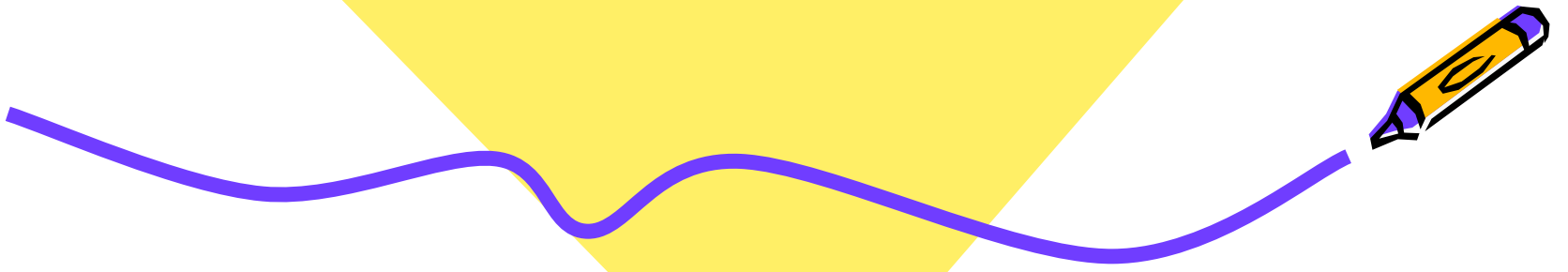




SOIL MODIFICATION



SOIL MODIFICATION



- Soil modification is a process of **improving soil engineering properties** such as *shear strength, bearing capacity, permeability and etc.*
- Soil Modification can be group into 4 main groups:
 - a) mechanical modification,
 - b) chemical modification
 - c) hydraulic modification
 - d) physical modification by inclusions & confinement.



- A) Mechanical Modification
- Increased soil density by application of short-term external mechanical forces.
- Using :
 - compaction of surface layers by static
 - vibratory or impact rollers and plate vibrators; deep compaction by heavy tamping at the surface or vibration at depth

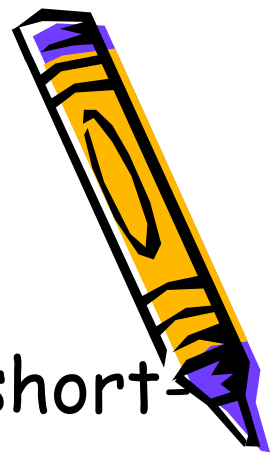


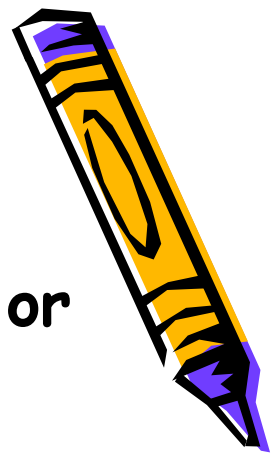


Fig. 1: Example of mechanical modification (Drum Rollers)

