UNIT-III

EARTH WORK AND BBR SHEETS (REINFORCEMENT)

Estimating earthwork for roads is a crucial part of the road construction and engineering process. It involves determining the quantities of earth materials (such as soil, rock ,or other fill materials) that need to be excavated, placed, or compacted to create the road's desired grade and alignment. Accurateearthworkestimationisessentialforbudgeting,planning,andmanagingroadconstruction projects effectively. Here's an overview of the steps involved in estimating earthwork for roads:

1. Data Collection:
Gather relevant project information, including design drawings, specifications, and survey data. This data should include the road's alignment, cross-sections, and elevations.

2. Cross-Section Analysis:
Divide the road into sections at regular intervals, typically perpendicular to the road's centerline. These sections are called cross-sections.
-Analyze each cross-section to determine the existing ground profile and the desired road profile. This involves measuring the elevations and slopes of the terrain.

3. Cutand Fill Calculations:
Determine the volume of earth that needs to be either cut (excavated) or filled (added) in each cross-section to achieve the desired road profile. This is typically done by comparing the existing ground elevations with the proposed road elevations.

4. Earthwork Quantities:
Calculate the cut and fill quantities for each cross-section. Cut quantities are usually positive (indicating excavation), while fill quantities are negative (indicating addition of material). Sum these quantities to get the total earthwork volume for the entire road.

5. Adjustments:
Accountforfactorssuchasshrinkageandcompactionthatcanaffectthevolumeofmaterial needed for earthwork. These adjustments ensure that the estimated quantities are accurate.

6. Material Properties:
Consider the specific properties of the earth materials involved, including the type of soil or rock, its density, and other engineering characteristics, as these can affect the earthwork calculations.

7. Estimation Methods:
Various methods and tools can be used for earthwork estimation, including manual calculations, spreadsheets, or specialized software. Many construction and engineering software packages have modules for earthwork estimation that can streamline the process.

8. Cost Estimation:
Compaction,anddisposalofexcessmaterial.Thiswillhelpinbudgetingandprojectcost management.

9. QualityControl:
Throughout the construction process, monitor and verify that the actual earthwork quantities align with the estimated values. Adjustments may be necessary if unexpected conditions or variations are encountered during construction.

10. Documentation:
Maintain detailed records of the earthwork estimation process, including all calculations and assumptions, for reference and quality control purposes.

Accurate earthwork estimation is essential for effective project management, budgeting, and resource allocation during road construction. It helps ensure that the road is built to the desired specifications and within the allocated budget. It's important to work closely with engineers, surveyors, and construction professionals to achieve the most precise estimates possible.

ROADS&IRRIGATION CHANNELS

- ✓ Allthecivilengineeringstructuressuchasbuildings,roads,canals,railwaylines, culverts and dams earth work will there.
- ✓ Cross-section of earth work of road in banking or in cutting is usually in the form of trapezium.

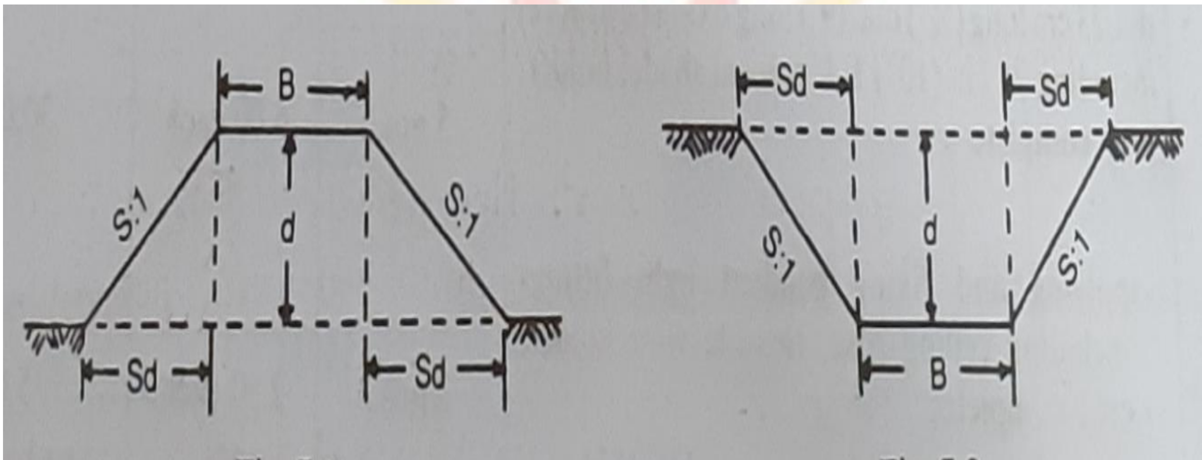


Fig. 7-1 Banking

Fig. 7-2 Cutting

Sectional area=Area of central rectangular portion +Area oft wo side triangular portions.

