified as recreational. Here the term is used to designate the type of harbor where private property

is not a part of the development and where the public has full use of al facilities. Financing here again would best be gained by revenue from harbor use and would probably need to be supplemented by public funds. Recreation is necessary to keep the nation healthy, and cannot be expect to be entirely self supporting. Every attempt should be made to lighter the public economic burden of operation by developing sections of the harbor which will be revenue producing.

Actually, in the practical sense, most small craft harbors are included in more than one of these classifications. Each classification presents a basic financing problem which must be solved. The people who are served by a harbor, should contribute a definite share towards its financial operations.

PROBLEMS OF LAW

In California the State "HARBORS AND NAVIGATION" Code delineates th jurisdictional powers under which the harbor administration operates. The Code distinguishes between Harbor Districts, Harbor Improvement Districts, Joint Harbor Improvement Districts, Port Districts, River Por Districts, and Recreational Harbor Districts. Therefore, each harbor ha a particular set of laws depending upon how it was organized.

At times, the law is not clear to those who operate the harbor and recourse must be made to seeking an opinion from legal counsel. Under the Code, powers are given to local jurisdictional bodies to pass ordinances to govern their harbor. Local ordinances may be more, but never less restrictive than the State Code. In the case of the Corps of Engineers, U. S. Army, who are the authority as to navigational aspects of a harbor, this also holds true. More restrictive harbor lines such as Pierhead and Bulkhead lines may be established by local authorities, but the bayward extent is set by the Corps of Engineers.

PUBLIC RELATIONS

As is the usual case with any worthwhile enterprise, good public relations are most important in the successful operation of a harbor. The harbor administrators must work harmoniously with Federal, State, County, City, and District officials in all levels of government. Permits for harbor structures and dredging, which are not adequately covered by local law, must be forwarded by harbor authorities to the Corps of Engineers for final approval. In problems of water pollution and highways, harbor authorities are required to work such problems out with State, County or District officials. They may also have to act between the public and other officials concerning flood control and right of way problems.

SWIMMING VERSUS BOATING

One difficult public relations problem is to settle disputes between the public over rights of using harbor waters. Swimmers demand beach

space where other harbor users request piers. Where waterfront owners have property to the waters edge they usual expect and receive pier permits. However, where there is public land between property owners and the water, the problem is not so easy to settle.

A fairly successful formula has been used in Newport Harbor, California, to satisfy inland and waterfront owners on an island where a public walk surrounds the island, separating the beach from property owner's land. First, two or three beach locations are reserved on each side of the island for swimmers. No piers or moorings are permitted in these areas. Applications for piers at other locations are considered on their own merits. Each applicant must submit ten or more signatures of non-pier owners living within a 500' radius of the proposed pier location. At least 50% of these signatures agreeing to the pier installation must be those of inland lot owners. If the proposed pier location is used as a bathing beach, the applicant probably would not be able to secure the required signatures and therefore is not eligible to make application.

OUTBOARD MOTORBOATING

Another harbor use problem becoming more serious each year, is caused by the tremendous growth of the number of outboard motorboats. Nearly 600,000 such units were sold last year in the United States. The people using these boats want to waterski and race in protected waterways. However, a crowded harbor must maintain a speed limit too slow for these activities. One answer to this problem is to set aside areas limited only to these uses or to set specific time periods when such use will be permitted. Ordinances and policing must be revised to cover the added hazards to public safety caused by these activities. It is difficult for the outboard operator to judge his speed, as there is no shaft revolution counter to indicate speed. This is no reason to permit outboards to exceed the lawful speed limit. However, it takes a good job of public relations to convince these operators that they are not being cited unfairly.

SPECIAL EVENTS

During the course of a year, several groups may wish to stage events which will interfere with the normal harbor operation. Some will have a beneficial effect on the community. Crew races, speed boat races and water carnivals are of this nature. Schedules can be set so that the special event will interfere little with normal navigation and yet be effective in its intended purposes. Intermissions to permit normal traffic, also make the events less of a nuisance to regular harbor operations.

HARBOR POLICING

Harbor operation covers many phases of policing. Protection of life and property; enforcement of laws and navigation; prevention of pollution of bay waters and improper mooring of vessels, and many other harbor operations, are the everyday duties of the harbormaster and his patrol.

