COMMUNITY CONSTRUCTION WORKS
A TECHNICAL MANUAL

(APPLICABLE FOR EMPLOYMENT GUARANTEE SCHEME)

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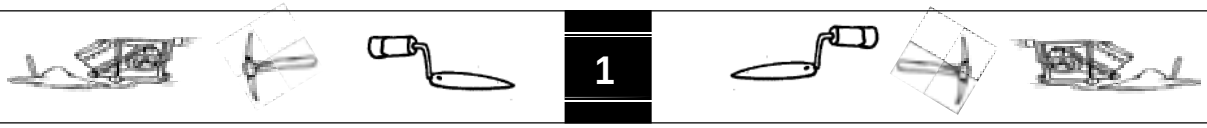

Community Construction Works: A Technical Manual is a handbook for construction workers or the beneficiaries under the Rural Employment Guarantee Scheme. It introduces the workers with the provisions under the employment guarantee scheme while providing guidelines to carry out the various works sanctioned under the rural employment guarantee scheme.

This Manual provides the Vigilance Monitoring Committees, constituted for each project under NREGA, with a true structural estimate in an easily understandable and accessible format of provisions for local works under the National Rural Employment Guarantee Act of 2005 that guarantees a hundred days of work in a financial year to adult members of every household who volunteer to do unskilled manual work.

As an aid to establish these employment rights, the Manual enhances livelihood security by providing an idea as well as defining the actual procedures of carrying out the works sanctioned.

The manual is a four section document with chapters on the various categories of present day construction works. While the first section introduces the reader with the provisions under the Rural Employment Guarantee Scheme and the community supervision aspects of the works, the second section provides for technical knowledge/know-how on the various possible works under Act. The third section describes all the present-day works under the scheme. This includes construction of buildings, road constructions, constructions for water conservation, as well as land improvement techniques. The last section has a mention of the detailed price list and Common Property Resources (CPR) management under NREGA for drought and flood control.

Through this Manual, the beneficiaries of the Rural Employment Guarantee Scheme gain the essential knowledge required to avail the various provisions under the Rural Employment Guarantee Act. Inputs on preliminary technical knowledge necessary for construction works and the essential technical measurements are provided with a detailed list of technical terms used in the manual. In-detail explanations and descriptions of the types of work that can be undertaken under the scheme are mentioned in the manual. Estimates and requirements for reference are provided for construction workers to understand the process and prevent corrupt practices in the process. Various works as building constructions, road constructions, water-bound macadam roads, cement concrete roads, bridges and culverts, tanks, ponds, stop dams, soak pits, masonry check dam, earthen embankments, land treatments, contour trench, etc. are explained with specification on each work in the technical manual.

This Technical Manual provides for correct specifications for all sorts of work that unskilled manual labourers can undertake without any prior knowledge on the area. It can in fact serve as a reference handbook for everyone who wishes to undertake such work, with the perfection of a specialised worker.

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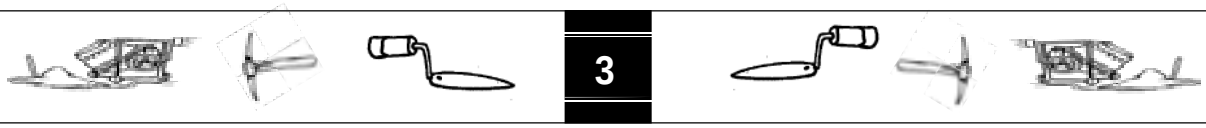


UNIT - I

Chapter – 1 The Employment Guarantee Scheme and its Provisions

With the basic objective of the Act to enhance livelihood security in rural areas by providing at least 100 days of guaranteed wage employment in a financial year to adult members of every household who volunteer to do unskilled manual work, the NREGA is a "Peoples' Act" in several senses.

Prepared after a wide range of consultation with people's organizations, the Act addresses chiefly to working people and their fundamental right to life with dignity. It empowers ordinary people to play an active role in the implementation of employment guarantee schemes through Gram Sabhas, social audits, participatory planning and other means. More than any other law, NREGA is an Act of the people, by the people and for the people.

The NREGA Act is an important step towards the realization of the right to work. It is also expected to enhance people's livelihoods on a sustained basis, by developing the economic and social

infrastructure in rural areas. The choice of works seeks to address the causes of chronic poverty such as drought, deforestation and soil erosion. This work guarantee can serve the objectives of generating productive assets, protecting the environment, empowering rural women, reducing rural-urban migration and fostering social equity, among others. Effectively implemented, the employment generated under the Act has the potential of transforming the geography of poverty.

Under the National Rural Employment Guarantee Act of 2005, the Central Government aims to provide for a guaranteed employment of a minimum of 100 days in Panchayats of Rural India towards unskilled labour.

1. Beneficiaries under the National Rural Employment Guarantee Scheme

Under the National Rural Employment Guarantee Scheme, any person above the age of 18 (male or female) residing in the rural areas of the country, who volunteers for unskilled labour, will be guaranteed an employment within a distance of 5 kilometres of his or her own village. Through this scheme, each and every family will be provided a guaranteed employment of 100 days within a year. This will reduce the frequent displacements at the village level.

Special care will be taken for women workers under the scheme. One-third of the workers provided work under the scheme will be women. A female would be designated at the worksite with the work of taking care of the children (below 6 years of age) accompanied by the women workers.

1. Procedures under the Scheme

Every adult worker to obtain a job card a preliminaryregistration is mandatory. This registration would be done once in five years. In case of need of work, the Gram Panchayat or the Program Officer has to file an application. This work application has to be done every time work is needed. The work application should be made for at least 14 days of work at stretch. A dated receipt should be collected at the time of filing the application.

