125/82

HERALD MAY 1ST. 1976

Slip plan: We pay

A BID was made on Wednesday to block a drainage improvement scheme to end landslip dangers at Encombe, Sandgate.

Shepway District Council decided to go ahead with the project — without asking property owners in the area to contribute towards the cost.

This brought protests from Councillor Cyril Lloyd (Cons., Folkestone) who wanted the plan reconsidered with a view to making the residents pay.

Councillor Claud Poll (Cons., New Romney) said it would be unfair to penalise those residents who had been prepared to make a contribution when some residents had been unwilling to assist.

The cost of the £65,000 scheme will be shared between Whitehall, Kent County Council and Shepway.

FOLKESTONE AND HYTHE
GAZETTE
Incorporating DAY BY DAY and WHAT'S ON

No. 1817 Tel. Folkestone 52231 Hythe 66667 WEDNESDAY, JULY 24, 1968. Registered at G.P.O. as a Newspaper. Postage 5d Pr

Boreholes to probe earth slips

COUNCIL AGREES TO PAY £1,000 CHARGE

BOREHOLES are to be sunk at Sandgate to try to establish just what is causing earth movement in the area and what further action will be necessary to prevent further land slips.

Folkestone Town Council decided at a special meeting on Thursday that the boreholes must be sunk and that it should pay the full cost of them, estimated at about £1,000.

It is thought likely that boring will reveal that a drainage scheme costing about £10,000 will be necessary for the Encombe area, but the question of who should pay for this work has not yet been settled.

There has been earth movement at Sandgate for hundreds of years.

It is thought that the latest slips, which began in 1966, are a follow-on to the last major slips in 1893.

At Thursday's council meeting there was some dispute as to who should pay for the £1,000 boreholes.

Councillor Jack Sainsbury, supported by Councillor G. F. Neame, moved an amendment that the householders in the Encombe development area should pay for the work.

But all other members of the council voted against this

Councillor Sainsbury pointed out that the slips were occurring on private property and the responsibility of remedial action should therefore lie with the private owners.

Advice

He suggested that the council could help the owners by offering to lend them the money for the work. If the council agreed to bear the cost it would be accepting responsibility for carrying out future works.

"I made requests some years ago for council houses to be built at Wilberforce Road and in Encombe Valley, and the reports at this time said these sites were not suitable for building," Councillor Sainsbury continued.

"These people who bought houses there must have taken expert advice and the responsibility for the land now must be entirely their own."

Councillor Neame said: "The responsibility must lie

CONT ON BACK

EARTH SLIPS: 'WATER PRESSURE BLAMED'

with the owners, developers and builders of property on this land, and with the people who made searches on behalf of the property owners."

Councillor P. F. Bushell replied: "If you do nothing you are going to negate your responsibility and you will be ignoring the job you were sent here to do.

"We as members of this council will at some stage or another have to take a decision on whether it is necessary for this work to be done or not. That decision cannot be taken without technical data, and we cannot obtain this data without sinking these bore holes."

Councillor Bushell went on: "If there was some disaster there, then we as a

CONT. FROM PAGE 1

council would have to accept some responsibility."

The Mayor, Councillor John Banfield, pointed out that once it had been established what work was necessary at Sandgate, then the cost of that work, he thought, would be apportioned between all property owners in the area, such as the council and the Ministry of Transport, which had an interest in the roads.

It would obviously be a matter for the district valuer to apportion the costs.

The town clerk, Mr. N. C. Scragg, told the council that before development had taken place at Encombe the developers had been told they must take necessary precautions.

NECESSARY

"The Halcrow report stated that if houses were not built on or near the 1893 slip then the houses would not behave any differently to houses to the east or west of the site," he said.

"This is really a question of trying to prevent or endeavouring to remove risk of any further movement. They think water pressure is doing this and if they remove the water pressure they will remove the risk of further instability.

"The Halcrow report suggests the bores are necessary to find out where the water is and what kind of drainage system is needed."

A report prepared by the town clerk and earlier submitted to the highways and watch committee stated that the council had very limited land drainage powers and no powers to carry out the suggested land drainage scheme.

It appeared, however, that the Kent County Council and the Kent River Authority might have power to carry out such a scheme. But owners of lands benefiting from the scheme would have to contribute towards both the cost and future maintenance.

Owners had a right to object to the scheme and a public inquiry could be called.

midnight that Mr. Ernest commercial traveller, of ne, thought he heard a

and went to the top of w a man, wearing a mask, e was then struck on the into his bedroom.

Friday by Mr. Michael Hyam, prosecuting four men, all of whom pleaded guilty to either burglary, theft or receiving in connection with the two offences committed on June 1 and 3 last.

