

# A Review on “Parametric Study on Geogrid Reinforced Retaining Wall System”

Ms. Radhika Borkar <sup>1</sup>, Dr. Shubhada S. Koranne <sup>2</sup>

P.G. Student, Department of Civil Engineering, Government Engineering College, Aurangabad, Maharashtra, India<sup>1</sup>

Associate Professor, Department of Civil Engineering, Government Engineering College, Aurangabad,  
Maharashtra, India<sup>2</sup>

**ABSTRACT:** The use of geogrids as reinforcement to improve the pull out strength of retaining structures has gained attention in field of Geotechnical Engineering. Reinforced retaining walls play important role in development of various retaining structures due to less cost, durability, strength, safety and its availability. Several researches have demonstrated that various parameters like length, layers ,spacing and aperature of geogrid in reinforced retaining structures can be varied to improve the strength and bearing capacity of the structures. This paper presents the summary of varies research papers currently worked on geogrid reinforced structures inclusive of its strength , durability and economic value.

**KEYWORDS:** Retaining Wall, Reinforced Earth Retaining Wall, Geogrid, Gravel Gabbion Facing, Soil System..

## I. INTRODUCTION

Retaining walls provide lateral support to the earthen walls. These walls are used in various construction applications such as Highway embankments, Stabilization of slopes, Temporary support to excavation etc. Reinforced soil techniques now a days is a popular ground improvement technique. Various materials and methods for reinforcement are available which increase its popularity. Reinforcement can be incorporated into natural ground to provide steeper slopes, improved load carrying capacity or to support weak soil embankments. As soil posses strength but low tensile strength which limits the ability of soil to resists shear stresses. Thus failure of soil due to shear or deformation can be reduced by soil reinforcement which absorbs tensile load or shear stresses.

In this paper various outcomes of different researchers about reinforcing of backfill of retaining wall system has been presented.

## II. LITERATURE REVIEW

**Jan Derksen & Martin Ziegler(1)**, Analysis of bearing capacity of reinforced retaining structures, The particle displacements and rotations are evaluated by sequential taken pictures during vertical loading using the DIC method . A medium sand is chosen for the subsoil, fill and backfill of the retaining walls . The model geogrid used for the reinforced structures is a regular biaxial product made of PET .The reinforced walls differ in geogrid, Results confirmed a considerable increase in bearing capacity with enlarged reinforcement length resulting in an improved bearing resistance.

**N.Yasufuku & H.Ochiai(2)**, full Scale Testing of Geosynthetic Reinforced Walls, A parameter for estimating the confining effect is derived as a function of the dilatancy angle of the reinforced soil mass in which the im-portant key idea is in an assumption of the dissipated energy done by unit volume of reinforced soil mass. The confining effect parameter defines the degree of the apparent incremental confining stress to the current normal stress on the expected sliding plain, was in the range of 0 to 0.3 against the supposed dilatancy angles from 0 to 30 degrees.

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 9, September 2019

**Mohammad Saleh Ahmadi and Parastoo Nikbakht Moghadam(3)**, Effect of Geogrid Aperture Size and Soil Particle Size on Geogrid-Soil Interaction under Pull-Out Loading Five types of geogrid samples with various aperture dimensions were produced and used for conducting pull-out tests along with four types of soils with different particle size distribution (PSD) and grading were used for this purpose. The proper aperture dimensions depends on soil gradation The POR is more sensitive to the transverse rib density of geogrids rather than their longitudinal rib density.

**R.J. Bathurst & D. Walters (4)**, Full Scale Testing of Geosynthetic Reinforced Walls Influence of reinforcement spacing, wall toe restraint and facing stiffness on reinforcement on reinforcement on loads/strains/deformations and overall level of safety. Connection loads for the structures with a modular block facing construction are the largest loads in the reinforcement at the end-of construction condition. The toe of the wall in these experiments carried a significant portion of the horizontal earth forces acting on the hard facing column.

**RICHARDJ. BATHURST(5)**, Instrumentation of Geogrid-Reinforced Soil Walls, The horizontal displacement response of extensometers mounted on grid layers of an incremental wall test. The data show that abrupt changes in grid displacement matched surcharge loading steps and that, as the magnitude of surcharging increased, there was increased creep deformation in the reinforcement layer. The comprehensive monitoring of model walls and the quality of the data has allowed the author to identify important mechanisms in the behavior of these complex systems during construction, under working load conditions, and at failure.

