

P. S. It may be problematical till the flank pier is far advanced, whether it may be better to cut off the point of the rock marked I K. Fig. 2. by the dotted line or not. It will undoubtedly render the passage in more perfectly clear if cut away; but as it may tend to catch the swell that will in some degree roll in between the pier head G and the point of the rock H, this operation is left till the effect of the flank pier is seen.

EXPLANATION of the Plan, Fig. 2. Plate 6.

- A B C The line to which the rocks are proposed to be cut away.
 D E The present pier as now terminated.
 E L The extension as at first proposed.
 F G The interior or flank pier as now proposed.
 G H The opening between the pier head and the nearest point of the platform rocks, being about 100 feet.
 I K A line in which that point of the rock may be cut off, in case it shall be found useful when the effect of the flank pier is seen.
 N. B. The Roman figures shew the soundings in feet at low water mark.
 N Comptroller's house. O lime troughs.
 Fig. 7. (Plate 5.) A plan of the intended pier F G in Fig. 2. Plate 6.
 — 8. Elevation of the same.
 — 9. Section of the same.
 A B Is the breadth of the pier upon the rough ground basement 40 feet.
 C D The breadth of the rough ground basement at about one foot above low water, 32 feet.
 E F The base of the pier at the bottom of the freestone work, 27 feet.
 G H Shews the top of the cap or platform of the pier, 18 feet.
 a b Fig. 9. the supposed surface of clay or hard matter.
 c d Supposed surface of the sand.
 X Y Z Fig. 8. The terminating pillar of the parapet capped with three circular stones, the two upper ones are supposed to be each single stones, the lower one of 2, 3 or 4 pieces, as most convenient, the rest of the pillar to be built as the outside of the parapet.
 L N Fig. 7. shew the stairs inside the pier head.
 O P Q R Shew the manner of forming the cap of the pier, being terminated with dovetailed stones in the manner of the Edystone, to bind the cap together.
 M A post or pillar for warping vessels into and out of the harbour.

DIRECTIONS

DIRECTIONS to Mr. GWIN, for the execution of the interior or Flank Pier for completing of the interior Harbour of Port Patrick.

THE middle line of direction of the base of this pier runs from a point about 45 feet from the westernmost termination of the top of the present pier, measured inside toward the east to another point about three feet from the southwest angle of the platform, measured along the south side, also toward the east, which line of direction will be nearly N. E. by the compass; and as the width of the pier at its base will be 40 feet, it will be proper to fix up leading marks from the present pier to the shore parallel to the above mentioned middle line of direction, at the distance of 20 feet on each side of it, so that a person standing at either end of these leading marks may be able to direct a person on board a vessel afloat, to drop stones in those lines, which are to form the extremity of the base.

It will be proper to have the stones so to be dropped (which are to be large pieces of rough rocks) suspended by tackles in slings, yet not to hook immediately by the slings, but by a loop made of as many turns of marline or rope yarn as will hold it, and then by cutting the loop when the stone is in its proper position, it will be sure to be dropped in the outline. The stones to form the internal part may be any how tumbled overboard, so as to be within the area formed by the outlines.

It is supposed that the first and perhaps the second set of stones so dropped will bury themselves in the sand, and the sooner or later according as there is more or less surge of the sea breaking upon the place where they are deposited; but notwithstanding the first, second, or third set of stones disappear, yet by repeating the dropping they will at last ground themselves upon the clay or gravel, and those dropped upon them begin to appear above the sand, and at last above the surface of the water at low water. But it is to be noted, that every subsequent sett of stones dropped to form the outline, must be nearer the centre line than the preceding, so that a slope somewhat like that shewn in the section may be formed. As to the interior parts they may be tumbled in promiscuously, and if they begin to appear in some places before others, the defective places may be afterwards supplied. The more rough weather you have in the course of making this basement, the more solid your work will be, as it will be the more firmly or the more deeply grounded upon the harder matter, and prevent after settlements, and in case any part of the work settles after it has appeared you must still fill up the addition by fresh matter.

