

# Ground-Penetrating Radar Applied to the Gas Station House Underground Emptied Tilt

Ming-Chih Lin, Yu-Ming Kang, and Kun-Fa Lee

**Abstract**—Using non-destructive Ground-Penetrating Radar(GPR) to New Taipei City Wulai Xindian river water source protection area gas station house tilted surveying the situation, reference drilling report compared the results. Ground-Penetrating Radar detection station house tilt results accurately identify the reasons. Because of that station house tilted backward about 3~5 degrees and 3/4 station house is located in a dense rock, so it does not affect the station house collapsed.

**Index Terms**—Ground-penetrating radar(GPR), tilt, collapse.

## I. INTRODUCTION

In order to understand whether the gas station house building tilt danger of collapse, thus ground-penetrating radar to detect, to understand whether there is a subterranean formation station house emptied phenomenon stratum structure and master stations. Ground penetrating radar is the use of wave reflection principle to detect the target, Fig. 1 is a schematic diagram of ground-penetrating radar surveying, Tx representative transmit antenna, Rx representing the received antenna. Transmitted wave through the formation of surface ground penetrating radar moves along the bottom of the interface when it reaches the surface, reflected waves back to the ground by the receiving antenna, the shape of the lower figure generated images and interface.

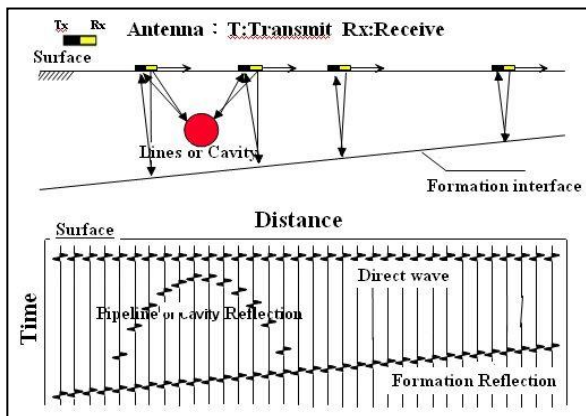


Fig. 1. GPR survey schematic diagram.

The use of Ground-Penetrating Radar geophysical survey systems, Inc. SIR-3000 host company and Hight Power 100MHz antenna.

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## II. LITERATURE REVIEW

From penetrating radar in the past, has emptied many experts to detect and outcomes research, example: (2003) [1] C. Maierhofer, Concrete infrastructure assessment. (2009) [2] G. Mori, evaluate levee safety. (2010) [3] D. P. Monica, Embankment monitored. (2010) [4] T. R. Ezzy t...et, Hydrogeology and groundwater modeling coastal plains. (2012) [5] X. B. Liu, Dike emptied and plate wet testing. (2012) [6] X. T. Han, Dike emptied and reinforcement corrosion testing. (2011) [7] M. R. Wang, Wave reflection and refraction method to explore concrete seawall cracks and holes. (2010) [8] X. C. Geng, *et al.*, Concrete dike structures emptied testing. (2009)[9]X. C. Geng...etc, Roadbed and embankments emptied testing. (2007)[10]W. T. Wu and R. G. Zhang, Road underground testing. (2003)[11]K. F. Lee...etc, Data parsing underground voids examples discussed. (2003)[12] C. K. Chang, Dykes whole detection and analysis database creation. (2000) [13] C. J. Xu, of the earth environmental investigation. (1999)[14]C. H. Yang. and L. R. Dong, Ground-penetrating radar technology. (1996) [15] Z .G. Zhou, Civil Engineering.

## III. GROUND PENETRATING RADAR SURVEYING

Ground penetrating radar needed a total of four survey lines (Table I and Fig. 2 – Fig. 5)

TABLE I: STATISTICS SURVEY LINE

No	File No	Line Length (m)	Line depth (m)	Direction
1	265	21	15	WE
2	268	8	15	SN
3	266	4.2	15	WE
4	270	3	15	NS



Fig. 2. Ground-penetrating radar WE survey line 265.

Then take Taiwan Kajima Engineering Consultant Co., Ltd. related to geological drilling core were compared, inspection

of the station house at about nine meters underground formation does have emptied the following, drill core data shown in Fig. 6.

