

GABION WALLS AND THEIR USE

¹BARAN TOPRAK, ²OZER SEVIM, ³ILKER KALKAN

^{1,2}Research assistant, Kırıkkale University Engineering Faculty Civil Engineering Dept. Yahsihan Kırıkkale TURKEY,
³Associate professor, Kırıkkale University Engineering Faculty Civil Engineering Dept. Yahsihan Kırıkkale TURKEY,
E-mail: ¹barantoprak@gmail.com, ²ilkerkalkan@kku.edu.tr

Abstract— Retaining structures are often used to avoid damage to the structures under loads of natural ground slope. Gabion type retaining structures constitute one of the most economical and efficient solutions for stabilization of natural ground slope. Gabion walls are also preferred for the efficiency of the drainage instead of gravity walls. The present paper is a summary of definition, types, areas of use and advantages of gabion elements.

Keywords— Retaining structures, Gabion Walls, Raw Material, Natural Ground Slope.

I. INTRODUCTION

The design of the retaining walls which focuses on keeping ground level at two different levels, is one of the main research topics of Geotechnical Engineering. Gabion wall have been used widely in the world and more then a century in numerous erosion control projects, soil reclamation work, stream channels construction and retaining structures (Giani,1992 and Kandarıs, 1999). Gabion walls can be designed as rigid, semi-rigid and flexible depending on construction area, groundwater status, cost and purpose of use.

II. MATERIALS AND PROCEDURES

Gabion is a word of Italian origin as the word means big cage. Soft interlocking mesh of hexagonal form filled by rock and stone create gabion retaining structures. Gabion walls can also be formed in rectangular, square and cylindrical shapes. ASTM A975 is used for shaping gabion retaining structures. The general properties of gabion wire mesh are given in **Table 1** (Uray and Tan, 2015).

Table 1: Gabion Wire Mesh General Properties

Raw Material	Gabion Wire Mesh General Properties		
Technical Properties	Unit	Descriptions	Tolerance
Mesh	mm	50x70, 60x80, 80x100, 100x120	
Wire Thickness (Max)	mm	2-5 mm	0,05
Amount of Covering	gr/m ²	30-300	5
Tensile Strength	N/mm ²	250-2000	2

2.1. Types of Gabions

The type of the gabion to be used in the field, determine the requirements of the process in the construction field. To determine the correct type of gabion is important in terms of cost and function. Gabion types commonly used today are gabion baskets, gabion mattresses, gabion sacks and gabion wire mesh.

2.1.1. Gabion Baskets

Net wire mesh produced usually in box-shaped and in different sizes. Gabion baskets are frequently used in

highway and railway works. Especially, providing the filling material from a quarry close to worksite is an economical alternative. **Figure 1** shows an example of a gabion basket.



Fig.1. An example of a basket gabion

Gabion basket reach a natural green appearance as the plantation between the rocks spread along the basket. **Figure 2** show an example of a green gabion basket.



Fig.2. An example of a green gabion basket.

2.1.2. Gabion Mattresses

Gabion Mattresses are generally used in the channel coating for preventing erosion. Gabion height is shorter than the other types of measurements. **Figure 3** shows channel coating for preventing erosion with gabion mattresses.



Fig.3. Channel coating for preventing erosion with gabion mattresses.

2.1.3. Gabion Sack

This type of gabions are usually used in hydraulic works in emergency situations and in a practical way and they are formed quickly. Gabion sacks has a porous and flexible structure. **Figure 4** shows how gabion sacks are used in hydraulic works.

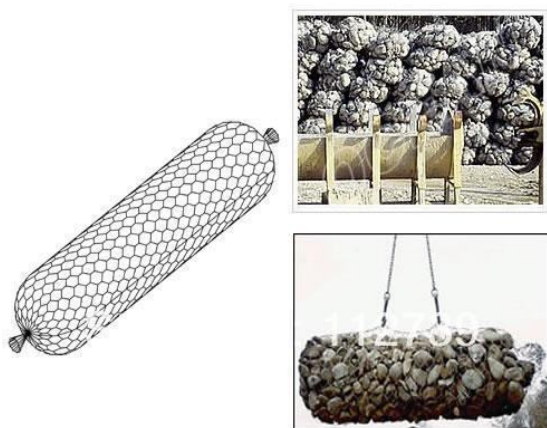


Fig.4. Gabion sacks in hydraulic works

2.1.4. Gabion Wire Mesh

Gabion wire mesh are used for keeping the possible fall of rocks and stones on the highway and railway surfaces and for directing the material to toe area to keep stability of the slope close to highway and railways. Gabion wire mesh reach a natural green appearance as the plantation between the rocks spread along the wire mesh and used for anti-erosion to slope.

