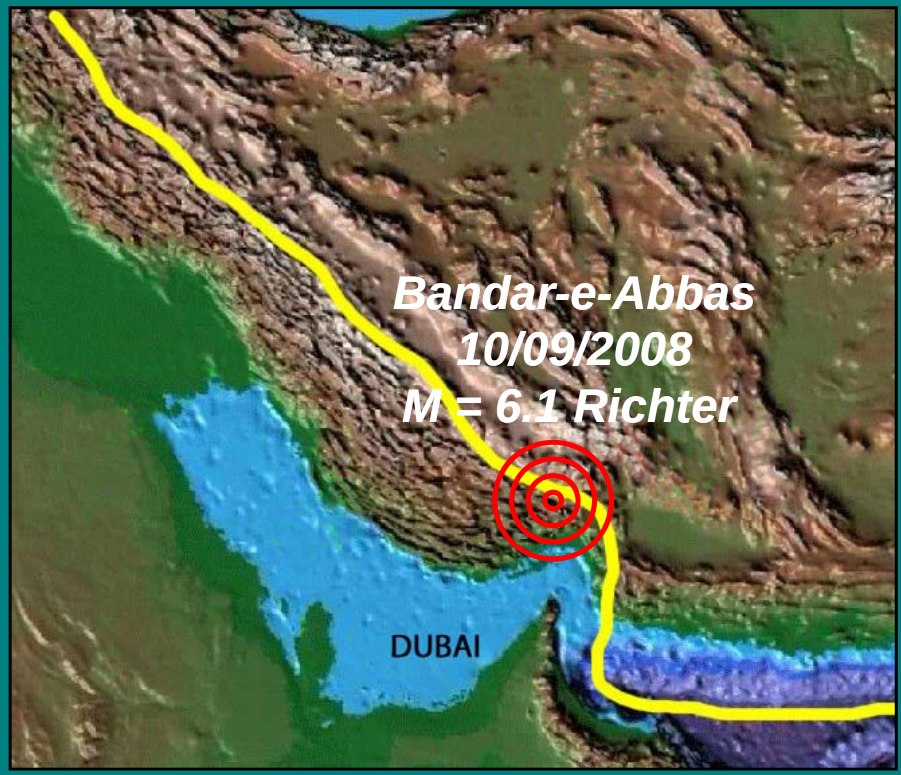
Study of a possible alternative progettual solution of Dubai’s Palm.

Seismic risk in Dubai

Dubai located in the northern part of United Arab Emirates (UAE) between Arabian Gulf and Oman Gulf, because of the particular position near one of the most seismotectonic areas, is subjected to the effects of the seismic activity.



The prevalent cohesionless character of soils and their usually weak consolidation, has great importance in the development of seismic site effects.

This conditions put several problems in the planning and monitoring of the territory urbanisation, since that several phenomenons closely related to the seismicity and the geological nature of deposits will be interest the structures insistent.

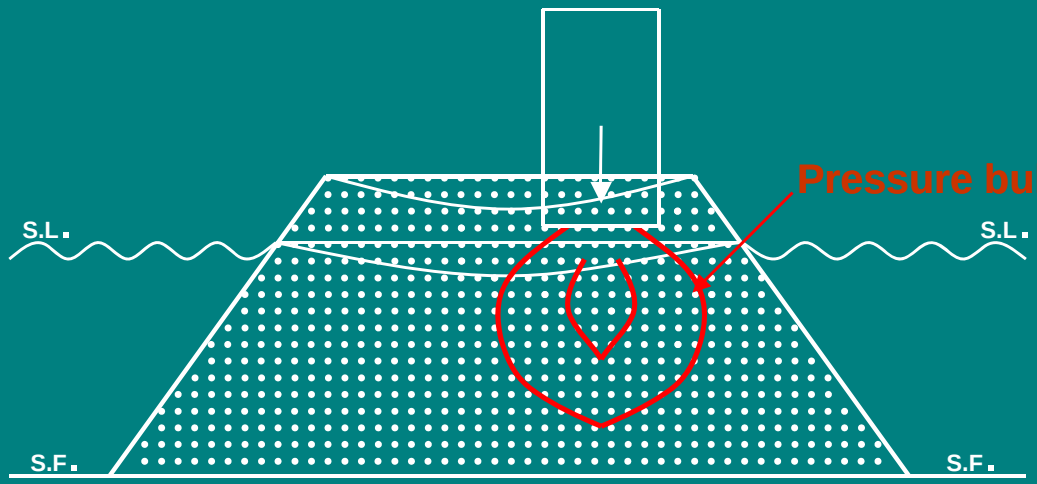
As example we report a semplified schematic representation of two possible modality of construction of Dubai's Palm putting in evidence the various aspects inherent the two possible solutions.