The accused were Jesse Parsons, aged 19, a soldier serving in the Queen's Regiment, whose home is in Thanet Gardens, Folkestone; Michael Joseph Sullivan, 17, a soldier serving in the Catering Corps, whose home is in Bouverie Road East, Folkestone; Brian Douglas Coulson, 21, a plumber, of Boscombe Road, Folkestone; and Ian Chadwick McParlin, 23, labourer, of St. George's Place, Hythe.

Coulson had also pleaded guilty to driving while dis-

fants in the Hall; 12 noon Holy Communion (fourth Sunday only); 4 p.m., Holy Communion (first Sunday); 6.30 p.m., Evensong

Catholic Church, Ashley Avenue: 8, 11 a.m and 6 p.m., Mass

St. Martin's, Cheriton: 8 a.m., Holy Communion; 10 a.m., Parish Eucharist and Sunday School; 6.30 p.m., Evensong

St. Mark's Garrison Church, Shorncliffe: 8 a.m., Holy Communion, 10 a.m., Choral Communion; 11 a.m., Morning Prayer

Catholic Church, Guildhall Street: 8, 9, 10, 11.30 a.m and 5 p.m Mass

Baptist Church, Rendezvous Street: 10.45 a.m., Morning Worship; 6.30 p.m., Evening Service

Pentecostal Church, Harvey Street: 11 a.m., Communion Service; 6.30 p.m. Gospel Service

Cheriton Pentecostal Church: 11 a.m., Breaking of Bread; 3 p.m., Sunday School; 6.30 p.m., The Gospel Service

Full Gospel Mission (Assemblies of God), Foord Road: 11 a.m., Breaking of Bread, 6.30 p.m. Gospel Meetings

Church of Jesus Christ of Latter Day Saints, St. John's

6.30 p.m. Gospel Service

First Church of Christ Scientist, Christ Church Road: Service at 11 a.m.; Sunday School at 11 a.m

Salvation Army Hall, Folkestone: Services at 11 a.m and 6.30 p.m., Sunday School at 10 a.m and 2.15 p.m

Christian Spiritualist Church, Masonic Hall, Grace Hill, Folkestone: 6.30 p.m., Service

Christadelphian Ecclesia, The Studio, Kent House, Grimston Avenue: 3.15 p.m., Breaking of Bread; 6 p.m Bible Lecture

HYTHE

Parish Church: 8 a.m. Holy Communion and 12 noon (first Sunday of month); 9.30 a.m., Sung Eucharist; 11 a.m., Matins; 6.30 p.m. Evensong

St. Michael's: 7.30 a.m., Holy Communion and after Matins on second Sunday of month; 11.15 a.m., Matins; 6 p.m. Evensong

Church of the Holy Cross, Palmarsh: 8.30 a.m., Holy Communion (first and third Sundays); 6.30 p.m., Evensong (second, fourth and fifth Sundays)

Saltwood: 8 a.m. and 12 noon Holy Communion (first and third Sundays); 10 a.m., Children's Church; 11 a.m., Matins

NOTICE!

To the Sandgate Ratepayers and Sufferers by the Landslip.

A

PUBLIC MEETING

To which all of the above are invited, will be held on

Tuesday, April 10th,

AT THE

GOUGH SOLDIERS' HOME,

At 8.30 p.m.,

To consider the following questions :—

I.—As to the advisability of petitioning the Executive Committee to apply the balance of the Relief Fund (or a portion of same) for the purpose of relieving the ratepayers of the cost of reinstating the public property damaged by the Landslip.

2.—The desirability of carrying on the enterprise of the Publicity Committee and taking steps to advertize the town.

.....

Chair to be taken by F. Martin, Esq.

COUCHMAN, PRINTER, SANDGATE.

THE

SANDGATE DISASTER.

For the best and most reliable account see the

"Folkestone Herald"

Of SATURDAY, MARCH 11th, 1893

SUPPLEMENT GRATIS,

CONTAINING,

Six Large Views

Of Scenes of Ruin in the Streets and the Encombe Estate.

FULL REPORT

OF THE

Great TEMPERANCE

(Local Option) MEETING

ON FRIDAY NIGHT.

42. Ground movements of the Encombe landslip at Sandgate, Kent

M. J. PALMER, BSc, MSc, ARSM, DIC, FGS, Sir William Halcrow and Partners Ltd, UK

The history of movements of a coastal landslip at Sandgate, Kent has been investigated. The present movements, believed to have commenced in the 1930's, are part of a reactivation of a landslip which took place in 1893. The average rate of movement is currently some 60mm/year. Rainfall records have been examined and information on beach levels at Sandgate, dating back to 1720, reviewed with respect to movements of the landslip. The landslip appears to move when the six months winter rainfall exceeds 400mm and the beach levels are low.

