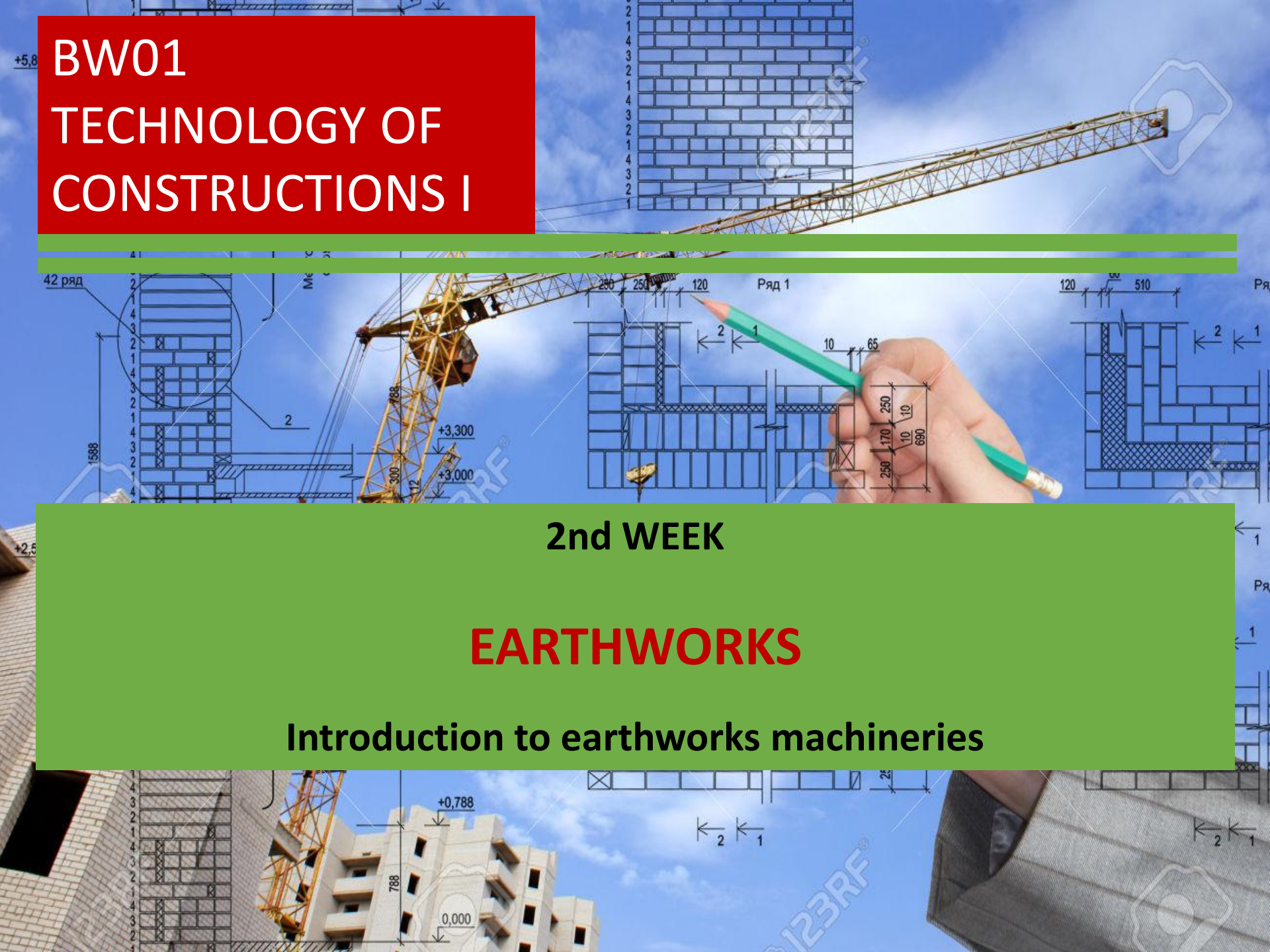
BW01 TECHNOLOGY OF CONSTRUCTIONS I



2nd WEEK

EARTHWORKS

Introduction to earthworks machineries

INTRODUCTION

- **Earthworks** are engineering works created through the moving or processing of parts of the earth's surface involving quantities of soil or unformed rock.
- The earth may be moved to another location and formed into a desired shape for a purpose.
- Much of earthworks involves machine excavation and fill or backfill.
- Typical earthworks include:
  - roads and railway beds,
  - causeways,
  - dams,
  - levees,
  - canals and berms.
- Other common earthworks are land grading to reconfigure the topography of a site or to stabilize slopes.