The

The diameter of the circular part of the head being two feet greater than the common breadth of the pier, the basement may be broader by one foot and a half each side, that is, 4.3 feet over all; and having determined the extremity of the basement of the head by cross marks at or about 88 feet from the nearest point of the platform rocks, this cross line with the others will be sufficient for dropping the foundation of the head in somewhat of a circular form, correcting it as you see it, for when you get the pier head to appear above low water, you then can mark off an actual centre and work by real lines.

As you have not said at what depth below the surface of the sand you found the clay, gravel, &c. I have supposed in the additional drawing, Fig. 7 & 8, (Plate 5.) that the sand lie three feet and a half below the surface of the water at low water, and the clay three feet and a half below the sand, so that from the solid matter to low water mark is supposed 7 feet; if it happens to be more in any or every part, the width of the ground tier of stones must be proportionably increased; if less, you may diminish it at discretion, but in general it is good to keep a good breadth upon the ground.

It is probable that at low water you will find the stones stuck in the sand, so that you may be able to borrow away your slings; but if you find the stones to bury themselves, you will save expense by procuring old cordage to make them of.

On supposition that the stones in still weather do not bury themselves, if you can at low water give them some assistance it may not be amiss; but at any event, the piling a weight of stones upon them will, with the aid of the action of the sea, cause them to settle, and at last to ground themselves.

Supposing this to be an operation that would occasion the foundation to go on for more than one year, the best way would be to carry on the work progressively from the rocks towards the head, as by that means every part would have time to ground, while the part beyond it was advancing; but as the whole at least of the basement is expected to be completed in one season, to give it all the chance possible of storms to make it ground, I am of opinion, that you should begin with the head, and go on to complete the rough basement between the head and the rocks, so as to bring the whole to a level about one foot above low water, and then go on with the upper works (the outsides of which are to be of scapped blocks) to proceed progressively from the rocks towards the head, for by this means the head, whose firm establishment is of the principal consequence, will have the greatest share of time to come to a firm bearing; and when you cannot on account of the tide work below, you may be employing the people in getting the work forward that is upon the rocks.

Your

Your first work will be during the winter to provide all the large rough pieces of rock you can procure, in order to make the rough basement, and as far as may be convenient to get them brought to the place.

In regard to the masonry of the upper works, as the turning of the head cannot be done otherwise than with stones upon their flat beds; and as I never intended this interior pier to be built otherwise than with the stones upon their beds, the distance between the head and the rock will be so short, that it will be hardly worth while to change the masonry; however, if you find any convenience in the diagonal way of working for the outside, you are at liberty to put it in practice.

The whole I propose to be built dry till you come to lay on the platform or top of the pier, after which you will proceed with mortar as usual. As the joints of the stones in turning the head of the pier will be radii, or pointed to the centre, and will have nothing naturally to retain them from getting outward but their own weight and the incumbent weight of the matter above, it will be proper to cramp them every third course, or otherwise to retain them to the more central parts by iron doggs. And by way of securing the platform or cap of the pier head, which will be the most apt of any other to get loose, and at the same time to make it a firm tie upon what is below, I propose the work thereof to be jointed dove-tail-wise in the Edystone fashion, as shewn in the additional design, Fig. 7. Plate 5.

If you find it adviseable by way of tying your work faster together to begin with mortar above high water, for some of the last courses next the platform, and can procure lime with pozzelana, I shall have no objection; but if this will embarrass the work, I do not hold it to be absolutely necessary.

Aufthorpe

6th January 1774.

J. SMEATON.

N. B. As the high and low water lines are not certain determinate heights, you are to be guided by the pier already done; the cap or platform of the flank pier, and the top of its parapet, being respectively of the same height as the present pier.

RAMSGATE HARBOUR.

(See the Plan, Plate 7.)

An Historical REPORT on Ramsgate Harbour, wrote by order of and addressed to the Trustees, by JOHN SMEATON, Civil Engineer, F.R.S. and Engineer to Ramsgate Harbour, 1791.

