# Analysis of Buried Plastic Pipes in Reinforced Sand under Repeated-Load Using Neural Network and Regression Model

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***Abstract:*** *The safety of buried pipes under repeated load has been a challenging task in geotechnical engineering. In this paper artificial neural network and regression model for predicting the vertical deformation of high-density polyethylene (HDPE), small diameter flexible pipes buried in reinforced trenches, which were subjected to repeated loadings to simulate the heavy vehicle loads, are proposed.*

*The experimental data from tests show that the vertical diametric strain (VDS) of pipe embedded in reinforced sand depends on relative density of sand, number of reinforced layers and height of embedment depth of pipe significantly. Therefore in this investigation, the value of VDS is related to above pointed parameters.*

*A database of 72 experiments from laboratory tests were utilized to train, validate and test the developed neural network and regression model. The results show that the predicted of the vertical diametric strain (VDS) using the trained neural network and regression model are in good agreement with the experimental results but the predictions obtained from the neural network are better than regression model as the maximum percentage of error for training data is less than 1.56% and 27.4%, for neural network and regression model, respectively. Also the additional set of 24 data was used for validation of the model as 90% of predicted results have less than 7% and 21.5% error for neural network and regression model, respectively. A parametric study has been conducted using the trained neural network to study the important parameters on the vertical diametric strain.*

***Keyword:*** *Neural network, Regression model, Soil reinforcement, Buried pipe, Vertical diametric Strain*

## 1. Introduction

The buried pipeline is decaying due to insufficient quality control, resulting in poor installation, little or no inspection and maintenance, and a general lack of uniformity and improvement in design, construction and operation practices. Many researchers have focused on this topic and developed the soil-pipe interaction experimentally, numerically or presented the mathematical relations or empirical equations. The original work was carried out by Marston and Anderson (1913) [1], and a theory for calculating diametric change under soil overburden, was used by Spangler (1941) [2] to obtain a formula for calculating the horizontal deflection of buried pipes under soil overburden. Masada (2000) was revisited the classical work of Spangler to derive a modified Iowa formula for estimating vertical deflection of flexible pipe under soil overburden [3].

These design methods, whether developed from empirical or theoretical bases, deal with