Frederick S. Merritt, M. Kent Loftin, Jonathan T. Ricketts, *Standard Handbook for Civil Engineers, Fourth Edition*, McGraw-Hill Book Company, 1995.

INTRODUCTION

- Earthworks can be described as "the disturbance of land surfaces by blading, contouring, ripping, moving, removing, placing or replacing soil or earth, or by the excavation, or by cutting or filling operations".

- The process of earthworks is to excavate the existing land to a suitable level so that construction may begin.
- The earthworks can take the form of either excavation in the form of cuts or the construction of embankments to carry an elevated construction.

➢ **EARTHWORK PROCESSES:**

- **Preliminary investigation** – lay-out (staking), clearing and grubbing(trees, bushes, etc.), demolition works, staking of engineering lines, etc.
- **Excavation**
- **Manipulation with removed soil**
- **Landscape modifications**
- **Finishing earthworks**

MATERIALS

- Originate from the Earth.
- Most of these materials are natural in origin, i.e. they are the result of geologic processes that occur naturally as opposed to synthetic materials which are the result of industrial processes.
- Earth materials consist of two types - soil and rock.

➢ SOIL

- *„Unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks“*
- Natural material that is **not** indurated (hardened, cemented) into a cohesive mass.
- Soil exists in a loose, unbound condition and therefore may be easily excavated with construction equipment.
- Sand, gravel, loam, clay, mud, etc.

MATERIALS

- **ROCK**
  - *„Natural solid mineral matter occurring in large masses or fragments.“*
  - Rock may be composed of hardened or cemented soil.

- **COMPOSED (ORDINARY) ROCK**
  - Can be excavated by splitting with crow bars or picks and does **not** require blasting, wedging or similar means for excavation such as lime stone, sand stone, etc.

- **HARD ROCK**
  - Generally any rock or boulder for the excavation of which blasting is required such as quartzite, granite, basalt.

MATERIALS

ROCK EXCAVATION

- Rock excavation consists of the excavation of igneous, metamorphic, and sedimentary rock and boulders or detached stones.
- The material for this type of excavation is removed by blasting, by power shovel with a bucket or by other equivalent powered equipment.
- **Exploratory drilling** may be required to determine the existence of cavities and possible sink holes in cut sections.
- **The rock is pre-split** by the use of drilling and explosives. The work is done in such a manner that minimum breakage occurs outside the neat lines of the typical cross section.

FOUNDATION EXCAVATION

- Dry
- Wet
- In water

MATERIALS

➢ DISPOSAL OF EXCAVATED MATERIAL

- SUITABLE MATERIAL
  - material may be used for construction of embankments, shoulders, special fills, or other places

- UNSUITABLE MATERIAL
  - paid storage places

MATERIALS BORROW

- **Borrow** is a material obtained from locations outside of the right-of-way to complete the planned grading section.
- Frequently this material is obtained from properties adjacent to the right-of-way.
- Many of the areas that are "borrowed" from become ponds or small lakes. Hence the term "borrow pit".
- Borrow material is required to be free of substances that:
  - rotting, harmful, produce toxic concentrations.
- These materials are suitable:
  - Recycled materials such as coal combustion products, recycled foundry sand, granulated slag, etc.
  - Sand
  - Other granular material
- When these materials are used they may not be placed within 30 cm of the required finished grade of the shoulders and slopes.
- The final 30 cm is required to be material suitable for the growth of vegetation.
- This material is required to be free from clods, debris and stones.

GENERAL PREPARATION

➢ CLEARING AND GRUBBING:

