

Geological Mass Movement :-

Mass movement is defined as the down slope movement of rock and soil near the Earth's surface mainly due to the force of gravity.

Mass movements are an important part of the erosion process, as it moves material from higher elevations to lower elevations where transporting agents like streams and glaciers can then pick up the material and move it to even lower elevations.

Mass movement processes are occurring continuously on all slopes. Some act very slowly, others occur very suddenly, often with disastrous results.

Agents of Mass Movement or Mass wasting —

- ① Gravity :- Gravity is the force that acts everywhere on the Earth's surface, pulling everything in a direction toward the center of the Earth.

② Trigger -

Initiates down slope movements.

③ Role of water in mass movement -

- Small amount of water can increase strength.
- Surface tension of water helps hold material together.
- Saturation with water weakens material.

④ Role of vegetation in mass wasting -

- Roots add strength to material by binding loose material together.
- In semi-arid and arid regions, forest fires can remove vegetation from hill slopes.

⑤ Planes of weakness in material -

- Planes of weakness in the material can facilitate mass movement if the planes are oriented parallel to the slope.
- Planes of weakness include bedding planes in sedimentary rocks and foliation planes in metamorphic rocks.

Types of mass movement -

- 1) Fall :- Rocks fall from great distances as a result of gravity.
eg - Rock fall.
- 2) Slide :- materials remain fairly and coherent and moves along a well defined surface eg - landslide.
- 3) Flow - moves down slope as a viscous fluid eg - mud flow.
- 4) Slump :- downslope sliding of a mass.
- 5) Creep - extremely slow movement due to gravity.
creep damages buildings, roads.

Causes of mass movement -

- * Increase in slope steepness.
- * Reduction of slope strength by weathering.
- * water saturation
- * Increase in weight at top of slope
- * Removal of support at the base of a slope.

How do we prevent mass wasting?

This is not possible but a better question is how do we lessen the effects of mass movement.

- ✱ Remove weight from slope.
- ✱ Engineering controls.
- ✱ Vegetation and Geofabric.
- ✱ Cables and anchoring systems.
- ✱ Tunnels built over highways thus reducing weight.
- ✱ Building codes are an effective way to reduce sliding problems.

LAND DISASTERS OR LAND SLIDING :-

Introduction :-

A land slide is a downward or outward movement of soil, rock or vegetation, under the influence of gravity.

Factor of safety (F) =

$$\frac{\text{Resisting force (R)}}{\text{Driving force (D)}}$$

When $F < 1$ a land slide occurs.

Common type of slides —

- a) Rotational slides — move along a surface of rupture that is curved and concave.
- b) Translational slides — occur when the failure surface is approximately flat or slightly undulated.

Causes of land slides —

There are various factors that contribute to a land slide —

① Gravity :- Gravity works more effectively on steeper slopes.

② Earth quakes :- Ground vibrations created during Earth quakes.

③ Slope :- The main factor that contributes to a land slide is the slope. The steeper the slope, the larger the threat.

④ Precipitation :- The other factor that contributes to a land slide is precipitation. Soil is typically more mobile when it is wet. A large amount of precipitation that a land form is not used to receiving can trigger a land slide.

⑤ Heavy Rainfall :- Slides occur often with intense rain by creating zone of weakness, also water tables rise with heavy rain makes some slope unstable.

⑥ Vegetation

⑦ Volcanoes

⑧ Waves

Effects And Losses Due to Land slides —

A) Direct effects :-

a) Physical damage :-

Debris may block roads, supply lines (tele communication, electricity, water etc) and water ways.

b) Casualties —

Deaths and injuries to people and animals.

B) Indirect Effects :-

a) Influence of land slides in dam safety —

Failure of the slopes bordering the reservoir, flooding caused by movement of large masses of soil into the reservoir.

b) Land slides and Flooding —

Debris flow can cause flooding by blocking valleys and stream channels, forcing large amount of water to back up causing / ~~back up~~ ^{back up} of

c) Direct losses :-

Loss of life, property, infrastructure and lifeline facilities, Resources, farmland and places of cultural importance.

D) Indirect losses :-

- * Loss in productivity of agricultural or forest lands
- * Reduced property values
- * Loss of revenue
- * Increased costs
- * Adverse effect on water quality and loss of human productivity.

How to minimize Land slide Hazards :-

* Choose a safe location to build your home, away from steep slopes and places where land slides have occurred in the past.

* Prevent deforestation and vegetation removal.

* Avoid weakening the slope.

* Proper water run off must be ensured by providing a proper canalization network.

* Drainage :-

Good ground drainage is essential to prevent saturation and consequent weakening.

* Proper land use measure :-

Adopt effective land use regulations and building codes based on scientific research.

* Structural measures :-

Nets, Retaining walls and major civil works to mitigate land slides.

* Use of GIS :-

Use of remote sensing and ground truth data for making landslide hazard zone map.