

**Research Article**

**GEO SYNTHETIC AND ITS APPLICATIONS IN THE CONSTRUCTION**

**\*Amir Bahmani Chahestani<sup>1</sup>, Ehsan Davarpanah<sup>2</sup> and Hojat Ghaedi<sup>2</sup>**

<sup>1</sup>*Department of Architecture, Iran Technical and Vocational University, Iran*

<sup>2</sup>*Department of Architecture, Payame Noor University, Iran*

*\*Author for Correspondence*

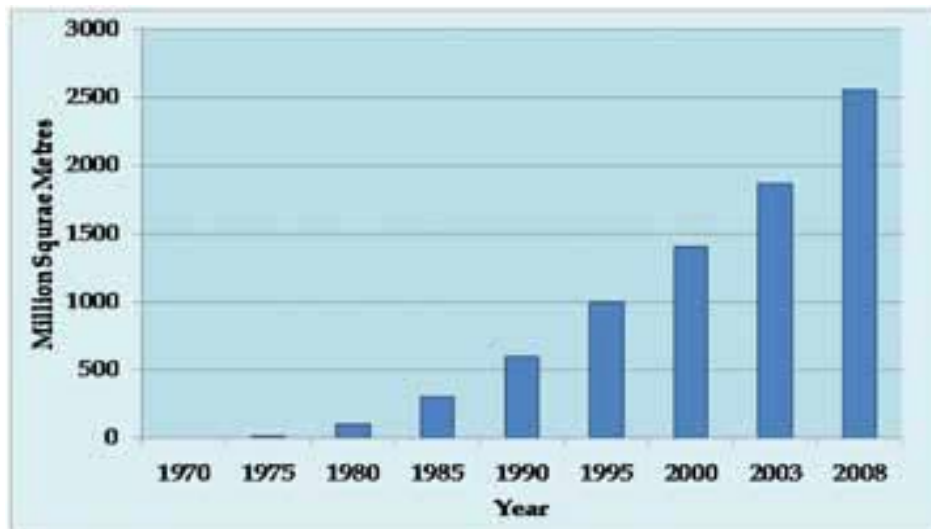
**ABSTRACT**

The Geo synthetic are the textiles and covers made of produced yarns from oil derivatives which their main characteristic is their incorruption. The Geo synthetic are used as the separator, filter, drainage, reinforcement and protector, and it is categorized in various shapes. Geotextiles, geogrids, geomembranes, geodrains, geocoils and... are some of Geo synthetic diversities, that each of them has special application based on its features which are used in the road and band, water and dam, hydraulic, geotechnical, oil, gas, and petrochemical and construct. In this article the brief introduction of the mentioned production and its properties and the role of geo synthetic in the energy management of the construction are investigated.

**Keywords:** *Geo Synthetic, Construction, Yarns, Oil Diversities, Energy Management*

**INTRODUCTION**

Generally geo synthetic is a universal title for describing the thin and flexible sheets which are used in the soil or in connection with soil materials with the different goals such as reinforcing, separating, moisture insulation, corrosion inhibition, playing the role of a filter, drain and.... In the most of cases, these sheets may take combination of the mentioned duties. The word geo synthetic is combined from two parts: Geo and Synthetic. The word geo is used in the cases related to the earth and the second part, synthetic is used for the materials which are made by human or in the other word the artificial materials that are not found in the nature. The word, geo synthetic, is used for the productions which are generally applied to remove the geotechnical problems. Their polymer nature makes them possible to be used in the earth, the place that we expect high durability. Geo synthetic are produced in the different forms and with the different materials which all of them are used for the similar final usages.

