YACHT HARBOURS IN THE UNITED KINGDOM

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ABSTRACT

The authors describe the introduction and development of commercial yacht harbours in the United Kingdom. In the case of the south and west coasts where there is a high mean spring tidal range of up to 8 metres, this has resulted in the provision of enclosed basins, provided with either some form of gate or sill to retain the water. These are described, with typical examples. Recent developments in the design of sector gates are reviewed.

INTRODUCTION

In this paper a yacht harbour means a harbour designed for yachts, and a marina means a yacht harbour combined with an integrated residential development, although these distinctions are not always observed. Yachts, in accordance with the PIANC definition, are taken to mean pleasure craft, either sale or powered, over 8 metres in length. Taken overall, about two thirds in U.K. are sailing yachts and one third are power boats. Few craft in U.K. exceed 12m to 15m overall length.

A yacht harbour provides protection from wave action, permanent access to berths and to adjacent deep water sailing or cruising areas, either the sea or a river/canal with sufficient navigable depth at all times. This is an ideal which is not always attainable because the costs involved may be unacceptable.

"Dry" yacht harbours, which provide land storage and launching facilities for small pleasure craft, are not discussed.

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DEVELOPMENT OF YACHT HARBOURS

About twenty years ago the growth in recreational sailing led to a shortage of moorings in popular sailing areas along the south coast of England and the development of commercial yacht harbours. Fig. 1 shows that in 1966/7 there were 17 commercial yacht harbours with access to tidal waters, concentrated in the south-east of England. In 1979 there were 63, the locations being shown in Fig.2.

Fig.1 Yacht Harbour locations, 1966/7

Fig.2 Yacht Harbour locations, 1979

Yacht harbours tend to be located in the south-east of England, within reach of the London conurbation. Popular sailing areas along the south coast are shown in Fig. 3.

Some sheltered rivers, for example the Hamble River, are so crowded with moorings that the navigation authority has put a limit on numbers. Few berths are vacant in the yacht harbours shown in Fig. 3 and most have waiting lists. In other, less popular areas, this is not the case and occasionally berths are advertised as being vacant.

The number of berths in a yacht harbour averages about 250, except for the two biggest harbours at Chichester and Brighton, which provide about 1,000 and 2,000 berths respectively.

With the introduction of low maintenance, glass reinforced plastics (G.R.P.) hulls it is no longer essential for yachts to be taken ashore for winter

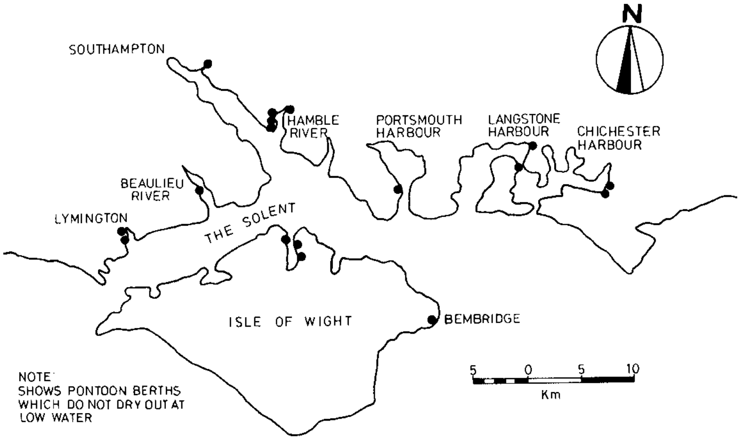


Fig. 4 Popular sailing areas - south coast

storage and most are kept afloat all year, apart from a scrub and application of anti-fouling in the spring.

BERTH CHARGES

There is no standard method of charging the yachtsman for his berth in a yacht harbour. In most cases the cost is expressed in pounds sterling per metre length per annum, on the assumption that the owner will keep his yacht in the marina all year. Typical rates, current in May 1982, are given in Table 1.

TABLE 1

TYPICAL BERTH CHARGES, MAY 1982

Location	Charge per metre
R. Hamble, Hampshire	£119
R. Thames, London	£53 to £66
R. Medway, Kent	£68
R. Crouch, Essex	£49 to £54
R. Orwell, Suffolk	£63
Poole Harbour, Dorset	£108
Falmouth, Cornwall	£75

COASTAL ENGINEERING ASPECTS

The first yacht harbours involved providing pontoons in a river, which replaced trot moorings, or mud berths, and gave sufficient depth for yachts to remain afloat at all stages of the tide.