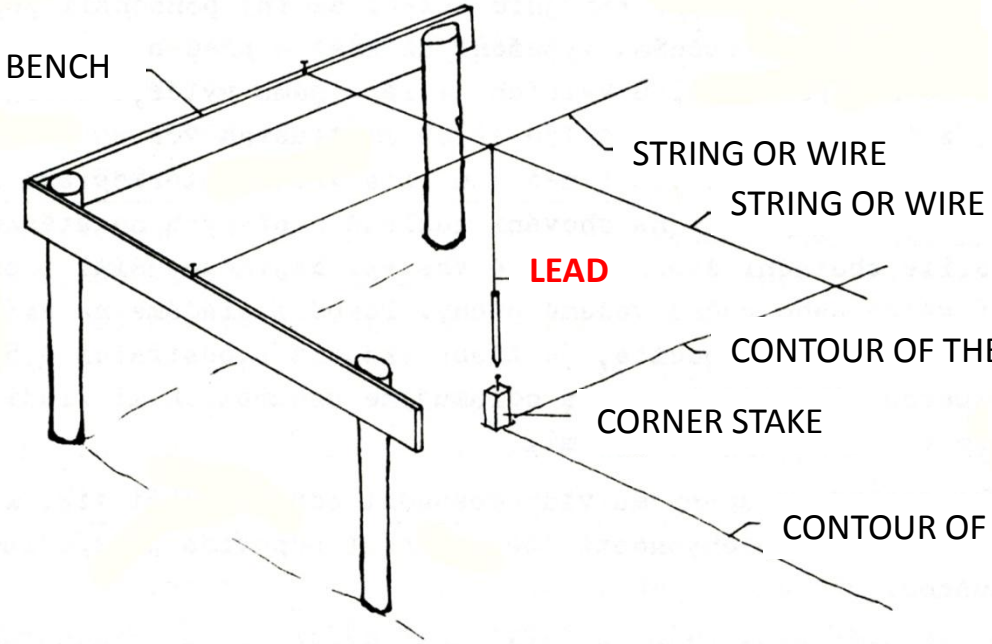
- When the Contractor arrives at the job-site, one of the first orders of business is to clear the right-of-way in preparation for construction.
- Consists of the removal and disposal of all vegetation and debris which is in the way of the construction work. Any items within the right-of-way that are designated to remain in place are not to be disturbed or damaged.
- **Trees** that are encountered within the construction limits may be removed.
- If trees are completely removed, the roots from the stump are required to be grubbed from the ground around the old stump. Any holes created in the embankment area are required to be backfilled satisfactorily up to the level of the existing ground prior to starting the new embankment.
- Burning perishable items may only be done if local laws, ordinances, and the contract permit burning. Perishable materials such as bush, stumps, and sod are removed from the right-of-way and disposed of at a location approved by local regulation.

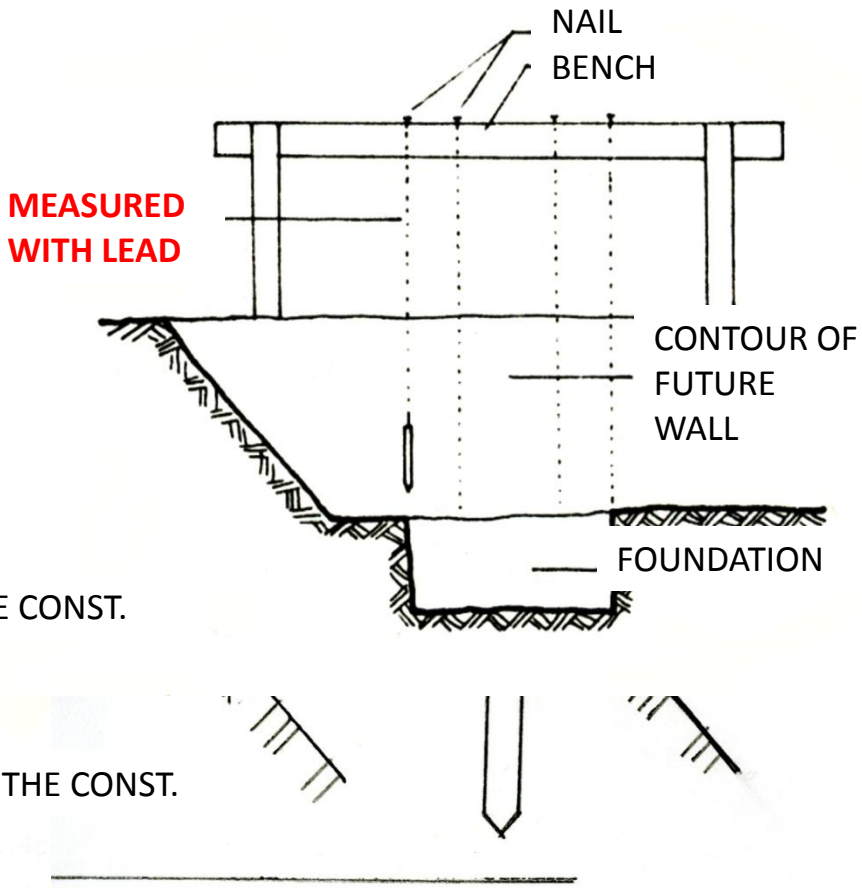
➢ DEMOLITION WORKS:

- This includes the removal and disposal of buildings, fences, structures, old pavement, abandoned engineering lines, and any other obstructions that are not designated in the contract to remain in place.