INTRODUCTION

1. The landslip under consideration is situated on the south coast of Kent and forms the west area of the town of Sandgate, known as Encombe Estate. Geologically, Sandgate lies on the north limb of the Wealden Anticlinorium. The regional dip is recorded as between one and two degrees north-north-east; however, borehole evidence indicates a south-east dip in the Encombe area.

2. Landslipped strata are widely present on the scarp slope of the Lower Greensand ridge almost continuously west of Sandgate for some 15km. This escarpment feature is believed to represent the degraded sea cliffs originating in Anglian times, some three hundred thousand years ago (ref. 1). The Encombe landslip occurs at the base of this escarpment, but unlike those inland is subject to coastal erosion.

3. Foster (ref. 1) suggested that deep-seated landslide movements probably commenced during Anglian and Woxnian times, but little evidence remains of such early activity.

GEOLOGY OF LANDSLIP

4. The general form of Encombe landslip is that of a multi-rotational progressive slip which displaces Atherfield Clay, Hythe Beds and Sandgate Beds (Fig 1).

5. The Folkestone Beds form the high cliffs behind the landslip; they consist of dense, yellow, cross-bedded sands and sandstones. These cliffs are the source of the sandy colluvium forming a mantle of landslip debris and slope wash material over the disturbed strata of the landslip. The material, moved downslope by mudflow and hillwash action, has accumulated to sufficient depths to become unstable and form superficial debris slides with well defined basal shear zones at the contact with the underlying landslipped Lower Greensand strata. The Folkestone Beds and the underlying glauconitic sandy clays and silts of the Sandgate Beds are major water bearing sediments behind the landslip.

6. The thickness of the Hythe Beds is reported to be between 10 and 18m. However, thicknesses varying between 0.3 and 7m have been recorded in the area (refs. 2-3), the reduced thicknesses resulting from landslip movements. These beds are characterised by the development of alternating layers of strong sandy limestone (Ragstone) and weak calcareous sandstone (Hassock).

7. A maximum of 11.5m of Atherfield Clay has been recorded in boreholes along the esplanade at Encombe (refs. 4-5), although a total thickness of 18m has been reported elsewhere (ref. 3). The Atherfield Clay, at this location, consists principally of very stiff

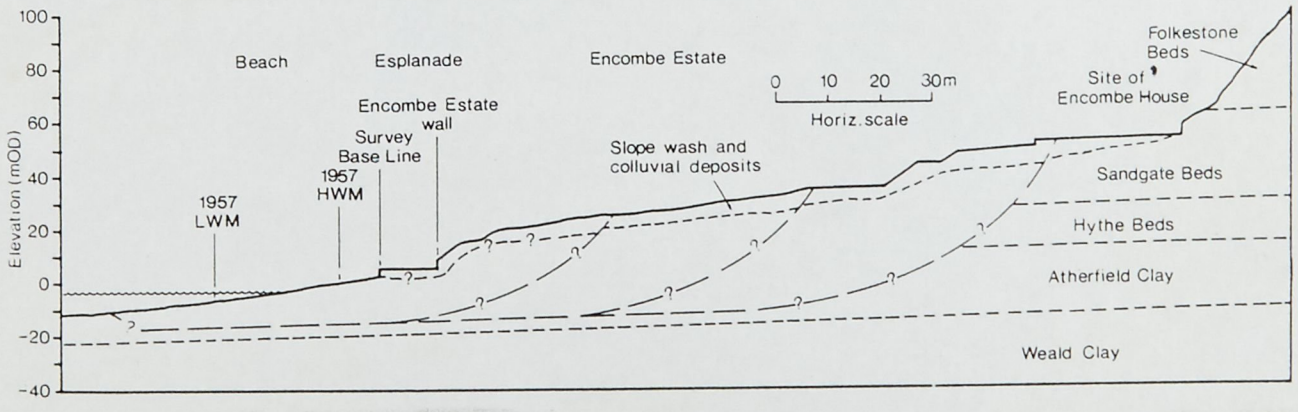

Fig 1. Geological cross-section (A-A) of the Encombe landslip.

Slope stability engineering. Thomas Telford, London, 1991.