PROTECTION OF LIFE AND PROPERTY

To do this job, the harbor patrol must be equipped properly. Spe is of the essence. To police the 700 acres of Newport Harbor, the Ora County Harbor Department operates three speed boats approximately 20' long and able to travel faster than 30 miles per hour. Each boat is equipped with a two way radio and powdered chemical fire extinguishers During the summer, life guards accompany the boats, as they can arrive much sooner at the beach accident scene in this manner than they could through crowded streets.

A fast, radio equipped fireboat is a necessity. The first few minutes fighting a boat fire, or explosion, can mean the saving of man; lives and much property. This harbor department has a 27' fireboat capable of over 30 miles per hour. It is equipped with a separate engine driving a 300 gallon per minute fire fighting pump which is connected with a reel mounted, high pressure hose. Fog applicators and foam attachments add to its effectiveness. A sturdy tow bitt mounted amidships, permits towing a flaming vessel clear of other moored craft.

In addition, the patrol has two heavy duty work boats, each with radios and tow bitts. For patroling the shallow Upper Bay, where speed ing of outboards and waterskiing is permitted, the harbor department operates two fast outboards - also equipped with radios.

The nerve center, coordinating the rescue calls to and from all patrol boats, is located at a central office. Here constant radio watc are maintained, except at night, when calls originate from the City Pol Department direct to the patrol boats.

ENFORCEMENT OF NAVIGATION LAWS

In California, State laws sets the speed limit of 5 nautical miles per hour for all boats operated within 100' of any swimmer, or within 200' of a landing float where passengers are using the facilities, or within 200' of a beach frequented by swimmers. In Newport Harbor, wher over 4,000 small craft are moored at bay moorings, or slips, along the waterfront, this enforcement is a real problem. In August of 1957, a boat count showed that 59,856 boats crossed back and forth across the harbor entrance. With this great activity, it has been necessary to establish a 5 MPH speed limit throughout the entire developed harbor. Fifteen patrolmen, divided into three shifts, man the patrol boats to enforce the laws and protect life and property. The number on duty, at any time, varys in the shifts which change in importance with the seaso Three extra men are hired in the summer months, when vacation crowds an early morning albacore fishermen place heavy burdens on both daylight and night shifts.

PREVENTION OF POLLUTION OF BAY WATERS

This becomes most important where swimming is one of the harbor uses and is a problem that is difficult to handle in a popularly used harbor. Pollution can be from sewage, debris, or dead fish.

Sewage Pollution - Laws forbid the using of boat toilets inside bay waters. However, the practical way to prevent this is by attempting to place proper shore facilities within available reach of moored craft. In Newport Harbor, in all the bay mooring areas but two, any boat owner using a mooring, must be a resident in the neighborhood, directly shoreward from his mooring area. This is to ensure that anyone on his boat has shore facilities closely available. In the two areas excepted, public rest rooms are located shoreward of them. Owners of slips along the waterfront must have access to adjacent private residential facilities, and slip operators must make rest rooms available to their patrons. To ensure that these requirements are followed, no permits for boat slips are approved until rough plumbing for facilities is completed. Another way to combat the problem would be to install chemical toilets on slips installed in units in the bay, in place of individual moorings. A shore connection could be made to this arrangement to eliminate the chemical toilet feature.

To guard against pollution of harbors, water samples are tested from many stations to determine the bacteria content. If any station sample is above a safe bacteria count, the reason for this is determined and eliminated.

Pollution from debris - This is a very difficult problem to control. Articles are pushed into bay waters at any opportunity or merely left to drift away with high tide. Identified property can be traced to the owner, but most debris is not marked that clearly. An appeal to the public pride through periodic notices is helpful in preventing debris from entering harbor waters.

In the operation of a harbor, thoughtful consideration should be given to reserving space for disposal of debris. As facilities grow, such space is often overlooked, and a time will come when disposal of debris will become a noticeable operational expense. This is usually due to the necessity for hauling the debris away in order to dispose of it.

Another debris problem is caused by the careless "over the side" disposal of cans and bottles by boat passengers. Mainly, this debris comes from rented boats or fishing party boats. These passengers do not want to bother taking home empty containers. A close watch and the issuance of citations to guilty parties, soon gets the word around that such conduct will not be tolerated. If these acts are left unnoticed, the debris will soon collect.

