

# Soil Stabilisation by using Waste Beverage Cans

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**ABSTRACT:** For any land based structure, the foundation has to be strong enough to support the entire structure. The soil around it plays a very critical role in enhancing the strength. The process of soil stabilisation helps to achieve the required properties in a soil needed for the construction work. This work present an investigation on the effect of penetration response of soil reinforced with waste aluminium beverage cans. These cans in the form of geo cell introduce into the soil and find the penetration response of soil by conducting triaxial shear test in a cylinder. Test is conducted on both reinforced and unreinforced soil. Test is performed by placing the cans with varying number of layers , depth and spacing. The present study covers the use of waste aluminium beverage can in enhancing soil stabilisation. The main of this study is to understand the penetration response of soil and compare the results of reinforced and unreinforced soil.

**KEYWORDS:** Soil stabilisation, Beverage cans, Penetration response , Bearing capacity.

## INTRODUCTION

Development of the infrastructure is the most important need in resent time. To full fill the infrastructural need of population, small multi-story buildings express highways, high speed rail tracks, new bridges, airports etc. are required to construct. Ultimately loads from such structure come on the ground. Due to space constrains many times construction takes place on poor soil. Replacement of weak soil by some strong soil or improvement of engineering properties of weak soil by different ground improvement techniques are used in such situation. Soil reinforcement is one of the most popular ground improvement techniques. Geosynthetics are human-made possible cost effective environmental, transportation and geotechnical engineering construction projects. Hence geocell can provide better lateral confinement to in fill soils. The reinforced composite formed by the geocell and the infill soil has a higher stiffness and shear strength than the unreinforced soil. The term geocell also have two parts first is “geo” which means soil or earth and second is “cell” which means cellular type of shape for infill material such as soil. Here we collect Sandy soil for the test and evaluation of the soil penetration that the reinforcement materials to be used. Here the material is Waste Beverage Cans reinforcement materials to be added. This Beverage Cans are aluminium materials and they are insoluble in soil. By using this materials we test these by making the materials into cells and applied in this sand soil and observing the value by load test. Compare the values and observe that the soil get strength or not.

## II.RELATED WORK

Hanifi Canakci, Fatih Celik Mohammed O. A, Bizne Media O. A. Bizne (2016) carried out a study on stabilization of clay soil using beverage cans and Based on his experimental results ,he concluded that. Adding aluminium beverage cans to the expansive soil increase bearing capacity; therefore less effort could be considered during compaction and stabilizing expansive soil.

Husna Humayoon and Binil G opinath (2016) carried out a study on improvement of CBR using waste plastic material as geocell in natural soil from Kuttanadu in Alappuzha district (specific gravity 2.22). In this study, usage of locally available waste plastic bottle is used to improve the strength of sub grade soil.

G. MadhaviLatha and Amit Somwanshi (2009) studied on bearing capacity of square footing on geosynthetic reinforced sand. Load test is conducted on 150x150x25 mm footing with different geogrids.

S.W Thakare and S.K Sonule (2013) studied the possibility of use of waste plastic bottles as soil reinforcement for bearing capacity improvement. Bearing capacity of square footing on sandy soil (specific gravity 2.58,avg grain size 0.46mm) reinforced with waste Beverage cans is evaluated.

III.METHODOLOGY

The materials used in carrying out this study were sand and waste beverage can cell. The properties of sand is shown in Table 1. Experimental penetration test would be conducted in a cylindrical tank of size 32cm height and 28cm diameter. The sand bed would be prepared in 6 layers of 50 mm thickness. Each layer was compacted to achieve the desired relative density of 1.5g/cc. Load is applied with strain rate of 6mm/min. Beverage cans are placed in required depth and spacing. Table 2 shows the test configuration.

**Table 1: Properties of sand**

FINENESS MODULUS	5.25
EFFECTIVE SIZE, D <sub>10</sub>	0.35
UNIFORMITY COEFFICIENT, CU	4
COEFFICIENT OF CURVATURE, CC	1.8
SPECIFIC GRAVITY	2.7

**Table 2: Test configuration**

NO OF LAYERS	DEPTH OF FIRST LAYER	SPACING OF LAYERS
1	1D,2D,3D	
2	1D	1D,2D
	2D	1D,2D
3	1D	1D,2D
	2D	1D,2D



**Fig.1 Preparation of test bed**



**Fig 2. Making of reinforcement location**



**Fig.3 Placing of beverage can cell**

IV. EXPERIMENTAL RESULT

1. Penetration test on unreinforced sand

Load test is conducted on unreinforced sand. The load-settlement curve is shown in figure 4.