**Wang Qingbiao & Zhang Cong(6)**, The Mechanical Property of Bidirectional Geogrid and its Application Research in Retaining Wall Design The mechanical properties in different temperature, loading and packing with the help of indoor pullout test and analyze the main factors affecting the mechanical properties of the geogrids in theory. Analyze the reinforced soil retaining wall with friction reinforcement principle. With high strength and good coordinate deformation capacity, when acting on the reinforced retaining wall as reinforcement material, bidirectional geogrid can be integrally formed with the filler after compaction to limit the lateral deformation of soil.

**Wang Chengzhi & Zhou Suntong(7)**, A Mesoscopic Damage Model of the Geogrid-Reinforced Wall An kind of sandy gravel filler geogrid-reinforced wall structure was remade indoors. and through high-speed displacement tracking and the filed strain test, the relationship between the mechanical properties of main particles and the wall in the process of loading was investigated. After analyzing the progressive collapse process of sand gravel packing geogrid-reinforced wall, it was found that the upright reinforced solid had small collapse range, and collapse sliding surface was close to "0.3H" simplified potential failure surface.

**Khan Farukh & Dhatrak A. I.(8)**, Performance of Square Footing on Sandy Soil Prestressed With Geogrid Reinforcement The investigation parameters are the bearing capacity improvement, magnitude and direction of prestressing force. prestress doubles the load-bearing capacity of the unreinforced soil, in comparison to reinforcement alone, which results in only 1.3– 2.5 times the load bearing capacity of the soil. Thus the addition of prestress is considered a worthwhile method of reinforcement.

**Harangad Singh & Dr. Saleem Akhtar(9)**, A Review on Economic Analysis of Reinforced Earth Wall with Different Types of Reinforcing Materials The cost analysis of the reinforced earth walls with different types of reinforced materials for different heights. Cost analysis proves that if the quantities are not changed and only the material is changed in the RE Wall backfill and reinforcing material is changed, then the cost of reinforced earth wall with synthetic geo grid is the cheapest with combination of local earth as a back fill material for the reinforced earth wall.

**Di WU & Jianjian WU (10)**, Scaled Model Tests on the Influence of Reinforcement Spacing on the Deformation of Reinforced Retaining Wall Different reinforcement spacing (20cm, 30cm and 40 cm spacing) was arranged inside of reinforced retaining wall models. Four dial gauges were arranged on the top of the retaining wall, and the three dial gauges were uniformly arranged on the front side panel of the retaining wall. In the same reinforcement spacing

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 9, September 2019

condition, the measured deformation of geogrid reinforced retaining wall was increased as the load of bearing plate increased

**C.R.Lawson & T.W.Yee(11)**, Segmental Block Retaining Walls with Combination Geogrid and Anchor Reinforcement Paper presents the design theory for reinforced soil walls where the reinforced fill zone is constrained and where anchor are used to dissipate the reinforcement residual tensile stresses beyond the reinforced fill zone. residual tensions in the geogrid reinforcements within the reinforced fill zone are transferred into the rigid zone by means of anchors or nails. A major consideration is that all components must fulfill the design life requirements of the retaining wall.

**Xinye HAN & Tomoharu MERA(12)**, Shaking Table Model Tests On Reinforced Soil Retaining Walls By Using Newly-Developed Geocell Reinforcements And Geogrid Reinforcements Square-shaped geocell is used to achieve a higher pullout resistance than both conventional-type geocell (diamond-shaped geocell) and ordinary geogrid. square-shaped geocell reinforced soil retaining wall has a substantially high seismic stability against a large seismic load. 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.

**Yeong-Saeng Lee & Jun-Yeong Yoon(13)**, Stability Analysis for a Reinforced Earth Retaining Wall with Vertical Steel Poles and Front Metal Meshes A light steel pole as a vertical member and wire meshes as a wall retaining the backfill soil was used Geosynthetic reinforced modular block walls, a new reinforced wall method using a light steel pole as a vertical member and wire meshes as a wall retaining the backfill soil was developed and it is economical and eco-friendly compared to the modular block type reinforced walls.