STAKING

- Bench mark have to be erected at a suitable p largest area.
- Profiles with strings stretched on stakes shall levels before the work is started.



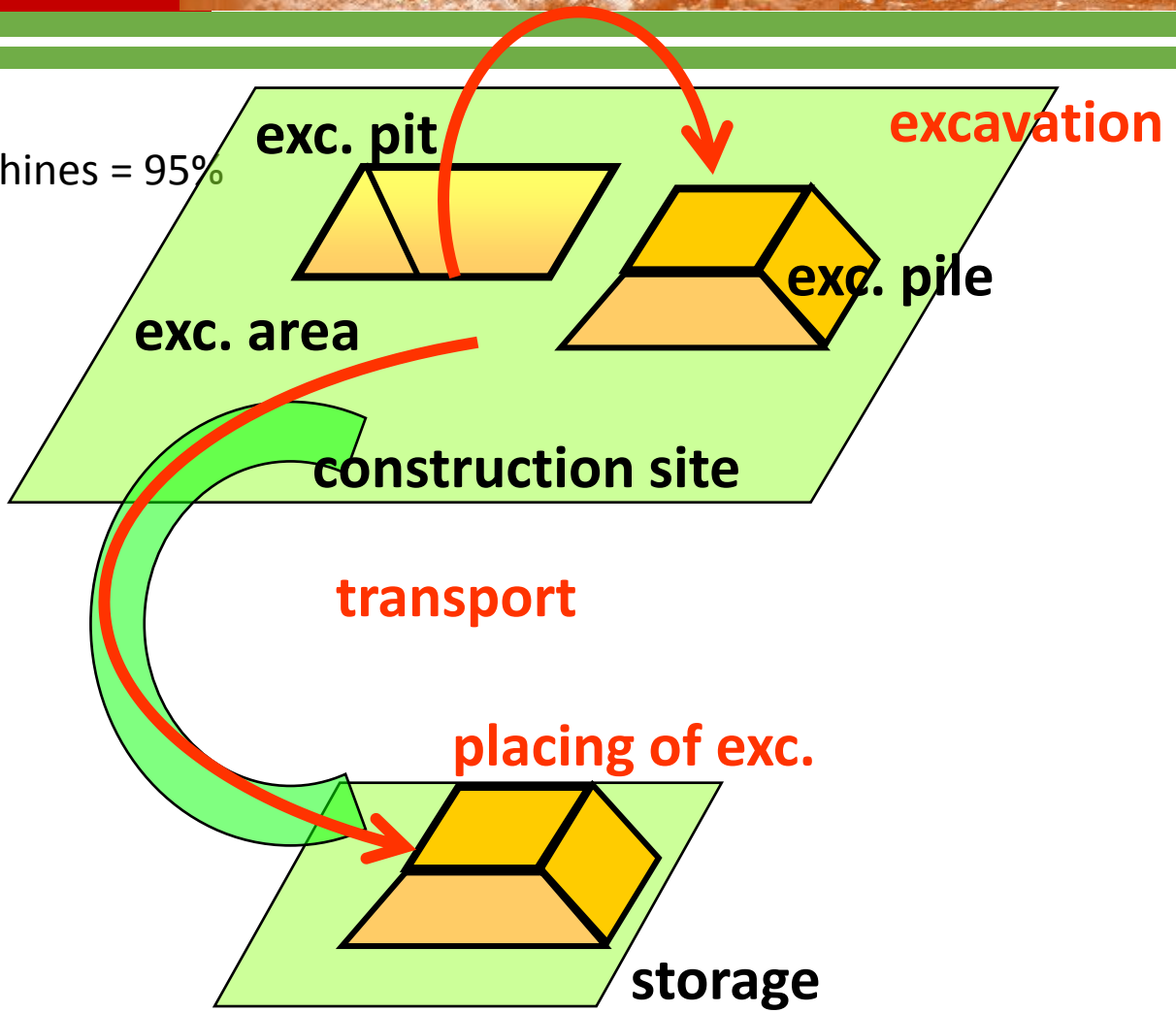


REMOVAL OF TOP SOIL

- **SCALPING (STRIPPING)**
  - Scalping in areas where excavations are to be made, or embankments are to be placed.
  - Scalping is the removal of the upper 25 – 50 cm of the soils.
  - Removal is necessary to ensure that decayable vegetation is not incorporated into an embankment.
  - **Although 50 cm** is the maximum depth, top soils containing large quantities of humus.

