

A Review Paper on Gabion Walls

Vishal Patil¹, Namdev Chopade², Grishma Nadkarni³

^{1,2}U.G Student, Dept. of Civil Engineering, Shaikh College of Engineering and Technology, Karnataka, India

³Assistant Professor, Dept. of Civil Engineering, Shaikh College of Engineering and Technology, Karnataka, India

Abstract - Due to rapid increase in the construction sector various building materials are being used universally. Retaining walls play crucial role in Geotechnical Engineering, wherein Gabion retaining walls have come more into limelight. The Gabion retaining walls are very much beneficial when it comes to economy, structural stability and aesthetic look when compared to others. They have multiple functions and are very effective when it comes to water draining properties. The current paper gives an overview about gabion retaining walls, types, applications, construction stages.

4. Sack gabion: these are used at the time emergency wherein Sack gabions are filled with rock on the project site to form flexible, permeable, monolithic structure.
5. Reinforced earth gabion: supplementary wires are used on the mesh. The wires may be placed parallel or vertical in the weave direction and the wire material is same as that of mesh material.
6. Welded gabions: Made from either galvanized or PVC coated mesh, the finished wall is aesthetic and cost effective.

Key Words: gabion retaining wall, structural stability.

1. INTRODUCTION

The primary function of any retaining structure is to provide lateral support to soil or the rock mass behind it. Different flexible and rigid bodies are being used as retaining structures in different parts of the world. Apart from the typical retaining structures, the gabion retaining walls are now gaining attention. The gabions are basically large baskets of galvanized steel which are filled with local stones or concrete rubble. The baskets are 1m high and up to 4m long. The baskets are placed one above another to form a solid structure. The gabion structures are resilient and can resist pressure without deforming, cracking or breaking as in the case of concrete and other materials. Their flexibility takes care of the soil movements and the effect is there is no reduction in the load bearing capacity of the wall. Over years vegetation grows over them and they turn out to be the most attractive alternative to concrete retaining walls. They are cost-effective and can be built quickly.

1.1 Types of gabions

Depending upon the applications and the site requirements there are different types of Gabions available. Some of them are as follows.

1. Gabion gravity wall: these are similar to gravity retaining walls which use their own weight to resist lateral pressure.
2. Mechanically stabilized earth: in order to secure the gabion walls to the backfills welded wire meshes are used.
3. Gabion mattress: these are commonly used in spillways, channels, banks in order to control erosion.

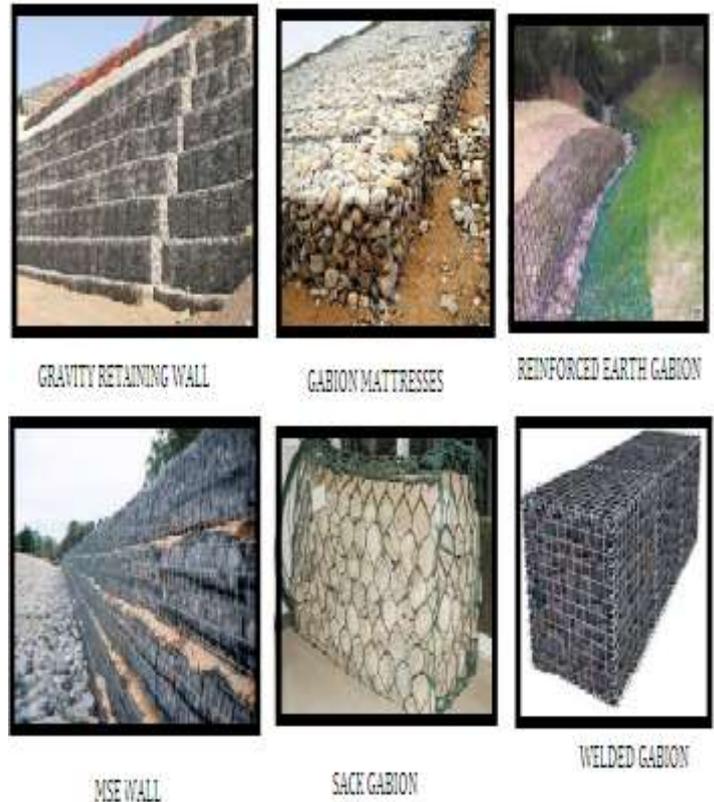


Fig -1: Types of Gabion Walls.

2. MATERIALS USED FOR CONSTRUCTION

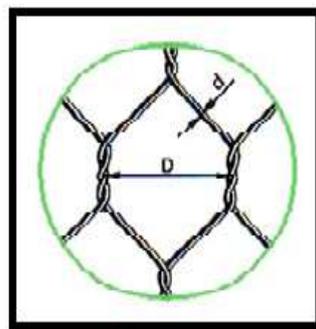
The strength and the stability of gabion walls depend upon the materials which are used for its construction. The materials required along with its types are as listed.