In case an applicant does not get work within 15 days of filing an application, he or she would be entitled to receive an unemployment allowance.However, after being intimated about having received the work entitlement, if the applicant does not appear for work within the stipulated timeframe of 15 days, the worker can be barred from work for 3 consecutive months.

2. Work prescribed under the Scheme

The decision would lie in the hands of the village community to assess and ascertain the type of work that can be undertaken by them. This would be decided in the Gram Sabha.

1. The decision for recommendation for the works would be taken in the Gram Sabha.

2. After receiving recommendation for work from the Gram Sabha, the Gram Panchayat would prepare the shelf of projects at its level.

3. After preparing the work plan, the Gram Panchayat would send it to the Panchayat Samiti.

4. The workapproval of all the Gram Panchayatswould be made by the the Chairman of the Panchayat Samiti.

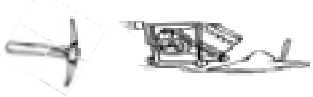
5. The implementation agency would be chosen as per the work.

6. After approval, Panchayat Samiti would send the scheme to the ZillaParishad.

7. The Shelf of Projects would then be approved by the Zilla Parishad.

3. Possible works under the Scheme

1. Work related to Water Conservation and Capacity Enhancement.



2. Work undertaken to prevent famine and drought (forest conservationand plantation)

3. Work related to Canals and Light Irrigation

4. Land improvement works

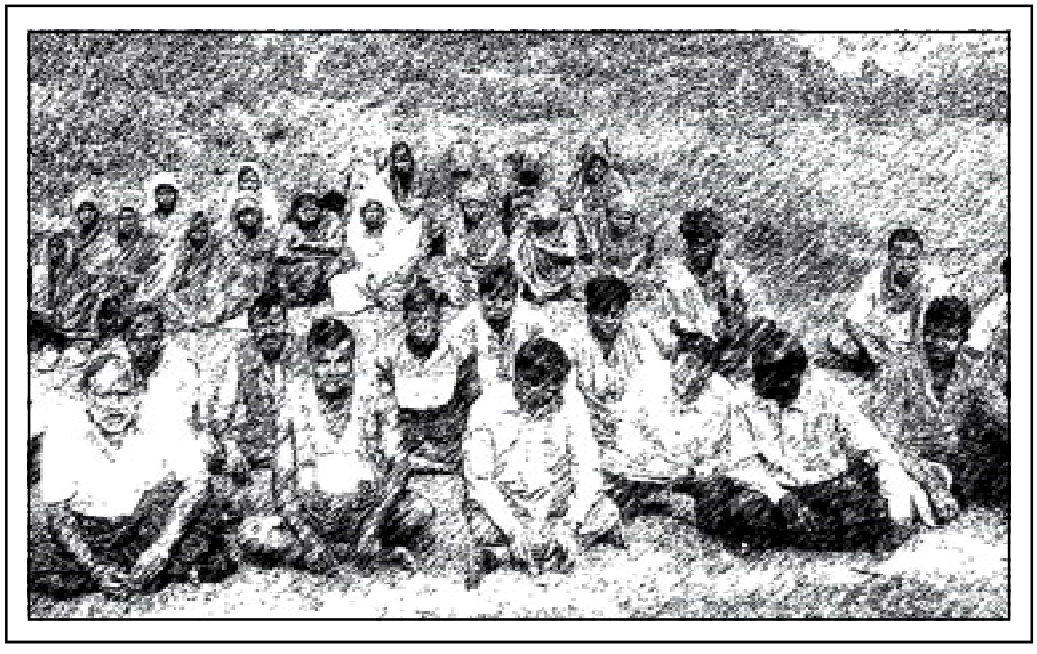
5. Revival of traditional water sources

6. Land development works

7. Flood control and water evacuation techniques

8. All weather roads

9. Other than these works, other works recommended by the State Government can be undertaken with the approval of Central Government.



Chapter - 2 Social supervision of construction works

When the society supervises and evaluates the work connected with their own benefit at their own level it is known as Social Supervision. Analysis for the work carried under social supervision (usefulness, quality, value and success etc) is done by the local people in the community. The intentionof this investigation is that people come to know about the profit gained from the work and how they are being helped.

Social valuation is not new for our society. It has been present in our society in some form or the other, may be in the form of evaluation, supervision or investigation. This system is in our society from past. Only its form changes from time to time.

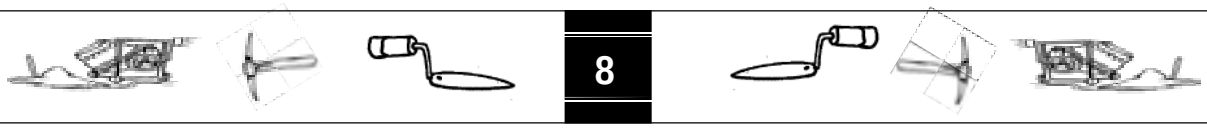
With the help of members of villagecommittee social supervision has become more practical and more helpful. With the help of social valuation/audit,on one hand investigation of buildingworks can be undertaken and on the other hand interestsare built-up and attachments created within people for future works. With these perspectives, social supervision comes into picture.

Points to be taken care of during investigation:

- Expenditure
- Approved amount
- Usefulnessof the work
- Number of people participated
- Whether work has been completed according to the schedule or not
- Quality of work
- Whether the work is permanent or temporary
- Beneficiaries
- Quality of materials used

Forinvestigation andtobringtransparencyinwork,followingpointsshouldbe followed:

1. Bills of expenditure on construction should be made. As expenditure for foundation during building a house it should be written on a single bill. It should



contain expenditurefor excavation of soil, ingredients for filling up the foundation and labor charge. In this way investigation can easily be done and transparency can be maintained.