Pollution from dead fish - Waters around fish canneries are like to contain dead fish, due to the unloading proceedures. This problem be controlled by employing men in skiffs to pick up the dead fish bef they are dispersed all over the bay waters, and by more careful unloa

PREVENTION OF IMPROPER MOORING OF VESSELS

This can be a difficult problem in harbor operation, if definite mooring areas are not maintained, and if rigid installation specificat are not followed.

Boundaries of mooring areas are dictated by channel widths and us and should be defined on harbor maps. Moorings within the areas shoul assigned and placed under the direction of the Harbor Master to insure correct spacing for use without taking up excessive area. Commercial boats should be in areas separate from pleasure craft moorings, as the uses and construction are not similar. If moorings are vacated over a period of time, the owners should be notified that they have forfeited their space and must make way for owners who will use this space. Thi is especially important in a harbor with limited mooring facilities.

Following good specifications for installations will prevent many mooring problems from occurring. The specifications shown below have proved themselves in Newport Harbor over a long period of time.

SPECIFICATIONS FOR SHORE MOORINGS, NEWPORT HARBOR, CALIFORNIA

Rowboats or Sailboats, Without Power, 17' or Less Overall

Maximum Length of boat	Minimum Weight of mooring	Minimum Size and Length of Chain	
12'	200 lbs	25'	3/8"
15'	250 lbs	25'	3/8"
17'	300 lbs	25'	3/8"

A 4x4 Redwood post, painted white, and with numbers assigned, painted thereon AT ALL TIMES, shall be placed against the sea wall, and project not more than 12" above the sand.

Mooring buoy shall be of an approved type constructed of metal, and painted white above the water line, with mooring numbers assigned, painted thereon AT ALL TIMES.

Buoy and post shall each have a pulley attached with a line of not less than 3/8" diameter at all times. Boat to be moored securely thereto, bow and stern, and must not be left on beach.

NOTE: Boats over 17' in overall length, and ALL power boats, regardless of size, must be moored on Off-Shore Moorings.

SPECIFICATIONS FOR OFF-SHORE MOORINGS, NEWPORT HARBOR, CALIFORNIA

All mooring weights must be metal.

All mooring buoys must be metal, or such type as approved by the Harbor Master, painted white, or aluminum, above the water-line, with numbers assigned by the Harbor Master, painted thereon AT ALL TIMES.

All vessels must be moored fore and aft.

All locations must be allocated by the Harbor Master, and moorings inspected before installation.

Top and bottom chain to be shackled together to form one continuous length.

IMPORTANT NOTICE

MOORING PENNANTS are an important part of your mooring and must be properly made up with thimble and shackled to each buoy, FOR INSPECTION AT THE TIME OF INSTALLATION OF THE MOORING. Mooring pennants must be kept in good condition AT ALL TIMES.

MINIMUM REQUIREMENTS:

Length of Boat	Minimum Dia. of Line	Length of Line
18'-20'	5/8"	Not over 10'
20'-25'	3/4"	Not over 10'
25'-30'	7/8"	Not over 10'
30'-40'	1"	Not over 12'
40'-50'	1⅛"	Not over 15"
50'-70'	1¼"	Not over 15'

Length of Boat	Weight of Mooring	Size of Chain Bottom	Top
20'	500 lbs.	1/2"	3/8"
25'	650 lbs.	1/2"	3/8"
30'	750 lbs.	1/2"	3/8"
35'	1000 lbs.	5/8"	3/8"
40'	1500 lbs.	5/8"	3/8"
45'	2000 lbs.	3/4"	1/2"
50'	2000 lbs.	3/4"	1/2"
55'	2500 lbs.	3/4"	1/2"
60'	3000 lbs.	3/4"	1/2"
65'	3000 lbs.	1"	1/2"
70'	3500 lbs.	1"	5/8"
75'	3500 lbs.	1"	5/8"
80'	4000 lbs.	1"	3/4"
85'	4500 lbs.	1"	3/4"
90'	5000 lbs.	1"	3/4"
95'	5000 lbs.	1"	3/4"

Length of mooring lines to be determined by the Harbor Master, he being governed by the depth.

Above specifications cover mooring for one end only.

To insure that the moorings are maintained, each mooring must be inspected every two years and all worn parts must be replaced.

