
WWJMRD2022; 8(09):109-111
www.wwjmrd.com
*International Journal*
*Peer Reviewed Journal*
*Refereed Journal*
*Indexed Journal*
*Impact Factor SJIF 2017: 5.182 2018: 5.51, (ISI) 2020-2021: 1.361*
*E-ISSN: 2454-6615*

**Irakli Ramishvili**
Georgian Technical University, Faculty of Construction, Tbilisi, Capital, Georgia.

**Correspondence**:
**Irakli Ramishvili**
Georgian Technical University, Faculty of Construction, Tbilisi, Capital, Georgia.

# Calculation of the stability of the anti-debris flow structure

## Irakli Ramishvili

**Abstract**
In order to assess the stability of the anti-debris flow construction, the holding power of the structure was calculated $M_{hold}$ and an overturning power acting on the structure $M_{overt}$ moments of force, according to which we can conclude, that the condition of stability of the structure is fulfilled and therefore the anti-debris flow construction is stable and reliable.

**Keywords:** debris flow, anti-debris flow construction, stability of construction.

**Introduction**
The calculation of the anti-debris flow construction is carried out by a proven method [1, 2], which considers satisfaction of its sustainability conditions, which means, that the holding power or in other words sustainable preservation force must exceed the overturning power.
To calculate the holding power, taking into account the cross-sectional shape of the construction, whose curvilinear shape elements can be represented in the shape of a rectangle, their total weight and moment overturning point was determined (Fig. 1).

**Fig. 1:** Anti-debris Flow Structure.

On the other hand, the overturning force in this case is represented by the mass of the ground overcome by the accumulated water in the upper water canal of the construction elements, which is placed above the slipping flat surface (Fig. 2). According to preliminary data, the natural inclination angle of this ground mass is equal to 30 degrees.

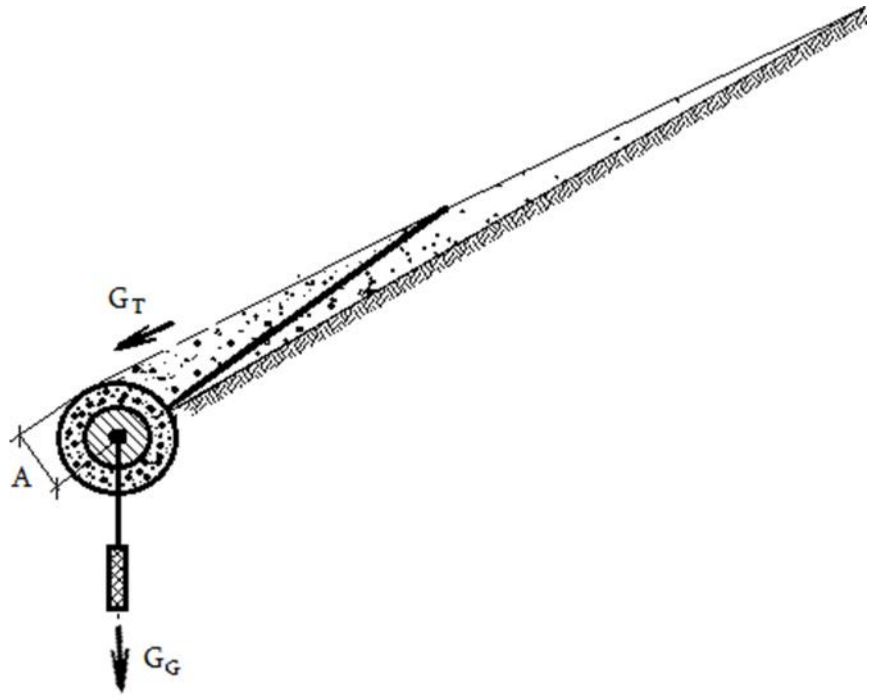


**Fig. 2:** Anti-debris Flow Structure Sustainability Calculation Scheme.

In order to meet the stability condition of the structure, it is necessary to calculate the overturning point caused by the weight of its elements so called a holding moment $M_{hold}$. and the overturning moment caused by the gravity of the soil accumulated in the upper water canal in relation to the same point $M_{overt}$, which must meet the conditions during the dam's operational conditions:

$$M_{hold} > M_{overt} \quad (1)$$

Below is the calculation of these two main parameters.