**Xiao-Song TANG & Ying-Ren ZHENG(14)**, Application and Analysis of the Reinforced Retaining Wall with Geogrid, Model I adopts reinforced soil slope of single stage and model II adopts the double stage. If the tensile stiffness in the axial direction and the length of reinforced bars are high enough, the soil in front of the failure surface would loosen and collapse when the retaining wall becomes unstable. If the pseudo-friction coefficient and the length of reinforced bar can satisfy the requirement and when the tensile stiffness in the axial direction reduces to a certain value, the reinforced bar would lose the effective constraint to the soil mass because of too large deformation .

**R. L. Curtis & V. E. Chouery-Curtis(15)**, Geogrid Reinforced Soil Retaining Wall on Compressible Soils, A polymer geogrid reinforced soil wall with a wrap-around facing was evaluated as the flexible wall system. A layer of biaxial geogrid, 24 feet (7.3 m) long was placed 1 foot (0.3 m) below the bottom of the wall to help minimize differential settlement. Drainage for the wall was provided using a continuous drainage net (TENSAR® DNI) with a light weight non-woven geotextile cover placed continuously along the wall face.

**Robert D. Holtz(16)**, Geosynthetics For Soil Reinforcement, In a direct analogy with reinforced concrete, steel and polymeric materials provide tensile resistance and stability to soils that have low to no tensile strength. Most geosynthetics are made from synthetic polymers such as polypropylene, polyester, polyethylene, polyamide, PVC, etc. These materials are highly resistant to biological and chemical degradation. Stiff geogrids with integral junctions are manufactured by extruding and orientingsheets of polyolefins.

**Jorge G. Zornberg(17)**, New Concepts in Geosynthetic-Reinforced Soil, The design of reinforced soil slopes is based on the use of limit equilibrium methods to evaluate both external (global) and internal stability of the structure. The number of reinforcement layers in the models ranged from six to eighteen, giving reinforcement spacing ranging from 37.5 mm to 12.5 mm. All models used the same reinforcement length of 203 mm. The use of a reasonably long reinforcement length was deliberate.

**R. Randeniya & A.I . Valsangka.f(18)**, Performance Of A Geogrid Reinforced W Allstone Ret Alning Wall System, Each wall is 1.6 m high and consists of masonry wallstone units. Geogrid reinforcement varying in length from 1.8 m

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 9, September 2019

to 7.3 m is used for mechanically stabilizing the backfill. For drainage and filtration purposes, geotextile (Type 200R) was placed at the interface between the existing till and the new backfill and immediately behind the wallstone units. The result of this inspection indicate that wallstone units have experienced very little damage due to freeze-thaw cycles over a period of 3 years.

**K. Hatami, R.J. Bathurst, and P. Di Pietro(19)**, Static Response of Reinforced Soil Retaining Walls with Nonuniform Reinforcement, The structural response of reinforced-soil wall systems with more than one reinforcement type (nonuniform reinforcement) is investigated using a numerical approach. The selected reinforcement types and mechanical properties represent actual polyester geogrid and woven wire mesh products. The model walls are mainly of wrapped-face type and have different reinforcement lengths, arrangements, and stiffness values. Additional wall models with tiered and vertical gabion facings.

**João Alexandre Paschoalin Filho & Geraldo Vanzolini Moretti(20)**, Study of the behavior of a reinforced embankment supported on alluvial soft soil, an embankment, 5.0 m high, reinforced with geogrids, and constructed over a soft soil 7.0 m thick. In order to determine the design strength (Td) of the reinforcement, For the embankment without reinforcement, it is evidenced a failure after a height of 3.0 m. It seems that in the embankment reinforced with the PET geogrid, the foundation presented distortion values of approximately 3 times greater for the embankment 5.0 m high

### III. SUMMARY

Various types of Geosynthetic material such as geogrid, Geocell, Geocomposite, woven & non-woven geotextile, etc. are used as reinforcement material in different soil system for strengthening the bearing capacity and settlement of soil. Following table summarizes several previous researches about the effect of geogrid material as reinforcement & optimum parameters of soil reinforcement.

