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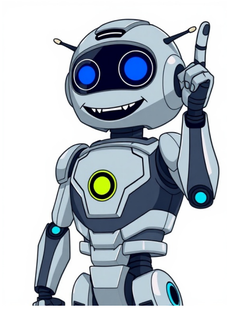

The realm of civil engineering presents numerous challenges when dealing with sloped terrains and erosion prevention. The construction of retaining walls is a common solution to these issues, and among them, gabion walls stand out due to their unique combination of functionality and aesthetic appeal. A gabion wall consists of wire mesh baskets or steel cages filled with rocks, stones, or other sturdy materials, stacked as a unit to form a gravity wall. The typical construction involves using 1m x 1m steel wire panels or mesh, which are unfolded at the site to form cages. These cages are then filled with materials, tied together, and assembled into retaining walls. The use of well-graded infill material is crucial, as it increases the overall weight of the wall, enhancing its resistance to sliding and overturning. A gabion wall acts as a gravity wall, ensuring stability by virtue of its cohesive mass design. The lateral pressure from the soil and any surcharge applied on the backfill is calculated using the Coulomb method. The coefficient of lateral pressure is determined using the formula: k_a = sin^2(α + φ) / (sin^2α sin(α - δ) [1 + sqrt((sin(φ + δ) sin(φ - β)) / (sin(α - δ) sin(φ + β)))]^2). The forces acting on a gabion wall include overturning, sliding, and pressure. To ensure stability, similar checks are carried out for gabion walls as for other retaining structures. The sliding resistance is calculated using the ratio of the total weight of the wall to the lateral earth pressure, while the overturning resistance is determined by the ratio of resisting moment to overturning moment. Gabion walls typically do not have a concrete footing and are instead constructed on a firm base level, often gravel.The gabion wall geometry must be verified to ensure that the resultant pressure does not create any tension within it. This involves checking the eccentricity of the pressure, which should be within the middle third of the base. To achieve this, the eccentricity value must be less than one-sixth of the width of the gabion wall at its base level. The position of the middle third is determined using the formula: e = (w/2) - (M_R-M_O)/V, where e represents the eccentricity, w denotes the width of the gabion wall at its base level, M_R and M_O signify the resisting moment and overturning moment respectively, and V symbolizes the total vertical load at the base level. Once the middle third position is established, the soil bearing pressure can be calculated using the formula: p = V/w ± (6Ve)/w^2. This value is compared to the bearing resistance of the base, with satisfactory results obtained when the pressure is found to be within the acceptable range. The gabion wall must then be designed and constructed using a trial-and-error approach, taking into account various parameters such as the dimension of each unit, stability in overturning, sliding at the interface of each unit, and face. The pressure at the base level should also be verified to ensure it is within the middle third and less than the bearing resistance of the base. In the case of a 10m tall gabion retaining wall, designed to create a change in elevation between two residential buildings, various calculations are required to determine the size of the wall. This includes considering factors such as the density of the granular soil, water table position, surcharge on the backfill, angle of shear resistance, tilt angle of the wall, and coefficient of friction between the base soil and concrete. For this specific example, the bearing resistance of the base is assumed to be 300kN/m2. ========== Gabion Units and Design Methodology ---------- Gabion units are typically manufactured in modules measuring 2 meters by 1 meter by 1 meter. However, the design method for verifying gabion wall functionality can be performed at the ultimate limit state analysis stage. Key Design Criteria ---------- * Soil Bearing: The applied base pressure should not exceed the soil's ultimate bearing capacity. * Sliding Resistance: A suitable factor of safety must be ensured to prevent sliding between the wall and underlying soil, taking into account active earth pressure conditions. * Overturning Stability: The wall's stability against horizontal forces that may cause it to overturn or fail due to unstable retained soil mass should meet specified conditions. Global Stability Considerations ---------- The maximum pressure transferred from the gabion wall to the ground must be compared with the safe bearing capacity of the soil, which depends on the type of foundation used. In this case, a non-stiff footing is assumed, and it is essential that each layer's bearing capacity and sliding resistance are verified. Internal Stability Verification ---------- Each layer of gabion should undergo internal stability verification to ensure it does not collapse or experience reduced bearing capacity compared to lower layers. This analysis starts from the top layer and moves down to the bottom layer. Limit State Checks ---------- Design limit state checks must be carried out at selected planes through the gabion wall, disregarding any resistance contributed by cage material or connections between cages. For stepped walls, stability checks should be performed at each major change in section shape. Proportioning and Mobilized Angle of Wall Friction ---------- To minimize deformation, gabion walls should be proportioned such that the resultant force acts within the middle third of the wall's cross-section. The mobilized angle of wall friction (δ) should not exceed half the angle of shearing resistance (ϕ') of compacted backfill material. Gabion Baskets ---------- Gabion baskets can be fabricated from various materials, such as nylon, polypropylene, and polyethylene grids, which offer advantages like lightness and corrosion-resistance. However, these materials are susceptible to fire and ultraviolet damage. Steel wire-mesh is a common material used in gabion production, with two types available: hexagonal woven and square welded. Wire Mesh Requirements ---------- The wires used for the wire-mesh should meet minimum tensile strength standards of 350 N/mm² and be galvanized for permanent applications. PVC coating is recommended to protect against aggressive infill or retained materials or groundwater. Infill Material Guidelines ---------- Rock used for filling gabions should be clean, sound, and well-graded. The maximum size of the rock should not exceed two-thirds the depth of the gabion or 300 mm, whichever is less.The minimum dimension of the rock should be at least twice as large as the largest dimension of the mesh aperture. ========== Gabion walls offer several benefits for landscape design, construction, and other uses, making them an attractive option for many projects. One of the main advantages is that they are significantly less expensive than traditional retaining walls built with materials like stone, brick, or concrete. The wire mesh baskets used in gabion walls are relatively inexpensive, allowing you to allocate your budget to select suitable filler materials such as construction leftovers, bricks, or stones. gabion wall location marking. mark your desierd locashun for the gabion wall using stakes and strings or other metheds, such as marking flags. prepare the fudation. while gabion walls dont requre the same level of fudation prep as other retaiining wall types, you stil need to make shure the surface is readdy for the wall’s konstruckshun. remove any gras, plantz, or weedz, along with the uper soft toposoil laier, in the markd locashun. dig jast deeprly enuf to reach your lawn’s harder laier of topsoil. if you have clay or sandy soile, you might need to dig down beetween 4 and 6 inchez and us gabion cage material to bakfill the area. assembel and place the empty cagizs in the desierd locashun. gabion cagiz are sold flat and unasembeld, so they will need to be assembeld following the manufaktur’s instrukshuns. afetr assembelding each cage, lay them out in the prepaird locashun, startng with jast the base laier. link the basketz together for sekurity. you wont be able to eazyly alter the wall’s lokashun once the basketz are filld, so make shure they ar placd exaktly where you want them. clean and sort the wall’s filding material (opshunal). its recomendated to first preserwash the stonz you plan to fill the gabion with to make zem look more atirktive and polischid. dependng on the matiralz you’re usin and your level of focus on aesthetiks, you can skip this step if desird. place the filding material into the gabion basketz. carefull fill each gabion basket with the stonz or other filding materizal. if you’re usin mulitple kolors or tryng to make a patteren, take kare to considder the filding material’s distribushun.