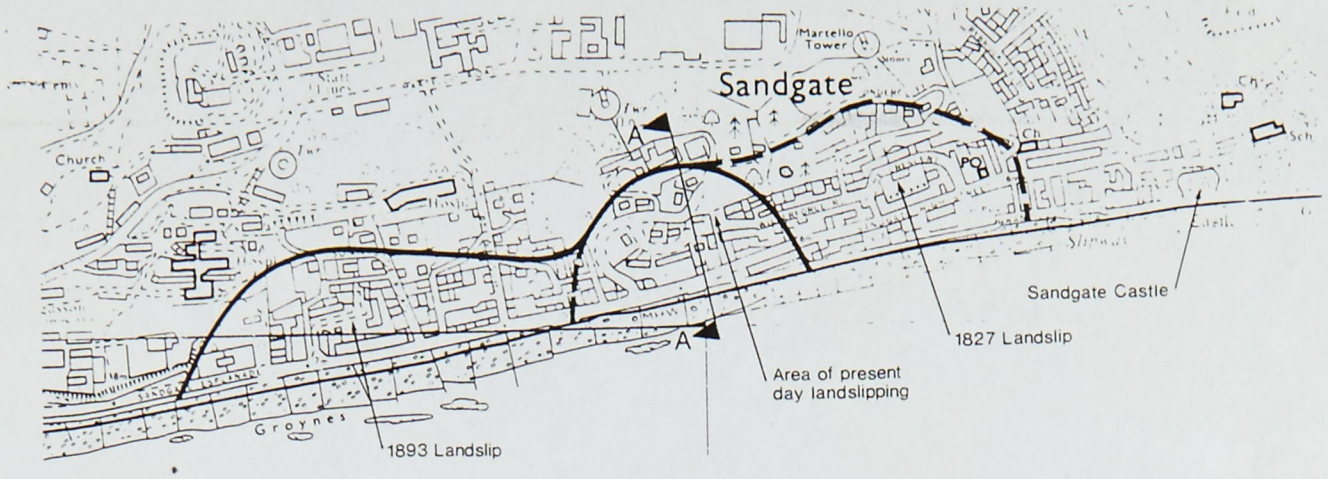

Fig 2. Old landslip positions, Sandgate.

blue grey clay and normally passes downwards into a very stiff brown massive clay. In the boreholes through the Esplanade the boundary between the blue grey and brown clay was frequently marked by the basal slip plane of the Encombe landslip. The location of the slip plane was confirmed by inclinometer readings installed in the boreholes.

8. Beneath the Atherfield Clay lies about 135m of Weald Clay, although only the upper 20m have been proved in the Encombe area.

HISTORY OF LANDSLIPPING

9. Reference is made by Topley (ref. 6) to a previous landslip that took place in 1827 on the eastern side of the Encombe landslip and which affected the majority of Sandgate town (Fig 2). It appears that landslip movements continued until approximately 1850, when deep drainage was installed at the back of the landslip to stabilise the Undercliff area.

10. The outline of the present Encombe landslip movements coincides with the areas of damage in the vicinity of Encombe reported for a larger landslip movement which took place during 1893 (Fig 2). The extent and damage caused by this event is well documented (ref. 6). The

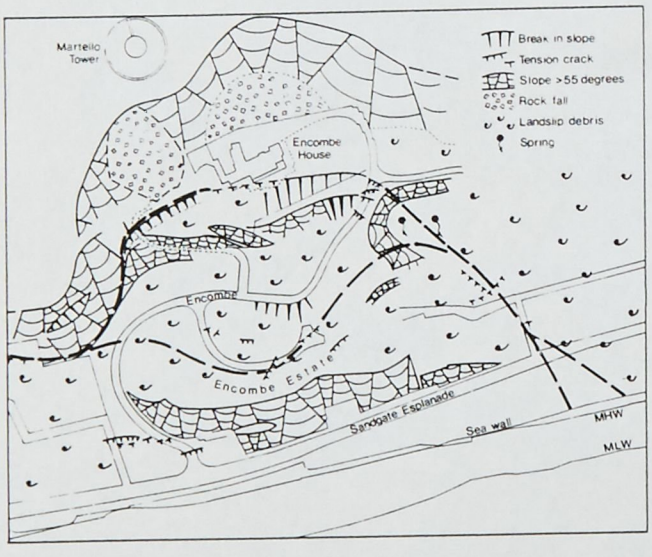

Fig 3. Geomorphological features of the Encombe landslip.

1893 landslip took place during a low spring tide when the beach was almost devoid of shingle following the construction of groynes to the west. At the same time, water would have accumulated in the broken mass of Sandgate Beds caused by the heavy rainfall of the preceeding month.

11. The landslip movements in 1893 extended some 500m further west than the present active landslip (Fig 3). Movement, up to 3m vertical displacement was reported to be very gentle, although many buildings were damaged. The slip commenced at about low spring tide on the evening of 4th March; the movement diminished as the tide rose, although not entirely ceasing, and at low tide the following morning renewed movements took place.

12. Descriptions of the damage caused by the 1893 landslip and the extent and location of features such as backscars and other cracks correspond almost exactly with similar features associated with the present movement. It would appear, therefore, that the present movements are a reactivation of part of the 1893 landslip.