2. Per day how manylabourercame to workand whatwere the things used should be documented for easyinvestigationand for maintainingtransparency in work.
3. Documents for labour should be present in which work done by them, amount paid to them and date should be properly documented.
4. Documents for things purchased should be written with details of when it was bought, bought for which work, from where (place or shop) it was brought,who bought it and how much was paid for it mentioned.
5. The amountof loan takenfrom the bank and the date of taking it must be clearly mentioned.
6. Mention of the amount of donation taken with details of the persons who gave donation.
7. Approved amount for work, approved date, financial institution, name of the department, institution responsible and name of the personresponsibleshould be written on a board and pasted on the site.
8. List of direct beneficiaries should be maintained properly

Display of the following documents to the people will help gain their confidence and participation. In this way participation of general public will increase.

UNIT-II

Chapter - 1 Preliminary Technical Information

It is essential to acquire technical knowledge to facilitate the initiation or maintenance of any construction work. Through this chapter we will try to acquirethe preliminary technical inputs about construction activities.

Essential Technical Measurements for Construction Work

Measurements are essential to undertake any type of construction work. In order to ensure that the work is as per the layout, it is essential to take prior Measurements. Moreover, it is also difficult to have a properestimate of the workwithout measurements. Hence, without measurements we can neither prepare a layout nor a budget estimate of any construction work.

As measurements are necessary for costing of works, it is important to have the correct understanding of measurements.

Usually, in the absence of measurement tapes, we measure with hand-spans. However, the length of everybody's hands is not the same. The hand-span measurements taken by us differ from the hand-span measurements taken by others. This leads to a wrong measurement and a further wrong estimate.

For this reason, it is necessaryto take measurementsas per the correct units while carrying out construction work.

Some Important Units of Measurements	
1 Inch = 2.54 Centimetres	1 Feet = 12 Inch
100 Centimetres = 1 Meter	1 Meter = 3.28 Feet
1 Kilometre = 1000 Meter	1 Furlong = 200 Metres
1 Square Meter = 10.76 Square Feet	1 Cubic Meter = 35.33 Cubic Feet
1 Versace = 1 Cubic Feet	100 Cubic Feet = 3 Cubic Meter
1 Pit = 100 Cubic Feet (10 Feet Breadth **x** 10 Feet Length **x** 1 feet Depth	

- Usually the length of a man's hand-span (from the elbow to the fingers) is 1.5 Feet or 45 Centimetres (slightly less than half a Meter).
- When the measurement is taken in only in either length or breadth or height, it is measured in only that particular unit.
- When we only have to take out the measurement of the place or theArea of the place, we measure the length and breadth and multiply to calculate the Area. The Area calculated, is either in Square Feet or Square Meters. While writing the unit of Square, we write the square of 2 above the unit obtained (meter 2). We read it as square root.
- When we need the Volume, we multiply the length, breadth and height of that area. To write the unit of volume, we write the root of 3 above the meter obtained (meter 3). We read it as cube/cubic meter.

To calculate the Area or Volume, we need to take out all the measurements in the same unit (for example, if we are measuring the length in foot, the breadth and height should also be measured in foot, and not in inches or centimetres). Calculations in different units of measurements will not provide the correct measurement.

Procedures undertaken in Construction Work

There are several procedures involved in order to carry out any work project, starting from its planning to its costing.

1. For allocation of work, there has to be an identification of the work project that needs to be undertaken as a solution to the problem arising in the area of operation.

2. After the identification of the work project, the worksite where the project is to be carried out is selected.

3. The selection of worksite is followed by the preparation of a work plan.

4. The work plan and estimate has to obtain technical sanction.

5. The technical sanction gives way to administrative approval for the initiation of the work project.

6. After the completion of work an accounts assessment is carried out based on the measurement book.

7. On the basis of the accounts assessment of the money utilised after the work, a utilisation certificate is issued with the detailed description of money utilised mentioned in it.

Use of Technical Terms in Construction Work

There are many commonly used terms frequently used in construction work that we have heard but do not know the actual meaning of such terms. We will try and understand these terms along with their processes in this section.

Technical Sanction (T.S)

Technical sanction is obtained from the concerned and respective officers for all kinds of work projects. The process of technical sanction involves the preliminary assessment of the estimate at the worksite by the concerned officer (of the accurate rates quoted, the actual scope of utilisation of funds, and of a situational analysis on possibilities and benefits of the particular work in relation to the worksite). No administrated work starts without a technical sanction of the concerned officer.

The concerned officer for Technical Sanction of different work projects are:

Concerned Officer	New Work Sanction	Repair Work
Junior Engineer	Up to Rupees 2 lakhs	Up to Rupees 5,000/-
Assistant Engineer	Up to Rupees 10 lakhs	Up to Rupees 10,000/-
Executive Engineer	Up to Rupees 25 lakhs	Up to Rupees 40,000/-
Superintending Engineer	More than Rupees 25 lakhs	More than Rupees 1 lac

The provision of sanction of an approval carried out on the basis of the cost estimate by the concerned capable officer approving to conduct work under any work or scheme is called Administrative approval. Providing an administrative approval is mandatory for any type of construction work. It is only after receiving an administrative approval that the payment can be released for the work to begin.

Concerned Officer/Authority	New Work Sanction
Programme Officer/BDO	Upto Rs 10 Lakhs
District Programme Coordinator/Collector	Above Rs 10 Lakhs

Current Schedule of Rate (C.S.R)

The most essential requirement for preparation of the estimate is to take into account the material and labour cost that would be incurred in the work project. It becomes easier to estimate the probable costs when we calculate the material and labour costs actually required in the process.

