

## CHAPTER 77

### FIELD TESTS ON TWO PERMEABLE GROYNES

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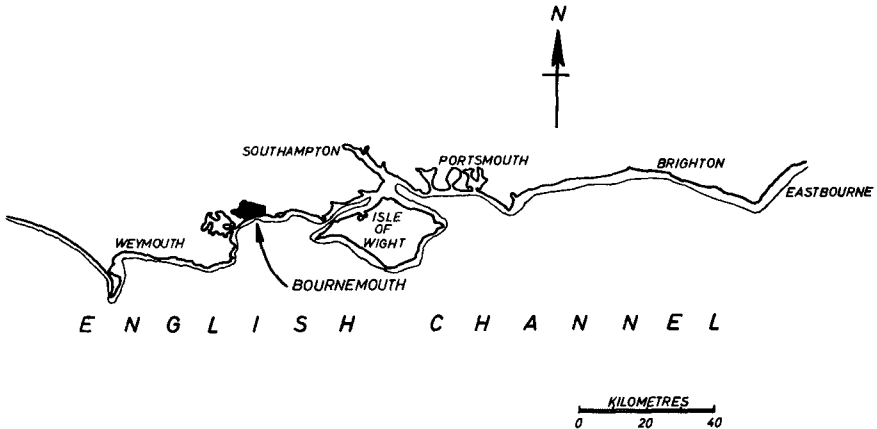
#### ABSTRACT

A section of beach on the south coast of England has been under surveillance for five years, from March 1966 until March 1971. During this period, two permeable groynes of the Makepeace Wood type were constructed. Beach cross-sectional areas and rates of accretion were compared before and after groyne construction. The groynes caused a build-up in beach levels updrift.

#### INTRODUCTION

Bournemouth is located on the south coast of England, see Figure 1. Because of its attractive beach it is a major tourist area. In recent years beach erosion has become a problem. To find a method of overcoming this loss of sand, the County Borough of Bournemouth have undertaken a number of sea defence schemes, advised and assisted by the Hydraulics Research Station, Wallingford.

One such scheme was the construction of two permeable groynes, in conjunction with Makepeace Wood Associates. This was in July 1968. The Hydraulics Research Station has measured beach profiles in the vicinity of the groynes at approximately 3 monthly intervals for 5 years; the first survey was in March 1966, almost 2½ years before groyne construction began, and the last was in March 1971, 2½ years after. This paper presents the results of these surveys.



**FIG 1 LOCATION**

#### DESCRIPTION OF BEACH

The beach, mean size of sand 0.2 mm, is backed by a seawall and promenade. As shown on Figure 2, the foreshore has a slope of about 1:15 between high and low water contours, flattening to a slope of 1:200. Varying between 100 to 200 metres offshore it steepens again to approximately 1:15. Further offshore, seabed slopes are relatively small.

The tidal range at the site is about 1.7 m on spring tides, and 0.6 m on neaps. Waves approach the beach from directions between south-east and south-west, with the dominant direction being south-west. The fetch is limited in most directions by the coast of France, but some Atlantic swell does reach the site via the English Channel.

#### DESCRIPTION OF GROYNES

The groynes were built to a design by Sidney Makepeace Wood, see Ref 1. Each consisted of a double row of piles, interlaced with precast concrete units, and capped by a flat deck which provided a working platform during construction and added to its structural stability, see Plates 1 and 2.

