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COST ANALYSIS AND COMPARISON OF RCC RETAINING WALL WITH GEOGRID RETAINING WALL

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Abstract: The issue of soil retention has existed for years. Man has explored numerous methods to retain information in his quest for better outcomes. Enormous piles of earth made up of random stonework, bamboo, wood, and alternative materials. RCC retaining walls are now the most frequently requested solution as time goes on. New ideas and materials have made it possible for technology to find more effective ways to hold heavy quantities of soil. However, India's application of this innovative soil retaining technique, RE walls employing Geogrid, falls short of international standards. The study of RCC walls and retaining walls using Geogrid for the comparison of costs is the main emphasis of this work. The systems are proved to be of significant cost benefit when compared to other types of structures and are capable of adapting specific local conditions such as terrain geometry and aesthetic preferences irrespective formal design limitations. The analysis and estimation of retaining walls using geogrid are the main topics of this study. In the realm of geotechnical engineering, attention has been drawn to the use of geogrids as reinforcement to increase the pull-out strength of retaining structures. Due to their availability, affordability, strength, durability, and safety, reinforced retaining walls are significant in the creation of many retaining structures. This article also summarizes many studies that are currently being done on geogrid reinforced structures, including their strengths, sturdiness, and economic benefits. The study of RCC walls and retaining walls using Geogrid for the comparison of costs is the main emphasis of this work.

Index Terms **- Cantilever Retaining Wall, Designing, Geogrid, Construction Cost.**

I. INTRODUCTION

In our built environment, retaining wall systems primarily consist of a retaining wall and backfill soil which are frequently used for things like basement walls, bridge abutments, residential elevations, highway walls, and more. The purpose of a retaining wall is to either keep the retained soil in certain shape and prevent it from falling (stability), or to restrain the deformation of the wall and the backfill to maintain its service function (serviceability).

Currently, due to an increased competition in the field of construction worldwide. Quality and cost are the biggest priorities of construction industry, and these can only be met if modern construction techniques are used. Earlier everyone used RCC retaining wall for soil retention. Presently Retaining wall using geogrid technology used in Europe and North America. In India, RCC retaining walls are frequently built, but the adoption of Geogrid reinforced soil retaining walls is not up to pace with other Asian nations due to a lack of understanding of the construction process, its costs, and how long it takes.

Therefore, in order to compare the two types of retaining walls on the basis of cost, this research has done a complete analysis of the construction method, types, construction costs, quality, uses, advantages, and disadvantages of RCC retaining walls and geogrid reinforced soil retaining walls.

II. OBJECTIVES

The main goals of this study are as follows:

- To evaluate the cost of construction by comparing R.C.C. retaining walls with Geogrid reinforced soil retaining walls.
- To put forward a suggestion for an environmentally friendly technology that might benefit society

III. LITERATURE REVIEW

1988, R. L. Curtis, V.E. Chouer Curtis and D. A. Miller, analysed geogrid reinforced soil retaining wall on compressible soils. A concrete facing was constructed as it reduces the settlement. As a result, it was found that, the geogrid reinforced wall tolerates the settlement and providing a temporary vertical face.

2007, Jorge G. Zornberg had an objective which advances in reinforced soil design for conventional loading, advances in design for unconventional loading and advances in reinforcement materials. In the result it was found that the addition of fibres can significantly increase the peak shear strength and limit the post peak strength loss of both cohesive and granular soil.

2014, Xinye HAN and Tomoharu MERA, study and focus on Square-shaped geocell (diamond-shaped geocell) and ordinary geogrid and found that the geocell-RS RW exhibited higher seismic performance than geogrid-RS RW and gravity-type RW from the evaluation of residual displacements and response acceleration of the wall.

2014, C.R. Lawson & T.W. Yee, studied segmental block retaining walls with combination geogrid and anchor reinforcement and found that residual tensions in the geogrid reinforcements within the reinforced fill zone are transferred into the rigid zone by means of anchors or nails.

2015, Harangad Singh and Dr. Saleem Akhtar made an economic analysis of reinforced earth wall with different types of reinforcing materials**.** In the result, Cost analysis proves that if the quantities are not changed and only the material is changed, then the price of a reinforced earth wall with synthetic geo grid is the least expensive when combined with local earth as a backfill material for the reinforced earth wall if only the material is altered.

2018, Izzaldin Almohd, Rami El-Sherbiny and Dimiter, Dr.Alexiew, made a study over very high reinforced geogrid retaining wall and as a result it was found that the measured surveys during construction and after completion showed small deformation and were lower than calculated numerical simulations.