13. Following the 1893 landslip, land drains were installed along the length of the landslip and they appeared to have arrested the movement for a time. However, cracks and settlement appeared at the front of Encombe House (Fig 3) in 1951. In 1966, the terrace at Encombe House sunk about 0.6m and this was followed by a period of increased ground movements involving minor incidents such as fractured gas and water mains particularly in the region of the backscar. In 1969, subsequent to the development of a number of houses in the area, now known as Encombe Estate (Fig 3), damage to some of the buildings was reported due to ground movements, and boreholes were sunk with associated instrumentation. Following increased movements in 1975 a scheme of limited drainage was constructed, comprising well points along part of the back of the slip to intercept ground water flow. The well points were installed in 1978; however, readings from the piezometers installed showed no significant drop in the water level and the rate of landslip movement was only marginally reduced from 80 mm/year to 60 mm/year (Fig 4).

RECORDS OF MOVEMENT

14. In 1983, a base line survey was set out by the Ordnance Survey to keep an accurate

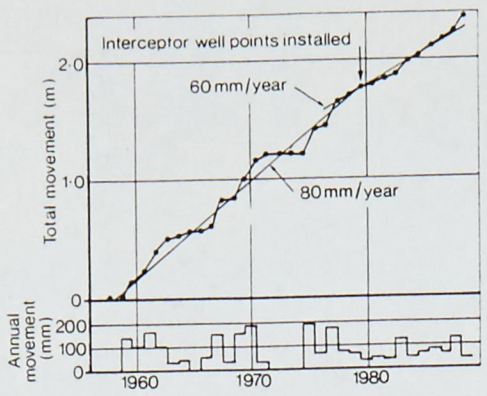

Fig 4. Movement of the Encombe landslip with time.

record of movements; Fig 5 shows the extent and amount of annual movements along the base line. Records of measured movements at both the toe and backscar are approximately equal. Maximum displacements occur over the central section of the landslide. Significant movements only occur in the winter months (i.e typically December to April) and not necessarily every year. Some movement is taking place east of the 1893 event, possibly due to "dragging" of the 1893 slip on part of the older 1827 slide.

MOVEMENT WITH RESPECT TO RAINFALL

15. Although monthly rainfall records correlate with ground movements, the correlation is clearer when the 6-monthly and 12-monthly accumulations are considered. Known annual movements were plotted against 6-monthly and 12-monthly rainfall accumulations given in Fig 6. Before 1968 there was very little monitoring of landslide movement and consequently the post 1968 correlation between rainfall and movement were used to predict the amount of movement in the earlier (pre 1968) period. It should be noted the total movements (predicted and measured) correlate closely with the movements of a retaining wall at the foot of the landslide recorded on Ordnance Survey maps between 1957 and 1982.

16. Threshold values for 6-monthly and 12-monthly rainfall accumulations of 400mm and 800mm, respectively (Fig 6), appear to correlate with the periods of principal movement, both measured and observed, in the winter and spring of each year. For example: in 1966/1967, the terrace at Encombe House sunk and there followed a period of increased ground movements; the movements in 1975 prompted the development of a drainage scheme; 1976/1977 saw further movement as did the winter of 1982/1983 and 1987/1988.

17. Recorded and calculated ground movements indicate that since 1958 the overall rate of movement has been approximately 80mm per year (Fig. 4) with a slight reduction in movement following the installation of the limited drainage system in 1978 (see above). Earlier rainfall records indicate that the 6-month and 12-month rainfall accumulation at the time of the landslip in 1893 were 510 and 875mm respectively. Although frequently exceeded since 1893 no sudden movement has occurred. Therefore, it would appear that the 1893 event is not only related to rainfall, but other factors discussed below may be at work.