When the river sites had been fully developed in popular sailing areas, it was necessary to look at coastal sites without natural wave protection. These can be developed either as tidal basins with surrounding breakwaters or as enclosed basins provided with a sill or a lock. All these solutions are expensive as they involve substantial civil engineering works as well as the basic pontoon accommodation provided at river sites; only a handful of yacht harbours come under this category at present because of cost constraints. They represent a challenge to the civil engineer because they present the same engineering problems as commercial ports but the investment is limited to a tenth (or less) of the cost. There are examples at Brighton and Poole, which have surrounding breakwaters with no entry restrictions, and at Chichester Yacht Basin and Ramsgate, which each have a locked entrance.

BREAKWATERS

Until recently the cost of infrastructure items, such as breakwaters, had to be borne by the developer. Grant aid is now available from EEC funds and from the British government for schemes in defined areas of Scotland. Two harbours have floating breakwaters but only one has been successful (1); the remaining few have fixed breakwaters. Examples from two ends of the scale are shown in Fig. 4. Fig. 4(a) is the breakwater at Brighton Marina, which is fully exposed to storm waves in the English Channel, whereas Fig. 4(b) is the one at Poole Harbour Yacht Club Marina, drawn to the same scale, which is in a relatively protected location.

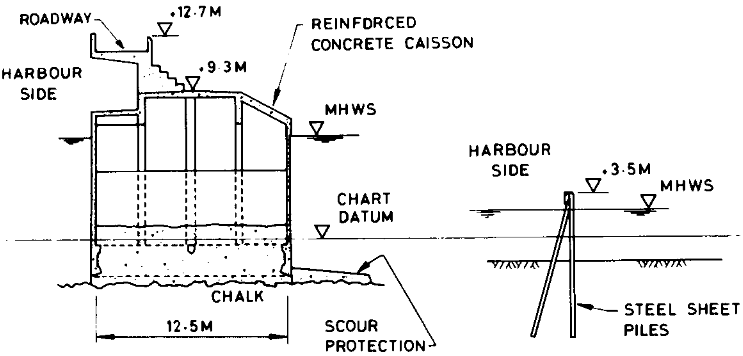


Fig. 4a Brighton Marina

4b Poole Harbour Yacht Club Marina

Fig. 4. Types of breakwater

The Brighton Marina breakwater, designed for about 5m waves, uses circular concrete caissons of the type used for Hanstholm harbour in Denmark. This type of construction was selected because the giant crane used for transporting and placing the caissons in Denmark was up for sale. The breakwater design was tailored to enable the crane to be reused at Brighton.

The Poole Marine breakwater, designed by the authors' firm, represents the other end of the scale. Although Poole Harbour is fully enclosed and land locked, apart from a narrow entrance from the sea, it is one of the largest natural harbours in the world. Wave action within the harbour from local fetches produces waves during the winter months approaching 1m, depending on the location. At the marina site the breakwater, which has a vertical face of continuous light steel sheet piling, was designed for a 50 year maximum wave height of 1.2m. Horizontal wave forces are resisted by inclined steel tube piles which are bonded to the sheet piling by means of a continuous reinforced concrete capping beam.

ENCLOSED BASINS

The need for enclosed basins arises from problems with tidal range and/or suspended silt load in the water. In the U.K. a mean spring range of about 4m can be considered as low, with 8m as a high value. This is not the highest; in the Channel Isles it reaches about 10m.

At coastal sites with a high tidal range the volume of material to be excavated or dredged to provide a basin is considerable. Capital costs can be reduced by partial or full control of water level in the basin. Set against this is the disadvantage that yachts do not have free access to the basin at all stages of the tide. There are however various means by which this disadvantage can be minimised and these are discussed below.

BASINS WITH FIXED SILLS

Partial control of water level can be achieved by providing a fixed sill around the basin so as to retain enough water at low tide to prevent yachts from grounding. Passage over the sill is only possible for an hour or two on each side of high water depending upon the tidal range. The principle is illustrated in Fig.5.

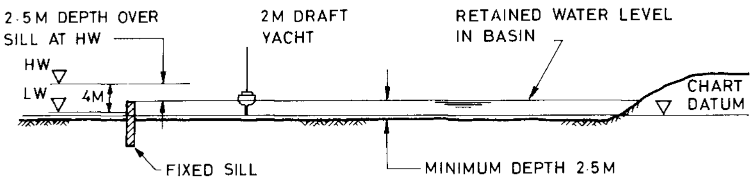
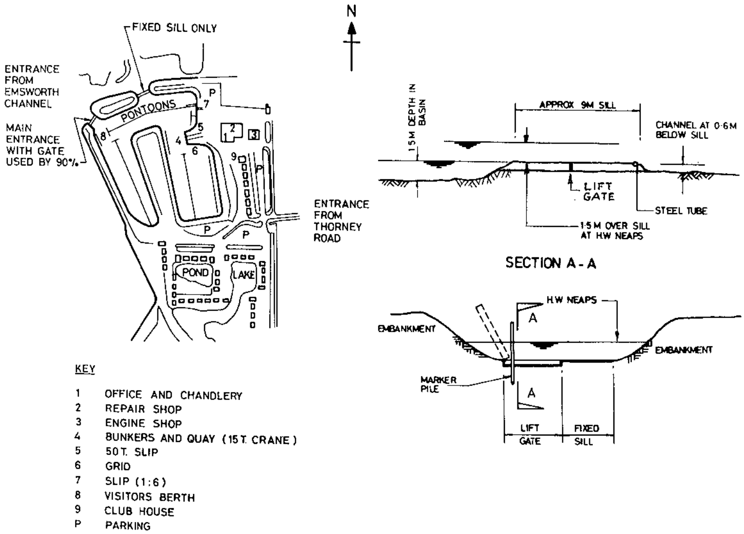