To the Trustees of Ramsgate Harbour.

SIRS,
THE following piece was begun last year by your order, principally with a view to inform the public of the improved state of Ramsgate Harbour, and of the Improvements that were in a way to be further brought about; as also of the unexpected difficulties that had occurred in the progress and actual execution of this long desired establishment.—Indeed the small length of time that it had been a Harbour, capable of fulfilling the purposes for which it was begun, had scarcely given opportunity to the maritime part of this Nation, and more especially to foreigners, to acquaint themselves with the advantages they might derive from the use thereof.

It is now somewhat more than ten years since Ramsgate Harbour was so far cleansed of sand and silt, as to be capable of taking in ships of superior draught of water and tonnage, to what appears to have been the object of Parliament in granting the act, as well as to the views of the original promoters of the undertaking; yet it was not till the winter before the present (January 1790), that the real practical utility of this Harbour appeared in full view, for it had so happened, that the same means that had been necessarily employed for cleansing it, (that is to say, for constituting it a Harbour), had subjected it to that kind of agitation and inquietude, which in general rendered it more eligible for vessels of burden, such as might very well have come in as to draught of water, to subject themselves to the wear and tear of their tackle, and the risk of riding it out in the Downs, than come into the Harbour till they had received some actual damage.

The quietude of the Harbour has at length in a great measure been happily effected, along with the other advantages, by the progress made in the construction of an advanced pier. This was only begun in the summer of 1788, and at Christmas 1789 was run out the length of 120 feet, that is nearly one third of its proposed length; which so

sensibly quieted the Harbour, that in January and part of February 1790, there were in it no less than 160 ships and vessels that came in for refuge, and to save the wear and tear of their tackle and furniture, all of which must otherwise have crowded the Downs.—Almost an equal number, for the same reason, came into the Harbour during the tempestuous weather of the past January.

It may however possibly seem to some, that the means now taking to quiet the Harbour may operate to render it less accessible: but this, when properly understood, will not appear to be the case, but so far otherwise, that in reality a ship will come in with greater facility; for the Harbour's mouth is in effect as wide as it was before the advanced pier was begun.—The original width of the Harbour's mouth, as intended, was 200 feet; the opening to be at S. S. W. The width ultimately fixed by the Trustees was 300 feet at S. $\frac{1}{2}$ E. but that width and position appear to have been settled at a time when the Trustees were apprehensive of the Harbour entirely choaking up with silt, if more inclosed, and not from any necessity of that width, merely for the sake of facility of entry; 200 feet clear opening being deemed a large sufficiency for the entry of an artificial Harbour, entirely raised out of the sea by the hand of man.

When the Harbour was formed, it was found that during all the time of full sea, a strong current sets almost right across the Harbour's mouth, that is, from west to east, which being a natural cause, cannot be diverted; a vessel therefore coming from the south, that is, from the Downs, were she to attempt to run into the Harbour, right across the current, would be carried eastward thereof, so as to miss it: it has therefore been an established maxim, ever since the Harbour was formed, and given out as a direction, for vessels to come in obliquely from the westward, and as close as properly may be to the west pier head; and this course, as marked out many years ago upon the plans of direction, will carry a vessel right through the present intended opening, betwixt the west head and the head of the advanced pier, which is full 200 feet in width, and she will always come in with the tide in her favour.

In consequence of your orders, in the course of last summer I made a considerable progress with this Report, intending to have completed it at leisure this spring, but if by being called upon more hastily than I had expected, it comes out less finished than I could have wished it, I have this only circumstance to plead in my excuse.

I remain, Sirs, &c.

J. SMEATON.

SECTION I.

ACCOUNT of early attempts towards a Harbour for the Downs, and of proceedings, inclusive of obtaining an Act of Parliament, for establishing a Harbour for that purpose at Ramsgate.

THE expediency of a Harbour for the reception of Ships in the Downs, has doubtless subsisted as far back as the increase of our trade and shipping has rendered it important; but the want of a situation strongly pointed out by nature, was probably the reason why we have not heard of any attempt towards it in the earliest ages.