EDUCATION NOT REGIMENTATION

In concluding the policing category, the importance of educating t public in observance of laws and regulations can not be too highly stressed. Many times, laws are broken, due to ignorance along. It is not required that a boat operator of a pleasure vessel be licensed, as is the case of an automobile operator. In the past few years, the increasingly popular boating activity has resulted in vast numbers of ope tors who know little about boat handling, laws of navigation, or what boat equipment is required. All this has lead to a move to license boa operators. The majority of men, with boating experience, resist any regimentation along this line. They feel that education is the answer, not licensing.

In Newport Harbor, Harbor Master Albert Oberg has organized a clas to train youngsters in the correct way to operate and maintain a vessel. Yacht clubs have also organized youth training in this program. Nationally, the US Power Squadron and the Coast Guard Auxiliary, have extended their training classes to reach vast numbers of these new boating enthusiasts. All these moves have appealed to the new boating public as attested by the huge response. At the end of the fiscal year June 30, 1957, a total of 139,890 people had been registered in US Power Squadron classes. The US Coast Guard Auxiliary's three pronged program of (1) courtesy pleasure boat examinations, (2) public boating education and patrol, and (3) assists to recreational boatmen, experienced considerable expansion throughout the nation during 1957. To date this year, a total of 48,781 pleasure craft inspections have been made by Auxiliarist in the Courtesy Safety Examination program, and by the end of the year this figure should exceed 50,000. Boating enthusiasts enrolling in the free public instruction courses totaled 30,216. The US Coast Guard sent 13 roving inspection teams throughout the nation last year to inspect and instruct boat operators on the spot in their harbors. It is hoped that these moves will solve the problem and result in proper boat operation by the public.

ENGINEERING PROBLEMS

Many new products made of plastics, fiberglass, styrofoam, light weight concrete, and coatings of anti-rust coverings have been developed to supplement older methods of combating the problem of sea water and other attacks on water-front structures. Here are examples of uses of these materials with a discussion of their advantages and limitations.

PONTOONS OR FLOATS

Older type pontoons were constructed of timber logs, wood planked cribs covered with paper and tar, or of steel barrels. The timber logs were subject to wood borers and to becoming waterlogged in time. The wood cribs would shrink and swell, thus allowing water to enter them, usually from wave action, or the paper would be subject to damage, thus

allowing worms to bore into the timbers or water to fill the wood cells and reduce the buoyancy. Steel tanks or drums, though coated with preservatives, are subject to corrosion of their thin walls which ends in loss by sinking. Newer types of pontoons have increased the useful life of floats, but sea water still takes its toll.

Plastic Pontoons - This type is not subject to corrosion, worm attack, or waterlogging, but there are disadvantages. The thin skin is subject to vibrations which after a time cause cracks to develop and results in the pontoon sinking. Compared to older type pontoons, their first cost is higher and their useful life no longer.

Fiberglass covered pontoons - These pontoons are claimed by many to be the answer to fighting sea water attack - no corrosion, no waterlogging no borer attack. Yet they are subject to dry-rot from inside the pontoon. If any moisture finds its way inside, the lack of ventilation and presence of moisture and heat will lead to dry-rot.

Styrofoam pontoons - This light weight material usually comes in logs approximately 2'x3'x6' or 2'x3'x9'. It is an expanded material with a very irregular surface. It can easily be sawed into the required shape by passing a hot wire through the log. It is not expensive and is easy to install. However, it has disadvantages. Diesel fuel or petroleum and fish oil will dissolve the styrofoam. Also, it must be shielded from the sun, birds, and inquisitive people, as it is easily picked apart. Otherwise it has proved to be a suitable pontoon in sea water.

Light weight concrete pontoons - These have proved very serviceable providing their manufacture is correct. They are usually cast in two pieces, one piece consists of bottom, sides, and a center bulkhead. The other piece is the top which is later cemented to the sides. Here is where trouble can be found. If the top wire reinforcing is not joined to the side reinforcing wire and the top and side joint properly veed out or grooved to form a good bond for the joint, this area will later crack and leak. As usual, water content should be carefully controlled to secure strength without loss of workability. Proper curing after assembling the pontoon is most important. The advantages of this construction are its resistance to corrosion, waterlogging and dry-rot. Due to its light weight it does not sink readily if damaged. This pontoon must be shielded against impact, as it is not as strong as ordinary reinforced concrete. In certain localities, a cement borer has damaged it. It is a most successful answer to the search for a good pontoon in areas where the cement borer is not evident and provided that proper construction is used and a facer of wood is placed above its waterline to shield the pontoon.