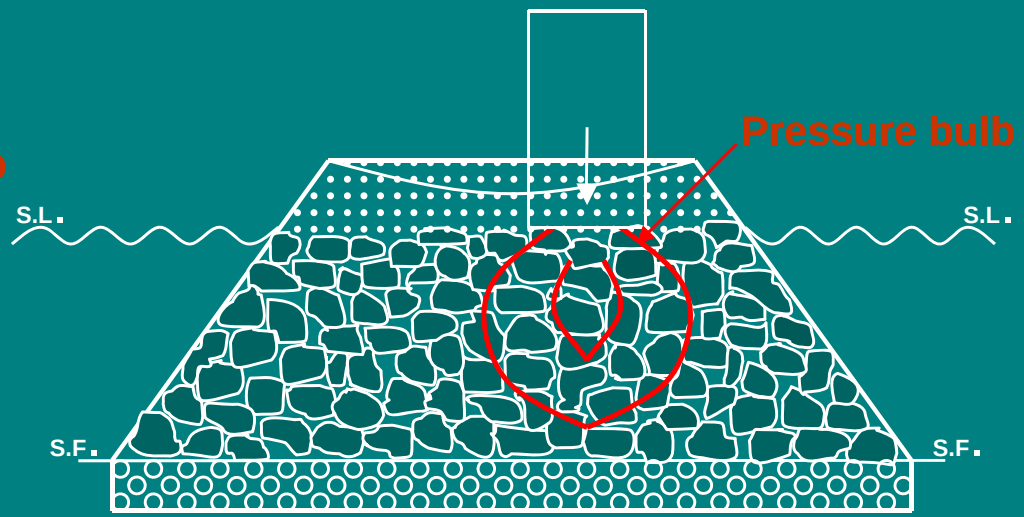
Illustrated representation of Palm section.

The Dubai's Palm project for the construction of the artificial islands has estimate the employment of a lot of amounts of sand that is dredged from bottom of sea and was sprayed from dredging ships for realization of the artificial structures.

Naturally this has required besides the problem of finding raw materials, also problems related to the stability, erosion and mantenance of the structural features of the island.

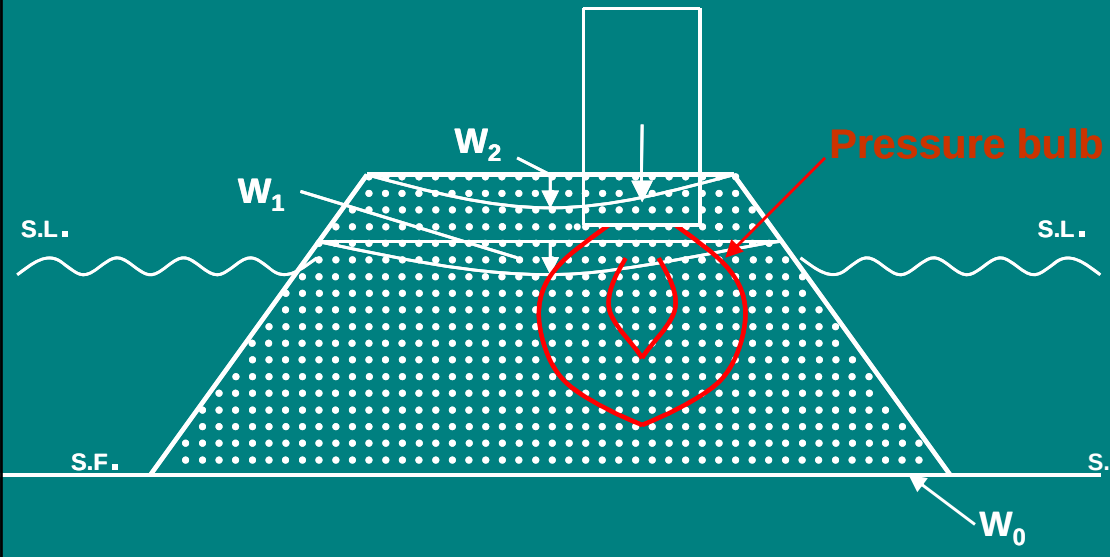
Here we propose to study the possible advantages who results adopting an alternative solution, which provide the employment of a basal stratum formed by blocks mixed with thin material to ensure maximum density, instead of only sand for all structure thickness.