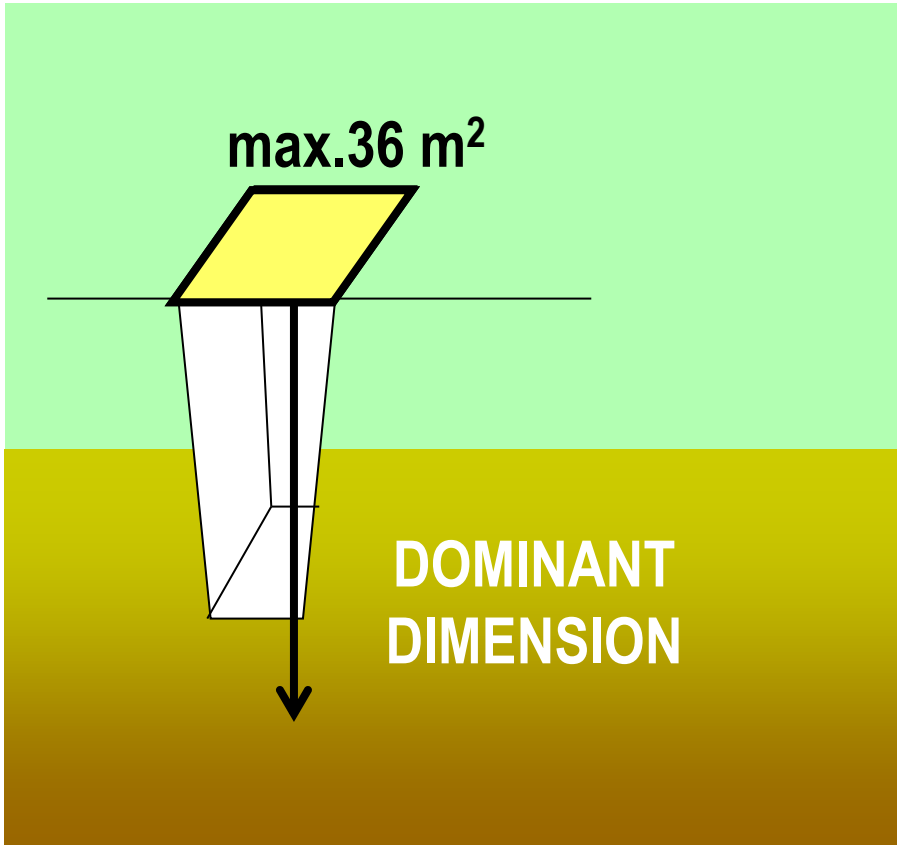
EXCAVATION

- **REALIZATION**
  - By relevant machines = 95%
  - By hand



EXCAVATION

- **SHAFTS**
  - Engineering lines



MACHINERY SET

- Nowadays machines do the most of the work in the construction field, starting with moving objects till mixing concrete and mobiles such as tractors, dumb truck, front loaders and cranes are the most important type of machines that we can not do any construction without using them.

MACHINERY SET

g up or haulin
nd.
osening compacted soils.