CONCRETE AND STEEL IN SEA WATER

Concrete, if properly manufactured and installed, is a most durable product in sea water if not stressed so that cracking developes. Many maintenance problems can be avoided or reduced to a minor nature, if a few fundamental practices are followed.

1. Obtain as dense a concrete as possible by keeping the water c tent low. To avoid an unworkable mix, use admixtures as directed. Vibration to the proper degree will help.

2. Obtain sufficient concrete coverage over reinforcing steel. Where possible, have 3" cover where the structure is exposed to sea water.

3. Cure concrete immediately after initial set, either by membra coating, or application of moisture continuously for seven days.

4. Use proper handling of concrete structures to prevent crackin Prestressing concrete will help to avoid those cracks caused by handli and loading.

If these practices are not followed and concrete deterioration is occuring, do not prolong corrective repairs. Once the reinforcing is exposed, the destructive process proceeds rapidly. Clean the damaged area of all loose concrete and rust, usually best done by sandblasting. Build up the area by welding new reinforcing steel to undamaged origin steel, and gunnite the structure to build up to required size and concrete cover.

There are times when steel must be used rather than the more durat concrete. This is the case where hard pile driving conditions would crack concrete, or where long spans or lengths dictate the more easily handled steel product. Then the problem of corrosion can be reduced by applying protective coatings to the exposed steel surfaces. Properly cleaning the surface, prior to coating application, is imperative. Coatings of bitumastic, vinyl plastic, and metalized zinc have proven value, if properly applied. Some coatings stand up better on areas exposed to the sun and should be used above water level. Such is the cas of bituplastic above the water, where bitumastic would alligator and peel. Pittsburg Chemical Company manufactures a protective coating that stands up well in sea water.

It has proved advisable to install cathodic protection systems on steel structures in contact with sea water, where electrolytic currents are known to exist. This is usually the case where steel ships with generators and welding equipment are located. These cathodic protection systems are most important where the steel installation costs are high and where any replacement would entail considerable expense, as in the case of sheet piling under wharves.

TIMBER IN SEA WATER

Timber structures are not as durable in sea water as sound concrete is - but there are conditions under which harbor operations dictate their use. Groin installations have not always proved to be the answer to maintaining an eroding shoreline. If the installation is of timber design, it is less costly to install and remove, if necessary, than one of steel or concrete. If a structure is liable to sudden impact forces such as a fender system attached to a wharf, a timber designed system

is recommended over a more rigid type. In other cases, timber structures, properly treated with preservatives, will permit a long enough useful life for obsolescency to require a new design. The problem is to design and install a facility within the approved budget appropriation, bearing in mind the useful intended life of the facility during which time maintenance costs will be kept to an economic minimum.

Following are a few maintenance functions that are practiced in harbor operation.

MAINTENANCE DREDGING

This can vary considerably in operating a small craft harbor. Many factors affect the unit dredging cost, but one of the most important is location and size of disposal areas.

Disposal areas - As harbor property develops, these areas become scarce. Then the dredged material is placed on beaches, where the material finds its way bayward to once again shoal the required water depths. Disposing of material only during high tides, is practiced so that the sea level will act as a dike to prevent the material from flowing back into the cut. This raises the cost as operating time is limited by the fall of the tide. Often the beach is not deep enough in land extent to warrant dike construction with bulldozers. If neither practice is desirable, the material must be barged to sea - which is expensive. For maintenance around individual boat slips, small barges carrying one hundred cubic yards of dredged material per trip are very useful - where the best disposal area is the open sea.

Small grain size and light weight dredged material can cause problems by being very difficult to contain as fill. Much of it is lost in suspension in the pump discharge water through the drainage pipes. Ordinary beach sand, if not contained by a dike or sea level, approximates a one on twenty slope when placed hydraulically. The coarser the grain size, the steeper the slope.

Problems also occur when placing fill on soft muddy ground. With the weight of disposed material increasing, a mud wave begins to flow bayward as the mud is displaced by the fill. This has been used to advantage to rid the filled area of an unstable base, but necessitates eventual removal of the mud - by some method. Where to put the undesirable mud is the main problem. It is easily dredged, but confining it while placing it results in a mud hole that has practically no soil bearing value. In cutting for the desirable beach slope in this material, it is necessary to overcut the slope and backfill with clean sand.