$=Bd+2(1/2sdxd)=Bd+sd^2$

- ❖ S:1istheratioofsideslopes as horizontal :vertical.
- ❖ For 1 vertical , horizontal is s, for d vertical, horizontal is

  sd. Quantity $=(Bd+sd^2)xL$

- ❖ Meanheight= $\frac{d1+d2}{2}$=dm

- ➢ Sectional area is taken out from mean height = $Bdm+sd^2m$ Qty=($Bdm+sd^2m$)x

Lead and Lift

- Earth work is estimated for 30m lead for distance and 1.5m lift for height or depth and this distance of 30m and height of 1.5m are known as normal lead and lift.
- For greater lead or lift the rates will be different for every unit of 30m lead & for every unit of 1.5m lift.
- Longitudinal section is usually plotted with horizontal scale of 1cm=10m to 1cm = 30m lead & a vertical scale of 1cm=1m to 1cm=5m.

Mid-Sectional area method

- Quantity= Area of mid-section area xlength.
- Let d1 & d2 be the height of bank at two ends portion of embankment, L the length of the section B
- Theformationwidth&S:1(horizontal: vertical).
- Area of midsection =Area of rectangular portion +area of two triangular portion.
- Area=Bdm +1/2Sdm^2+1/2Sdm^2=Bdm+ Sdm^{2}Quantity of earth work=(Bdm +Sdm^2)xL.
- General Q=(Bd+Sd^2)x L where dstands for mean height or depth.

Area ofsideslopingsurface

- The area of sides which may require turfing or pitching , may be found by multiplying the mean sloping by length.

Mean sectional area method

- Quantity= Mean sectional area x length. Sectional area at one end A1=Bd1+sd1^2
- SectionalareaatotherendA2=Bd2+sd2^2
  d1andd2 are the heights or depths at the two ends
- Quantity or Volume =1/6[A+A +4A], where A and Aare the cross sectional areas.

Estimating Earth work For Channels

- Involves determining the quantities of soil or other materials that need to be excavated or filled to construct a channel, which is a waterway designed to convey and manage the flow of water. This estimation is an essential part of the planning and budgeting process for construction projects, such as drainage systems, irrigation canals, or storm water management channels. Here are the key steps and factors to consider when estimating earthwork for channels:

1. **Define the Project Scope:**

   Start by defining the purpose and requirements of the channel, including its dimensions, shape, and capacity. This will help you understand the volume of earthwork involved.

2. **Gather Project Data:**

   Collect all relevant project data, such as engineering drawings, topographic surveys, geotechnical reports, and any other information that can help you understand the site conditions.

3. **Calculate Cross-Sectional Areas:**

   Channels are typically designed with specific cross-sectional shapes, such as trapezoidal, rectangular, or circular. Calculate the area of each cross-section at various points along the channel's length. This often involves using mathematical formulas or software tools.

4. **Determine Cut and Fill Sections:**

   Identify where you need to cut into the ground to create the channel and where you need to fill to construct the channel's embankments or sides. Calculate the volume of material to be cut and filled for each cross-section.

5. **Account for Sloping Sides:**

   Channelsoftenhaveslopingsidestoprovidestabilityandfacilitateproperwaterflow.These side slopes are specified in the design and should be considered in your calculations.

6. **Consider Compaction and Swell Factors:**

   When estimating earthwork quantities, take into account factors like compaction and swell. Compaction involves reducing the volume of soil through compression during construction, while swell refers to the increase in volume when soil is excavated. These factors can affect the final quantities.

7. **Calculate Total Earth work Volume:**

   Sum up the cut and fill volumes for all cross-sections along the length of the channel to determine the total earthwork volume required.

8. **Apply Unit Costs:**

   Once you have the earthwork volume, you can estimate the cost by applying unit costs for excavation, filling, and any other associated work. These unit costs will depend on local labor, material, and equipment rates.

9. **Contingency and Overages:**

It's a good practice to include a contingency percentage in your cost estimate to account for unexpected changes or variations during construction. Additionally, consider any overages that may be needed to accommodate potential discrepancies.

10. Review and Update:

The earthwork estimate should be periodically reviewed and updated as the project progresses and more detailed information becomes available.

Estimating earthwork for channels is a crucial aspect of project planning and cost management. Accurate estimates help ensure that the project stays within budget and thatthe necessary resources are allocated appropriately. It is essential to work closely with engineers and geotechnical experts to obtain the most reliable data and to apply sound engineering

A Bar Bending Schedule (BBS) is a detailed list of all reinforcement bars in a concrete structure, specifying their type, size, length, shape, quantity, and weight to guide cutting, bending, and placement.