WHEEL LOADER


KOMATSU
CK
35
TRACK MINI-LOADER


WAY
903
SPEED
LOCUST
WHEEL LOADER


TRACK LOADER

Tracked dump truck

ate

that can carr

Rigid Dump Truck

or

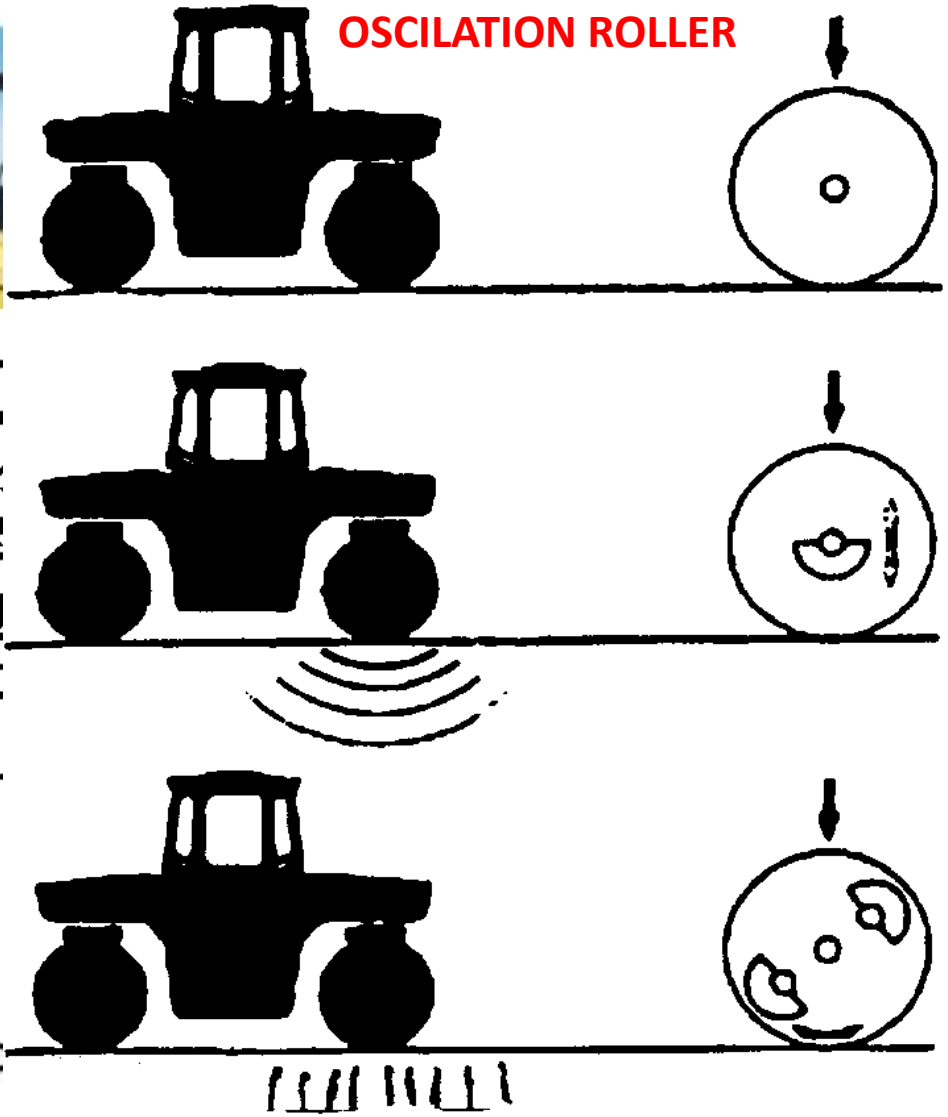
Articulated Dump Trucks

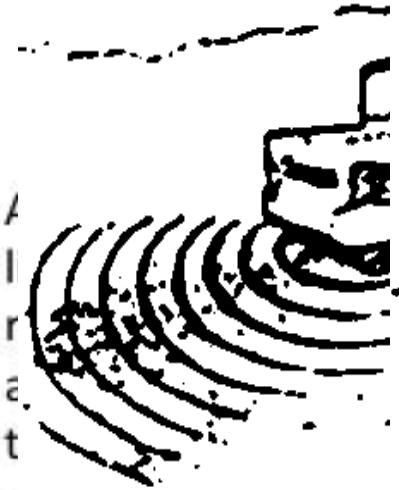
Mini dumpers


DEMOLITION EXCAVATOR
with grab shovel

MACHINERY SET

OSCILATION ROLLER





Sheep foot ro

ler

MACHINERY SET



- **SCRAPERS**
  - Have a characteristic long blade at the bottom.
  - It is mainly used in roads construction to the make the ground flat.
  - Their basic function is to flatten the ground.
  - Civil engineers use to it to finish after the rough work has been done by the scrapers and bulldozers.
  - The name “maintainer” refers to the fact that a grader is used to maintain dirt and gravel roads. In the construction of large buildings, a grader is used to set the foundation.

THANK YOU FOR YOUR ATTENTION

THAT‘S ALL FOLKS ☺