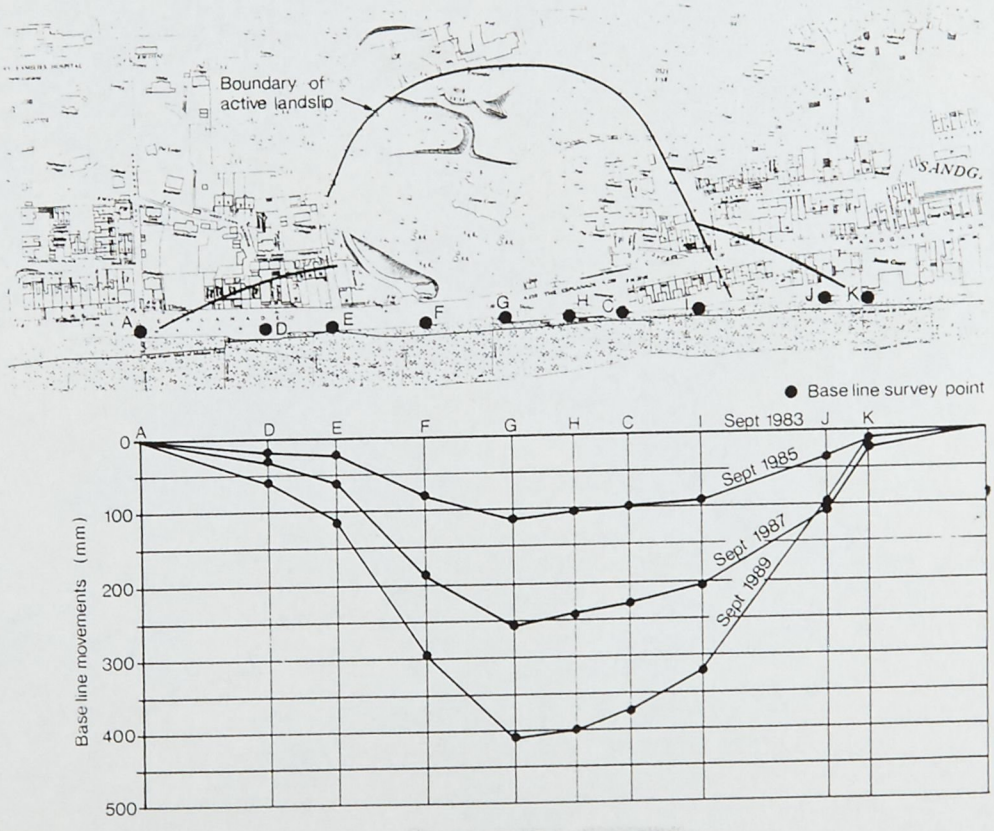

Fig 5. Movement of the Encombe landslip measured along a base line located on the sea wall.

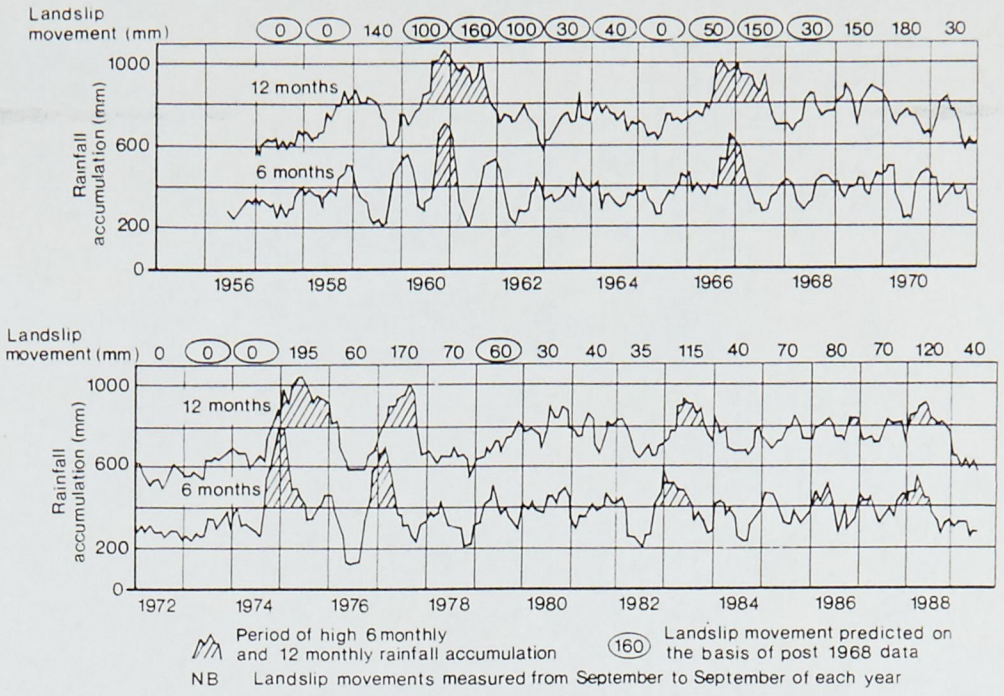

Fig 6. Rainfall measurements and associated movements at Encombe.

MOVEMENT WITH RESPECT TO BEACH LEVELS

18. The migration of beach gravel by longshore drift along the south coast is well known (ref. 7) and is from west to east.

19. During the 1939 to 1945 war, groynes along the front at Encombe were not maintained due to the beach being mined. Consequently the beach was seriously depleted. Partly as a result of this it was necessary to construct a new sea wall in 1959. Local residents at Encombe remember when it was possible to step off the seawall on to the shingle beach; now there is a 2 to 3m drop.