Table 1. Summary of Previous Research Studies on Geogrid as Reinforcement

S.N O.	Author/Year	Focus	Variable parameters	Findings
1.	Robert D. Holtz/2001	Geosynthetics For Soil Reinforcement	Various types of natural and synthetic reinforcements with its properties are studied	Most of the failures are due to (1) inadequate design, particularly of the foundation and back slope of the wall, and/or (2) problems in construction.
2.	Jorge G. Zornberg/2007	New Concepts in Geosynthetic-Reinforced Soil	Advances in reinforced soil design for conventional loading, advances in design for unconventional loading , and advances in reinforcement materials .	The addition of fibers can significantly increase the peak shear strength and limit the post peak strength loss of both cohesive and granular soil.
3.	N.Yasufuku & H.Ochiai/2002	full Scale Testing of Geosynthetic Reinforced Walls	Dilatancy angle of the reinforced soil mass $\Psi=0,10,20,30$ degree	The confining effect parameter defines the degree of the apparent incremental confining stress to the current normal stress on the

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 9, September 2019

				expected sliding plain, was in the range of 0 to 0.3 against the supposed dila-tancy angles from 0 to 30 degrees.
4.	R.J. Bathurst & D. Walters/2000	Full Scale Testing of Geosynthetic Reinforced Walls	Reinforcement stiffness , strength,reinforcement spacing	Connection loads for the structures with a modular block facing construction are the largest loads in the reinforcement at the end-of construction condition.
5.	RICHARD]. BATHURST/2012	Instrumentation of Geogrid-Reinf orced Soil Walls	Number of layers 1,2,3,4, Type of reinforcement SR1 & SR2 , Wall type - Single Panel & Incremental Panel..	The comprehensive monitoring of model walls and the quality of the data has allowed the author to identify important mechanisms in the behavior of these complex systems during construction, under working load conditions, and at failure.
6.	Mohammad Saleh Ahmadi and Parastoo Nikbakht Moghadam/2017	Effect of Geogrid Aperture Size and Soil Particle Size on Geogrid-Soil Interaction under Pull-Out Loading	Five types of geogrid samples varying width and length -AA 18 18 ,BB 23 23,CC 31 31,CA 31 18,CB 31 23	The proper aperture dimensions depends on soil gradation. The POR is more sensitive to the transverse rib density of geogrids rather than their longitudinal rib density
7.	Wang Qingbiao & Zhang Cong/2015	The Mechanical Property of Bidirectional Geogrid and its Application Research in Retaining Wall Design	2 types of geogrids used in the test are TGDG300 unidirectional geogrid and TGSG5050 bidirectional geogrid.	With high strength and good coordinate deformation capacity, when acting on the reinforced retaining wall reinforcement material, bidirectional geogrid can be integrally formed with the filler after compaction to limit the lateral deformation of soil
8.	Wang Chengzhi & Zhou Suntong/2017	A Mesoscopic Damage Model of the Geogrid-Reinforced Wall	The piling size under four working conditions were 6.58kPa, 8.39kPa, 10.19kPa and 11.81kPa	After analyzing the progressive collapse process of sand gravel packing geogrid-reinforced wall, it was found that the upright reinforced solid had small collapse range, and collapse sliding surface was close to “0.3H” simplified potential failure surface;
9.	Khan Farukh & Dhatrik A. I./2014	Performance of Square Footing on Sandy Soil Prestressed With Geogrid Reinforcement	Reinforcement depth B/2 and B/4 in prestressed condition in unreinforced and reinforced soil.	Prestress doubles the load-bearing capacity of the unreinforced soil, in comparison to reinforcement alone, which results in only 1.3– 2.5 times the load bearing capacity of the soil. Thus the addition of prestress is considered a worthwhile method of reinforcement.