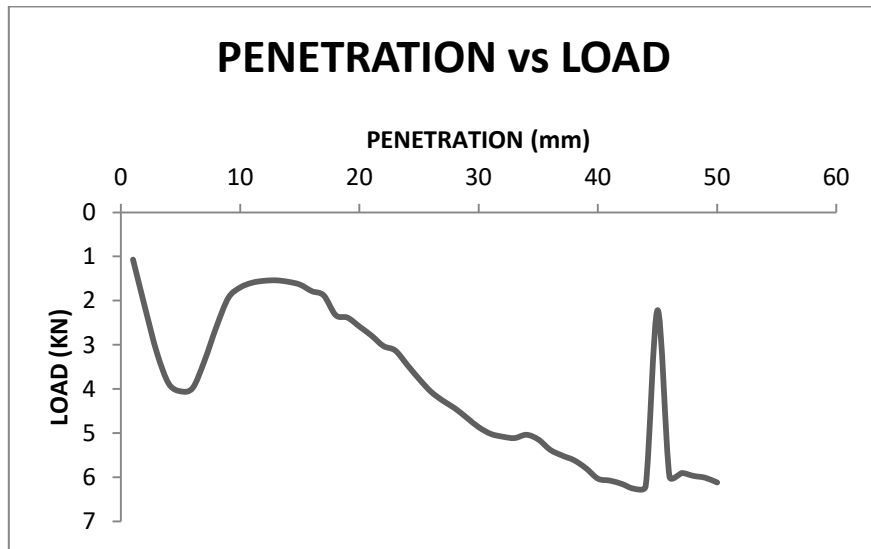


Fig.4 Load-Penetration curve for unreinforced sand

2. Penetration test on reinforced sand

2.1 Single layer

A series of load test conducted on sand reinforced with single layer of reinforcement at different depth. Figure 6 shows settlement response of sand reinforced at 1D, 2D and 3D depth using beverage can cells. Table 3 shows the maximum load carrying capacity of reinforced sand in single layer.