Purpose of a Bar Bending Schedule

A BBS serves multiple purposes in construction:

- **Material estimation**: Helps calculate the exact quantity of steel required, reducing wastage and cost.
- **Guidance for workers**: Provides clear instructions for cutting and bending bars according to structural drawings.
- **Quality control**: Allows site engineers and inspectors to verify reinforcement work against design specifications.
- **Procurement and stock management**: Facilitates ordering the correct steel sizes and managing inventory efficiently.
- **Billing and cost estimation**: Assists in preparing bills for clients and tracking project costs

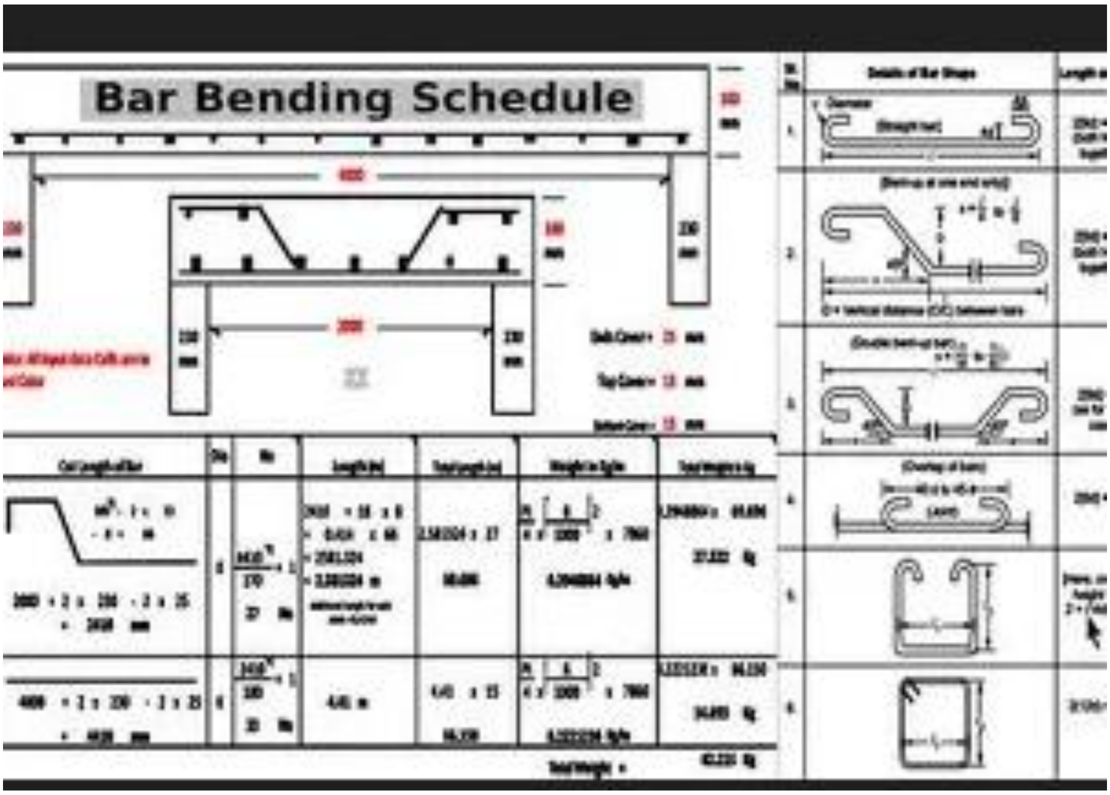
Information Included in a BBS

A typical BBS contains:

- **Bar mark**: Unique identifier for each bar type.
- **Diameter**: Size of the reinforcement bar.
- **Length**: Calculated cutting length including development length and cover.
- **Shape**: Bent shape of the bar (straight, L-shaped, U-shaped, etc.).
- **Quantity**: Number of bars required.
- **Weight**: Unit weight and total weight of each bar type

Steps to Prepare a BBS

1. **List all bars**: Identify each bar type, mark, and location in the structure.
2. **Calculate cutting length**: Use formulas based on structural dimensions, concrete cover, and development length. For example, for a slab:
   Number of Bars = (Slab Length – 2 × Cover) / Spacing + 1
   Length of Bar = Slab Length – 2 × Cover + Development Length .
3. **Determine quantity**: Count the number of bars for each type.
4. **Calculate weight**: Unit weight of a bar can be calculated using Weight (kg/m) = $D^2 / 162$, where D is the diameter in mm
5. **Tabulate details**: Organize all information in a table for easy reference by workers and engineers


Bar Bending Schedule

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