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 9, September 2019

10.	Harangad Singh & Dr. Saleem Akhtar/2015	A Review on Economic Analysis of Reinforced Earth Wall with Different Types of Reinforcing Materials	Reinforcement by copper and aluminium strip. Height of walls- 4m,5m,6m,7m,8m and 9m.	Cost analysis proves that if the quantities are not changed and only the material is changed, then the cost of reinforced earth wall with synthetic geo grid is the cheapest with combination of local earth as a back fill material for the reinforced earth wall.
11.	Di WU & Jianjian WU /2015	Scaled Model Tests on the Influence of Reinforcement Spacing on the Deformation of Reinforced Retaining Wall	Different reinforcement spacing -20cm, 30cm and 40 cm spacing	In the same reinforcement spacing condition, the measured deformation of geogrid reinforced retaining wall was increased as the load of bearing plate increased
12.	C.R.Lawson & T.W.Yee/2014	Segmental Block Retaining Walls with Combination Geogrid and Anchor Reinforcement	Paper presents the design theory for reinforced soil walls where the reinforced fill zone is constrained and where anchors are used to dissipate the reinforcement residual tensile stresses beyond the reinforced fill zone.	Residual tensions in the geogrid reinforcements within the reinforced fill zone are transferred into the rigid zone by means of anchors or nails.
13.	Xinye HAN & Tomoharu MERA/2014	Shaking Table Model Tests On Reinforced Soil Retaining Walls By Using Newly-Developed Geocell Reinforcements And Geogridreinforcements	Square-shaped geocell (diamond-shaped geocell) and ordinary geogrid.	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.
14.	Yeong-Saeng Lee & Jun-Yeong Yoon/2012	Stability Analysis for a Reinforced Earth Retaining Wall with Vertical Steel Poles and Front Metal Meshes	Light steel pole and wire meshes	light steel pole as a vertical member and wire meshes is economical and eco-friendly compared to the modular block type reinforced walls.
15.	Xiao-Song TANG & Ying-Ren ZHENG/2014	Application and Analysis of the Reinforced Retaining Wall with Geo-grid	Angle of inclination of model 1- 44° model 2- 57° and 62°	The paper also proves its adaptability in the engineering and the reliability in the design and calculation
16.	R. L. Curtis & V. E. Chouery-Curtis/1988	Geogrid Reinforced Soil Retaining Wall on Compressible Soils	Subsurface condition and wall height	A concrete facing was constructed as it reduces the settlement. The geogrid reinforced wall tolerates the settlement and providing a temporary vertical face.
	R. Randeniya & A.I .	Performance Of A Geogrid Reinforced W	length of geogrid reinforcement 1.8 to 7.3m	The wallstone blocks experience very little damage due to freeze-

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 8, Issue 9, September 2019

17.	Valsangka.f/1994	Allstone Ret Alning W All System		thaw cycles
18.	K. Hatami, R.J. Bathurst, and P. Di Pietro/2001	Static Response of Reinforced Soil Retaining Walls with Nonuniform Reinforcement	Reinforcement type-mixed, uniform & grouped .Facing type-Gabbion & wrapped.	Reducing the stiffness of reinforcement layers placed at small spacing reduces the lateral displacement and stiffnes.
19.	João Alexandre Paschoalin Filho & Geraldo Vanzolini Moretti/2013	Study of the behavior of a reinforced embankment supported on alluvial soft soil	Type of reinforcement PET and PVA	Theformation values obtained for the studied embankment conditions were lower than the deformations commonly used by the technical means on soil reinforcement projects PET=12% and PVA=5%.
20.	Jan Derksen & Martin Ziegler/2018	Analysis of bearing capacity of reinforced retaining structures	The reinforced walls differ in geogrid anchoring length to construction height ratios $L_a/H = \{0.50; 0.70; 0.85\}$ .	Results confirmed a considerable increase in bearing capacity with enlarged rein-forcement length resulting in an improved bearing resistance

### IV. CONCLUSION

From above research work done by different researchers following conclusions are drawn-

1. Anchoring length of geogrid reinforcement in various ratios as 0.5, 0.7,0.8 gives pull out strength to the reinforced structure. Effect of longer and shoter length of reinforcement with other parameters needed to be studied.
2. The POR is more sensitive to the transverse rib density of geogrids rather than their longitudinal rib density.
3. The horizontal reinforcement is found to be more effective in improving the bearing capacity as compared to the vertical reinforcement.
4. Prestress doubles the bearing capacity by 1.3 to 2.5 times of unreinforced soil as compared to reinforced soil.
5. As the reinforcement spacing increases the strength of the structures decreases as increase in pull out effect of reinforcement. Strength of structure with different spacings needed to be studied.
6. Cost analysis proves that if the quantities are not changed and only the material is changed in the RE Wall backfill and reinforcing material is changed, then the cost of reinforced earth wall with synthetic geo grid is the cheapest.