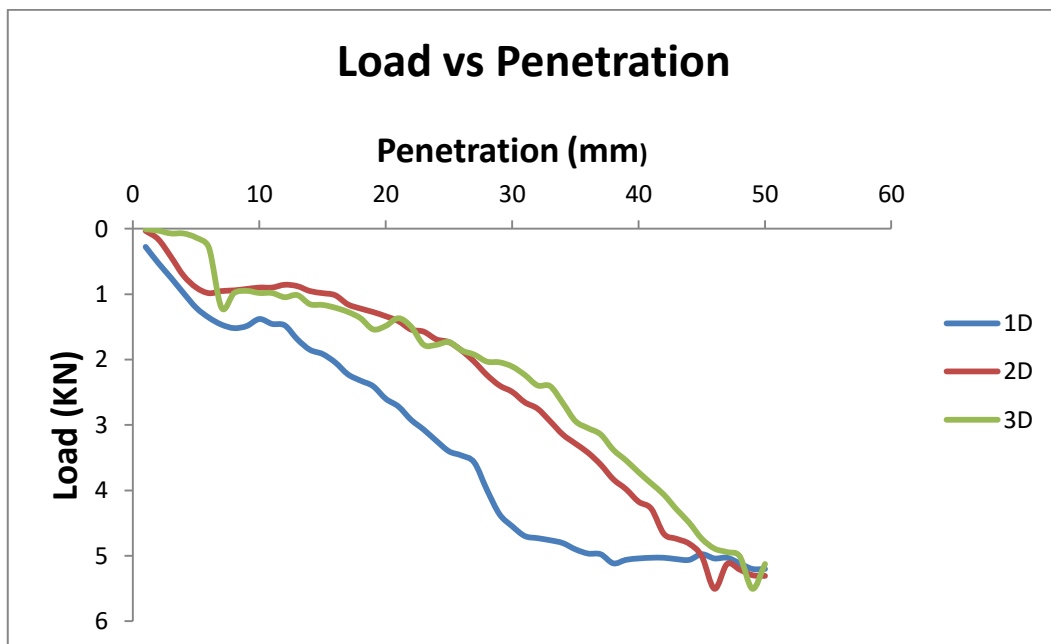


Fig.6 Load-Penetration curve for reinforced sand with single layer



Table 3: Maximum load carrying capacity of single layer

DEPTH	Max LOAD(KN) FOR 50mm PENETRATION
1D	5.3286
2D	5.23072
3D	5.1253

2.2 Double layer

Penetration tests were conducted on sand reinforced with double layer of Beverage can cell. The depth and spacing was varied and the reinforcing effect is studied. Figure 7 shows the Penetration VS Load curve for double layer of reinforcement. Table 4 shows the maximum load capacity values of sand reinforced with double layer of beverage can cells.

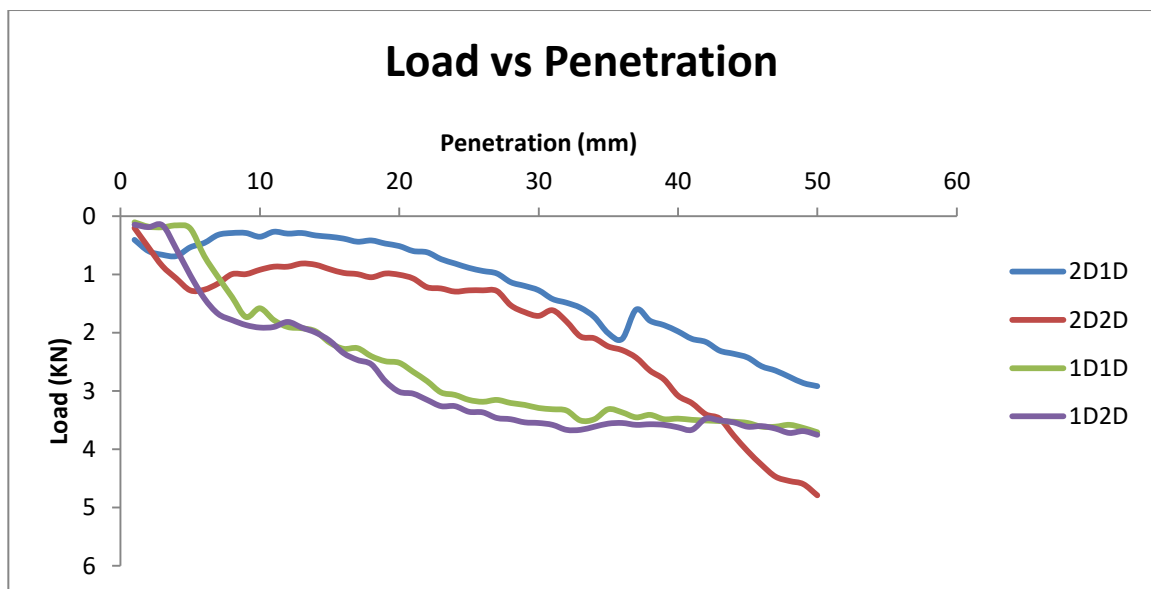


Fig 7. Load vs Penetration curve for reinforced sand with double layer

Table 4: Maximum load carrying capacity in double layer

DEPTH		Max LOAD
1D	1D	3.638
	2D	3.7557
2D	1D	2.9211
	2D	3.476



2.3 Triple layer

Penetration tests were conducted on sand reinforced with triple layer of Beverage can cell. The depth and spacing was varied and the reinforcing effect is studied. Figure 8 shows the Penetration VS Load curve for triple layer of reinforcement. Table 5 shows the maximum load capacity values of sand reinforced with triple layer of beverage can cells.