In construction works, the material and labour cost keep changing as it is dependent on several factors. In order to regulate rates at the Panchayat level, a rate fixing committee has been constituted at the Panchayat level. The rate fixing committee constitutes the followingmembers:

- The Project Director, DRDA
- The Executive Engineer, Public Works Department
- The ExecutiveEngineer, Water Supply Department
- Executive Engineer, Rural Works

The prepared list of rates regulated by the rate fixing committee is called the Current Schedule of Rate (C.S.R). All the rural development works are carried out on the basis of the Current Schedule of Rate. Every year October, the Committee members reviews and fix the rates for unskilled, semi-skilled and skilled labourers. Rates of materials are taken as per the currentschedule of rates publishedby the Govt., with Lead of materials(Transportation from source to work site)

Muster Roll:

The form in which the attendance of labourers is filled up is called muster roll. It is important to practise transparency whilefilling up musterrolls. The musterroll attendance should be filled within an hour of work commencement in the morning. The complete details of the labourers should be provided in the muster rolls with evidence of labour performed by the people whose names are entered.

The estimate of labour is done not in accordance to the construction work but in accordance to the units of measurement. It is hence advisableto maintain different muster rolls for each work to facilitate convenience in calculation of the labour cost.

Measurement Book:

A measurement book is prepared for every construction work to be undertaken. It is an important record of that particular construction work. While filling up the measurement book, the instructions provided in the measurement book should be followed.

The measurement book is only filled once with the work measurements, by the designated technical officer. The measurements taken on the basis of the measurement book are considered to be the last and final measurements for all work projects.

A sample of the Measurement Book

Sl.No	Description of Work	Length	Breadth	Height/Depth	Quantity

Chapter - 2 Quality Control

FIELD TEST FOR QUALITY CONTROL OF DIFFERENT CONSTRUCTION MATERIALS:

FILED TEST OF CEMENT:

- It looks brownish in colour.
- When dip your hand in a bag of cement, it feels cool.
- It should be free from grits.
- When a pinch of cement will rub with two finger tips, it feels smooth.
- Weight of one bag of cement is 50 kg.
- Volume of one bag of cement is 0.0354 cum.

FIELD TEST OF BRICK:

- It looks greyish in colour.
- If should not over burnt or under burnt.
- It should not break when fall from 1m height.
- It should not absorb water more than 20% of its weight after immersion of 24 hours in water.
- When struck with each other or with nail it should give clear ringing sound.
- Size of standard brick 8"x4"x4" (19 cm X 9 cm X9 cm).
- Standard weight of brick is 3kg.
- NO. Of bricks in 1 cum are 400 nos.

PROPERTIES OF GOOD SAND:

- It should be clean and coarse
- If should free from any organic or vegetable matter
- It should contain various sizes of particles in suitable proportions.
- It should free from silt and clay
- It should not contain salts which attract moisture from the atmosphere

CHARACTERISTIC OF GOOD AGGREGATE:

- It should be clean, hand, non-pores and free from lumps of clay, organic and vegetable matter
- It should not absent water more than 5% of its weight in 24 hours.
- Angular and roughly cubical shape
- Brick aggregates should not be used.

UNIT OF PROCUREMENT OF COMMON CONSTRUCTION MATERIAL:

Sl. No.	Particulars	Unit
1.	Cement	Bag
2.	Sand	Cum or cft
3.	Aggregate	Cum or cft
4.	Earth	Cum or cft
5.	Wood	Cum or cft
6.	Cardboards/ plywood/Zinc sheet	Sqm or sft
7.	Brick	Per 1000 nos
8.	Steel (Angle, Beam)	Kg
9.	Reinforcement	Kg
10.	Steel plates or sheets	Sqm
11.	MS pipe, GI Pipe (I pipe, sew pipe)	R.M.
12.	Stone	Cum or cft
13.	Sanitary fittings and hard works	No.
14.	Paint	Litre(Liquid) or kg (powder)
15.	Water proofing compounds	Kg
16.	Polish	Kg or litre

UNIT-III

Current Construction Work Projects for Rural Development

There are different departments and schemes, under which rural development work is sanctioned nowadays, as: building construction, road development work, constructions for water conservation, ponds and soak-pits, and land improvement and development works, etc.

We will discuss in detail about the technicalities that need to be considered while undertaking each such construction work. This will help us gain essential knowledge and provide better assistance to construction work.

Chapter - 1 Building Constructions

Procedural Details of Building Constructions:

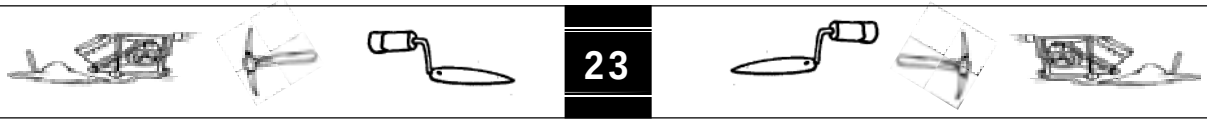
Various building constructions are undertaken by the Rural Development and other departments of the government like Panchayat Buildings, School Buildings, Anganwadi Centres, Health Centres, etc. from time to time at the grass root level in the country. For any such building construction work, technical and procedural knowledge is essential. Through this chapter we would try and acquire that essential knowledge.

Soil classification:

- Ordinary soil - Light black cotton, sandy earth sandy loam, dry silt, fragile red earth, soft earth and soft moorum.
- Hard soil- hard stiff clay, stiff black cotton, hard red earth, shales, moorum, ordinary gravel
- Stony earth- earth mixed, with gravel and boulder not exceeding 0.014 cum in volume.
- Slushy soils- a soil having the characteristic s of liquid mud with negligible bearing capacity which can be removed with aid pans and vessels only.
- For excavation of foundation including dressing and levelling the bed and depositing the soil with initial lead 50m and initial lift 1.50m and 20% over the respective rates of earth work in excavation.
- Dewatering will be paid as per actual rates
- In the event of differenceof opinion regardingclassification of soil the decision of the engineer - in -charge is final and binding.