Common shoaling problems - One of the most common and costly of these problems is shoaling of harbor entrances. This is caused by littoral sand drift which is trapped by the breakwaters or jetties. As the trapped sand increases it builds around the entrance and deposits

in the breakwater lee or else sifts through the rock breakwater or jetty. This shoaling effect can be decreased if the tidal prism of the harbor is sufficient to cause currents that will scour the entrance to keep it clean. Making the breakwater or jetty more impervious to sand infiltration may help, although in time the sand will build around the end into the entrance. Another method is to bypass the sand, past the entrance, by dredging. If the entrance is trapping sand the beach in the down drift direction, without any other source of sand, will erode. All of these are factors to be considered before harbor construction commences. However, in many cases, it has become an operational problem.

Another shoaling problem is caused by pier and float installations. If sand is moving past a point on the shoreline, any structure will tend to cause a lee and the moving material will deposit to form a shoal behind the structure. This is particularly true if the structure is solid in form and parallel to the shore lengthwise. The longer and closer to the shore the structure is, the faster and larger the shoal forms.

If storm drainage must run down a beach slope before entering the water, it will scour out beach material that will build a shoal bayward. To eliminate this, the drain should be carried bayward to a headwall, so that drainage will run directly into the bay waters at all tides.

Types of dredges - Maintenance dredging requires two types of equipment. A cutter head is best to cut to unobstructed channel project depths. However, around slips and piling, the hydraulic suction dredge is preferable. In this case, the cutter head might damage these installations. Also the suction dredge is more maneuverable and less costly to operate on small jobs which are prevalent around boat slips.

Sounding equipment - For short sounding ranges not exceeding 800' and including beach slopes, use of a tally reel line marked off in tens of feet is the handiest way to locate the sounding positions. A 6 lb. lead line, marked off in feet, is used to obtain the depths. If the ranges are longer and channel navigation is heavy, the use of a recording fathometer is recommended. Ratheon produces a portable set, the 1373 type recorder which can be easily mounted on a skiff. Sounding positions can be determined by sextant angles from the sounding boat or with transits from the shore.

REMOVAL OF KELP BEDS FROM CHANNELS

Kelp grows on rocky ground. The kelp holdfasts or fingers attach themselves firmly and have even pulled up their rock base to the surface before breaking loose. I had been advised that if sand was deposited over the holdfasts the kelp would die and disappear. However, this was not the case in the entrance channel to Newport Harbor. Kelp beds had been growing larger each year, so that navigation was being affected. Investigation proved that ordinary kelp cutting 3 or 4' beneath the surface as done commercially would only stimulate the growth. It was

deemed advisable to cut the kelp off at ground level, which was over 20' below the water surface. A diver was hired to do this job. As he cut the kelp, he sank his 2' long knife blade into sand without striking rock. Yet the kelp was thriving in the area. Since he completed the job over 6 years ago the kelp has not come back to interfere with navigation.

SUBTERRANEAN INVESTIGATIONS - THEIR USEFULNESS AND LIMITATIONS

The more data that can be obtained of the subterranean stratas, the less will be the contingent cost of a dredging or pile driving project. One type of investigation practiced over the years is by test hole boring. Boring and lab analysis techniques have been perfected, so that a complete picture can be gained of the stratas bored. However, one of the most important phases of determining the underground condition is the selection of the test hole locations and their number. Ground conditions can change from spot to spot and readings of holes bored may be misleading for gaining a comprehensive finding. Boring is expensive and if the area to be surveyed is extensive, other means of determining the soil structures may be advisable. Geophysical seismic surveys can cover much ground in a short time and correlated to a few test holes, can convey a good picture with less cost than many test holes could do. The principal points of seismic surveying are these. Blasting charges are set off at known points at a precise signal. Sound detectors are strung out on known locations to pick up the shock waves rebounding from the underlying stratus. These recorded echoes are timed. The more dense the stratus, the faster will be the return signal. These signals are calibrated as to velocity, to determine the nature of the subsurface. Seismic surveying is adaptable for hydrographic work as well as on dry land.

GROIN INSTALLATIONS - NOT ALWAYS THE ANSWER TO EROSION

Too often when erosion is cutting away the shoreline, the first remedy considered is the installation of groins to hold or build back the beach. However, there are times when groins are not the answer and in fact may increase erosion. Two pertinent facts must be in evidence before any groin will be effective.

1. There must be a source from which comes the beach material to be trapped by the groin, and

2. There must be a predominant direction to the littoral drift of material passing the groin location.

If this is the case, and the groins are properly designed and installed, the erosion should be decreased.