Illustrated representation of Palm section. (Settlements)

- Original plan

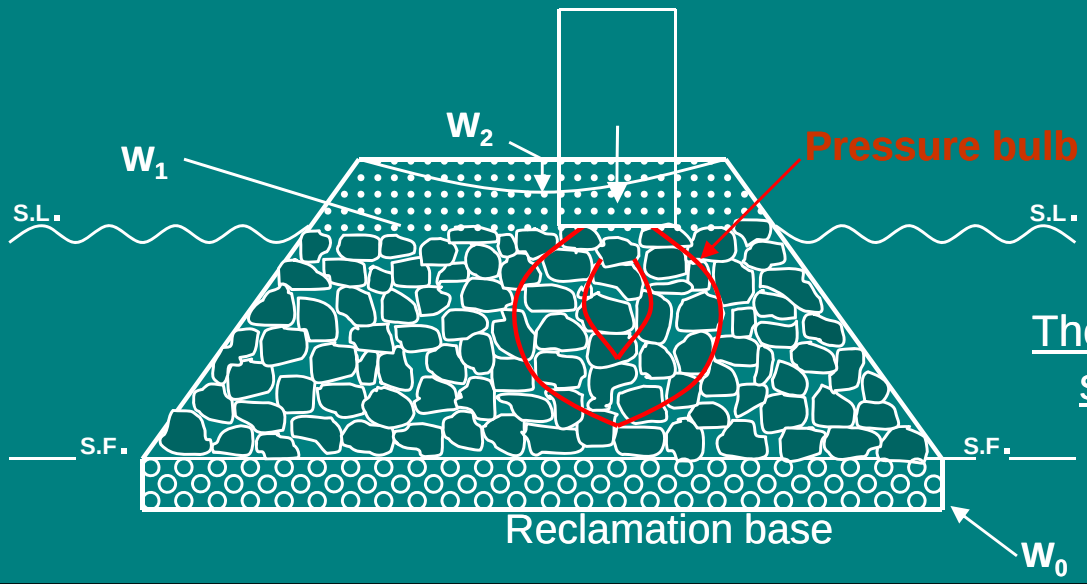


W_0 = settlement of the basal plane
W_1 = settlement of sand at sea level interface
W_2 = settlement of sand at surface

$$W = W_0 + W_1 + W_2 \Rightarrow \mathbf{W = W_{consolidation}}$$

The total settlement will be related to the consolidation of sand at various interfaces level

- Alternative plan



$W_0 \cong 0$
$W_1 \cong 0$ $\Rightarrow$ $W = W_2$

The total settlement will be limited to the upper level of sand, since than the lower will be has a negligible settlement.

Illustrated representation of Palm section. (Liquefaction and lateral spreading).

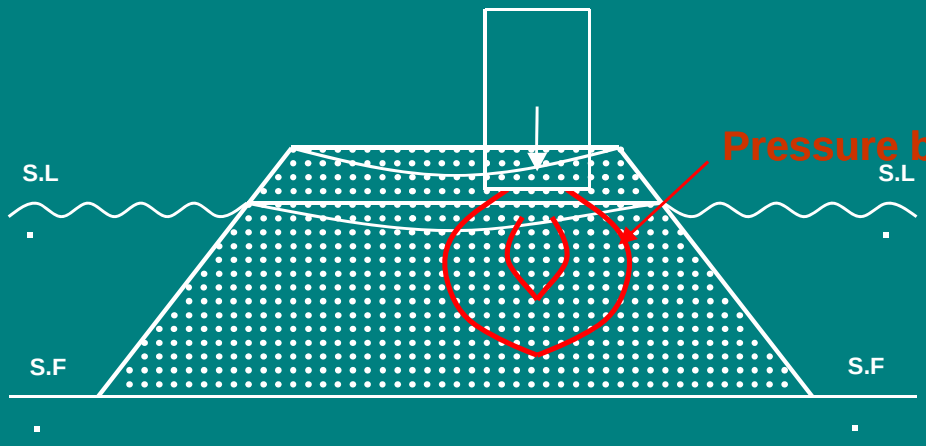
The phenomenon of liquefaction take great importance where earthquake waves interesting deposits of thin saturated sands with low degree of consolidation. As consequence the porewater pressures quickly increased, reducing until to cancel the effective stress and the flow liquefaction occurs.