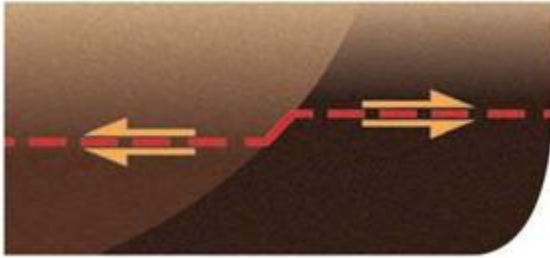


**Diagram 1: The growth of geotextile usage in the world till 2008, source (Baloch and Qnad, 2010)**

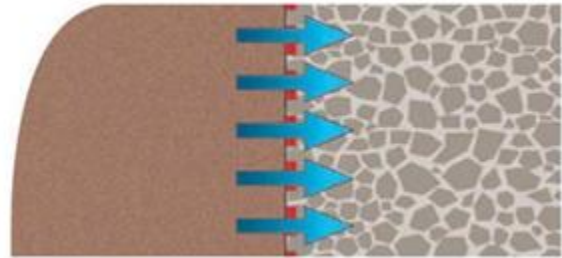
***Geotextile and its Application in the Construct***

Some of geotextiles applications are as follow:

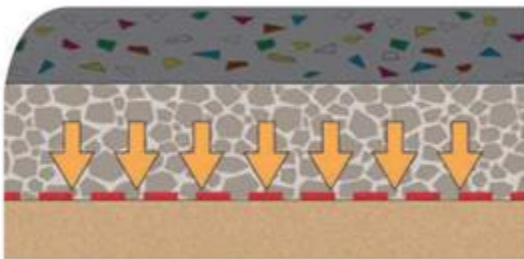
**Research Article**



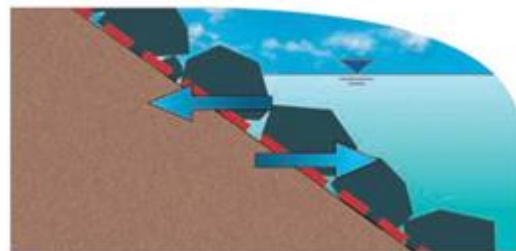
**Picture 1: Filtering reinforcement**  
www.fatehco.com source:



**Picture 2: Soil**  
www.fatehco.com source:



**Picture 3: Erosion control**



**Picture 4: Separating**

Geo synthetic are categorized to various groups: 1. Geotextile, 2. geogrid, 3. geomembrane, 4. Geonet, 5. Geocel, 6. Geocomposite, 7. Geomat, 8. Clay protective linings (GCLs) (in the following we investigate some of the above cases which are used more in the construction:

**Geotextiles**

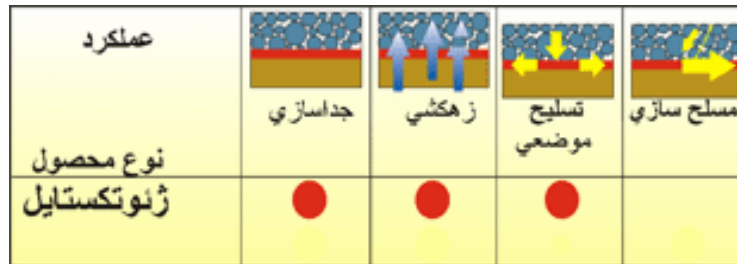
It is used for reinforcing, separating, proper drainage, improving the bearing strength of the soil and asphalt, structural protection of the coasts and the ports, assimilated settle in the sea structures such as bulwarks, protecting the eroding lands, improving the bearing strength of the way and railway bed, protecting the geomembran layouts and so many other applications. Geotextiles are usually produced in the form of woven and nonwoven fabrics. The woven geotextiles are made of woven strings that its final result is forming a strong layout and something similar to felt. The unwoven geotextiles are produced in the different ways. The usual ways are as the follow: bonded heat, punched needle or mechanic forming, and chemically bonded.