Also a combination of the use on geogrid reinforcing with gabion in the soil embankment provides increasing strength of embankment soil to support the gabion face wall (Chen and Tang, 2011).

Figure 5 shows gabion wire mesh used in keeping the possible fall of rocks and stones.



Fig.5. Gabion wire mesh used in keeping the possible fall of rocks and stones.

Figure 6 shows combination geogrid reinforcing with gabions.



Fig.6. Combination geogrid reinforcing with gabions

2.1.5. Decorative Gabion Elements

Gabion elements are also used indoor and outdoor decoration, garden design and landscaping. Gabion elements provide a suitable environment for the growth of plant roots. **Figure 7** shows an example for the outdoor design with gabion elements



Fig.7. Outdoor design with gabion elements.

III. RESULTS AND DISCUSSION

3.1. The Advantages of Gabion Elements

The main advantages of gabion elements are:

- a. Flexibility: Gabion elements constitute a convenient solution for soils with a high settlement and swelling potential. Flexible gabion elements do not crack and are not affected by the earthquake such as gravity retaining walls.
- b. Permeability: Gabion elements do not require an additional drainage system because of the gaps between filling materials. Permeability of gabion elements are shown in **Figure 8**.

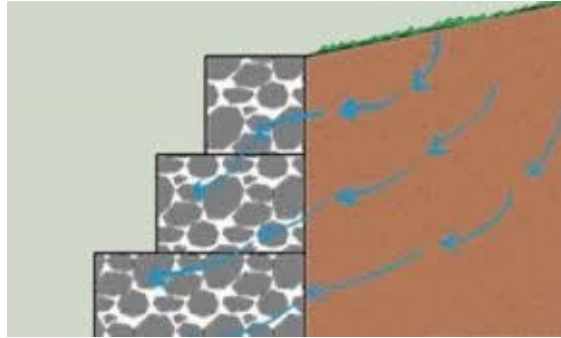


Fig.8. Permeability of gabion elements

- d. Economical: Shipping costs of gabion elements are lower due to the ease packing. Assembling the net mesh does not require qualified labor, and therefore, the labor costs are low. Filling material can easily be provided from a quarry close to worksite. Maintenance costs of gabion elements are extremely low.
- e. Eco-friendly: Gabion elements are environmentally compatible. The gaps in the soil between filling materials allow the plantation to grow over time. Gabion elements are not affected by natural phenomena.

- f. Esthetical: In architecture gabion elements are used for indoor and outdoor arrangements. Gabion elements have a natural outlook.

CONCLUSIONS

The use of natural materials in construction industry decreased significantly over the last decades. In the construction industry and landscaping, industrial materials are preferred generally. However, the human eye and natural habitat refuse industrial materials.

Gabion elements are preferred because of their flexibility, permeable nature, low costs, environmentally friendly and aesthetically pleasing nature in replacement for gravity retaining walls. In today's technology, production of flexible wires and the use of these wires up to 30-100 years without any deformation makes gabion elements indispensable.

For a green world, humanity needs the natural materials to enter our lives much more such as gabion elements.

REFERENCES

- [1] ASTM A975-11, "Standard Specification for Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses (Metallic-Coated Steel Wire or Metallic-Coated Steel Wire With Poly (Vinyl Chloride)(PVC) Coating)", 2011
- [2] C.W. Chen, A. Tang, "Evaluation of connection strength of geogrid to gabion wall", Geotechnical Special Publication No.220, pp 231-238, ASCE, 2011
- [3] E. Uray ve Ö. Tan, "Gabion Tipi Dayanma Yapıları", Broadcasts of Chamber of Civil Engineers Turkey (TMMOB), pp 19-29, TMH- 485, 2015/2
- [4] G.P. Giani, "Rock slopes stability analysis", 347, Balkema, Rotterdam, Netherlands, 1992
- [5] <http://www.senbaymetal.com/urun.html>, Web of Şenbay Metal, 2015
- [6] P.M. Kandarıs, "Use of gabions for localized slope stabilization in difficult terrain", The 37th U.S. Symposium on Rock Mechanics (USRMS), pp 1221-1227, Vail, Colorado, 1999.

★★★