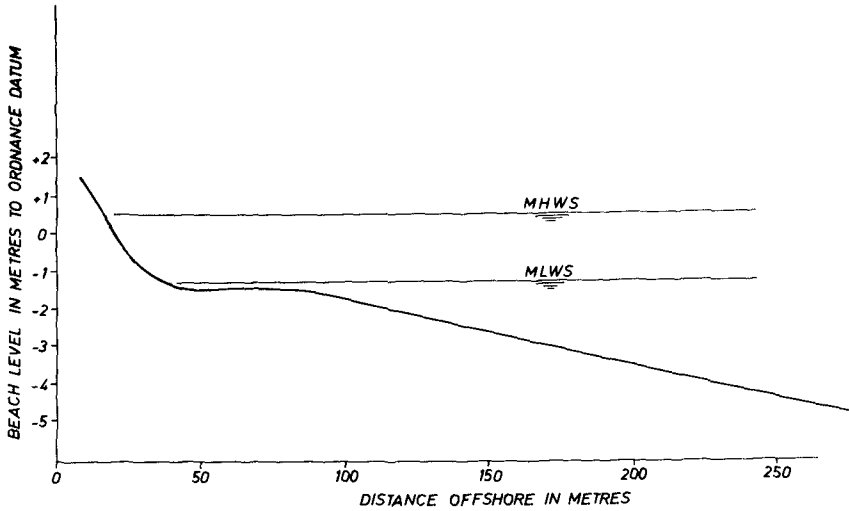


FIG 2 BEACH PROFILE

The longitudinal precast concrete units are castellated so that the groynes are permeable. The percentage of open area increases seaward as shown in Figure 4. The groynes were 190 m apart and designed to be 90 m long, although shortly after construction approximately 16 m of the seaward end of one collapsed. During the discussion of this paper at the 13th Coastal Engineering Conference a delegate reported the collapse of the seaward ends of a number of Makepeace Wood groynes in Jamaica.

#### DATA COLLECTION AND ANALYSIS

A general plan of the site is given in Figure 3.

On each of the 10 sections shown on this figure, beach profiles were measured at 3 monthly intervals, beginning in March 1966. In July 1968, groyne construction began. The surveys were continued until March 1971.

Beach volumes were calculated as shown in Figure 5. In order to obtain an estimate of the rate of erosion or accretion the data was subjected to regression analysis of volume on time. The slope of the regression line was then taken as the growth rate, summarised in Table 1.

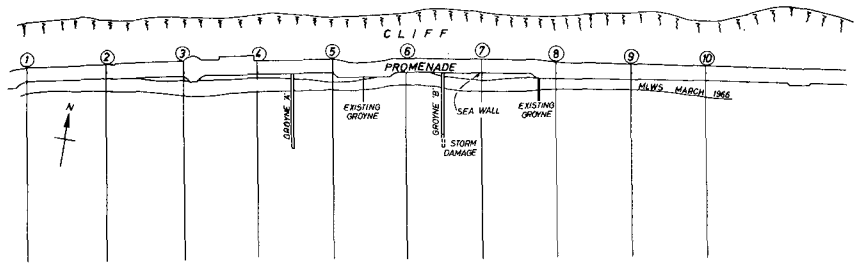


FIG 3 SITE PLAN

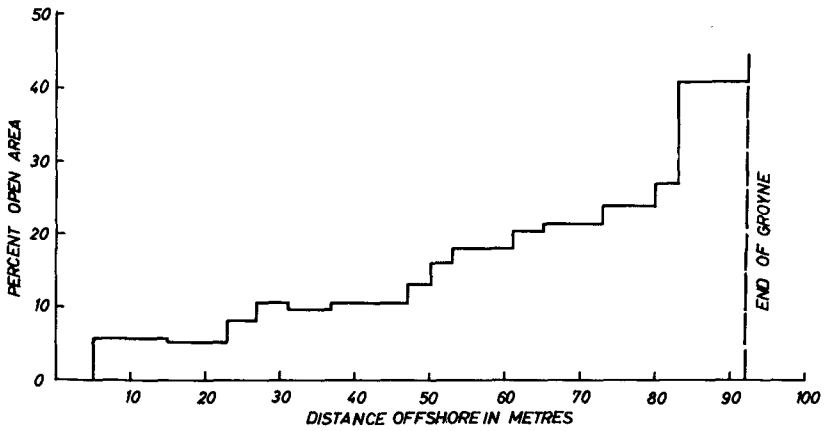


FIG 4 VARIATION OF OPEN AREA WITH DISTANCE ALONG GROINE

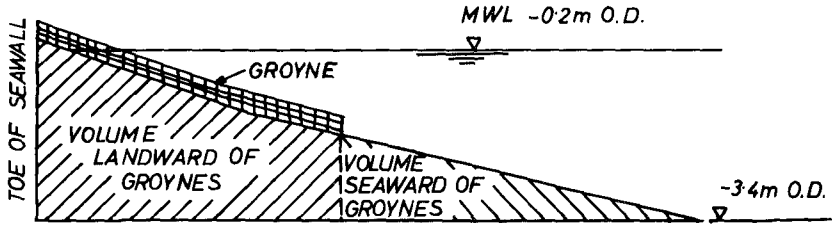


FIG 5 KEY TO CALCULATED VOLUMES

Of the 20 regression lines, it is significant that 14 showed an increase in slope following groyne construction. These increases were most marked landward of the groynes and updrift, Sections 3, 4 and 5. Although erosion downdrift was expected, Sections 6 through 10 showed some improvement as well, and it is possible that the beach as a whole would have accreted, but at a slower rate, if the groynes had not been constructed. Plate 3 shows the beach as it was before groyne construction, and Plate 4 shows it in the spring of 1971. The build-up in beach levels in the immediate vicinity of the groynes is marked; there appears to be little downdrift erosion. Figure 6 shows the changes in some typical cross-sections between March 1966 and March 1971.