PREVENTION OF CHANNEL ENCROACHMENTS

This problem must be continually watched and prevented if unwarranted. Pierhead and Bulkhead Lines once established should be

followed. If they are not practical in application in certain areas, they should be revised so that they can be used as intended - PIERHEAD LINE, to define the bayward extent of any open structure; BULKHEAD LINE to define the bayward entent of any solid fill. To be practical in setting these lines, consideration should be given to the type of use to which the shoreline will be put, as well as the clear width of the channel to be maintained. In the conventional boat slip installation a minimum one and one half feet of water should be under the pontoon at the shore end, to prevent grounding during wave action.

Use of vertical view aerial photographs to desired scale is recommended to study channel encroachment and shoreline changes.

TRAILER BOAT LAUNCHING

The tremendous increase in trailer boat craft has caused a demand for launching facilities. In the case of established harbors that are completely developed, this has presented a real problem, as the necessar space for launching and trailer parking is not available. Crane launching and multiple vertical parking space is the answer here. Where undeveloped space is available, the launching ramp has advantages.

1. Many boats can be launched simultaneously.
2. Ramp launching is less hazardous than crane launching.
3. Maintenance costs are less if the installation is correctly installed.
4. There is no possibility of launching cessation due to a mechanical failure.

A convenient ground slope for a launching ramp is 10 to 1. A durable ramp surface is a mixture of sand and shell that can be packed by truck tires rolling over the surface.

CALIFORNIA'S PROGRESS TO OVERCOME HARBOR SCARCITY

The problems stated above can be remedied by efficient harbor operation. However, the basic problem in California is the scarcity of harbors. Along its 1200 miles of coastline exposed to the Pacific Ocean, only San Francisco Bay and San Diego Bay are naturally protected harbors. The remaining harbors have necessitated expenditures of millions of dollars through dredging and construction of protective breakwaters or jetties before becoming safe havens for vessels of any size. The East Coast of the United States is naturally blessed with hundreds of protected bays and inlets due to its coastline of submergence over the past era. The coastline of California being a shoreline of emergence is lacking these natural barriers to ocean waves. Consequently, harbors of refuge are scattered far apart and harbor facilities here are far behind the public demand. Due to the great expense involved, those harbors that have been constructed have taken years of effort on the part of many people before becoming a reality. In 1947 the Corps of Engineers made a survey, and a "Report on Preliminary Examination of

the Coast of Southern California with a View to Establishment of Harbors for Light Draft Vessels", with an attempt to locate such harbors approximately every 30 miles apart along the coast. The Korean War interrupted the survey before completion and it is still unfinished.

It is difficult for local communities to raise the total cost of a protected harbor and it is almost as difficult to obtain aid from the Federal Government for this purpose. Realizing these facts, a large group of harbor minded people, mainly within the organization of the California Marine Parks and Harbor Association, have worked hard for the past several years to organize within the State Government an agency which could negotiate as a central body with the Federal Government to aid localities in developing their feasible harbor sites.

Establishment of California State Division of Small Craft Harbors - This year two great steps were taken toward small craft harbor development in California when Governor Knight signed into law

1. a bill creating a State Division of Small Craft Harbors, and,
2. a bill appropriating $100,000 to be adminstered by the Division, for making loans to local jurisdictions for planning feasible small craft harbors.

General policies for the guidance of the Division are vested in a five-man Harbor Commission appointed by the Governor - with the advice and consent of the Senate. Members of the Commission serve without compensation, but may be reimbursed for actual and necessary expenses incurred in the performance of official duties. A Chief has been appointed by the Commission to head the staff of the Division. A Small Craft Harbors Revolving Fund has been created to support the Division and also to be used for loans to local agencies for planning harbors. For construction loans, specific appropriations must be made by the Legislature.

The enacted law states that money loaned from the Revolving Fund must be repaid in full within 10 years, such repayment to include an interest rate that could be derived by investing the total deferred payment at the interest rate prevailing for legal state investment.

Private enterprise to aid Small Craft Harbor Development - There is evidence that private enterprise, once basic protection and dredging is completed, will undertake to develop the needed facilities such as slips, lockers, boat launching, repair yards, and retail sales business. This development, along with sound State and Local planning, should show definite progress during the next few years, in solving the problem of shortage of small craft harbors in California.