- B) chemical modification

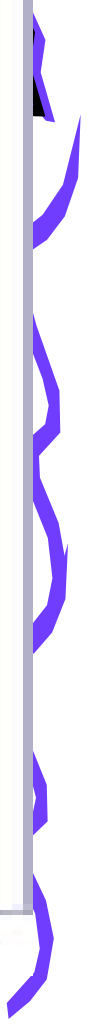
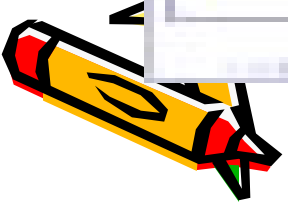
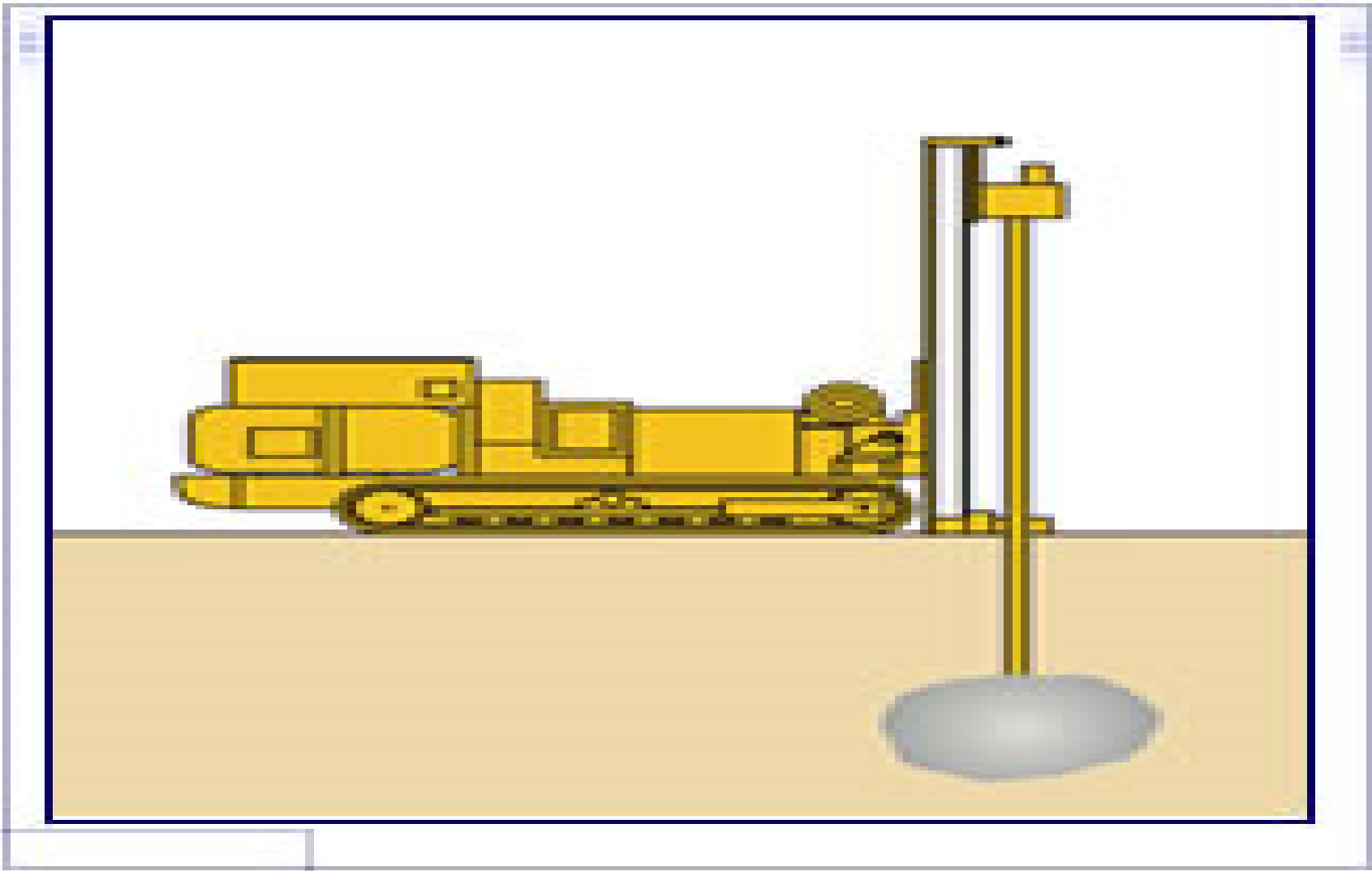
- Stabilization by **chemically** is a process of mixing **additives** with surface layers or columns of soil.
- Additives include natural soils, industrial by products or waste materials, and cementitious and other chemicals which react with each other and on the ground.





- When additives are injected via boreholes under pressure into voids within the ground or between it and a structure, **the process is called grouting.**
- Soils stabilization by heating the ground and by freezing the ground are both considered thermal methods of modification. **Heating** evaporates water and causes permanent changes in the mineral structure of soils; freezing solidifies part of all of the water and bonds individual particles together. Improve in shear strength and reduce permeability