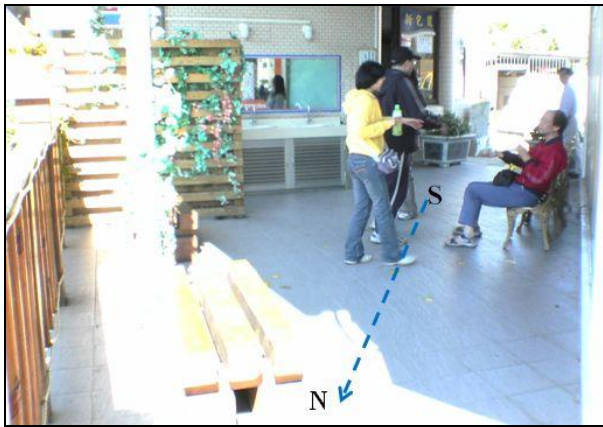


Fig. 3. Ground-penetrating radar SN survey line 268.

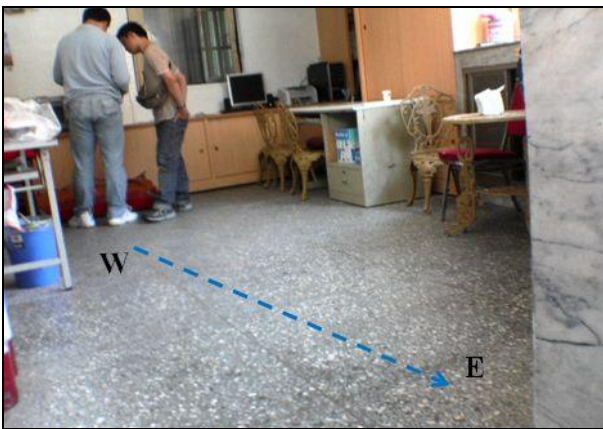


Fig. 4. Ground-penetrating radar WE survey line 266.

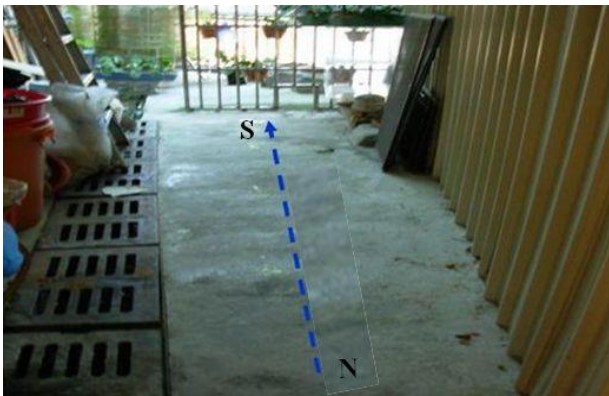


Fig. 5. Ground-penetrating radar NS survey line 270.

IV. DATA PROCESSING, ANALYSIS, INTERPRETATION

Ground penetrating radar station house building ground stations emptied, to the depth of detection works in the data processing, and then to explain the interception optimum profile analysis, the following results can be presented in a clear profile data performance emptied location. analysis explained as follows:

Fig. 7 section emptied about 3.2 ~ 5.2m and 15.5 ~ 18.5m position, a depth of about 10 and 10.8m, hollowed out by a cross-section shows two points from a depth of about 10 ~ 10.8m after presenting a flat surface extending downward ,

where there are septic tanks (approximately 2.5m length and width), the stage hands have crashed at about 1m down situations. There is a 3 ft × 6 ft thick steel barrier in five minutes at 15.5 ~ 18.5m.