**Picture 5: Geotextile activity**

Source: [http://satrup.ir/Geo\\_synthetic\\_product.html](http://satrup.ir/Geo_synthetic_product.html)

**Research Article**



**BETEX TP Picture 6: Unwoven geotextile**

Source: [http://www.pardissazan.com/farsi/abilities/Geo synthetic/geotextiles.html](http://www.pardissazan.com/farsi/abilities/Geo%20synthetic/geotextiles.html)

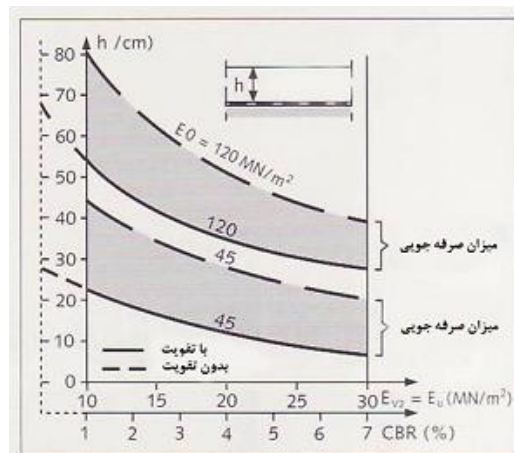
Using unwoven geotextiles for protection against the holes in the different layouts of the civil projects



**Picture 7: The woven geotextiles**

Source: [http://www.pardissazan.com/farsi/abilities/Geo synthetic/geotextiles.html](http://www.pardissazan.com/farsi/abilities/Geo%20synthetic/geotextiles.html)

Using woven geotextiles as a low cost method in order to improve and break down in the dike walls and soil dam's projects



**Picture 8: The amount of thrift resulted by the use of geotextiles**

Source: [http://www.pardissazan.com/farsi/abilities/Geo synthetic/geotextiles.html](http://www.pardissazan.com/farsi/abilities/Geo%20synthetic/geotextiles.html)

**The Cases of Geotextile Applications in the Civil Projects**

**Separating**

The main reason of the road, construct, parking, and... failure is the injection of the materials of the adjacent layouts to the aggregate and the consequence is the fall of strength in the gravel layout when the gravel layout is placed on the subgrade. The underlay is combined with the soil and the traffic and the

**Research Article**

vibration gradually injects the aggregate to the soil and causes the upward movement of layout. In the wet places, the traffic causes the pumping of the weak subgrade soils to the aggregate and all these conditions reduce the effective thickness of the aggregate, and as the result the supportive layout will be destroyed and the useful life of the construct will be reduced. Woven and unwoven geotextiles are used for improving highways operation, non-carpet roads, parking locations, airports, docks, the places for keeping the goods and high buildings.

**Coating**

The main source of the destruction of the roads carpet, building, and... is the injection of the unwanted water to the construct through the crack of the surface. In the time of constructing or re carpeting the highway, road, and the runway, the coat tack and the new layout of the asphalt will create an effective moisture dam and will support the foundation in front of the water penetration.

**Protective Walls**

The protective walls allow their owners to maximize their own lands application; nevertheless building a cement gravity wall is impossible due to its heaviness and gravity. Geotextiles are widely used for strengthening the dikes on the soft soils, flood dam and retaining walls, the budget of the geotextiles makes possible the retaining walls construction, in fact a geotextile which is applied for retaining wall can be constructed by the half of the costs of a traditional retaining wall. The woven geotextiles have the considerable advantages in comparison with the traditional methods such as easy installation, easy construction, and the ability of using the excavation materials of the project location.

**Drainage**

Geotextile is a substitute for the usual soil filters to drain almost all the constructions including groundwater control systems, roads carpets, constructions infrastructures, dams, and walls. In comparison with the traditional soil filters, the geotextiles in addition to creating a continuous and proper drainage, also will reduce the excavation and environmental effects and causes the main decrease in the costs.