Selection of Land for building constructions

The following precautionary measures should be adopted during selection of land for buildingconstructions:



- The land should be free from water-logging.
- The land should not be an agriculturalland and neither a forest land.
- The land should not be used for grazing purposes, and should be free from land disputes of any kind.
- The land should not be a slushy land and the connectingroad to the landshould be good enough for easy access to those centrally located important constructed buildingsin villages (as schools, anganwadis, communityhalls, water tank, etc).
- Hard strata land is the best type of land for building constructions.

After the selection of land, the land where the building is to be constructed should be cleared from bushes, jungles,dust and garbage.The chief mason should mark the layout of foundation with the help of rope and lime under the supervision of the Junior Engineer.

Preliminary work for laying out the Foundation

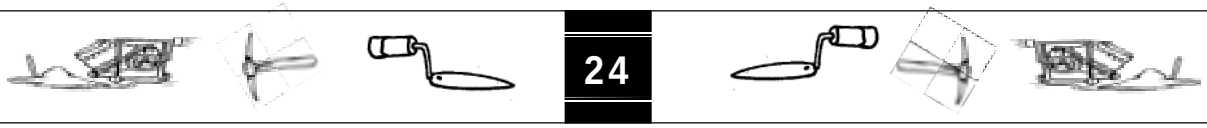
Special care should be taken for layingout the foundation of buildings. The type of foundation to be laid should be decided on the basis of the quality and capacity of the soil. There are two types of foundations:

1. Open Foundation
2. Pile Foundation- to be laid out in case of Black Cotton soil

Before excavation, the moisture level should be checked, as soil affected by moisture expands and shrinks due to heat and cracks develop.

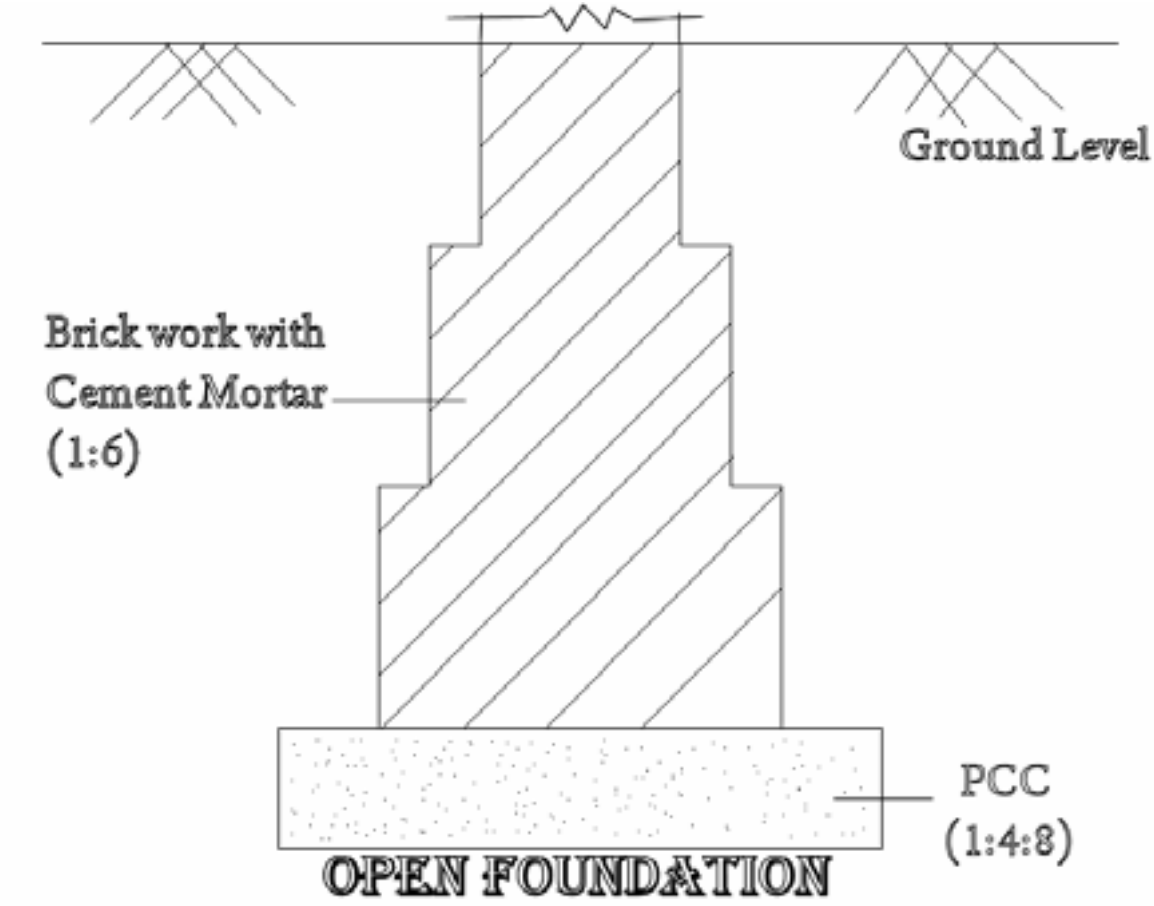
The moisturelevel of the soil and the depth and width of the cracks formed due to contraction of the soil with increase in temperature, determine the type of foundation to be laid. In case the depth of the cracks is more than 1.5 meters (5 feet), it is advisable to go for Pile Foundation.