Fig.5. Basin with fixed sill

Where wave protection is needed the basin can be enclosed by an embankment with a gap in which the sill is installed. Emsworth Yacht Harbour with 250 berths is a typical example; its layout is shown in Fig. 6 (a). The basin is enclosed by banks of dredged spoil, the sill consisting of undisturbed material. Puddled clay is used as a watertight lining to the sill, which is shown in cross-section in Fig. 6 (b).



6a Layout 6b Sill Detail

Fig. 6 Emsworth Yacht Harbour

As the lifting gate, shown in Fig. 6 (b) is not working now, all the sill is fixed. The impounded depth is 1.5m.

The sill level was chosen to give 1.5m depth over the sill at lowest (i.e. neap) high water. Craft drawing only 0.9m can cross the sill for $2\frac{1}{2}$ hours each side of high water.

Another example, this time of a natural rock sill, is in Guernsey, at the Channel Islands Yacht Marina. The yacht harbour, which has pontoon berths for 150 craft, was made from a former 18m deep stone quarry by blasting a channel to the sea. The sill is undisturbed rock, and is shown in Fig. 7. The sill level has been chosen so that there is 2.8m of water at half tide, which gives a good duration of access. This is a consequence of the very high tidal range in the Channel, which accounts for use of basins with sills in several French yacht harbours in the area.

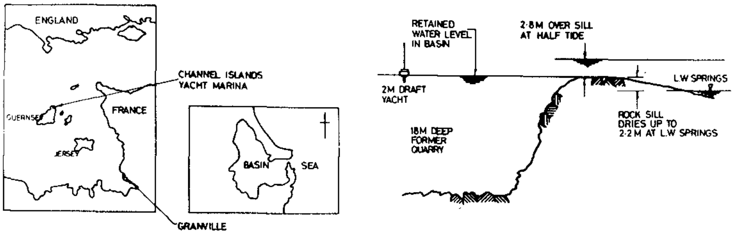


Fig. 7 Channel Islands Yacht Marina

This limitation leads to a fairly recent development - the use of a moveable sill - which goes some way to solving the problem. This arrangement is described below.

BASINS WITH MOVEABLE SILLS

Fig. 8 illustrates the principle of the moveable sill. When the level of the rising tide equals that of the retained water in the basin, the gate is lowered to give an immediate increase in depth. Movement of the sill is controlled automatically by a float system which responds to changes in tide level.

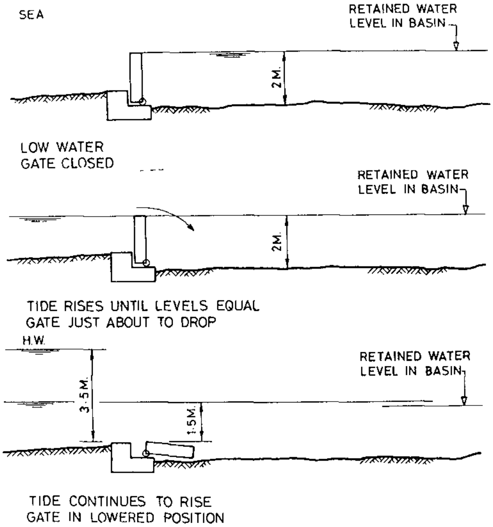
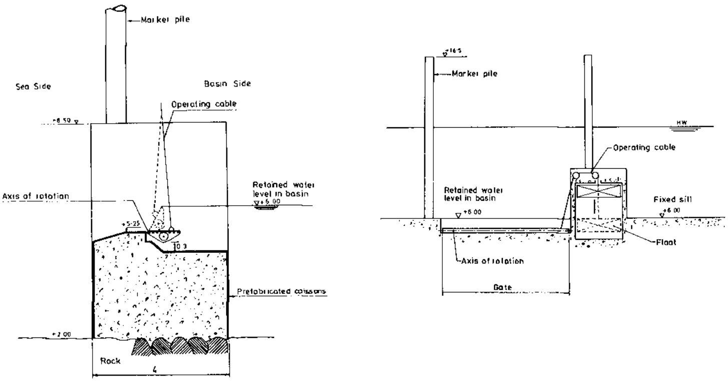


Fig. 8 Moveable Sill

Moveable sills represent a most useful facility for sites with high tidal ranges as they extend the time during which yachts can enter or leave the basin. They are cheaper than a lock and provided the resulting restrictions on yacht movements at mid tide and below are accepted, they should find further application in the U. K.