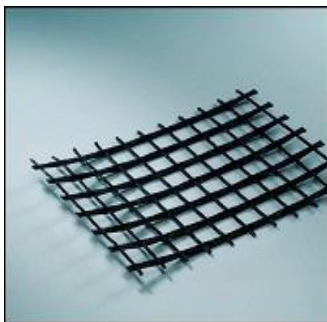
**Geogrid**

The geogrids are produced from the polyester yarns with high tensile strength, which are covered with the PVC covers with the lace like structure, these materials are produced in the following ways:

Uniaxial geogrid

Biaxial geogrid

These materials are made with different strengths and their main application is in the reinforcement. Also they are applied for reinforcing and building the crooked walls. Geogrid is a reticulated lace grids which are used in the form of horizontal columns to hold the walls. Geogrid is like a protector for the stability of the exterior surface movements. Geogrid stabilizes the soil in order to increase the strength of the walls which are constructed on it. Geogrid is a reticulated sheet that in comparison with geotextile has the better locking feature, it means, it involves with the soil particles and gives the high longitudinal and cross strength to its bed.

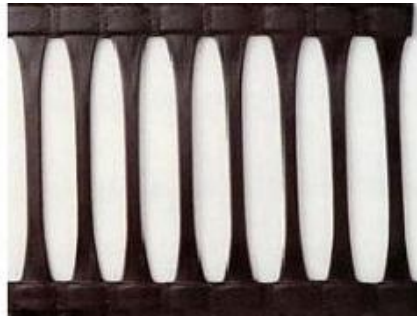


**Picture 9: geogrids operation**  
 source: <http://satrup.ri>

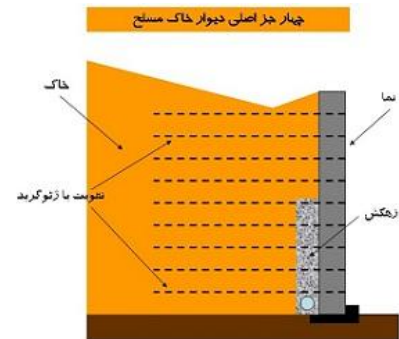
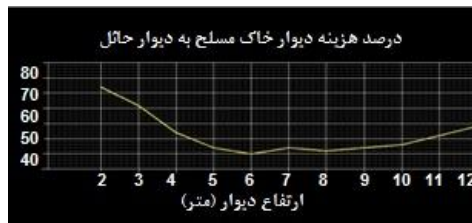
عملکرد				
نوع محصول	جداسازی	زهکشی	تسلیح موضعی	مسلح سازی
ژئوتکستایل	●	●	●	
ژئوگرید			●	●

**Picture10: Biaxial polyester geogrid**  
<http://yucivil.blogfa.com>source

**Research Article**



**Picture 11: Uniaxial poly ethylene geogrid E'GRID**



**Picture 12: Economic comparison between the concrete retaining wall and the soil reinforcement wall**

**Geomembrane**

Geomembrane is a sheet made of poly ethylene, PVC and... which has the ability to insulate all kinds of surfaces without the need of any special infrastructure. It causes impermeability to the different kinds of the fluids (for example: water, chemicals and oil materials), and is applied for sealing off, creating the artificial lakes, fish ponds and industrial pools, the water and sewer pipes. The geomembrane can be installed alone or with the different kinds of covers such as concrete sheets or aggregate. Using to improve the quality of the old dams, isolation, preventing the leakage on the bottom of the tanks, water constructions and... are some of the applications of this product. The life of the geomembranes without any cover, due to its exposure to the UV, is a little shorter than the life of the geomembranes with cover, but in the contrast their repairmen is easier than the geomembrane with cover. The geomembranes with cover are more exposed to perforation. A geotextile is placed under and above a geomembrane in order to prevent it from perforation.