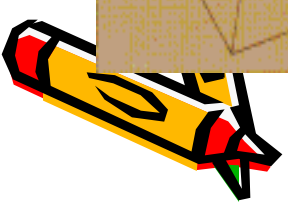
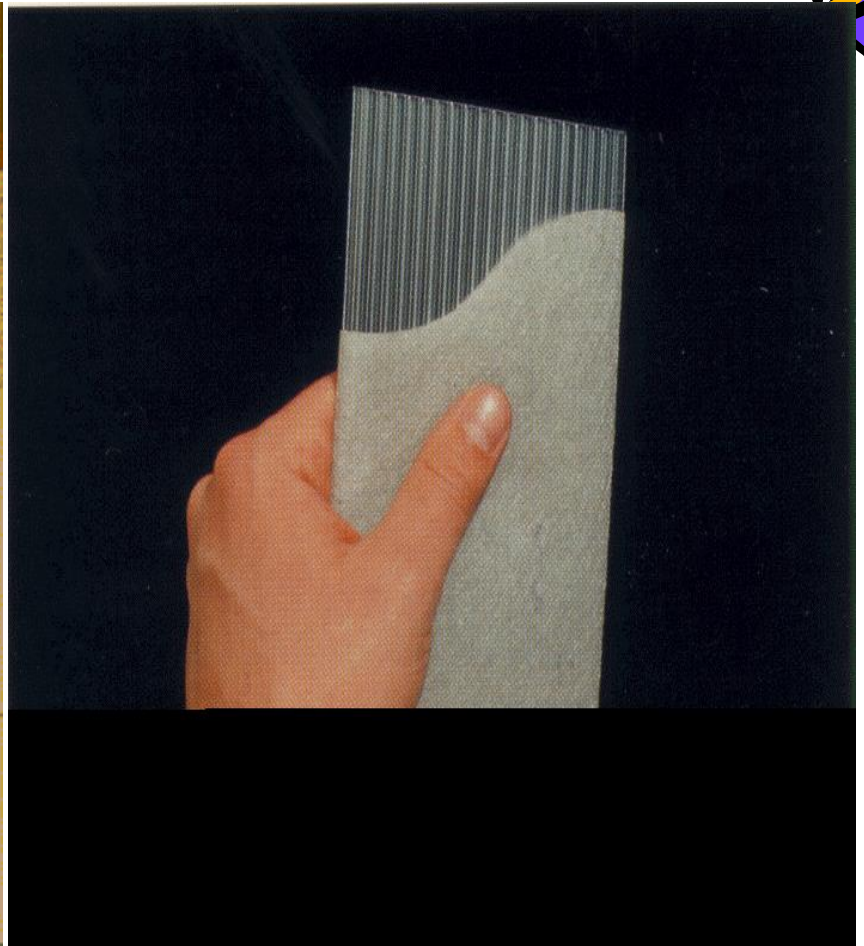
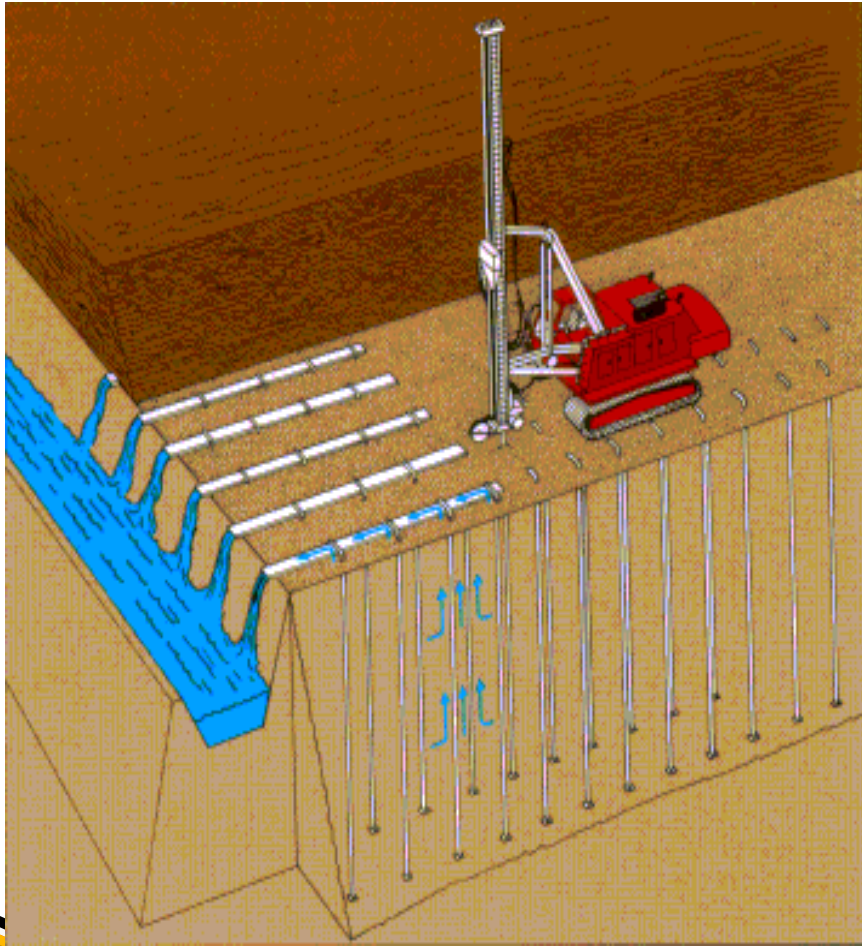




• c) Hydraulic Modification

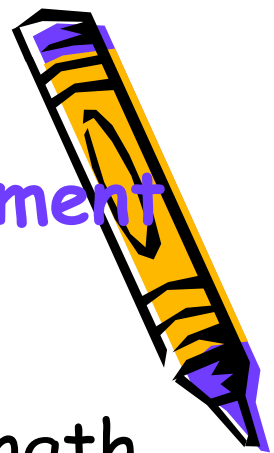
- **Free-pore water** is forced out of the soil via drains or wells.
- In coarse-grained soils this is achieved by lowering the groundwater level through pumping from boreholes or trenches.
- In fine-grained soils the long-term application of external loads (preloading) or electrical forces (electro kinetic stabilization) is required.
- Traditional techniques have benefited from the development of geosynthetics, as in the case of vertical drains.





- d) Modification by inclusions & confinement

- Reinforcement by fibers, strips, bars, meshes and fabrics imparts tensile strength to be constructed soil mass. In-situ reinforcement is achieved by nails and anchors.
- Stable earth-retaining structures can also be formed by confining soil with concrete, steel, or fabric elements (including crib and bin walls and sandbags).





17 11 2004

**Anchor Earth
retaining
structure**



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