THE PARRYLANDS F. 15/DM – 13 LANDSLIDE – A CASE STUDY

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ABSTRACT

The ideal site for the surface location of an oil well is directly above the most geologically favourable position of the hydrocarbon-bearing formation. However, consideration must be given to the existing topography and near-surface geological conditions. A shallow-seated landslide which curtailed planned drilling activity at location F. 15/DM-13, in the Parrylands “D” area, southwest Trinidad, has been investigated. The slide developed on a gently sloping hillside composed of oil-impregnated sands and silts interbedded with silty clays of the Morne L’Enfer Formation. Topographic surveys and geotechnical investigation indicate that movement occurred within the silty clay sequence along multiple rototranslational slip surfaces. Failure is attributed to plastic deformation of oil sands in the slide crown, combined with toe instability resulting from excavation and a softening of the failure zone due to the development of perched water conditions during a period of heavy rainfall. The eruption of “oil volcanoes” in a zone parallel to and beyond the head scarp is thought to represent upward flow of low API gravity crude along tension fractures and bedding surfaces opened by the slide movement.

INTRODUCTION

The Parrylands “D” Area is located 4.5 km east of Guapo Bay, southwest Trinidad (Fig. 1). It is a major oilfield, on lease to the Trinidad and Tobago Oil Company Limited (TRINTOC), and has been, since 1930, an important zone of intense hydrocarbon development. Within the last four years, a number of small landslides has developed in the “D” area, mainly at the sites of oil wells. Damage to infrastructure resulting from the failures has been severe and has either brought actual drilling operations to a standstill or has curtailed planned drilling activity. These landslides have cost the company considerable losses in revenue.

In July 1982, following a period of heavy rainfall, a shallow-seated landslide was initiated at location number F. 15/DM-13, a proposed well site situated at the northern margin of the “D” area (Fig. 1). In its path, the landslide displaced the northern half of the location, destroying a paved area and two concrete cellars. The site was subsequently abandoned. Between February and April 1983, a second, larger failure moved approximately 43,000 m³ of material from a source some 20 m upslope. An engineering geological investigation was conducted to identify the limits of sliding, the cause of failure and to determine the effect, if any, on other proposed sites in the vicinity. The investigation consisted of field mapping, a topographic ground survey, subsurface investigation and geotechnical testing. This paper describes the geometry and geology of the failure and analyses the landslide movements at F. 15/DM-13.

PHYSICAL SETTING

The F.15/DM-13 landslide occurred in a densely vegetated area of low-lying undulating topography, characteristic of the terrain of southwest Trinidad. Maximum relief does not exceed 100 m. The most prominent topographic feature in the immediate area of the landslide is a narrow dissected ridge trending east northeast to west southwest, which rises to an elevation of 81 m (Fig. 1). A small stream draining west into the Vance River defines the northern limit of the ridge. The landslide lies on the lower north-facing ridge slope.

The Lot One Anticline is the major structural feature in this area, and is an east north-east to west south-west trending asymmetric fold (Fig. 2). The northern flank has dips of 20° – 55° which are much steeper than the northern limb with dips of 8° –

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