The first U. K. installation has been constructed at St. Helier Marina in the Channel Isles. An earlier example, but this time on the French coast, is at Granville (location shown in Fig. 7). The principle of the operating mechanism is shown in Fig. 9.



9 (a) Gate detail 9 (b) Operating principle

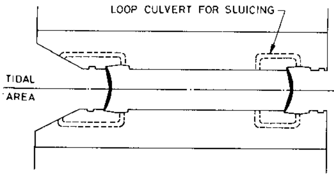
Fig. 9 Moveable sill - Operating Mechanism

BASINS WITH TIDAL GATES

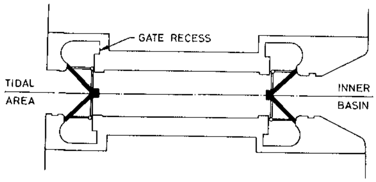
There are a few yacht harbours, usually conversions of commercial docks, which have single gates which can be opened for an hour or so each side of high water. Although inconvenient this restriction is accepted. Ramsgate Yacht Marina in Kent, with 500 berths, is a good example. It is popular with yachtsmen because it gives the shortest crossing to France.

BASINS WITH LOCKS

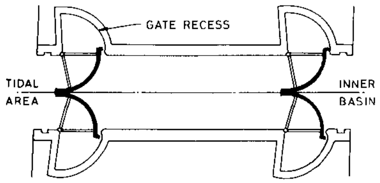
A few former commercial docks with conventional lock access have been adapted for recreational use. The locks are of the mitre gate type illustrated in Fig. 10 (a), which are much longer than are needed for pleasure craft and slow to operate. The sector type of gate, illustrated in Figs. 10 (b) and 10 (c), has been developed in U. K. to reduce delays.



10 (a) Mitre gates



10 (c) Delta sector gates



10 (b) Curved sector gate

Fig. 10 Types of Entrance Lock

DEVELOPMENT OF THE SECTOR TYPE LOCK GATE

At sites where the installation of a lock cannot be avoided, the provision of sector type lock gates gives rapid lock cycle times and, at suitable sites, a free-flow period when both sets of gates remain open. The first installation in U.K. was at Chichester Yacht Basin (1,000 berths) in 1966, shown in Fig. 10 (b), followed by Brighton Marina (2,000 berths) in 1978 shown in Fig. 10 (c).

Both installations were the responsibility of the authors' firm. The development of the cheaper flat faced "delta" gate from the curved type used at Chichester was carried out with the help of hydraulic model tests.

PONTOON LAYOUT AND CONSTRUCTION

Floating berths using pontoons are normal in U.K. Yacht harbours where craft moor end-on to a quay (i.e. Mediterranean fashion) are rare owing to tidal variations. Main piers are normally provided with "fingers", as illustrated in Fig. 11.

In the earlier marinas pontoons were constructed on a "do-it-yourself" basis using timber superstructures supported on oil drums or steel tanks. Current U.K. practice is to use expanded polystyrene as the buoyancy medium, in association with steel, timber or concrete superstructures.

Pontoons are located in position generally with vertical piles, but some are secured by chain moorings.

Increasing sophistication of services has meant that the provision of space for pipes and cables has come to dictate the design of pontoons. Electrical

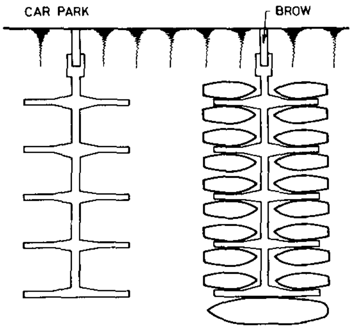


Fig. 11 Berth Layout

power outlets are a usual requirement in most new yacht harbours, as well as water and sometimes telephone services. Provision of firefighting equipment is extremely important.

Until recently no provision has been made for discharging sewage from holding tanks aboard. The first installation in U.K. was completed recently and with recent stricter legislation on pollution, more yacht harbours in U.K. will be providing this service.

References

1. McGregor, R. C. and Gilbert, C.H.G. (1983). Floating tyre breakwaters: a case history. Proc. 18th Int. Conf. on Coastal Engineering.