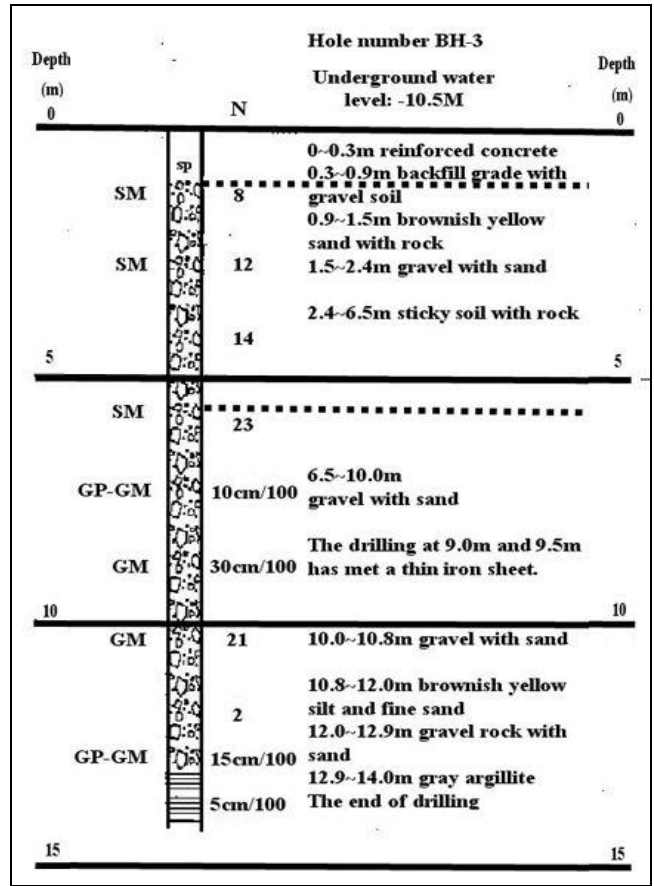


Fig. 6. Core cross-sectional data.

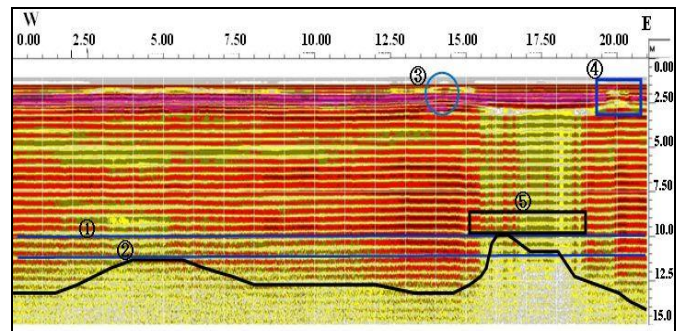


Fig. 7. Ground-penetrating radar W-E survey lines 265 WE direction section. (①Depth:10m ②Depth:10.8m ③Monitoring wells ④Ditch ⑤Steel plate 3x6 feet).

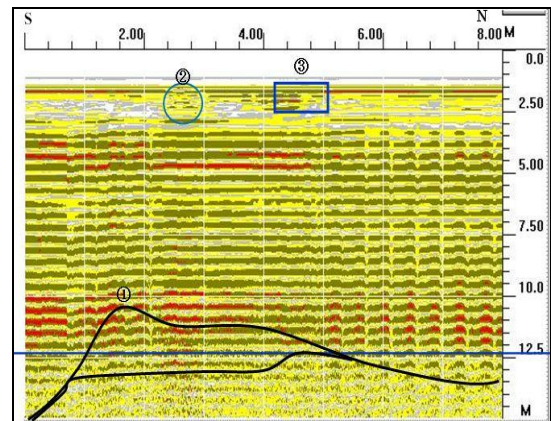


Fig. 8. Ground-penetrating radar SN survey lines 268 SN direction section. (①Depth:12.48m ② Monitoring wells ③Ditch).

Fig. 8 section hollowed position about 3m depth of 10.8m, as File265 file extension, the depth of File265 to 268 file extension changes seen in depth from about 10.8 ~ 10.48m, may be due to changes in surface topography, and almost horizontal direction then the next crashed.

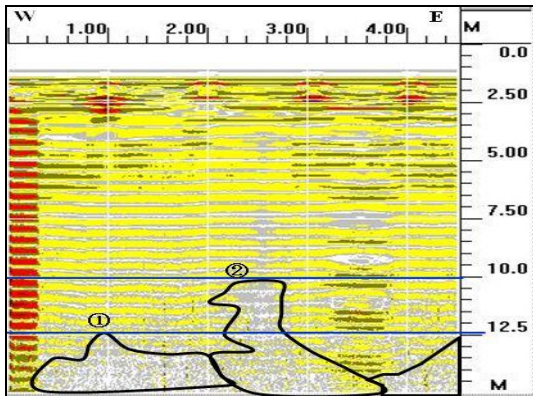


Fig. 9. Ground-penetrating radar WE survey lines 266 WE direction section.(①Depth:12.48m ②Depth:10.2m).

