NED UNIVERSITY OF ENGINEERING &TECHNOLOGY, KARACHI-75270

SUBGRADE STABILIZATION USING GEOSYNTHETICS

By

Dr. Amanullah Marri
Dr. Adnan Qadir
Mr. Sajjad Ali

OUTLINE OF PRESENTATION

- INTRODUCTION
- OBJECTIVES
- METHODOLOGY
- RESEARCH PLAN
- RESULT AND DISCUSSIONS
- CONCLUSIONS

introduction

- The use of traditional techniques in earthworks, such as engineered fills, canal lining, and subgrades for pavements, often faces problems because of high costs and/or environmental issues.
- Such problems are primarily because of the need for borrowing great volumes of good quality material which might be difficult to find nearby, and the transportation costs could be high and disposing the local soil in deposits

introduction

- In these cases an alternative could be the improvement of the local soil by the addition of cementitious and geosynthetic materials.
- In this study the Mechanical Behaviour of Typar Geosynthetics under static loading was carried out on subgrade materials.
- The work includes qualitative and quantitative assessment of the effectiveness of Typar geosynthetics as reinforcing materials and its performance under the

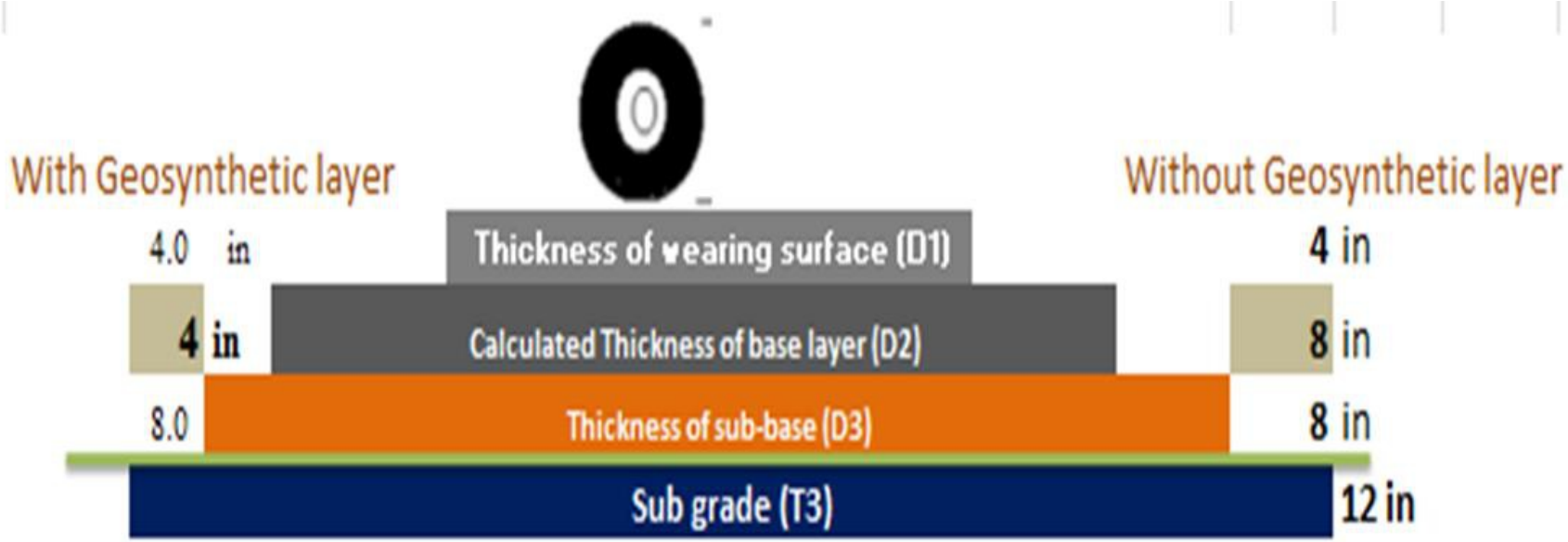
introduction

- In this study it was focussed to investigate the Mechanical Behaviour of Typar Geosynthetics under static and fatigue /cyclic loading material.
- The work included qualitative and quantitative assessment of the effectiveness of Typar geosynthetics as reinforcing materials and their performance under the local environment.

OBJECTIVES

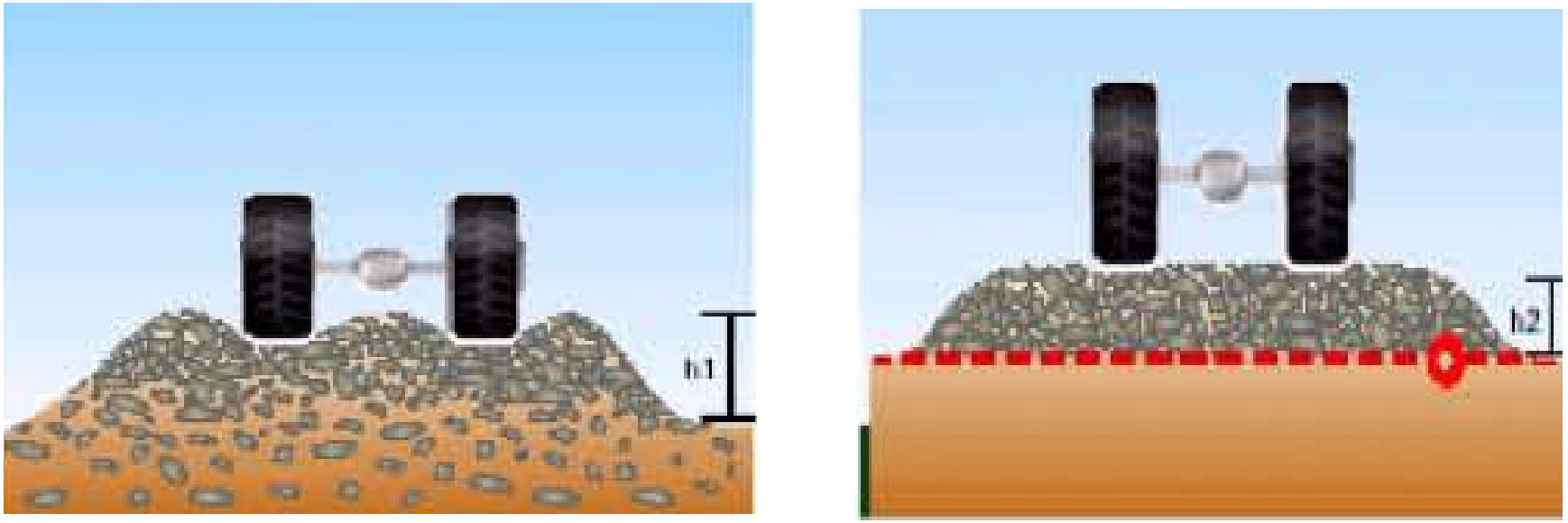
- Determination of the effectiveness of TYPAR Geo-synthetics as reinforced material under static loading
- Evaluation of the cost effectiveness of TYPAR as reinforced materials.