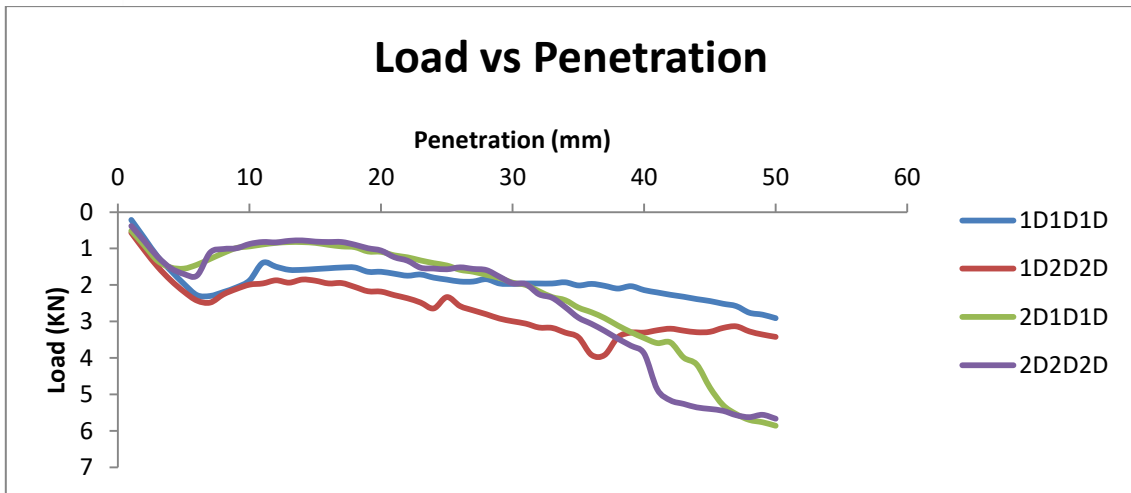


Fig 8 Load-Penetration curve of reinforced sand with triple layer

Table 5: Maximum load carrying capacity in triple layer

DEPTH			Max LOAD
1D	1D	1D	2.9104
	2D	2D	5.924
2D	1D	1D	5.8636
	2D	2D	5.671

3. Penetration ratio

Penetration ratio (PR) is the ratio of load of reinforced soil to that of the unreinforced soil the same settlement.

3.1 Effect of depth of placement

A series of Penetration test were conducted to study the effect of depth of single reinforcement. Beverage can cell were placed at 1D, 2D, 3D depth. The Penetration ratio (PR) for single layer is shown in Table 6. The variation of PR is shown in figure 9.

Table 6: PR value for single layer

DEPTH	PR(%)
1D	90.23
2D	45.96
3D	45.96

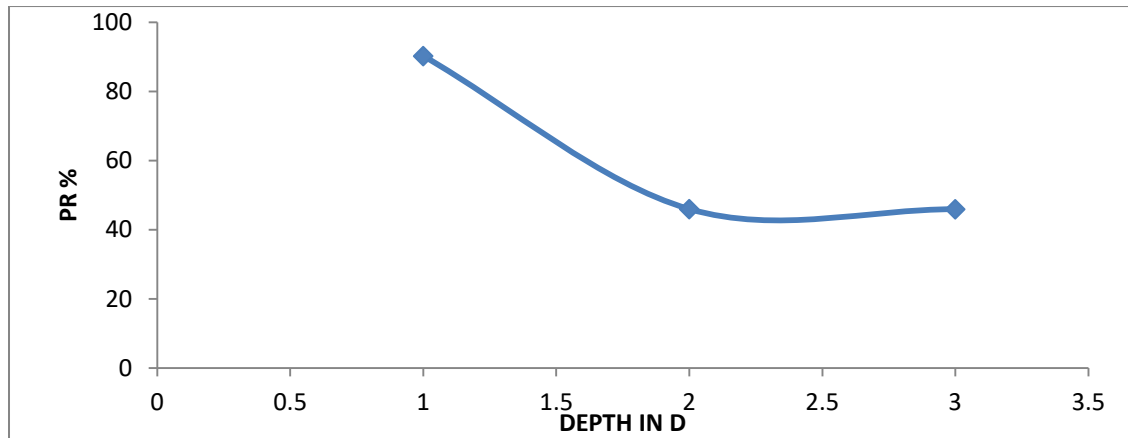


Fig 9 PR-Depth curve for single layer

3.2 Effect of spacing of layers

A series of Penetration test were conducted on sand reinforced with beverage can cell at constant depth and different spacing. Effect of spacing is studied on sand reinforced with two layer and three layer. It is observed that the magnitude of load varies with spacing. For each depth the peak bearing capacity is observed for 2D spacing. It is also observed that the settlement varies with spacing. Fig 10 and 6.11 shows the effect of spacing on PR for double and triple layer of reinforced beverage can cell respectively. Table 7 and table 8 shows the PR and maximum load variations of two layer and three layer with spacing respectively.