Kobe

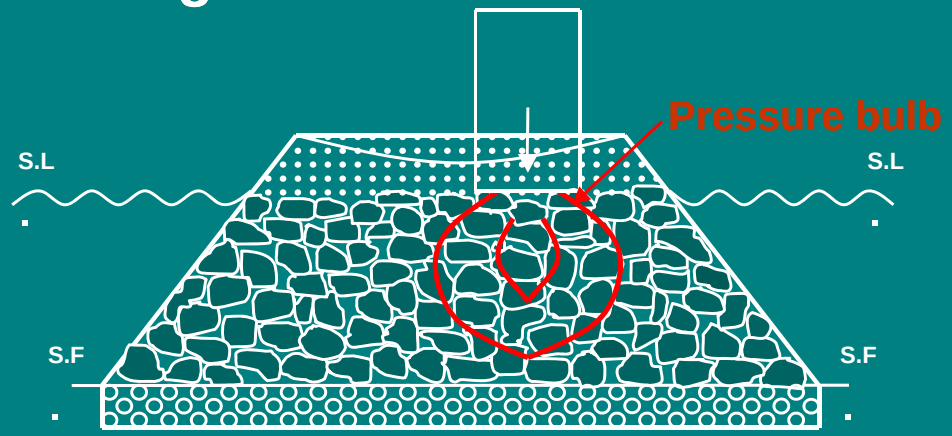
Irregular settlement causes damage until collapse of structures.

Higher urbanisation

High risk zone



Liquefaction can interest the construction for all thickness giving possible lateral spreading phenomenons.

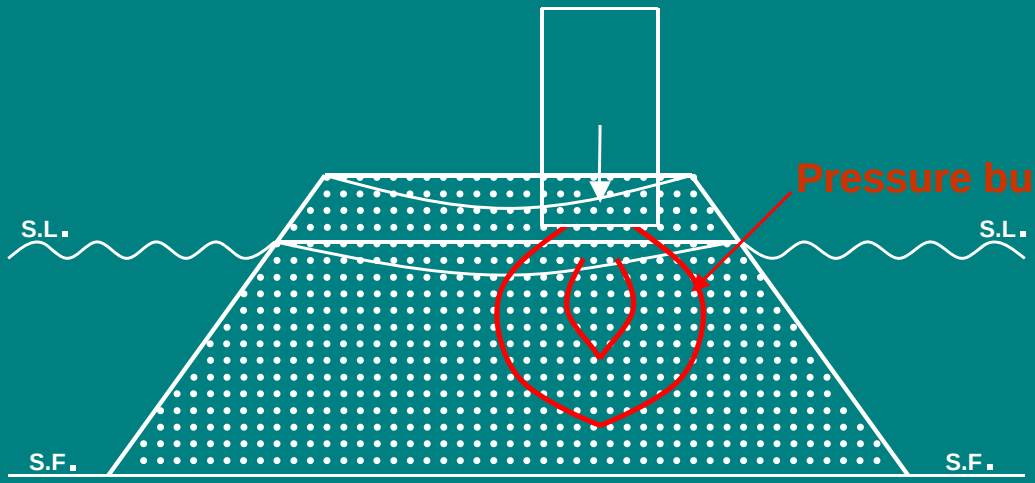


Liquefaction is inhibited for the upper level formed by sand since that there isn't a saturated stratum and risk of lateral spreading is also reduced.

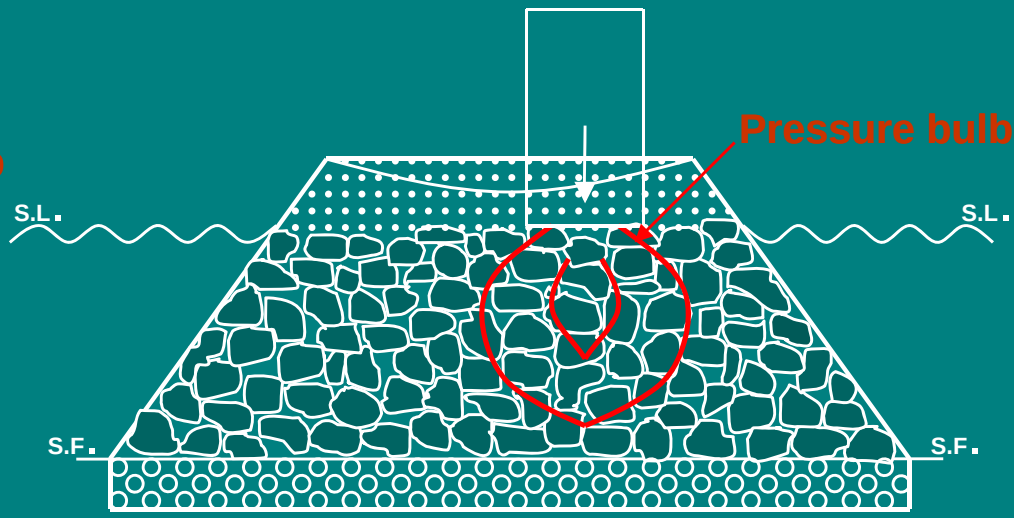
Illustrated representation of Palm section (Erosion).