In the time of King Edward 6th it is said there was an attempt to make a Harbour from Sandwich into the Downs, and that the evident traces of a canal, which still subsist in the level grounds, between Sandwich and Sandown Castle, are the remains of that attempt. It is also said, that commissioners were appointed by Queen Elizabeth in 1574, for taking a survey of Sandwich Haven, and to give their opinion as to the making a better Harbour near Sandown Castle. Also that in 1706, a plan, report, and estimate, were delivered by persons appointed to survey and estimate the expense of a new Harbour from Sandwich into the Downs, accompanied with a certificate of the Flag Officers, and many commanders of the ships of her Majesty's royal navy, who then gave it as their opinion, that such a Harbour might be of general advantage to the public.

It seems also that petitions were presented to the Honourable House of Commons, praying for a new Harbour near the Downs, April 2d 1736; and that a committee appointed by the House heard evidence upon the matter thereof; and that in consequence a plan and survey of the Downs and coasts adjoining, were undertaken by Mr. Labelye, afterwards Engineer to Westminster Bridge, at the expense of Sir George Oxenden, Baronet and Josiah Burchett Esquire, then members for the town and port of Sandwich; a copper plate of which was published in 1737-8, in which he exhibits a scheme for sheltering ships from the Downs by a navigable canal and basin, in the very direction of the Old Cut above mentioned, and by sluices to join the river Stour.

In April 1744, the House of Commons presented an address to the King, "that he would give directions to proper and skilful persons, to view the Haven of Sandwich, and examine whether a better and more commodious harbour may not be made into the Downs near Sandown Castle, fit for the reception and security of large merchant ships and men of war; and to survey the said ground and shore; and also the river Stour, necessary

fary to cleaning and scouring the said Harbour when made; and to make an estimate of the charges and expenses thereof;" to be laid before Parliament the ensuing session.

In consequence of the above, an order was issued from the Admiralty, appointing the following persons to this business; W. Whorwood, John Redman, John Major, Thomas Slade, Charles Labelye, and R. Charles; who reported, that having made the necessary observations, "a better and more commodious Harbour, than the present haven of Sandwich, may be made from the town of Sandwich into the Downs near Sandown Castle."

They proposed to carry out two stone piers, each 2,096 feet in length from the shore, into twelve feet depth of water at low water; to have a clear opening between the heads of 300 feet; to narrow from that to 100 feet; and that the middle line should point S. S. E. $\frac{1}{2}$ E. by the compass; that is nearly S. E. by the true meridian, or S. S. E. as the compass now points. The estimate for this work was £.389,168. 13s. 2d. exclusive of the value of the grounds to be purchased.

The report being referred to a committee of the whole House of Commons; after examining evidence of pilots and persons best skilled in the navigation of the Downs, the committee came to a resolution, dated the 26th February 1744-5, importing, that it appeared to them, "that a safe and commodious Harbour may be made into the Downs near Sandown Castle, fit for the reception and security of large merchant-men and ships of war of sixty and seventy guns, and be of great use and advantage to the naval power of Great Britain.

Why this great work was suspended, after being brought this length, does not now distinctly appear; but if we consider the largeness of the sum estimated, for a work supposed to be undertaken by Government, at a time when we were at war with France and Spain, we perhaps need not be at a loss to judge.

The whole affair seems however to have lain dormant for some time, till the public was roused by a violent storm which happened on the 16th December 1748, wherein a great number of vessels were driven from their anchors in the Downs, and being forced upon the south coast of the Isle of Thanet, several found safety in the little harbour of Ramsgate.

This

This seems at once to have opened the eyes of the public, and caused them to be turned upon Ramsgate as the proper place for the reception of ships when in distress from bad weather in the Downs; and accordingly, the 8th February following, a petition was presented to the House of Commons, by several merchants of the city of London, owners and masters of ships, whose names were thereunto subscribed, amounting to 131, which was referred to a committee appointed to sit the 13th following; and on this day a petition was presented from the mayor, magistrates, freemen and inhabitants of Sandwich; setting forth the damage that would be likely to arise to the haven and port of Sandwich from the extension of piers into the sea at Ramsgate, which was referred to the same Committee.