background


With Geosynthetic layer
Without Geosynthetic layer
4.0 in
Thickness of wearing surface (D1)
4 in
4 in
Calculated Thickness of base layer (D2)
8 in
8.0
Thickness of sub-base (D3)
8 in
Sub grade (T3)
12 in

background

PERFORMANCE OF GEOTEXTILE

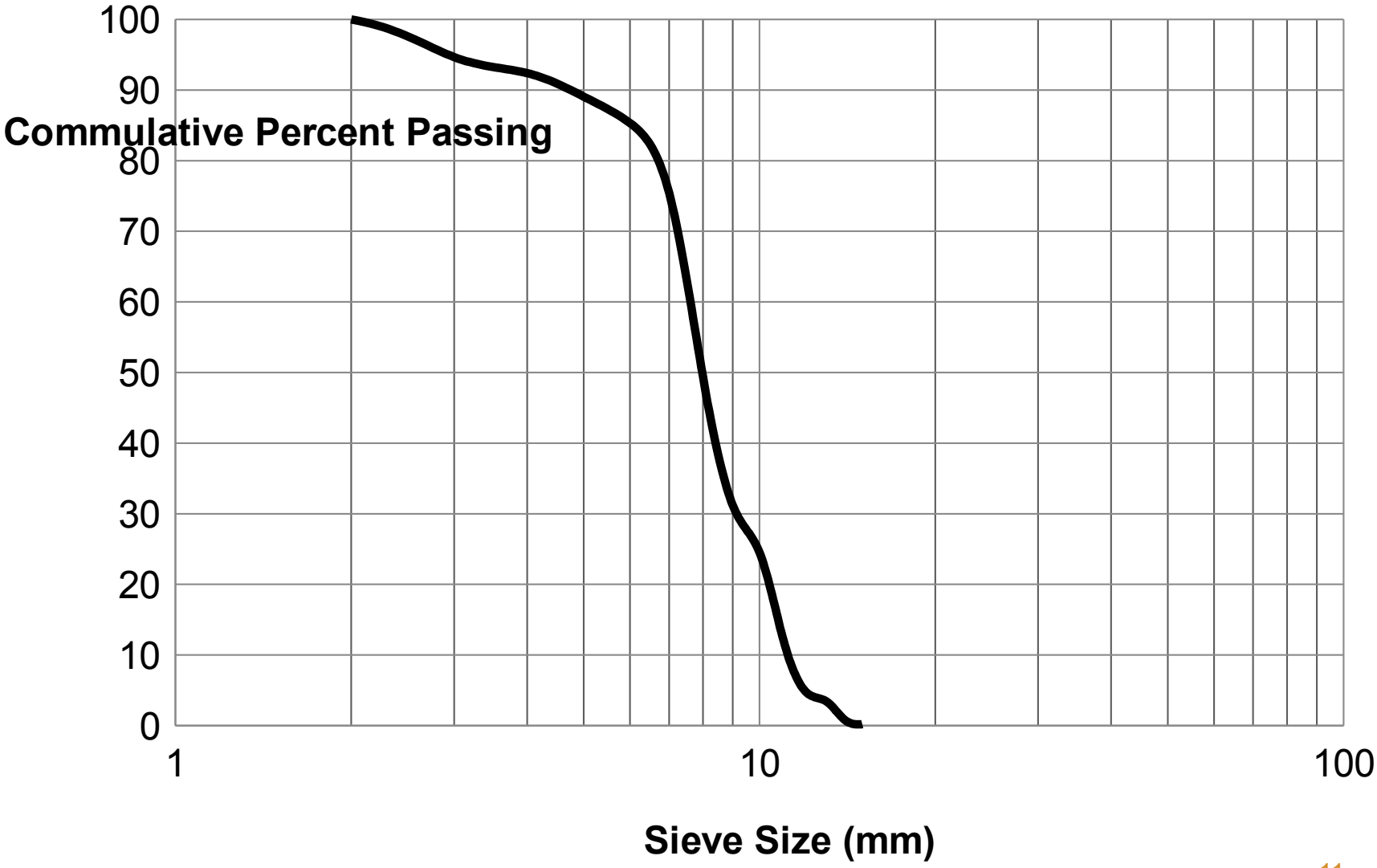


Aggregate and subgrade interaction (a) without geosynthetic layer and (b) with geosynthetic layer