Another aspect to hold in consideration is the erosion of the island's boundaries.

This action mainly operating by mean of the waves and wind, can meaningfull causes regressing of coastal line and than reduce the width of beach.



Erosion can involves the entire thickness of sand.

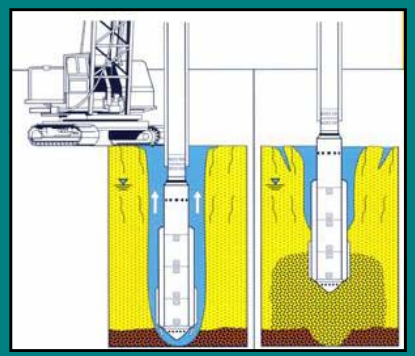


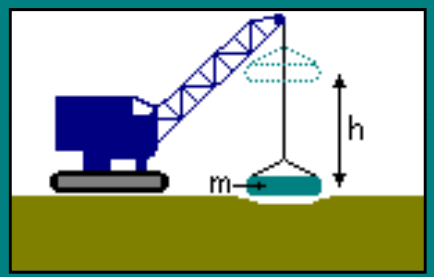
Erosion is limited to the upper layer of sand.

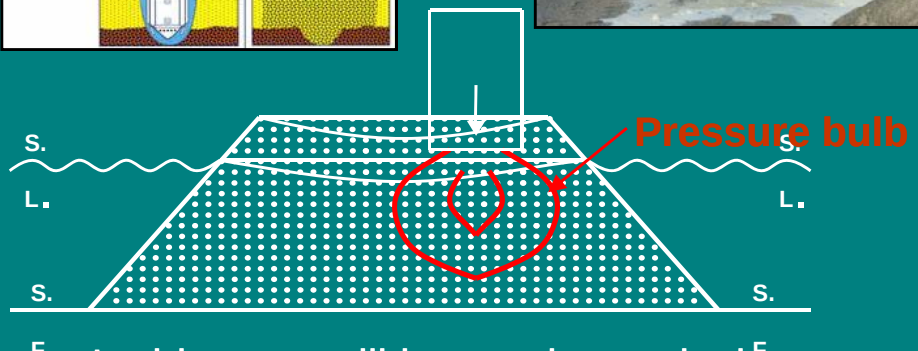
Illustrated representation of Palm section (Vibrocompaction).

In order to prevent the risk of liquefaction is useful to adopt measures necessary to reduce the liquefaction potential of an area. With reference only at geological characteristics is clear how the deposit's density affects his susceptibility at liquefaction, since that loose thickening, during an earthquake, favours increase in pore pressure.

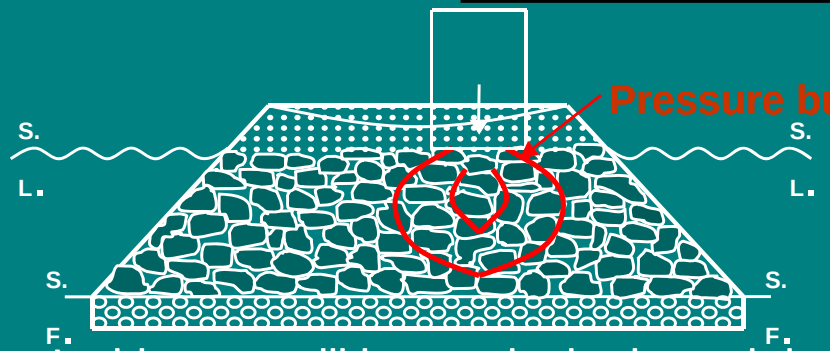
A method to obtain a mitigation of liquefaction potential is that to use vibrocompaction.







In this case will be used a vertical depth vibrocompaction method



In this case will be used a horizontal dynamic vibrocompaction method for thicken the superficial sandy level.