**Picture 13: Geomembrane**

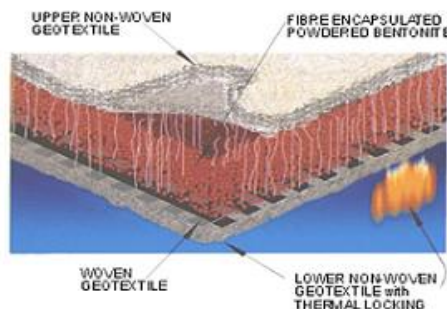
**The Protective Clay Linings (GCLS)**

The protective linings of the clay are a combination product of a polymer production and natural soil. This product is produced in the form of factory made fabric roles which includes a concrete layout that is



### Research Article

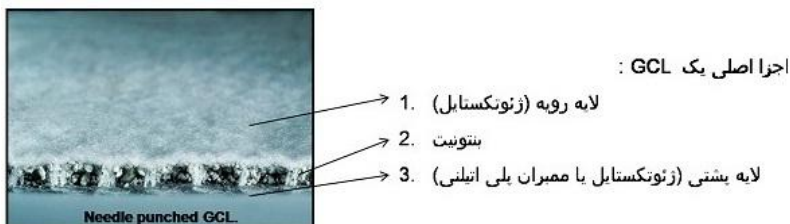
fixed between two geotextile and geomembrane layouts and makes a unit product. These linings, as a complete infrastructure, singly or with the geomembrane, are used in the environmental applications. The unique property of volume increase in the time of contact with water and as the result the permeability and also self-repairment are some of the advantages of this product. Also they are applied in the transportation fairs, geotechnic, and the hydraulic and other unique usages. But their main operation is protection.



Picture 14: The protective clay linings

### The Application of the Clay Protective Linings

- As the dike in the different constructions foundations at the areas with high water level.
- In creating the places for burying the garage
- As a dike in constructing the tanks and the ponds for the chemicals evaporation to prevent the material leakage in to the environment.
- Using in constructing the dams and the earthen dams
- In the research, the geo synthetic diversities are mentioned which have more application in the buildings. The geo synthetic diversities are more than what have mentioned in this research, but because they don't have considerable application in the building so they are not discussed here.
- 



Picture 15: Layouts of protective clay linings

### Conclusion

The history of the construction and the application of the geo synthetic materials date back to 1950, at that time the single sheets were used as a filter in controlling the erosion in Florida State of America. Bob Bart was the first one who brought up the first designs of the geo synthetic application in the water and soil projects, and therefore he became famous as the father of geotextiles. In America also, from the late 1970s, the application of single geotextiles increased. If in the civil projects, the geo synthetic be used we would have 1. Economic profits 2. The speed and ease of the performance 3. The flexibility in design and performance 4. Longer life and the less maintenance, 5. Preventing the quality fall in the time of performance, 6. The adaptability with natural environments, 7. So many applications in the construct.

By considering the above information, Geo synthetic are used in dike, drainage, isolation, protector, separating, and infrastructure and.... The use of geo synthetic materials in Iran unfortunately is not progressed due to lack of knowledge of the employers and the engineers, and also these materials have no considerable expansion due to their expensive costs. This material just has been used in the few projects and its application is limited.

**Research Article**

**REFERENCES**

- Angina Born AD (No Date).** Geo synthetic introduced and its application in civil engineering, civil engineering students across the country Eleventh Conference, University of Tehran, July 83 from 1 to 4.
- Asmayly and Valiolah Khalilian (No Date).** Vally Allah. Use of a railway embankment on soft substrates, papers presented at the Twelfth Conference and Exhibition fifth rail transport.
- Baloch M and Qnad Z (2010).** Features of geo synthetic materials, new technologies in the construction industry, knowledge management, Caisson Company.
- BCC Research Institute (No Date).** Leading information resource producing markets, Available: <http://www.bccresearch.com>.
- Day RW (2001).** *Building Design and Construction Handbook*; Section 6; *Soil Mechanics and Foundations*, sixth edition (published by McGraw-Hill Book Company).
- Rahimi H, Ghobadi MS and Sohrabi D (2006).** The use of Geo synthetic in irrigation and drainage, printing, Tehran, Iranian National Committee on Irrigation and Drainage.