Fig. 9 section hollowed position about 1m, depth of 12.48m, as File268 extension file, the depth of the File268 to 266 file, change the extension to see the depth of about 10.2 ~ 12.48m, due to changes in subsurface formations emptied the worst, followed by local crashed almost directly down.

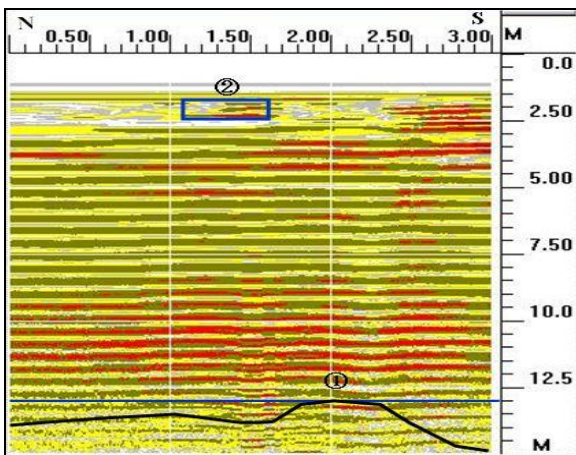


Fig. 10. Ground-penetrating radar NS survey lines 270 NS direction section.(①Depth:13 m ②Ditch).

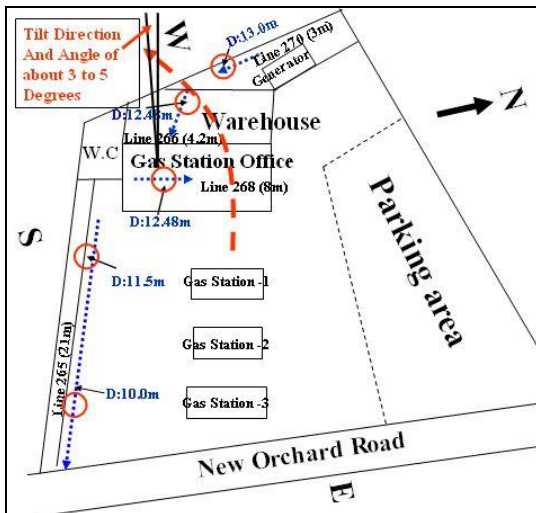


Fig. 11. Overall Gas stations and station house building range assessment tilt back schematic.

Fig. 10 section emptied location approximately 3m, depth of about 13.0m File266 file for the extension of its depth from the File266 to 270 files, see the depth extension varies from about 12.48 ~ 13.0m, an underground formation cut by river water erosion caused emptied (back filling stations New Taipei City Xindian.), subsidence, and by measuring station house tilted backwards (about 3 to 5 degrees) show steady last change phenomenon.

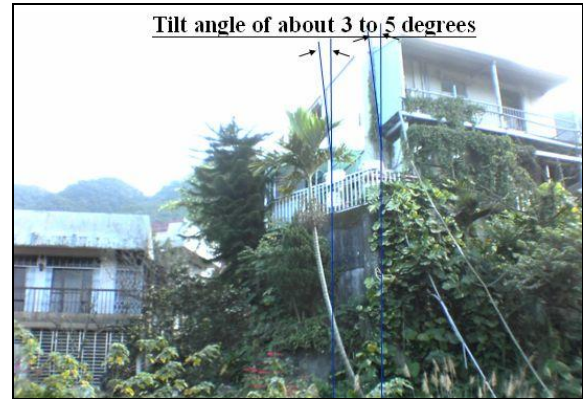


Fig. 12. Tilt the back of the gas station house building (Tilt angle of about 3 to 5 degrees).

## V. CONCLUSION

From Ground-Penetrating Radar cross-section and core drilling report data, the gas station house is emptied and tilted backward about 3 to 5 degrees (see Fig. 11 and Fig. 12), but the whole building is located on the rugged rock formations, So there is no danger of collapse and fixed-time prosecutors.

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