#### CONCLUSIONS

There seems little doubt that the two Makepeace Wood groynes constructed at Bournemouth have resulted in a build-up of the beach in their immediate vicinity. Although erosion would be expected downdrift, it is not immediately obvious. Beach surveys are to be resumed.

TABLE 1  
 BEACH-GROWTH RATES BEFORE AND AFTER GROUYNE CONSTRUCTION

Section No.	Growth Rate in Cubic Metres/Metre Per Month			
	Before Groyne Construction		After Groyne Construction	
	Landward of groynes	Seaward of groynes	Landward of groynes	Seaward of groynes
1	1.54	-0.20	0.26	0.11
2	2.97	-0.65	0.97	0.30
3	-2.45	0.71	2.63	0.69
4	-0.60	0.06	3.01	1.11
5	0.36	0.60	2.75	1.44
6	1.65	0.57	2.03	0.12
7	-0.29	0.30	1.37	0.37
8	-0.31	1.13	0.92	-0.37
9	0.48	-0.42	1.44	0.63
10	-0.19	0.30	0.66	-0.24



Plate 1. General view of groyne  
 Plate 2. Detail of groyne construction

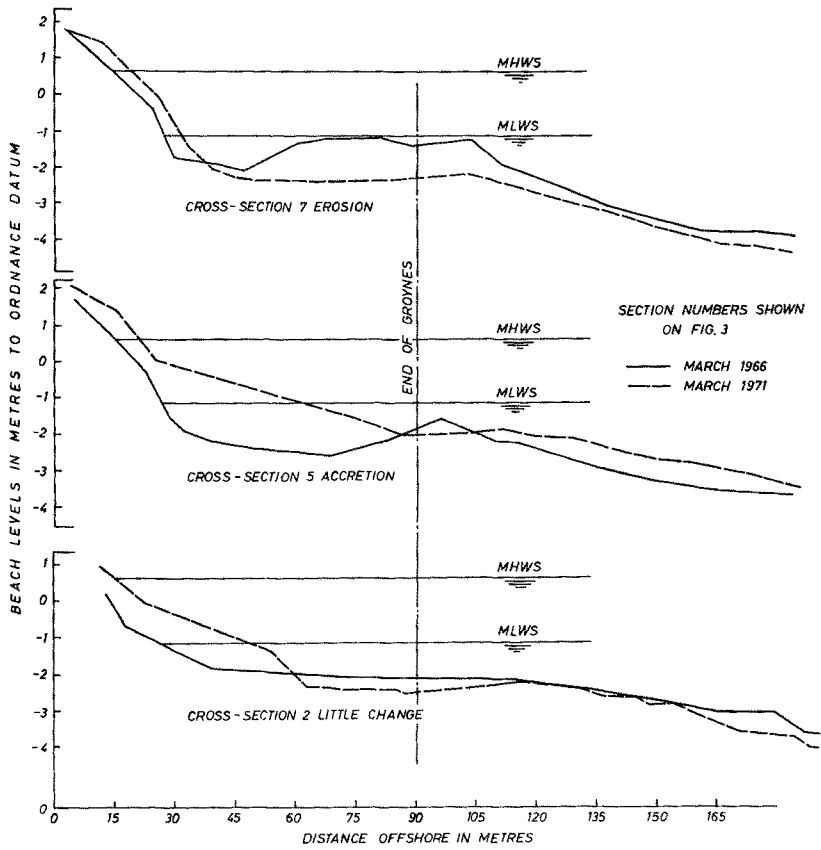


FIG 6 BEACH CROSS-SECTIONS



Plate 3. The beach before groyne construction  
Plate 4. The beach in 1971

#### ACKNOWLEDGEMENTS

This report is published by permission of the Director of Hydraulics Research, Wallingford, Great Britain. The authors gratefully acknowledge the help and co-operation of the Office of the Borough Engineer, County Borough of Bournemouth.

#### REFERENCES

1. MAKEPEACE WOOD, S. "Erosion of our Coastal Frontiers", Bulletin of the Associated State Engineering Societies, April, 1938, pp 32.