1. Open (Spread) Foundation: After the foundationpit is excavated, water should be sprinkled on the bottom surface and compacted by Earth rammers. In case the surface appears to be soft, it is necessaryto remove the soft soil and fill up

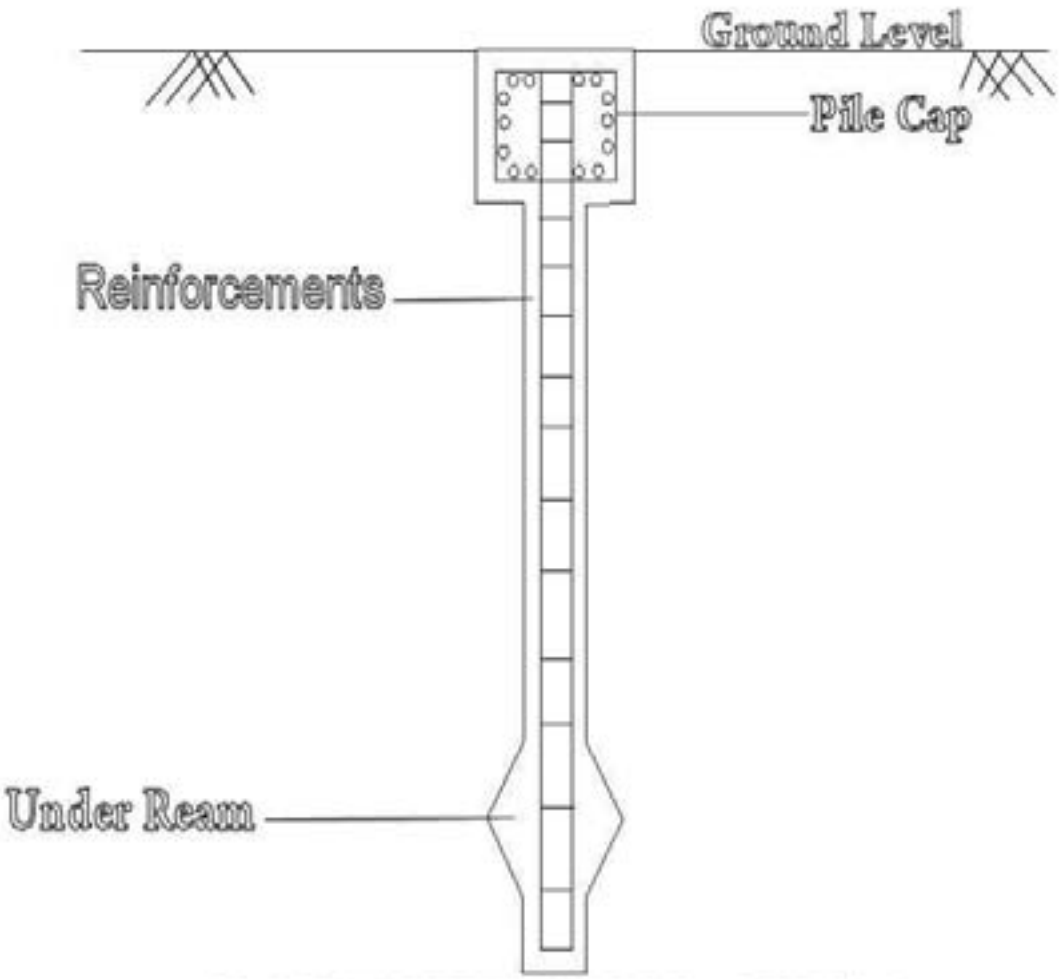


with sand, moorum, chips or stone dust to fill the foundation. Usually concrete with cement, sand and hard soil in 1:2:4 ratios is used to make the foundation.

The propermixing shouldensure that the cementsand mortarcomes to should be on the top layer before ramming it with the Earth Rammer. The concrete should be watered for about 14 days. This process is called curing.



2. Pile Foundation: Building constructed in black cotton soil expands and contracts due to rain and heat and generally develop cracks. In such case file foundation is necessary. Usually two types of file foundations are followed:



UNDER-REAM PILE FOUNDATION

(i) Bearing Pile: This piling is done up to 10 feet deep or till the hard strata so that the weight of the building is transferred to the hard surface.

(ii) Friction Pile: Friction pile is used in case the soil is black or soft. In these piles the weight of the building is transferred to the ground due to friction between the pile and the soil. The depth of the piles should be up to 3.5 meters, or 10 feet or till the hard surface. The depth of the pile depends upon the hard surface.

When the depth is decreased, care to should to be taken so that the base of the pile should be at least 50 centimetres in the hard surface. The diameter of the pile should be from 20 centimetres to 37.5 centimetres. Single or double under-ream piles are used depending upon the weight of the building.

A round cage is made using four or six no's 10 mm reinforcement bars, with 6 mm rings. This is placed in the pre-constructed pile hole. The hole is filled with cement concrete in the ratio of 1:2:4 ratios of cement, sand and chips of 20 mm, this is followed by curing with water for 7 days.

Construction of Foundation

Usually the construction of foundation is done with stones or bricks. Generally the height of the plinth is 1.5 to 2 feet. Care should be taken in deciding the plinth in lands that have Slope, Usuallythe heightof the plinthshould be more than the level of the road, so that the water from the road does not enter the building and water from the building flows out easily.

Super Structure

The constructionabove the plinthis calledsuper-structureand the workbelow this is called sub-structure. In both the cases, wall construction is required.Usually, the construction of the wall is done in two ways, one with stone and the other with brick.

Stone Construction/ Stone Masonry Work

The length of the stone should not be more than three times the height of the stone. In stone masonry, the heightof the stone shouldnot be less than 15 centimetres. It should be immersed in water for sufficient time before use. The surface on which the stone is to be laid out should be clean and moist. In case of old masonry work, the top layer should be removed before resuming the new work.