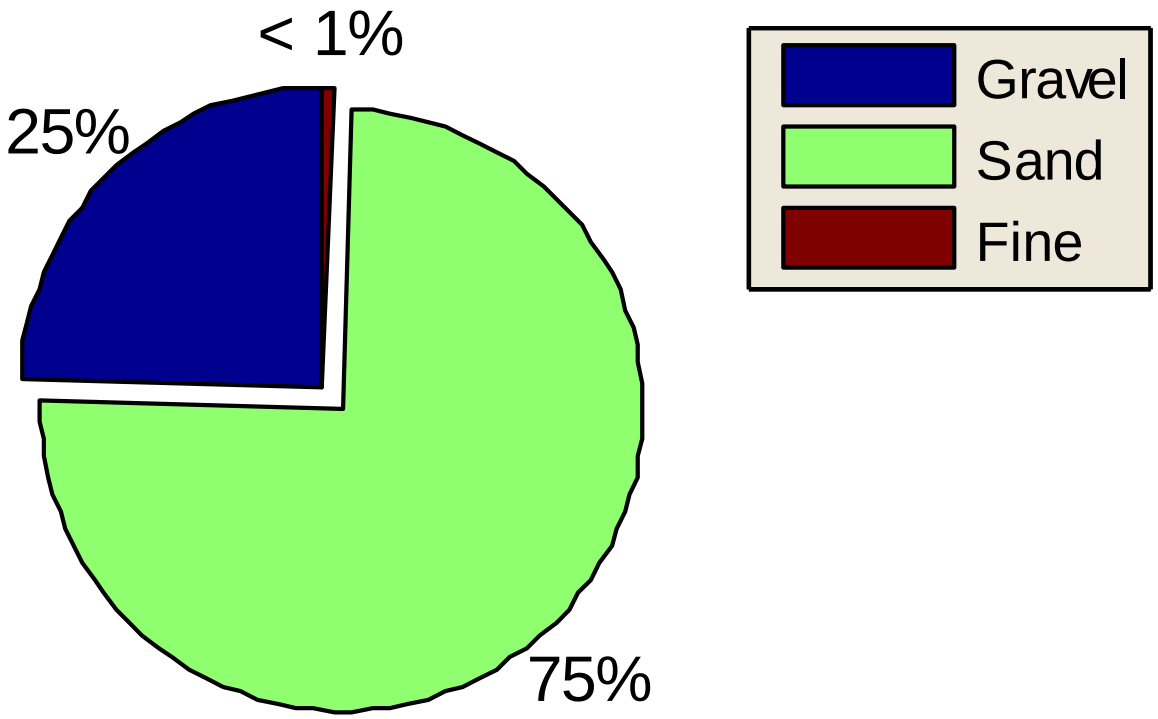
Materials

PROPERTY OF TYPAR	SPECIFICATIONS
Colour	Gray
Specific gravity	0.91
Length	100 m or 150 m
Width	4.5 m or 5.2 m
Fibre Diameter	40-50 μm
Tensile strength	3.3 kN/m -30 kN/m
Elastic modulus	6000-9000 (N mm-2)
Water absorption	none
Softening point	165° C
Composition	100% polypropylene
Existing styles	13 existing styles

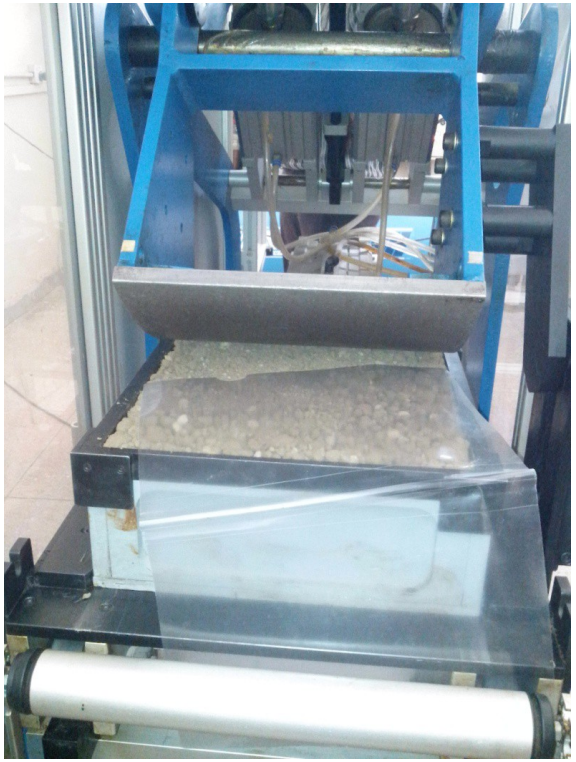
Subgrade soil



Subgrade soil



CBR Test setup



setup for load-deformation

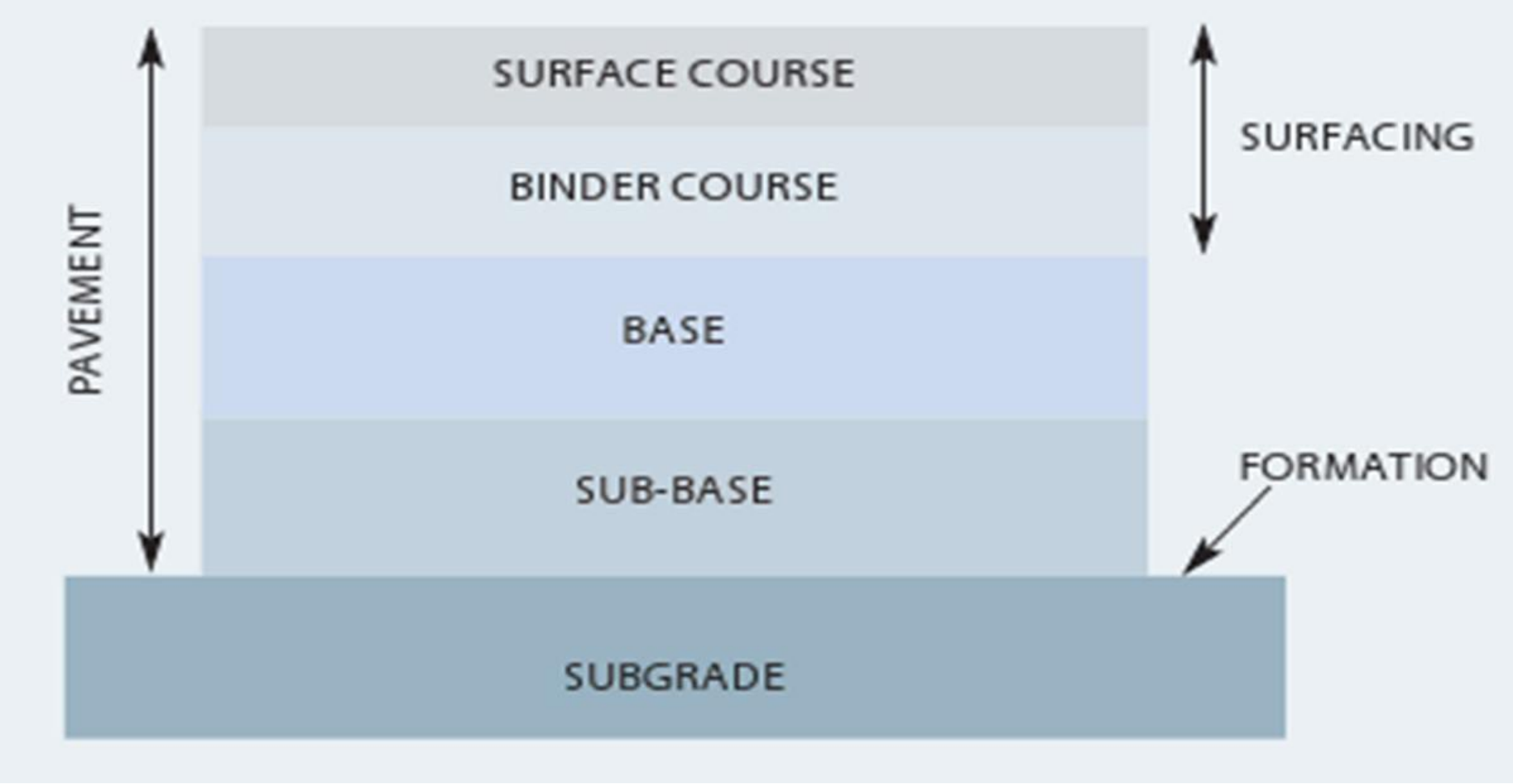
EXPERIMENTAL SETUP FOR REINFORCED SUBGRADE TESTING