In support of the Petition of the merchants, owners, and masters of ships, a great number of witnesses were examined, and to a considerable length: and the following points were fully and clearly proved, to the satisfaction of the Committee.

1st. That, in the said great storm of December preceding, a number of ships were actually forced into, and saved in Ramsgate Harbour, although then so small as to be scarcely capable of receiving vessels of 200 tons, at any time of tide; that pier having been only built and maintained by the fishermen of the place.

2d. That the winds in the Downs, whereby ships riding there are most apt to be annoyed, are from S. S. E. to S. S. W.

3d. That at Ramsgate, or near it, was not only the best, but in reality the only place, where any harbour could be built, that could be serviceable to ships in distress in the Downs, because Ramsgate was right in the lee of that road, with such winds as produced that distress; and at such a proper distance, that, after driving or breaking loose, they had time to get under sail, so that with a slender share of seamanship they could make a harbour if built there.

4th. That though this shore was universally flat, yet as it gradually increases in depth from the Cliffs towards the Downs, it was practicable, at a moderate expense, to carry out piers into six feet and a half water, at the low water of a middling spring tide; and that, according to the rise of the tides, there would be water enough from three-quarter flood to one quarter ebb even at neap tides, to carry in vessels drawing fifteen feet water, which, if full built, was supposed to be full 300 tons burthen.*

* I understand it can be made to appear that more than two-thirds of all the tonnage and value of shipping is carried on in vessels not exceeding 300 tons.

5th. That

5th. That when vessels break loose from their anchors in the Downs it is generally from three-quarter flood to one-quarter ebb,* during all which time the course of the current of the tide is to the North and N. E. which therefore would carry them right into a harbour at Ramsgate, so that by the time they got thither, it would be within an hour of high water.

6th. That the soil at Ramsgate being a chalk sufficiently firm to build upon, but yet so yielding that the keels of vessels readily make a dock for themselves therein; this, with sometimes a slight cover of sand, forms a proper bottom to lay full built ships aground upon at low-water; and even if sharp built, will, in case of necessity, subject them to the least possible damage; and indeed to little or none, if proper precaution be taken to lay them against a pier; nor can they suffer in the least, if a proper basin be constructed to lay them afloat.

7th. That in time of war merchant ships are built sharper than in time of peace; but that at an average more of the London traders are built full than sharp.

8th. That the great ships in the Downs are obliged to ride in a bad road to be out of the way of the small vessels, which commonly lie in the small Downs, and those small vessels being often ill-furnished with anchors and cables, frequently break loose, and drive upon the large ships, which then run foul of each other; whereby sometimes a whole fleet is set adrift; and in the opinion of Captain Conway (then an elder brother of the Trinity House) if a harbour were only made for the reception of ships of 200 tons and under, it would prevent nine-tenths of the damage that happens in the Downs; as he supposes all ships under 200 tons, waiting for a wind to proceed westward, would take shelter therein.

9th. That ships in Ramsgate Harbour may sail out of it with any wind, that would carry them westward out of the Downs; and even with a strong wind at east, or with a scant wind at S. E. by E. they can make good their course out of Ramsgate Harbour, by virtue

* This will appear clearly to be the case, when it is considered that they are the Goodwin Sands that constitute the Downs to be a road for ships. At low water those sands may be considered as a pier or break-water to all the easterly winds; and even at high water, it is too shallow over them to admit the great seas to pass, without being much broken and dispersed, especially in stormy weather. From the situation therefore of the Downs, these sands on one side, and the coast of Kent on the other, it is only the southerly winds that can annoy them, which also are much moderated by the proximity of the coast of France; and still more so, by the first part of the flood tide running southward, and meeting the seas; it is therefore not till the tide turns to the north (which is at or about three-quarter flood) that the combined force of wind and tide, makes the great effort to break the ships from their moorings.