Relationship between artificial ground and liquefaction, based on the 3D laser profiling method

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In 2003 year, the Sanriku-Minami earthquake and the Miyagi-ken Hokubu earthquake occurred at May 26th and July 26th, respectively. Large-sized liquefactions occurred following the two earthquakes at Hamaichi and Ushiami districts, Naruse town, Miyagi prefecture. The Japanese Geotechnical Society had done field survey consisted by research of surface and measurement and reported the damage at the district. From their report, liquefaction points were mainly located at near canals, and infilled river channels, where the depth of groundwater level was shallow. Additionally, some of points repeated liquefaction following the Miyagi-ken Hokubu earthquake, since 1978 Miyagi-ken Oki and the Sanriku-Minami earthquakes.

We measured the surface to obtain detailed form of the liquefaction using 3D laser profiling instrument on December 24th and 25th. Until this measurement, rice had been already reaped from rice field. The location data of about 476 thousands points was obtained in 140 meters by 220 meters area as result of the measurement. After re-sampling by 0.5 meters mesh, we made 0.1 meters interval contour map and gradient tints. From these map, geometric pattern popped up. The pattern was seems not to be naturally occurring, we compared it with geographical map modified at 10 years ago, when current rice field had not been formed, and small rice fields were distributed. We found that relative uplifted area was corresponding with farm road at the time. And, rice field before re-formation of current rice field was just the area of liquefaction and secondary surface deformation. From hearing, we obtained collateral evidence as below; Current deformed area was originally infertile sandy rice field. The sand was used as constructive aggregate, and the area became like pond. Finally, pit sand filled the pond.

In fact, liquefaction occurrence do not mainly locate near canal infilled river channels with shallow groundwater level, but located at only area constructed artificially, where original distributed sand was extracted and re-infilled by pit sand. This idea was confirmed by boring and geoslicer survey done at same time as laser profiling.