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LIQUEFACTION OF DEEP SAND SOIL IN ROSARNO (RC) AREA AS A TRIGGERING FACTOR OF LARGE SPREADING

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In the area of Rosarno (RC, Italy), a wide tabular area is characterized by a peculiar morphology showing undulations perpendicular to the coast line. In literature (Guerrichio et Al. 2001) the cause of this morphology has been presumed to reside in deep lateral spreading phenomena, induced by sand liquefaction at great depths (more than 60-70 m). Even if the plain of Rosarno is characterized by the presence of potentially liquefiable sands (as reported in historical documentation of the earthquakes of Calabria 1783 when sand liquefaction phenomena took place), usually this phenomena occur at depths no greater than 10-15 m.

A study has been then developed by means of a numerical simulation. In particular a section was built that could represent the geo-structural assets in the area before the landslide. The area was indeed constituted by a wide plain terrace ending with a relatively gentle scarp and groundwater level at a depth of about 70 m. The study has been developed by means of software FLAC that allow to analyze the movements of the slope modeled as a quasi-continuous body obtain a deformed shape of the slope profile which can be compared against the real morphological soil profile. Also in this case it was possible to point out that the presence of the liquefied sandy layer was a necessary condition for the earthquake to trigger the instability. However the final slope profile obtained by the simulation was more similar to an earth flow than to the real topographic profile, characterized by a series of dunes that could be interpreted,

from a morphological point of view, as a succession of horst and graben following an earth block slide. The good result was in having found the triggering conditions of a landslide movement with equivalent size to those theoretically estimated but with a striking dissimilarity in the slope profile deformation between simulation and real situation.

It was then conjectured that liquefaction occur in local lenses and not globally involving the entire sandy layer, and that the liquefied material in these lenses kept separated during the event. This last hypothesis is considered unlikely in literature (Seed 1968), where conjuction of lenses is theorized during the event right after their beginning. However only assuming that the lenses kept separated, it could be obtained in the simulation a type of motion resembling an earth block slide, characterized by a terrace translating and descending not uniformly and generating a number of horst and graben equal to the number of liquefied sand lenses. That was the situation that could be noticed on site.

At last attention was paid to the investigate how was it possible to have sand liquefaction phenomena at great depths where litho-static load are relevant. The explanation comes by observing some problems affecting earth dams. Whereas compaction is not sufficient (likely even in young and thick sand deposits, like those in the area) it is possible for *wet seeks* to form, that is wet cicatrices. The latter are zones of material having poor mechanical characteristics packed within stratified deposits. Their resistance is guaranteed by the set up of an *arch effect* that could occur when layers with good mechanical characteristics stratify over a poorer material. As a consequence of the formation of arch effects, litho-static burden does not load uniformly the underlying layer that could thus be characterized by a low tensional state. Under these hypothesis is thus possible that these lenses undergo liquefaction even if bounded at great depths and allow for activation of wide lateral spreading that develop along the ensamble of these lenses of liquefied material.