

CVEN2101 Study Notes

Trimester 3, 2019

EXCAVATION

- **Excavation** is the process of removing soil or rock from a hole/cavity using tools and machinery
- The excavation process is typically as follows:
 - Removal
 - Loading
 - Hauling
 - Dumping
 - Compaction
 - Filling
- Certain issues pre-excavation that must be considered by engineers:
 - Demolition and Condition surveys
 - Site establishment
 - Waste management
 - Contamination
 - Stormwater and sediment control
 - Materials handling
- **Trafficability** is the ability of a soil to support the weight of loading or working machinery whilst on-site
- **Loadability** is a qualitative measure of the difficulty of excavating and loading soil
- **Soil swell** is the increase in volume which occurs after excavation
- Freeze-thaw processes and the presence of moisture can increase the potential of slope failure surrounding an excavation
- Engineers must consider that the density of soil is different in-situ compared to post-excavation; this should be agreed upon with subcontractors
- **Bank** is rock/soil whilst in-situ, whereas **loose** is material that has already been excavated
- **Shoring** is a technique used to reinforce the inside walls of an excavation
- Common methods of shoring include:
 - Soldier pile
 - Pressure/chemical grouting
 - Soil nails and Shotcrete
 - Sheet piling
 - Hydraulic shoring
 - Pneumatic shoring
 - Timber/Aluminium
- A slurry wall is a permanent shoring system which is expensive to install
- **Piling** involves drilling boreholes to be filled with concrete in order to surround an area to be excavated
 - At high depths, **anchors** can be used to resist the bending moment impacted against the pile
- Excavations should begin from the section with the highest natural elevation in order to improve efficiency and minimise falling dangers

- General site management requirements:
 - Access to the site should be made wide enough for all trucks/machinery to enter
 - All truck loading and storage of materials must be conducted within the site at all times
 - Toilets should be placed as close as possible to outside access so that they can be serviced regularly and easily
 - Minimum of one skip bin should be allocated to every block
 - Cranes and similarly large machinery should be placed so as to not interfere with transport/loading vehicles

CONCRETING AND FOUNDATIONS

- **Formwork** is used as a mould within which to pour concrete
- All materials arriving on-site should have tags identifying which part of the final structure they should belong to
- **Footings** are reinforced concrete piles built directly into holes excavated from the ground, forming the base of a structure
- Steel reinforcements are added to concrete structures at points of tension
- **Concrete** is a mix of cement, water, fine aggregate (typically sand) and coarse aggregate (gravel)
- Concrete generally reaches full maturity after 28 days, with a typical strength of around 25-35MPa
- The three most favourable properties of concrete are:
 - Strength
 - Workability
 - Durability
- Steel reinforcement bars are named with their grade (i.e. N, R) followed by their diameter in millimetres
- 'SL' is a grade of mesh bars (which are produced in matrix formation)
 - These are named as: SL-9-2 where '9mm' is the bar diameter and '2' represents a 200mm*200mm spacing in the matrix
- On reinforcement design plans, **cog** represents the length of anchorage whereas **lap** is the length of reinforcement overlap between multiple bars
- **Stirrups** (often known as 'ties') are rectangular shaped reinforcements that hold together other bars and support the structure in shear
- Space allowances for **recesses and services** must be made in the design of concrete slabs
- Trench mesh comes in a prefabricated formation of these separate bars
- **Curing** is the application of moisture to finished concrete to improve the durability and strength of the concrete
- The finishing of concrete involves three processes:
 - **Screeding** involves levelling off the concrete and forcing the bleed water to leave the surface
 - **Floating** is performed with a wooden trowel in order to embed the aggregate
 - **Trowelling** is performed with a steel trowel to provide wear resistance and an aesthetic finish
- Concrete is often **vibrated** straight after pouring in order to avoid honeycombing and concrete cancer