Table 7: PR values of double layer

DEPTH	SPACING		PR
1D	1D	1D	49.08
	2D	2D	61.85
2D	1D	1D	38.87
	2D	2D	41.71

Table 8: PR values of triple layer

DEPTH	SPACING	PR (%)
1D	1D	83.7
	2D	89
2D	1D	23.55
	2D	33.76

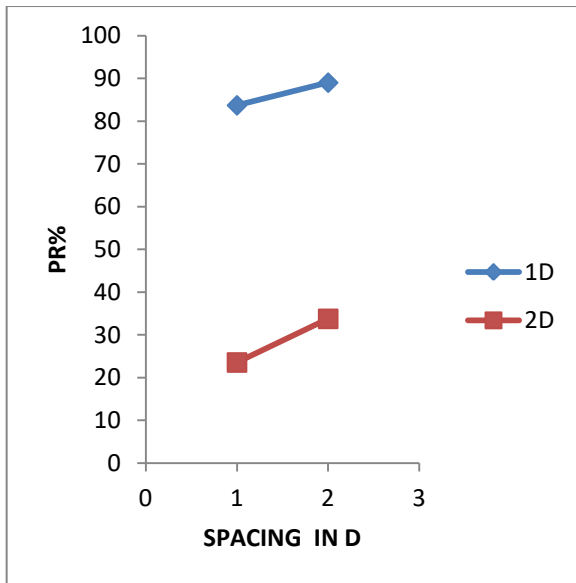


Fig 10. Variation of PR in double layer

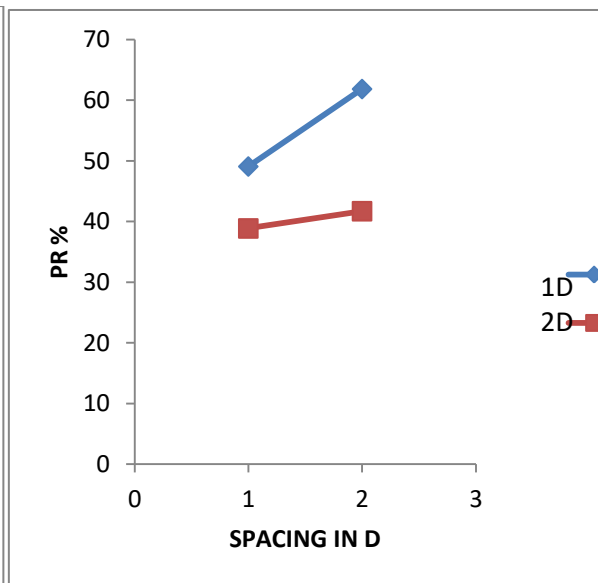


Fig 11. Variation of PR in triple layer

In above two layer condition the maximum load carrying is the top layer placed 1D from top and spacing between the layer is 2D.

In above three layer condition the maximum load carrying is the top layer placed 1D from top and spacing between layer is 2D

### V.CONCLUSION

A series of laboratory Penetration tests were conducted on beverage can cell reinforced sand foundation to investigate the effect of using reinforcement. The inclusion of beverage can cell significantly increases the load-carrying capacity and reduces the settlement.

Based on results obtained from the present investigation, the following conclusions can be made.

- 1) The magnitude of improvement in bearing capacity depends on the depth of placement of beverage can cell and spacing of layers.
- 2) For single layer beverage can cell reinforcement the peak improvement is observed at 1D depth.
- 3) For double layer beverage can cell reinforcement the peak improvement is observed at 1D depth with 2D.spacing
- 4) For triple layer beverage can cell reinforcement the peak improvement is observed at 1D depth with 2D spacing
- 5) The bearing capacity is maximum at triple layer for beverage can cell

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