**Calculation of the moment with the support forces of the structure**

The holding power of each element of the structure are mainly represented by their body G weight, which in our case is the shock-mounted tire, its rims, the sum of the weights of the insulating material placed in the hollow body of the tire. i.e.

Gstruc = Gtyre + Grim + Vsoil + Ysoil (t.) (2)

For the firs section (8.2.) by calculating the formula, we get:

Gtyre + Grim + Vsoil + Ysoil = 3.9 + 2.2 + 35.7 = 41.8 (t.) (3)

For the second section (8.2.) by calculating the formula, we get:

Gtyre + Grim + Vsoil + Ysoil = 6.6 + 7.2 + 88.5 = 102.3 (t.) (4)

For the third section (8.2.) by calculating the formula, we get:

Gtyre + Grim + Vsoil + Ysoil = 8.2 + 2.6 + 110 = 120.8 (t.) (5)

Component elements of construction sections - The tires are placed into the ground, half of the diameter. Considering this, the weight of each section amounts to:

$$G_1 = 41.8 + 16.2/2 \times 2.2 = 59.6 \text{ (t.)}; \quad (6)$$

$$G_2 = 102.3 + 20.1/2 \times 2.2 = 124.4 \text{ (t.)}; \quad (7)$$

$$G_3 = 120.8 + 25/2 \times 2.2 = 148.3 \text{ (t.)}. \quad (8)$$

After determining the center of gravity of the construction sections using a graphical method, the magnitude of the side of the holding moment was determined, that accordingly came up as following:

A1=0.65 m;

A2=0.7 m;

A3=0.75 m.

The holding moment of the construction sections towards the overturning point will be:

$M_1=G_1 x A_1 = 59.6x0.65 = 38.8$ (t.m) (9)

$M_2=G_2 x A_2 = 124.4x0.7 = 86.8$ (t.m) (10)

$M_3=G_3 x A_3 = 148.3x0.75 = 111.2$ (t.m) (11)

**Calculation of the moment due to the overturning forces of the structure**

The overturning power of the sections of the structure are represented by the volume of the ground, which is filled with water accumulated on its upper canal, which weight, the volume of the sliding prism is calculated with prism placed above the flat surface passing through the line corresponding to the angle of internal friction of the ground and by the product of the volumetric weight of the soil. i.e.

Gsoil = Wsoil + Ysoil (t.). (12)

If we assume that the distance between the sections of the structure is 15 m, then the weight of the prism acting on them will be proportionate:

$G_{1soil}$ = 13.8 x 2.2 = 30.4 (t.); (13)

$G_{2soil}$ = 45.1 x 2.2 = 99.2 (t.); (14)

$G_{3soil}$ = 51.8 x 2.2 = 113.9 (t.). (15)

Control allowed from the overturning point on a line parallel to the bottom of the ravine, drawn from the center of gravity of the ground prism, that is, the side of the force according to sections will be following:

$B_1$=0.65 m;

$B_2$=0.7 m;

$B_3$=0.75 m;

The overturning point, correspongingly will be following:

$M_1$overt = $G_1$soil x $B_1$=30.4 x 0.65=19.8 (t.m.); (16)
$M_2$overt = $G_2$soil x $B_2$=99.2 x 0.7=69.4 (t.m.); (17)
$M_3$overt = $G_3$soil x $B_3$=113.9 x 0.75=85.4 (t.m.). (18)

Thus, following condition is met $M_{hold} > M_{overt}$, which means that the sections of the structure have a reserve of stability and correspond to following magnitudes:

38.8/19.8=1.95;

86.8/69.4=1.25;

111.2/85.4=1.30.

**Conclusion**

Based on the above calculations, it can be concluded, that the stability condition of the anti- debris flow structure is fulfilled and therefore the anti-debris flow structure is stable and reliable.

**References**

1. Astvatsaturov A. - Construction mechanics: special course. Sustainability and dynamics of buildings: a guide for students of higher technical schools. - Tbilisi, Education, 1976. - 438 p.
2. Hydraulic structures (Designer's Handbook). Moscow, 1983, p. 542.