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The Challenging of Direct Current Resistivity Survey in River Bank Protection

Chatchai Vachiratienchai [a]* and Puwis Amatyakul [b]

[a] Curl-E Geophysics Co., Ltd., Nakhon Pathom, 73170, Thailand.
[b] Department of Physics, Faculty of Science, Mahidol University, and Thailand Center of Excellence in Physics, Ministry of Higher Education, Science, Research and Innovation, Bangkok, 10400, Thailand
* Corresponding author. E-mail address: chatchai.vac@gmail.com

Abstract

River bank erosion is a serious problem that continuously evolves. To prevent or reduce the erosion process, river bank protection was designed and constructed based on every 200-meter boring log information. Roughly 50 percent of the constructed protection deteriorated or collapsed. The main reason is the lack of information between the boring logs. Therefore, 2D direct current resistivity survey was introduced to the river bank protection project.

2D direct current resistivity survey was developed based on two assumptions which are (1) the survey profile is a straight line and (2) the perpendicular structure is invariable. Both assumptions are invalid in the river bank protection project since the survey profile has to deploy along the river and close to the construction profile. Therefore, the shape of the river bank will affect to direct current resistivity data and also affect the reliability of the resistivity model.

In this work, 3D forward modeling was used to simulate direct current resistivity along the direct current resistivity profile. The effect of river bank shape can separate into 2 parts which are (1) slope effect and (2) curvature effect. For the slope effect test, the resistivity profile was a straight line and 1-m offset from the river bank boundary. The slope of the river bank was varying by changing the dip angle from 0º to 90º. For the curvature effect, the river bank boundary was bent from 0º to 80º at the center of the resistivity profile of which the offset was 1 meter from the boundary. The simulated data were inverted by 2D inversion to find the maximum angle at 2D inversion can provide a reliable resistivity model.

Keywords: direct current resistivity survey, river bank protection, 3D forward modelling, slope effect, curvature effect