2.1 Types of Gabion wires

1. Unprotected, Uncoated Wire: these are 5mm diameter wires which are used for temporary works.
2. Steel wire: these are high quality low carbon 2mm to 4mm diameter having strength of 38kg/m².
3. Galvanized wire: Hexagonal woven mesh gabions should be made from galvanized wire (low carbon mild steel wire with a heavy duty coating of zinc or Zinc-Al alloy).
4. PVC coated galvanized steel wire: The radial coating applied to the galvanized wire core should be a minimum of 0.25 mm. The PVC should be sufficiently bonded to the galvanized wire core to prevent capillary flow of water.
5. Polymer Plastic Rope Mesh: New materials such as Tensar, a heavy duty polymer plastic material, have been used in some applications in place of wire mesh. Nylon or polypropylene rope gabion baskets are usually used for anti anti-erosion works.



Galvanised wire



Gabion wire mesh

Fig -2: Gabion wire meshes.

2.2 Properties of rock fill

The stones should be hard, durable, angular and well graded with a minimum size of 1.5 times the aperture size and maximum size of one half the heights of the gabion baskets. Naturally occurring rounded stone or quarried stones are acceptable. Gabion fill is normally a graded fill of between 100 to 200 mm in diameter. The more angular the fill, the better interlock and the less deformation of the face occurs. Quarried Stone which is normally angular is the preferable fill as the interlock is very good. Construction waste, debris from demolished structures, quarry rejects stones, and Industrial waste has been used as a gabion filler material. However care has to be taken to check the durability, strength and chemical properties of the fill material. Artificial stones made from cement concrete with color pigments to give it the color that would match the natural landscape have been used recently.

Table -1: Various types of gabion fill materials and their densities

Flint rejects and whole stone	14.5 KN/m ³
Crush stone	15.0 KN/m ³
Sandstone	15.5 KN/m ³
Limestone	16.0 KN/m ³
Granite	17.0 KN/m ³
Basalt	20.0 KN/m ³
Aggregate fill	16.0 KN/m ³ (geotextiles lined units)

2.3 Construction Stages

1. Foundation: the engineer specifies the foundation requirements based on the site conditions and the height of the wall. The top layer of the soil is stripped off till the required bearing capacity is reached.
2. Assembly: the gabion boxes are assembled by folding the four sides and joining the edges with spiral binders. Diaphragms are used to connect base panel to the spiral binders. The empty gabions are first placed on the foundation level; when position is made secure adjacent gabions are placed and are connected with vertical spiral binders. Corner stiffeners are then installed diagonally across the corners. The stiffeners must be hooked over crossing wires and crimped closed at both ends. Bracing ties should be provided in each gabion to prevent heavy deformation caused by filling. Final gabion alignment must be checked before filling begins.
3. Filling: A well graded stone fill increases density. Place the stone in 12-inch lifts with power equipment, but distribute evenly by hand to minimize voids and ensure a pleasing appearance along the exposed faces. Keep baskets square and diaphragms straight. Level the stones and bind along all gabions' edges and at diaphragms' tops with spiral binders.
4. Placing successive courses: Place the next course of assembled empty gabions on top of the filled course. Stagger the joints so that the vertical connections are offset from one another. Bind the empty baskets to the filled ones below the spirals or tie wire at all external bottom edges. Bind vertical edges together with spiral binders and continue with the same steps as for the first layer. Successive courses are placed in like manner until the structure is complete.

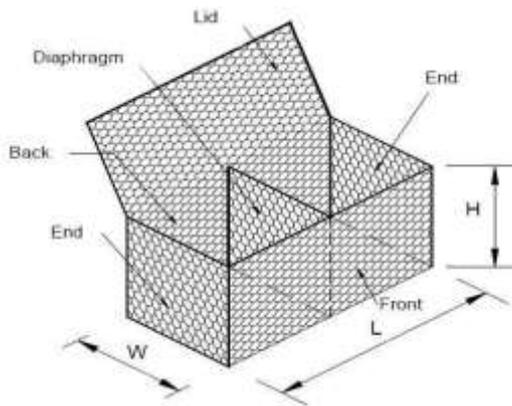


Fig -3: Construction of Gabion.

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3. RESULTS AND DISCUSSION

The following are the advantages of gabions:

1. Gabion wall has got various possibilities of installation.
2. Aesthetical appearance suiting the environment.
3. Long life, economical and quick construction.
4. Materials available near the site can be used.
5. Permeable structure not susceptible to frost damage
6. Flexibility, strength.

4. CONCLUSION

The use of gabions deserves attention because of its multiple advantages. Few of its characteristics like high flexibility, less permeability, eco-friendly nature, economy and attractive look are almost on the verge of replacing gravity retaining wall. It is one of the best methods to reuse the construction waste. Vegetation can be grown over it which in turn helps to increase the greenery around. The gabion structures reduce the usage of steel and concrete and will help in sustainable development.

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