Universal testing machine

Universal testing machine (UTM).

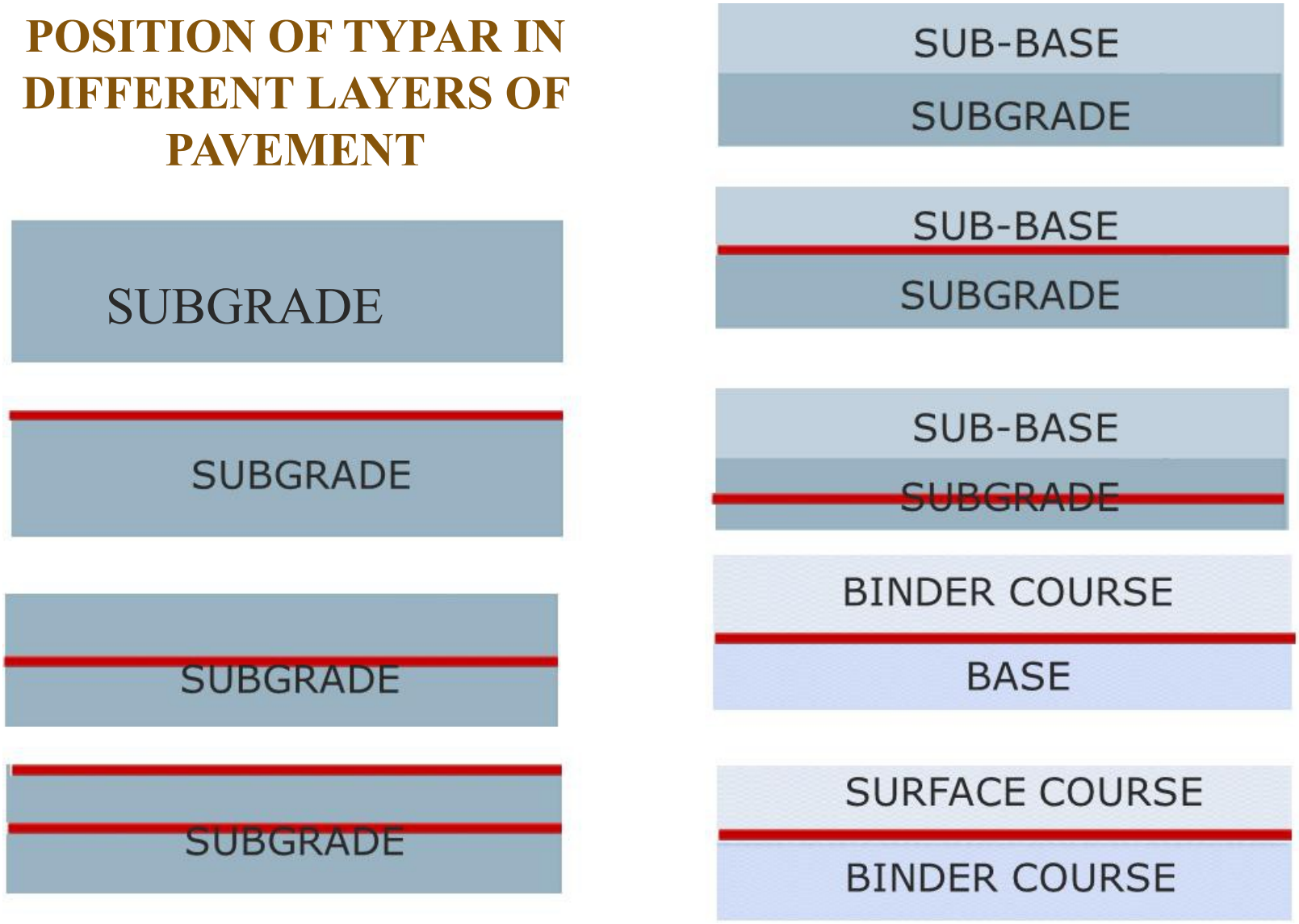
TESTING PLAN FOR REINFORCED PAVEMENT

EXPERIMENTAL SETUP FOR REINFORCED HIGHWAY PAVEMENT

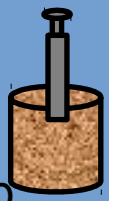
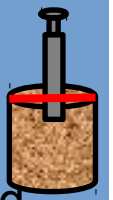
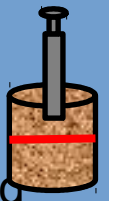
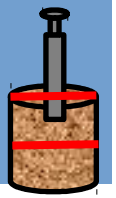