2020, Anjali Diwalkar, made an analysis of retaining wall stability against overturning & sliding of the retaining wall. As a result, it was found that the retaining wall with relieving platform is safer against overturning and sliding as compared to cantilever retaining wall.

G.Q. Yang, P. Lv, B.J. Zhang and Q.Y. Zhou, examined the field test of moulding concrete rigid panel faced geogrids reinforced soil retaining wall and found that the magnitude along the length of geogrid reinforcement is nonlinear distribution, the maximum is near the middle of reinforcement, to the wall face and the end of reinforcement direction, it is gradually decreasing

Rameesha K., Aloshious Kannanayakkal, Chithira P. U., Naima Shamsudheen and Vibitha P. K., worked on finding the stability analysis of retaining wall using GEO5. The use of crusher dust or quarry dust, a waste product derived from the quarry, increases the stability of the backfill.

From the above-mentioned different research papers, we hereby going to make a detailed cost analysis of traditional RCC retaining wall and geogrid retaining wall and determine the total cost effectiveness of geogrid usage over steel reinforced retaining walls by making a detailed comparison between both types of retaining walls.

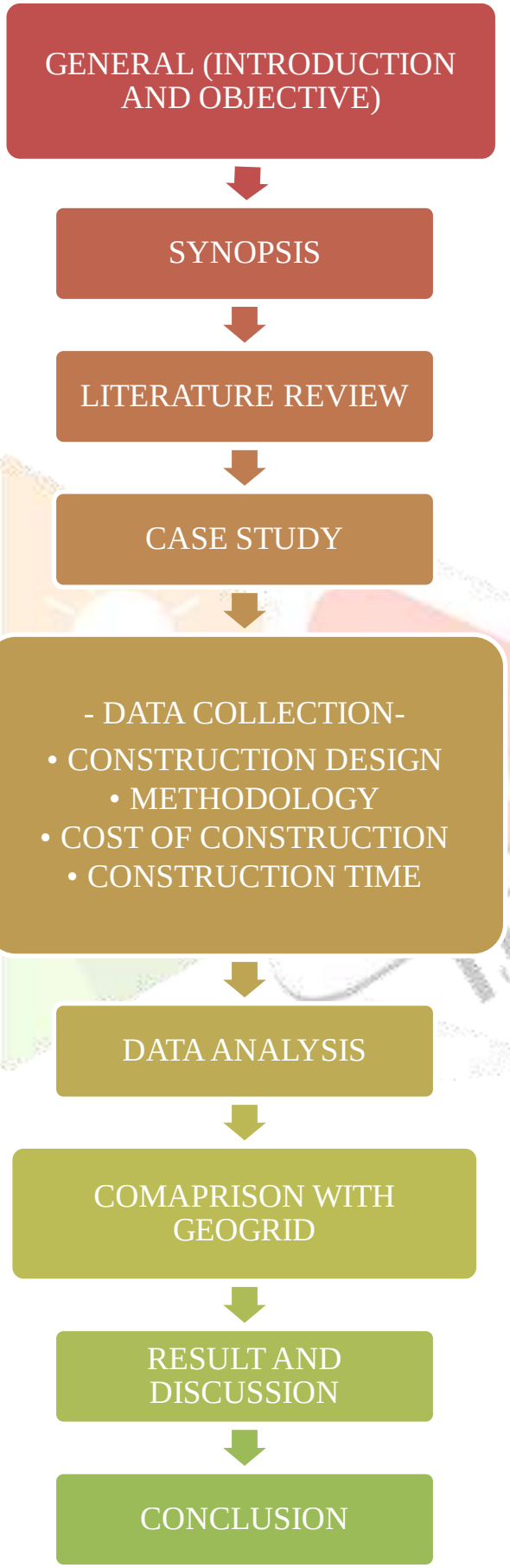
IV. SITE INVESTIGATION AND METHODOLOGY

Site Selection:

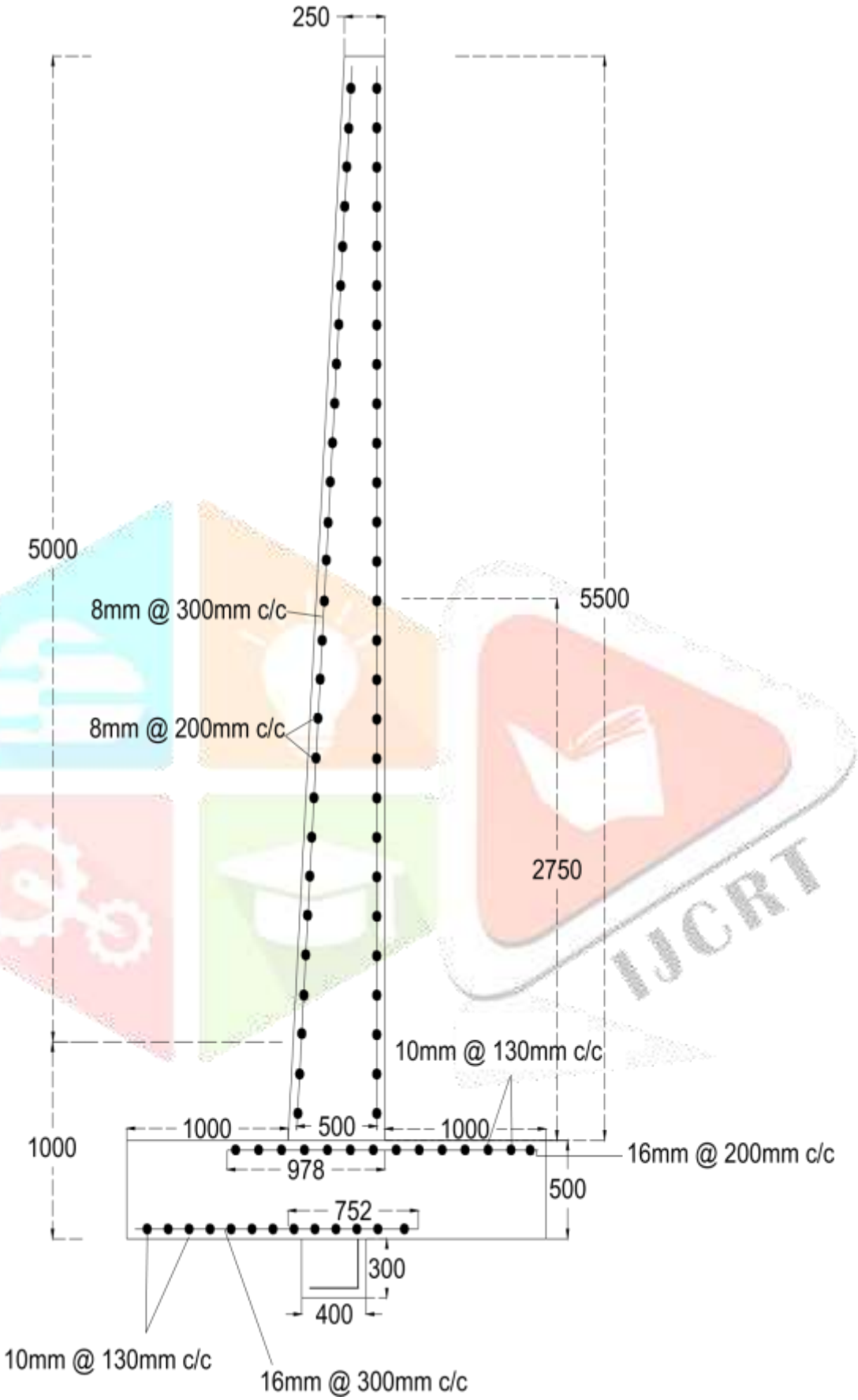
In this study, building cost analysis is carried out near Malhaur Railway Station, Viraj Khand, Gomti Nagar, Lucknow 226010, Uttar Pradesh. The retaining wall is to be constructed to protect the railway track from the road which is at higher elevation, hence to prevent collapsing of road to the railway track a RCC retaining wall of total height 6m is to be constructed over a length of 850m along the railway track. Data related to construction of geogrid reinforced soil retaining wall in terms of cost was identified. Comparison between these walls were done based on cost and quality parameters.

Flowchart of Methodology:

The given below is the flowchart representing the necessary steps to be followed in order to conduct the study:



Designing of cantilever retaining wall:



(Figure 1 Detailed view of Cantilever Retaining Wall with Design Dimensions)

Cost Analysis of Cantilever Retaining Wall of 6m height:

Description	Unit	Rate (Rs. / Unit)	Quantity	Amount (Rs)
Earth Work Excavation	cum.	152.5	9	1372.5
Levelling Pad (M20 Grade Concrete)	cum.	8364.20	0.0656	548.69
RE wall with Facia Panel	Sq m.	1299	5	6495
Back Filling (murum) in Reinforced Zone	cum	200	33	6600
Steel Reinforcement	kg	70.97	255.08	18103
Total				**33115.02**

(Table 1 Cost Analysis of Cantilever Retaining Wall of 6m height)