Brick Masonry Work

Only Burnt bricks are used in construction and the length, breadth and thickness should be 25, 12 and 8 or 23, 11 and 8 centimetres respectively. Following principles should be observed in brick constructions:

- Similar type of bricks should be used.
- Brick should be uniform with 90deg corners.
- Brick should be submerged in water till bubbles stop appearing. Bricks which lose their shape in water should not be used.

Lintels must be provided over doors and windows in constructions. Chhajas or cantilevers are required over the external walls to protect the building from rain and sun. The Chhajas or cantilevers are usually made of stones or R.C.C.

Roof Work

After foundation, the next important feature of the building is its roof. The beauty, strength and age of the building depend upon its roof. At the rural level, the following types of roof are in practice:

1. R.C.C Roof:

Due to scarcity of wood, R.C.C roofs are constructed in rural area. The cost of R.C.C roof and slope roof with asbestos are almost equal. For the construction of R.C.C roof, the following materials are required:

- Shutteringand Centring
- Cement, M.S rods, 20 mm chips, sand and water

Before shuttering and centring, the soil of the Ground-floor is mixed with water and rammed. This is done so that the woodensupports do not sink under the weight of the concrete roof.

For shuttering, iron sheets or wooden planks are used. The thickness of the sheets or planks should be such that theydo not bend due to the weight of the concrete. The wooden

planks should not have gaps in between. The gaps should be filled with soil and pieces of wood. The sheets should be flat.

All the shuttering plates should be spread in one level. The level should be checked with level-thread. The distance of the shuttering plate should be filled with soil and wooden pieces. The wooden posts should be strong enough, and the posts with joints should not be used in centring.

Coal tar oil or polythene sheets should be used above the surface of the shuttering plank before tying rods on to it, to avoid gluing with concrete. The Assistance Engineer should inspect the materials to be used in shuttering to assess the quality, before starting the work. The rod details must also be as per approved drawing.

Fresh Ordinary Portland Cement (O.P.C) or Portland Slag Cement of reputed manufacturers should be used for concrete work. The chips-sand-cement ratio should be 4:2:1 while mixing in the mixer container. Dry mixing by rotating for 2 - 3 minutes followed by mixing with water for 2 minutes in the concrete mixer. Laying of concrete and Camping should be done within 30 minutes of mixing the mixture.

Vibrators should be used for compaction. Compaction is done to eliminate the formation of air holes in the concrete. Curing should follow for 28 days. Curing shall be started after 10-12 hours of concreting. Mud partitions should be prepared on the upper surface with water filled up till 5c.m. above the surface. This is the most effective procedure of curing.

2. Sloped roof using Tiles/Asbestos/G.I Sheets

Burnt clay tiles of size 45cm X 30cm or Asbestos or corrugated Galvanised Iron Sheets are laid over wooden beams and battens placed in slopes with fixing wires/hooks with nuts etc. If wood are not available, steel sectionslike Angles or channelsare used in place of wooden beams in Asbestos and G.I. Sheet roofing. For Govt. Building these types of roofs are not recommended as they are not permanent in nature and are not cost effective in the long run.

II- PrecautionaryMeasures while carrying out the work of Building Constructions:

- It is better to construct open foundation above hard soil.
- It is advisable to take the pile foundation 10 feet below the surface, in case of black clay soil or soft soil.
- The pile foundation should comprise of 6 numbers of 10 mm iron rods with a spacing of 8 inches in between the 8 mm thick rings.
- It is important to undertake 8-10 days of curing. Moreover,pile foundation done within 24 hours of concrete work helps retain the softness within the pile. The ratio of 1:2:4 should be maintained for concrete mix.
- Constructionwork shouldbe done with stonesup to the plinth. It is only after the plinth that bricks should be used for work. It is financially viable to use locally available strong and burnt bricks.
- The outside wall should be 10 inches. The inside partitions (notload bearing)wall maybe 5 inchesthick, with R.C.Clintelor 2 iron rods of 8 mm each shouldbe used.
- The joints should not be larger than 1 cm and should be filled properly on both the sides with cement mortar 1:6 (1cement: 6 sand). There should be 'breaking joints' and not cuts above the joints.
- Plaster of 20 and 15 mm should be done on the outside and inside wall, and not more than 10 mm on the ceiling.
- Generally the R.C.C roofing should not be more than 4 inch thickness, and should have 1" slope for water to flow out.
- There should not be any space in centringplates and wooden posts should be strong enough with close spacing.
- M.S. Pipe centring may be used if available.
- A plinth protection filled up with boulder/Moorum of 1-2feet should be constructed all-round the building to avoid problems of water seepageto the foundation.
- Iron rods are placed at the layer not bottom layer for the Chajas or cantilevers.
- The centring of the roof of the building should not be removed before 15 days.
- For columnconcreting, vibratorsshould be used.In case vibrators are not available, then tamping should be done using a 16 mm iron rod.

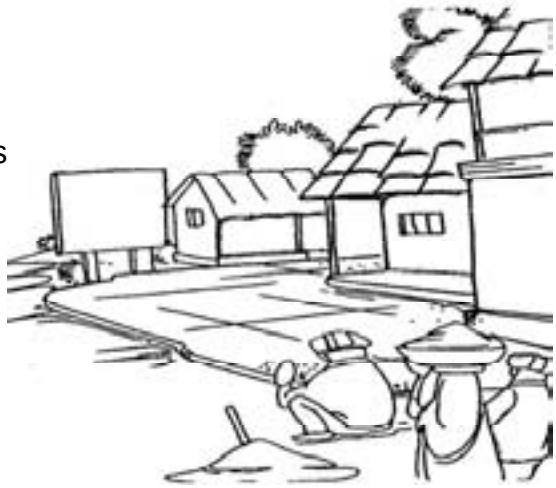
Chapter - 2 Road Construction

Road Construction Work

The connecting roads to the village are an important agenda in rural development projects. It is mostly seen that the villages that are connected to other villages and hamlets are more progressive and developed than otherwise, since easy exchange of available produces and resources in ensured only through roads.