TESTING PLAN FOR REINFORCED PAVEMENT

POSITION OF TYPAR IN DIFFERENT LAYERS OF PAVEMENT



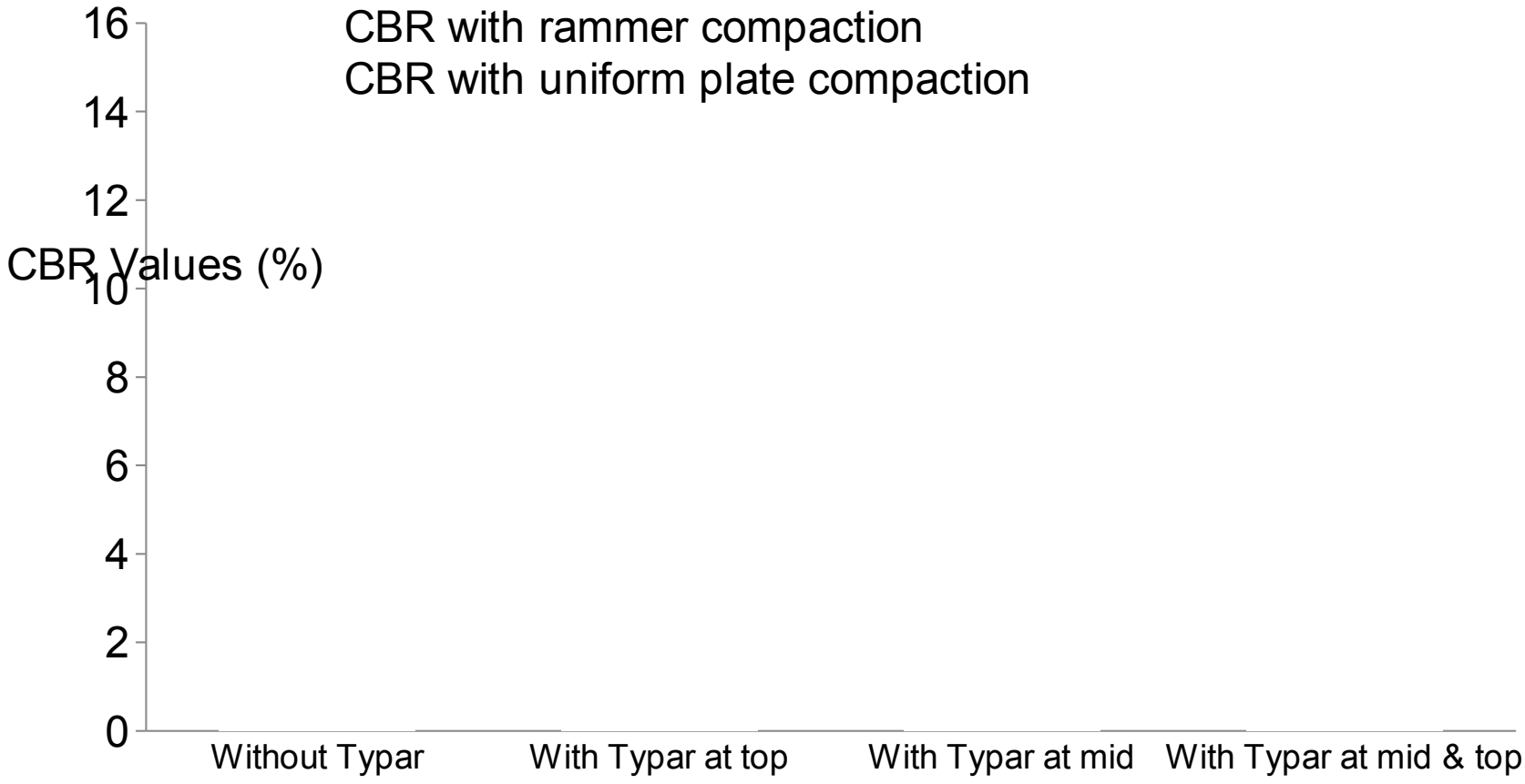
CBR TESTING PLAN

CBR ID	WEIGHT OF SOIL	Typar sheet(s)	Purpose	POSITION OF TYPAR LAYER
CBR 1	4300gm	Nil	As reference value	Without Typar 
CBR 2	4300gm	01	Effect of geosynthetics	With Typar at top 
CBR 3	4300gm	01	Test 2 and 3 effect of change of position	With Typar at mid 
CBR 4	4300gm	02	Test 2,3 & 4 effect of geosynthetic layers	With Typar at mid & top 

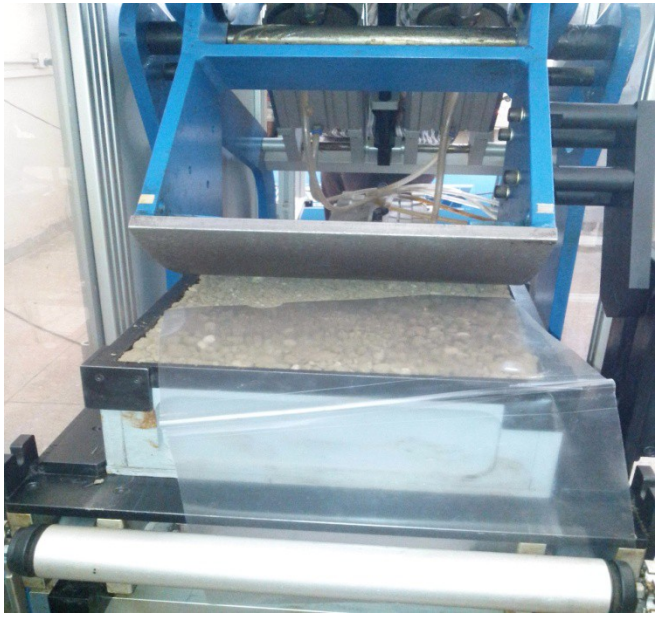
Difficulties in sample preparation

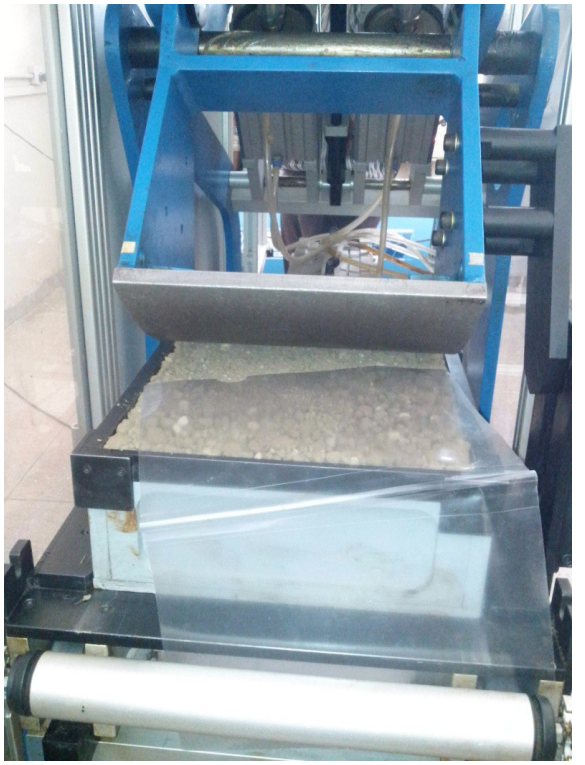
Compaction can generally be achieved through, tamping, vibration, kneading and/or pressure. The compaction through tamping resulted bulging and therefore, pressure compaction was adopted to achieve the targeted density of the sample.