Total Cost per Running Meter for Cantilever Retaining wall of 6m height= Rs. 33,115.02
Total cost for 850m long wall= 33,115.02 × 850 = Rs. 2,81,47,767

Cost Analysis of Geogrid Retaining Wall of 6m height:

Description	Unit	Rate (Rs. / Unit)	Quantity	Amount (Rs)
Earth Work Excavation	cum.	152.5	9	1372.5
Levelling Pad (M20 Grade Concrete)	cum.	8364.20	0.0656	548.69
RE wall with Facia Panel	Sq m.	1299	5	6495
Back Filling (murum) in Reinforced Zone	cum	200	33	6600
Geogrid	Sq m.	140	48	6720
Total				**21736.19**

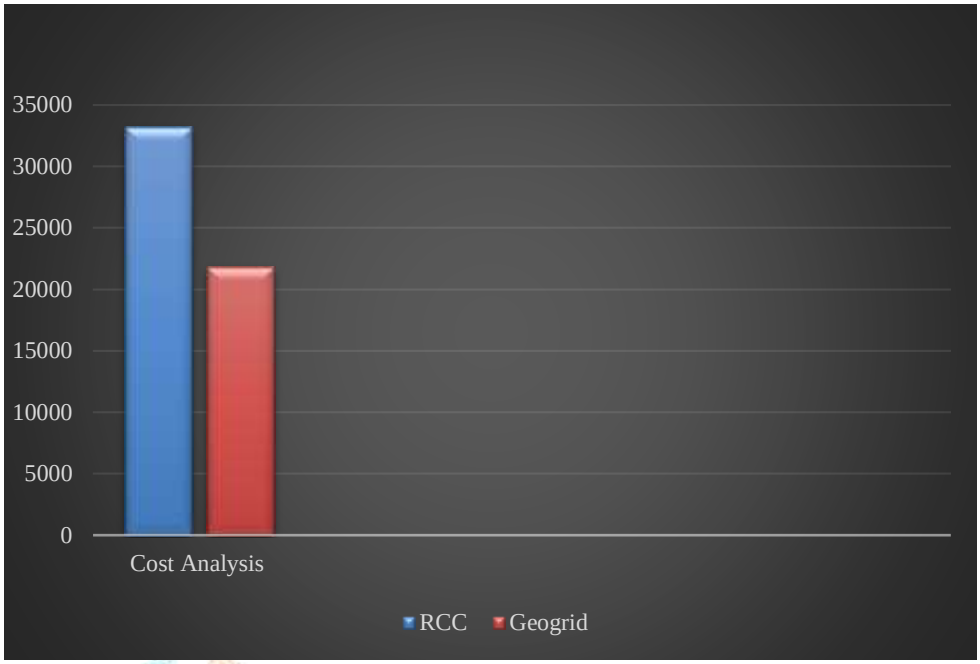
(Table 2 Cost Analysis of Geogrid Retaining Wall of 6m height)

The average market price of Biaxial Geogrid in India is Rs 140 per Square Meter.
Total Cost per Running Meter for Cantilever Retaining wall of 6m height= Rs. 21736.19
Total cost for 850m long wall= 21736.19 × 850 = Rs. 1,84,75,761.5

V. RESULT AND DISCUSSION

When compared to R.C.C. retaining walls, geogrid reinforced soil retaining walls have many advantages. The main points are as follows:

- Use quick and straightforward construction techniques; do not use heavy machinery.
- Do not require skilled craftspeople with experience or specialised knowledge for construction.
- Need less site preparation than different options.
- Reduce the amount of space needed for construction activities in front of the building (facia panels).
- Less time was needed for construction.
- Cost study data shows that the reinforced earth wall with synthetic geo grid is the most affordable option if only the material in the retaining wall's backfill and reinforcing material is altered.



(Graph 1 Cost Comparison between RCC and geogrid retaining wall per running meter length)

VI. CONCLUSION

The following points can be concluded from the study:

- RCC retaining walls cost an average of Rs. 33,115 whereas Geo-grid reinforced soil retaining walls cost an average of Rs. 21,736 for a 6m height. For a 6m height, the cost savings as a percentage is therefore about 35%.
- Therefore, a geogrid reinforced soil retaining walls may have 50% cost savings when higher walls are to be constructed.
- Due to the simultaneous nature of all the construction operations, the geo-grid retaining wall takes less time to complete. RCC retaining walls take a long time to construct since every step is done in order. Hence Geo-grid retaining wall uses less material.
- Quality control is better in Geo-grid retaining wall as compared to RCC retaining wall.

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