20. Positions of mean low and high tide marks relative to the sea wall were recorded from the various editions of Ordnance Survey maps. These measurements reveal that the mean high and in particular low tide marks have been moving landward since the first edition in 1871. The landward migration of the tide mark positions effectively represents a loss of beach material.

21. The volume of shingle lost at the toe of the landslip can be approximated by comparing the positions of the high and low tide marks for different editions of Ordnance Survey maps and assuming a uniform gradient of the beach (Fig 7). Fig 8 indicates the changes in the volume of shingle with time at three typical locations along the coast line: the west end of the 1893 slip; Encombe Estate; and Sandgate Castle, east of the 1827 and 1893 movements (see Fig 2). Notable at the west end of the 1893 slip is the large loss of material during the period 1871 and 1907, that is at the time of the 1893 landslip; over subsequent years, the rate of material loss was greatly reduced. At the

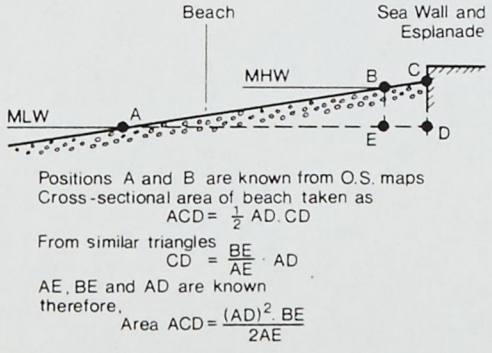

Fig 7 Calculation of the volume of beach shingle from high and low tide marks.

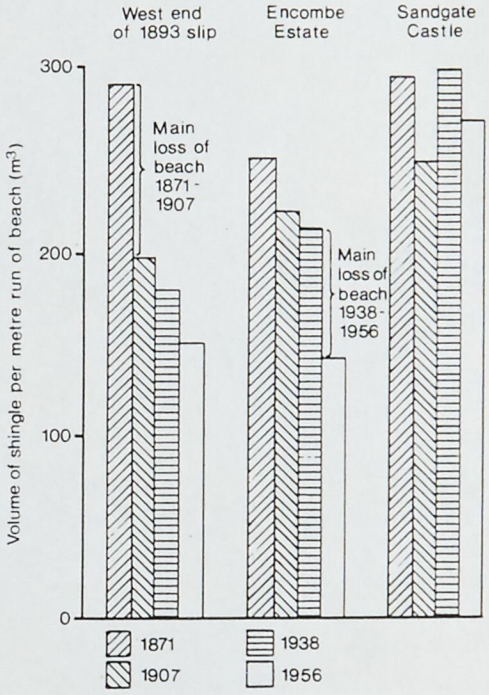

Fig 8 Changes in the volume of beach shingle present on the foreshore at Sandgate.

Fig 9 "View of Sandgate with Romney Marsh in the distance" by Findlater and Havel, 1812. Reproduced with the kind permission of the British Museum Map Library.

front of Encombe Estate, Fig 8 indicates that the initial loss of material during the 1871 to 1907 period was not as great as further west. However, there is a sudden loss of material between 1938 and 1956, when present day movements in this area commenced. Beach levels adjacent to Sandgate Castle fluctuated during the past 120 years. However, there has been no significant loss of beach, and present day levels are similar to those of 1871.

22. The original castle at Sandgate was built in the 16th century and rebuilt in the early 19th century; drawings from the period 1810 to 1850 (Fig 9) show the castle wall intact, but it was subsequently eroded by the sea. In addition, the drawings reveal that considerably more shingle existed at that time than is present today. A sea wall was not necessary to protect the town in the first half of the 19th century and houses and quays located seaward of the present high tide levels are recorded on these drawings. A plan of the castle in its original form dated approximately 1757 demonstrates mean low and high tide marks 25m and 9.5m seaward of present day positions, respectively (Fig 10). The amount of shingle in this vicinity has remained relatively stable

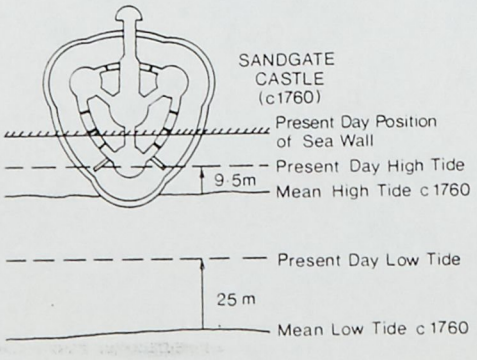

Fig 10. Change in high and low tide levels at Sandgate Castle, based upon a plan dated c.1757.

since 1871 (Fig. 8), whereas at Encombe the low and high tide marks are now some 18m and 8m, further landward, respectively. It is therefore possible that high and low tide marks at Encombe have migrated about 43 and 17.5m landward since the c.1757 plan.