Difficulties in sample preparation

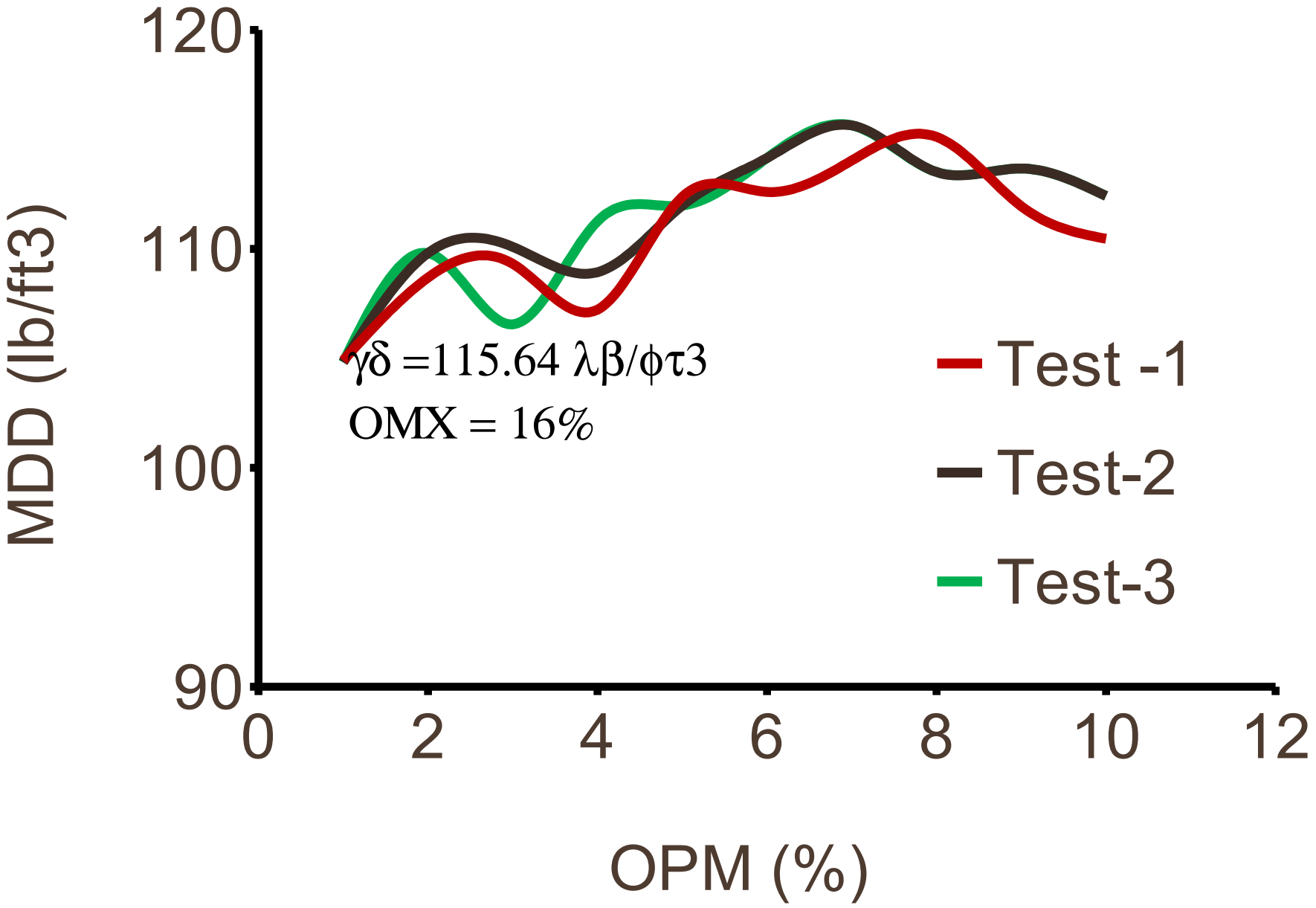


COMPACTION CHARACTERISTICS





COMPACTION CHARACTERISTICS



SUMMARY OF THE TESTS PERFORMED

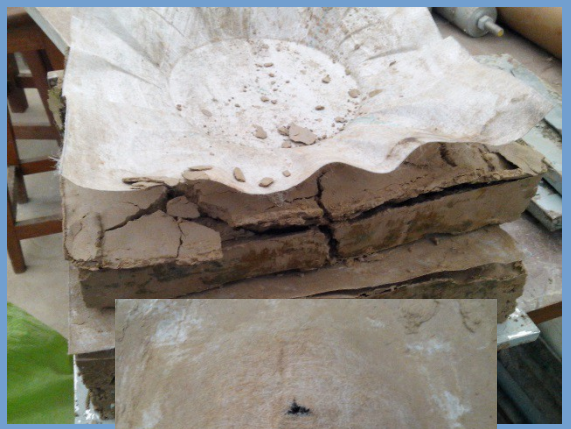
Without Typar

With Typar at top

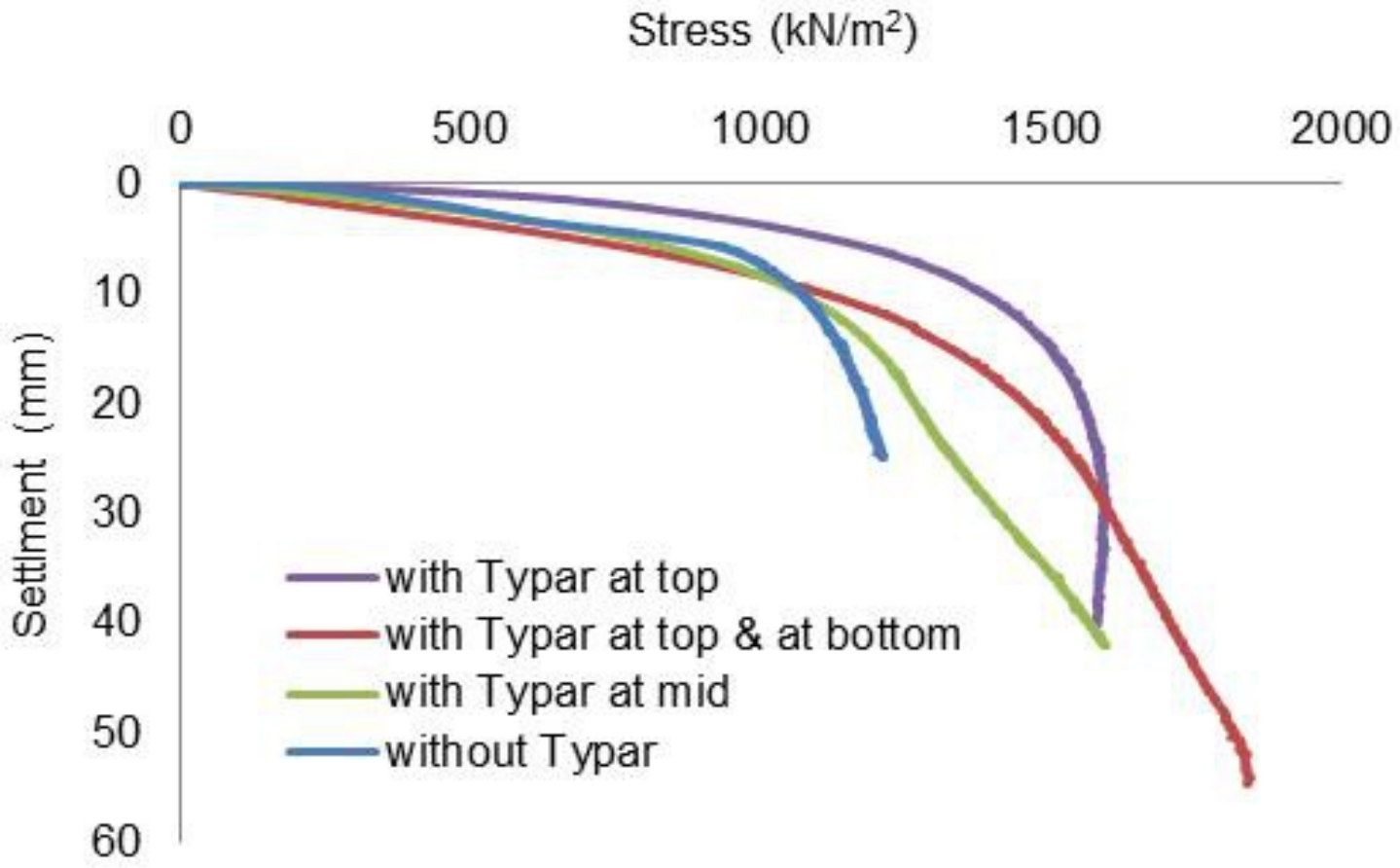
SUMMARY OF THE TESTS PERFORMED

With Typar at mid

With Typar at top and mid



Load-deformation results



SUMMARY OF CBR TESTS PERFORMED

WITHOUT TYPAR

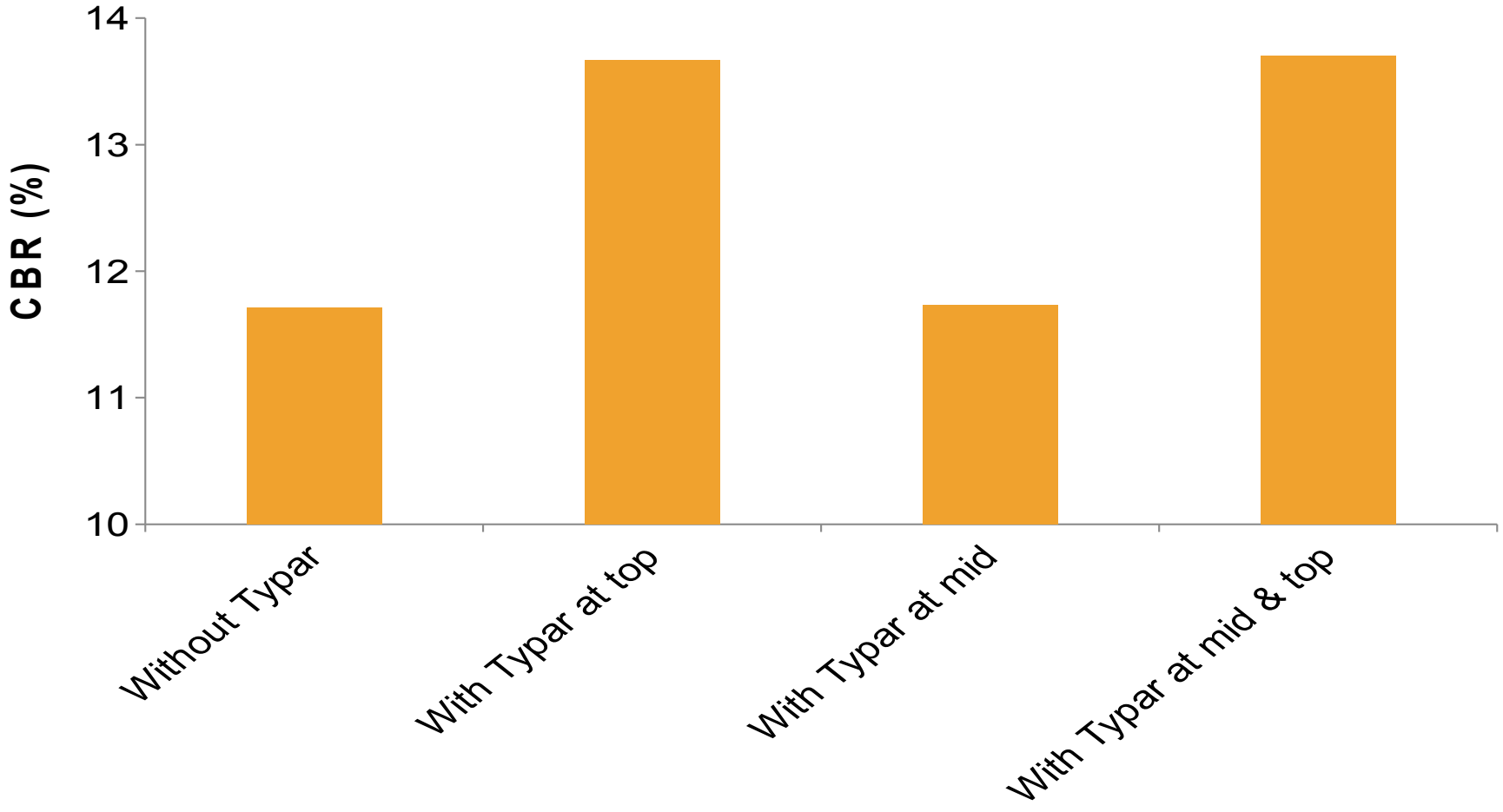
WITH TYPAR AT TOP

SUMMARY OF CBR TESTS PERFORMED

WITH TYPAR AT MID

WITH TYPAR AT MID & AT TOP

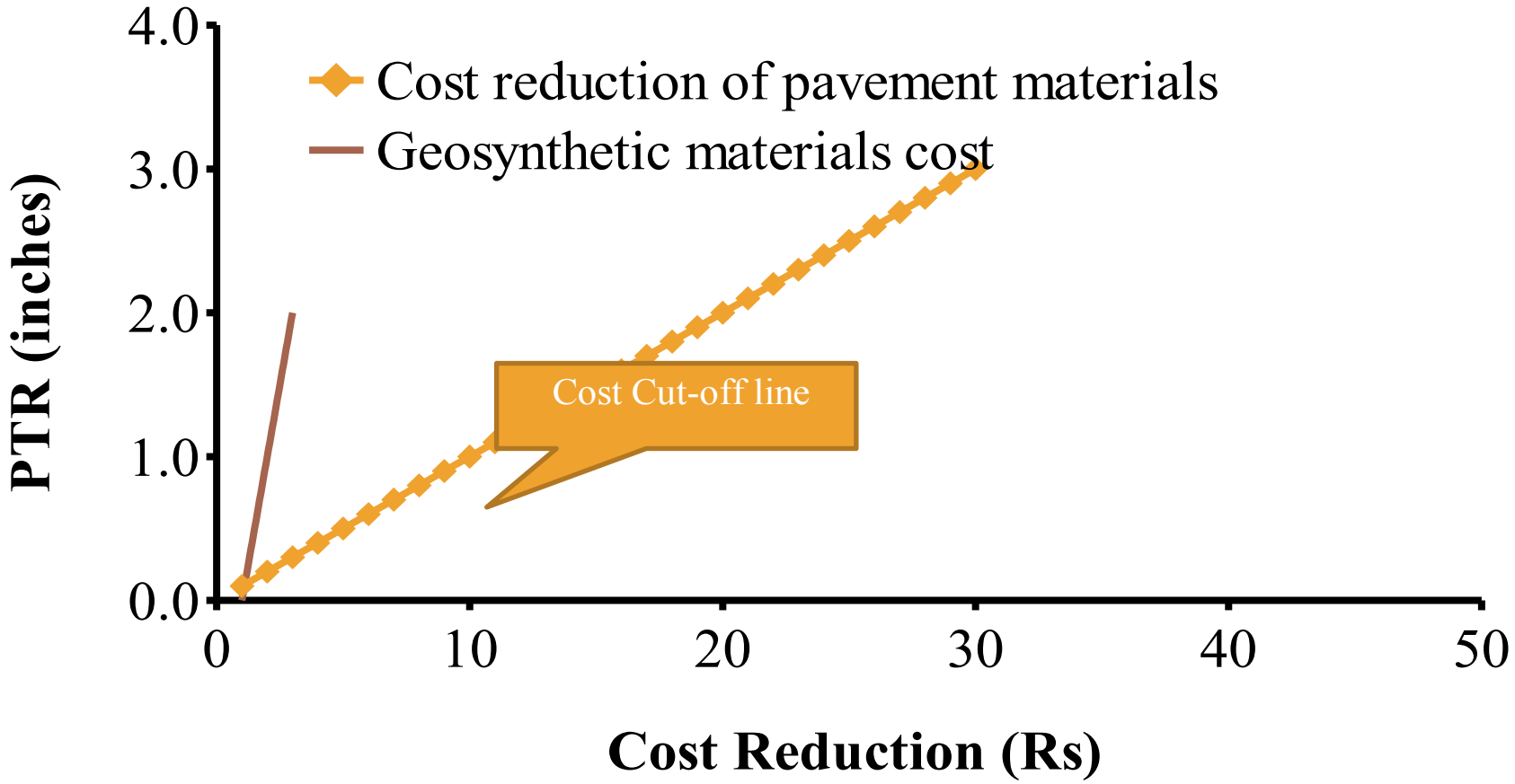
CBR test results



COST EFFECTIVENESS

