

Technology Fact Sheet

Landslides protection measuresⁱ

1) Sector: Extreme events

2) Subsector: Protection of engineering-economic facilities and population from landslide processes

3) Technology description:

For the protection from landslide processes, the following technologies are approved worldwide:

1. Regulation of surface waters and arranging of water channels; preventing of infiltration of waters into the ground;
2. Regulation of ground waters (keeping of ground waters or lowering levels);
3. Changing of topography landslide relief for the purpose of improvement of slope stability;
4. Phyto-reclamation;
5. Increasing of slope stability by supporting constructions (counter-banquet, counter-force; anchor; piles);
6. Artificial improvement of rock features (resistance to shifting and improving stability; cementation of landslide and other kinds of splits, applying of clay, silicate, electro-osmotic draining, electro-chemical reclamation, burning out, covering with concrete spray, gunned material, etc.);
7. Changing of landslide ground – arranging of so called ‘terramesh’;

4) Recommended technology version:

The world practice proves that the landslide protective cardinal measures listed as 4, 5, and 6, are very expensive and hard to implement. This kind of measures is implemented only for the protection of especially significant objects. For instance, the ‘terramesh’ method has been used for the protection of the road to St Nino Monastery in Bodbe and the area (15000m²) in town Signagi damaged by landslide. This method envisages removing of the landslide mass and lining the bottom with the well drainable ground. An iron net must be arranged from above, and only after that, the removed several meters thick ground must be applied. The clay/ground mix must be rammed and approximated to natural conditions as much as possible. After that, the iron (wire) net must be applied again, and then – the clay/ground mass. Such layers must be repeated as much as it is necessary to get the surface maximally approximated to natural profile of the relief (Fig 1 and 2).



Fig 1. Road destroyed by Bodbe landslide



Fig 2. 'Terramesh' method used for Bodbe landslide

These measures cost 1 million GEL, or approximately 600 000 USD. However, the carried out measures were effective. It should be underlined that, taking into account the categories of objects to be protected from landslide processes, the following prophylactic (palliative) measures are carried out: regulation of surface waters, construction of overflow pipes, drainage of water saturated rocks, removal of landslide mass, bank protective gabions, and phyto-reclamation. Plant cover regulates surface flows, hinders infiltration of rain and snow waters, promotes significant draining of rocks by transpiration, and protects from washing and gullies. Deep roots of some plants (for instance, beech or acacia), penetrate down to 6-20 m and spread around the tree up to 8-12 m, absorbing significant amount of water and improving the ground features. It should be noted also that to avoid the risk of landslide processes, the special landslide protection instruction (CH-519-79) was developed in 1981 that points out priority of implementation of the above listed measures.

However, relevant assessment of the target territory must be conducted before implementation of the mentioned measures

- 5) **Availability:** Landslide preventive prophylactic technologies are efficient from financial point of view and are easy for technical implementation. Local population can also take part.
- 6) **Socio-economic and environmental priorities:** Protection of population from landslides, ensuring normal operation of highways, maintenance, and reclamation of significant areas of agricultural lands
- 7) **Expenses:**
 1. Regulation of surface waters and removal of 1 cub meter of loose and clay grounds cost approximately 1.0 USD;
 2. Construction of 1 cub meter of gabion – 70 USD; planting of 1 tree – 0.30 - 0.50 USD

ⁱ This fact sheet has been extracted from TNA Report - Adaptation for Georgia. You can access the complete report from the TNA project website <http://tech-action.org/>