23. From the 18th and 19th century drawings it would appear that there has been an overall reduction in beach levels along the coast at Sandgate since 1720. Construction of groynes to protect Shorncliff Battery in the early 1800's, west of the 1893 slip, led to the impoverishment of beach and serious erosion to the east, the coast road being destroyed. By the 1850s the protective sea walls had been built.

24. Prior to the 1893 slip, extensive groyning west of Sandgate caused the seafront of Sandgate to become almost bare of shingle. As a consequence, the sea wall was partly destroyed, and a small tract of land near the sluice of the Military Canal west of the 1893 slip, was washed away. The sea wall was repaired a few years before 1893 and new groynes were made about this time. Although, as a result of the groynes, shingle would have started to accumulate, their construction was too late to avoid the 1893 landslide.

MOVEMENT AND TIDAL VARIATION

25. Topley (ref. 6) reports that the 1893 landslip commenced at about low spring tide and that movement diminished as the tide rose; on the following low tide a second slip took place. Measurements of the present-day movements using an automatic crack-width measuring device, located on a crack in a wall across the rear scarp of the slide show a similar response to tidal fluctuation. A sample of results, obtained over a period of tides in 1970, is shown in Fig 11 (ref. 8).

26. Movements averaging about 1mm/day, decelerate or stop as high spring tide is approached and accelerate at low tide. The spring tide range is about 5.8m (Fig 11). At neap tides, which have a range of about 3.7m,

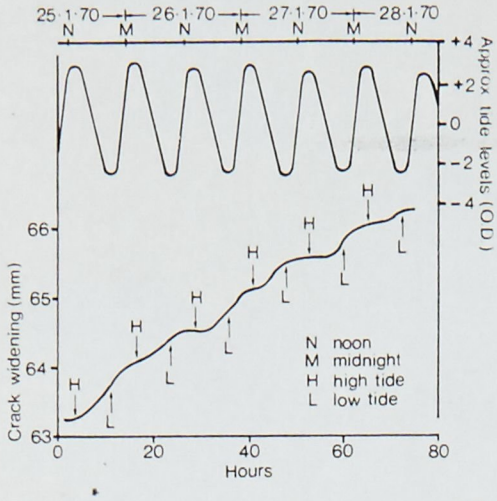

Fig 11 Movements of the Encombe Estate landslip in relation to tide levels (after ref. 8)

the above pattern is barely discernible.

27. The effect of toe support is further emphasised in the stability analysis of the landslip; the difference between mean low and high tide results in a change in the Factor of Safety of almost 10 per cent. A reduction in beach shingle would obviously decrease the Factor of Safety further. On the other hand, an increase in the water table at the back of the slip by 2m reduces the Factor of Safety by only 4 per cent. From observations and measurements of the ground movement it appears that only a small increase in the Factor of Safety is necessary to arrest movement whether it be the result of a low water table at the back of the slip or a rise in the tide level.

MECHANISM OF MOVEMENT, DISCUSSION

28. It would appear that movement of the Encombe Estate landslip, both past and present, is influenced by a combination of factors.

29. Over the long term, stability of the landslip would seem to be controlled principally by the beach level; in particular by the amount of shingle removed or left remaining on the foreshore; also, but perhaps to a lesser extent, by erosion of landslipped strata lower down on the foreshore. It has been shown how the change in beach levels along the coast of Sandgate has dramatically affected the history of slipping in this area.

30. In considering movements of the landslip on an annual basis during which time it is assumed that there is no significant loss in beach material, a clear relationship between displacement and rainfall is discernable. During a dry winter very little movement will take place; however, following a wet winter, movements of between 100 and 200mm may occur.

31. Movement on a daily basis can also be considered with respect to the nature and state of the tide. The crack width measuring device demonstrates how movement can stop and start as a spring tide rises and falls.

32. It should be noted that the stability of the landslip is dependent on all three factors: for example, during a dry winter no movement will be detected even at low spring tide; equally, the rainfall levels at the time of 1893 slip have been frequently exceeded although no major movement comparable to the 1893 event has been recorded.

33. Current movements of the landslip are both gradual and intermittent. The movement process might be of repeated cycles of loss of support at the toe of the landslip at low tides, the expansion of the compressed landslip mass and seaward movement of the toe. Movements would be enhanced by an increase in the groundwater level due to infiltration of rainfall at the back of the landslip and the resulting increased pressure causing recompression of the landslip mass. In addition, the magnitude of each movement of the landslip is limited by the degree of associated expansion or compression of the landslip mass.

34. It would appear from Fig 11, however, that during low spring tides the movement of the back of the landslip follows almost immediately after loss of toe support.

ACKNOWLEDGEMENTS

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