Typar Price List			
ITEM	Categories	Retail Price	
		/ sq. m.	/ sq. ft.
Typar SF 20	Light	60	6
Typar SF 27		75	7
Typar SF 32		90	8
Typar SF 37		103	10
Typar SF 40	Medium	112	11
Typar SF 44		123	12
Typar SF 49		135	13
Typar SF 56		157	15
Typar SF 65		180	17
Typar SF 70	Heavy	198	18
Typar SF 77		213	20
Typar SF 85		236	22
Typar SF 94		262	24
Typar SF 111		307	29

PAVEMENT THICKNESS REDUCTION (PTR)



conclusions

From the experimental work carried out on the reinforced subgrade soils, it may be concluded that:

- Introducing Typar geosynthetics in subgrade improves the CBR values and therefore the strength of soils provided it is placed within the zone of influence.

conclusions

- As compared with CBR values of soil without reinforcement and a single layer of reinforcement the maximum increase in CBR value is approximately 16%.
- Typar is going to induce separation at the point of insertion; therefore, this side effect may also be considered while designing the reinforced subgrades.

conclusions

- While considering the cost effectiveness it is necessary to analyse the cost effectiveness with PTR for the current market rates of the reinforcing material and borrowed subgrade materials.

Acknowledgement

The authors would like to thank Soil Mechanics Lab staff at NED University of Engineering for the their technical assistance.


Thank You!