

3. COMPACTION EFFECTS

3.1 INTRODUCTION

Compaction results in the subsidence of ground level due to reduction in the void ratio of the underlying soil, and in coastal areas contributes to a local relative rise in sea level. Reduction in void ratio is often the natural response of a soil to an increase in loading, because an increase in the interstitial stresses between solids is required. An increase in the loading of a soil stratum can be the result of an increase in loading on the ground surface (e.g. building construction or additional sediment deposition), or due to removal of ground fluid (e.g. water, oil, or natural gas). Compaction occurs in nature as mud is deposited on the beds of rivers and estuaries, and especially in river deltas. Another example is the increase in loading as a barrier island migrates over a stratum of peat, causing the peat to compact and ground level to subside. Because compaction is a time-dependent process, the relative rate between deposition and compaction will determine whether bed elevation increases or decreases. Compaction of a region can also be induced by man, due to 1) loading by the weight of structures, 2) the extraction of oil and natural gas, and 3) depletion of the groundwater table due to active pumping or by preventing recharge of aquifers.

The literature in soil mechanics and foundation design is too replete with articles on the general topic of compaction to review in detail. The proceedings of a symposium "Land Subsidence" held in Tokyo in 1969 (in reference list in section 13) provides a thorough treatment of the causes of compaction, its theoretical description, field measurement techniques and analysis, physical consequences and remedial measures. Much of the subsequent material is gleaned from this collection of studies. However, no investigations have been found which identify any specific effects of the inverse problem, i.e. the effect of sea level rise on compaction and subsidence.

Shiffman et al. (1985) review the available theories regarding consolidation (compaction). The simplest is Terzaghi's "Conventional Theory" governed by