

# Engineering Division

## Notes on Lyme Regis Environmental Improvements Preliminary Studies

### Introduction

Lyme Regis is located on an actively-eroding section of the West Dorset coastline, and is therefore subject to attack from the sea and to coastal landsliding.

Before the construction of the town's sea walls, which are relatively recent, the coastline would have been actively eroding and retreating, and there is strong historical evidence that a large part of the original medieval town has been lost to the sea.

Despite the existence of the coast protection structures, there have been several destructive landslip events and sea wall breaches this century. If no action is taken it is considered that, sooner or later, there will be further destructive failures.

West Dorset District Council, with its principal consultants High-Point Rendel, are therefore carrying out a series of inter-disciplinary studies in order to gain an understanding of the coastal system from the sub-tidal zone to the top of the coastal slope, particularly in terms of long-term coastline evolution.

The purpose of the studies is to obtain information for use in the conceptual design of appropriate engineering schemes to ensure the long-term integrity of coast protection in the town.

### Methods of Data Collection and Analysis

- Research into the history of landsliding and the development of the coast protection structures
- External condition and geophysical surveys of the coast protection structures
- Bathymetric surveys, side scan sonar surveys, shallow sub-bottom profiling, grab sampling, marine seismic profiling and seabed videoing
- Aerial photogrammetric surveys of beaches and landslides
- Geological mapping

- Analysis of long-term coastline evolution and sediment budgets using historical charts
- Analysis of short-term beach changes and sediment budgets using the data from successive recent beach surveys
- Geomorphological mapping of the sea bed and landslides
- Analysis of the nature, distribution and timing of landslide events
- Analysis of historical rainfall data
- Cored boreholes, trial pitting, exposure logging.
- Natural gamma-ray borehole logging
- Geotechnical laboratory testing
- Monitoring ground movements using inclinometers, slip indicators, GPS surveying, visual observation
- Monitoring groundwater pressures using both manually read and automated piezometers
- Development of ground models for the landslip systems
- Slope stability analyses
- Assessment of the possible scenarios for seawall breaches and landslide development in the “do nothing” scenario
- Assessment of economic benefits of implementing new coast protection schemes
- Landscape and visual appraisals at the sites of possible new schemes
- Ecological assessments and flora and fauna surveys in the more environmentally sensitive areas of the town
- Investigating the extent and condition of the existing surface water and groundwater drainage systems
- Public opinion surveys and consultations on ideas for new coastal protection schemes

## Principal Findings to Date

### The Condition of Coast Protection Structures

- There has been a gradual long-term deterioration in the condition of the existing coast protection structures.
- The East Cliff sea wall is being out-flanked by marine erosion at its eastern end.
- The Marine Parade sea wall is seriously undermined at its foundation in several locations.
- The Cobb has numerous minor defects, particularly on the outer face of the High Wall, which require continual maintenance.

## Marine Geomorphology and Coastal Processes

- In the 18th century there was once a substantial continuous beach along the whole of the Lyme Regis frontage.
- The beaches are in long-term decline and are now a small fraction of their original volume. The decline is part of a natural process of fragmentation of the beaches along the West Dorset coastline which has been exacerbated and complicated by the building of structures such as the Cobb and the sea walls.
- There is no longer any natural supply of beach-forming shingle.
- The sea bed geomorphology is closely related to the underlying geology with the more rugged rocky parts of the seabed corresponding to the outcrop of Blue Lias, and the more subdued and sediment-covered areas corresponding to the outcrop of Shales-with-Beef.
- The seabed and shore platform in front of the sea walls have undergone considerable erosion and lowering over the last two centuries, such that the sea walls' exposure to wave attack has increased.
- The connection of the Cobb to the mainland in the 1750s has resulted in the interruption of the west to east longshore drift and the substantial build-up of Monmouth Beach on its western side.
- There has been little sediment input to Monmouth Beach since the 1840's when the Humble Point landslip interrupted longshore transport. The growth of Monmouth Beach at the Cobb has therefore been at the expense of the western end of the beach.
- Limestone quarrying in the 19th century accelerated cliff and foreshore erosion in both the East Cliff area and the Devonshire Head area.

## Landslide Systems

- The landslide systems extend over a kilometre in land from the high water mark and consist of numerous interrelated elements.
- There are four main landslide mechanisms:

Mudslides

Translational block slides

Deep-seated compound slides

Shallow rotational or translational failures

- The landslides have formed as a result of marine erosion prior to the construction of the coastal defences causing the reactivation

of ancient landslide systems. In addition, first-time failures are developed on the lower coastal slopes.

- The basal shear surfaces of the principal landslide units occur above a particular marker bed within the Lias, which impose strong control on the landslides and give rise to a typical bench scarp morphology. The Lias strata has a gentle dip to the south-east, facilitating the seaward movement of landslide blocks.
- Near-hydrostatic groundwater pressures exist within the landslide debris of superficial deposits, whereas under-drainage occurs within the deeper Lias strata.
- Stability analyses indicate that many of the landslides are at or close to failure.
- The ground instrumentation has confirmed continuing widespread movement over most parts of the landslide systems.
- The eastern part of Lyme Regis may be under threat from the continuing long term westwards expansion of the Spittles/Black Ven landslide system.