### REFERENCES

1. Jan Derksen & Martin Ziegler/2018, Analysis of bearing capacity of reinforced retaining structures, Proceedings of the 11th International Conference on Geosynthetics.
2. N.Yasufuku & H.Ochiai/2002, Full Scale Testing of Geosynthetic Reinforced Walls.
3. Mohammad Saleh Ahmadi and Parastoo Nikbakht Moghadam/2017, Effect of Geogrid Aperture Size and Soil Particle Size on Geogrid-Soil Interaction under Pull-Out Loading, Journal Of Textiles And Polymers, Vol. 5, No. 1, January 2017.
4. R.J. Bathurst & D. Walters/2000, Full Scale Testing of Geosynthetic Reinforced Walls, Bathurst et al., ASCE Special Publication, Proceedings of GeoDenver 2000, 6-12 August 2000, Denver, Colorado.
5. Richard]. Bathurst/2012, Instrumentation of Geogrid-Reinf orced Soil Walls, Civil Engineering Department, Royal Military College of Canada,Kingston, Ontario, Canada K7K SLO.

## International Journal of Innovative Research in Science, Engineering and Technology

*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

Visit: [www.ijirset.com](http://www.ijirset.com)

**Vol. 8, Issue 9, September 2019**

6. Wang Qingbiao & Zhang Cong/2015, The Mechanical Property of Bidirectional Geogrid and its Application Research in Retaining Wall Design, The Open Construction and Building Technology Journal, 2015, 9, 214-222.
7. Wang Chengzhi & Zhou Suntong/2017, A Mesoscopic Damage Model of the Geogrid-Reinforced Wall, Vol. 22 [2017], Bund. 05.
8. Khan Farukh & Dhattrak A. I./2014, Performance of Square Footing on Sandy Soil Prestressed With Geogrid Reinforcement, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181, Vol. 3 Issue 5, May – 2014.
9. Harangad Singh & Dr. Saleem Akhtar/2015, A Review on Economic Analysis of Reinforced Earth Wall with Different Types of Reinforcing Materials, Volume IV, Issue XII, December 2015 IJLTEMAS ISSN 2278 – 2540.
10. Di WU & Jianjian WU /2015, Scaled Model Tests on the Influence of Reinforcement Spacing on the Deformation of Reinforced Retaining Wall, Advances in Engineering Research (AER), volume 72, International Conference on Architectural Engineering and Civil Engineering (AECE-16).
11. C.R.Lawson & T.W.Yee/2014, Segmental Block Retaining Walls with Combination Geogrid and Anchor Reinforcement.
12. Xinye HAN & Tomoharu MERA/2014, Shaking Table Model Tests On Reinforced Soil Retaining Walls By Using Newly-Developed Geocell Reinforcements And Geogridreinforcements, Institute of Industrial Science, University of Tokyo Bulletin of ERS, No. 47 (2014).
13. Yeong-Saeng Lee & Jun-Yeong Yoon/2012, Stability Analysis for a Reinforced Earth Retaining Wall with Vertical Steel Poles and Front Metal Meshes, The 2012 World Congress on Advances in Civil, Environmental, and Materials Research (ACEM' 12) Seoul, Korea, August 26-30, 2012.
14. Xiao-Song TANG, Ying-Ren ZHENG & Yong-Fu WANG(2014), Application and Analysis of the Reinforced Retaining Wall with Geo-grid, International Conference on Mechanics and Civil Engineering (ICMCE 2014).
15. R. L. Curtis, V. E. Chouery-Curtis & D. A. Mille(1988), Geogrid Reinforced Soil Retaining Wall on Compressible Soils, International Conference on Case Histories in Geotechnical Engineering (1988) - Second International Conference on Case Histories in Geotechnical Engineering.
16. R.D. Holtz(2001), Geosynthetics For Soil Reinforcement, 9th Spencer J. Buchanan Lecture, November .
17. Jorge G. Zornberg (2007), New Concepts in Geosynthetic-Reinforced Soil, REGEO, 2007, Recife, Brazil, 18-21 June, pp 1-26.
18. A.I. Valsangka.f2, and I.L. Dawe(1994), Performance Of A Geogrid Reinforced Wall stone Retaining Wall System 10<sup>th</sup> IB2Mac ,Calgary Canada.
19. K. Hatami, R.J. Bathurst, and P. Di Pietro, Static Response of Reinforced Soil Retaining Walls with Nonuniform Reinforcement, The International Journal of Geomechanics Volume 1, Number 4, 477–506 (2001).
20. João Alexandre Paschoalin Filho & Geraldo Vanzolini Moretti(2013), Study of the behavior of a reinforced embankment supported on alluvial soft soil, Acta Scientiarum. Technology Maringá, v. 35, n. 4, p. 661-668, Oct.-Dec., 2013.