Massive efforts are being made to carry out development projects for the construction of all weather roads to villages that are still deprived of connecting roads. The following are the type of roads being constructed under the projects:

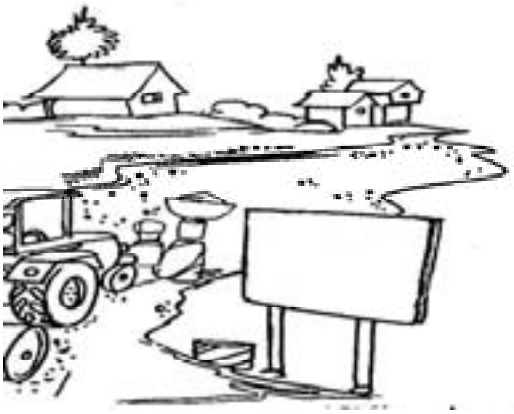
- Water Bound Macadam Roads (W.B.M)
- Cement. Concrete Roads
- Berm Constructions
- Road Levelling
- Construction of Bridges and Culverts



Under the Employment Guarantee Scheme, more and more road construction works are being sanctioned to facilitate a guaranteed employment in worksites in or near their own village premises, and hence most of the problems at the village level get resolved. Moreover, road construction works do not involve issues on land selection.

Water Bound Macadam Roads

Before starting the process of construction, it is important to survey and inspect the area. It is important to ensure that the height of earthwork should be more than 45 cm to 60 cm according to the surface. The survey also helps take into account the variation in the height of the places where facilities for water filling and flowing out (bridges and culverts) are constructed.



Materials required for construction of Water Macadam Roads:

a. Moorum: The Moorum particles to be used should be rough, strong and hard without big lumps the size of which should not be more than 3 cm.

b. Bajri: Chips used should be rough, strong and hard with a total thickness of 1 cm.

c. Gravel: Gravel obtained from the river is not considered feasible for construction work as they are not hard, rough and strong enough for use. Gravel to be used should be as strong as rock with maximum size of 2cms.

d. Boulder: These should only be small pieces obtained from hard rock. These should be angular shaped, neither too flat nor too long, without scalings and with two faces broken.

e. Crusher Dust: These should be pointed, strong and hard with a size not more than 1 cm.

Of the materialsthat should not be used in the work is mud. Mud should never be used for construction of W.B.M roads.

Construction Procedure of Water Bound Macadam Roads:

While setting the alignment for road construction, it should be ensured that the length of the road is the least in comparison to the benefits associated with its construction. The heightof the road should be more than the groundlevel to facilitate rain water to flow down to the sides, ensuring that water does not harm the road. There should be less cutting

down of trees in the process. The existing alignment should also be examined before taking up the new alignment, and should be chosen in case it is more suitable technically and financially. Before construction of Road, grass and bushes are to be removed.

Earth filling is done to increase the height of the road from the surface level. The width of the road on the surface should be more than 4.5 meters, so that after construction, the width of the road at least remains 4.0 meters.

After earth filling, moorum or crusher dust should be spread up to a thicknessof 20cm, so that after rolling it remains15centimetres. While spreading gravelor moorum, care should be taken to provide slope to the right and left sides (camber), so that water flows down without accumulating. Rolling should follow after pouring water, with a road roller of 8-20 tons. Binding of materials in the road is not possible without the use of water while rolling.

After the moorum layer is rolled, a 90-24 mm layer of Grade 1 boulder should be rolled. The width of the boulder layer should be 4.05 meters and the thickness should be 15cms so that after consolidation, the layer should come to 10cms.

After rolling the boulder, a layer of moorum should be spread to a thickness of 30% of the boulder layer. Another layer of 15cm thick boulder of 65-45mm size should be spread over the moorum layer that retains a thickness of 9 cm after being rolled. This results in a 4m wide road. A final 5cm layer of moorum is rolled to a 3cm layer on this 4 meter road.

Before consolidation, berms of moorum or boulder layer are constructed on both sides of the road, followed by a pavement of moorum for ease of commuting and for preventing cuts on the road.

Estimating the cost of construction of W.B.M Road

The cost estimate of the road construction is done on the basis of the rates provided on the previously prescribed estimate rates in which materials used are calculated by multiplying the length and breadth with rates prescribed for materials,to obtain the total cost of construction of the road.

Labour Cost:

a. Labour Cost for Soil Excavation:

The cost of digging up of a 15 cm deep layer of soft soil, as per C.S.R is Rs. 5.25/- per square meter, while of hard soil is Rs. 7.00/- per square meter. For example, if it is a 1 kilometre long and 3 metre wide road, 1000 x 3= 3000 square metres soft soil values to 3000 x 5.25= Rs15750.00 and hard soil values to 3000 x 7.00= Rs21000.00.

Labour Cost for Boulder Consolidation:

A Grade 1 boulderconsolidation(from spreading with the use of hand to levelling the layer according to requirement) of 90 to 24 cm yields a labour cost of R. 26 per cubic meter.

Length x Breadth x Height = Quantity x Rs. 26 gives us the rate of consolidating Grade 1 Boulder.

In case of a spread of moorum, gravelor bajri, a rate of Rs. 14.80 per square meter labour cost is fixed.

Labour cost of a Grade 2 boulder consolidation is fixed at Rs. 19.90.

Note: These rates are based on the C.S.R of the year 2003. The rates vary from time to time on date and place.

Cement Concrete Roads

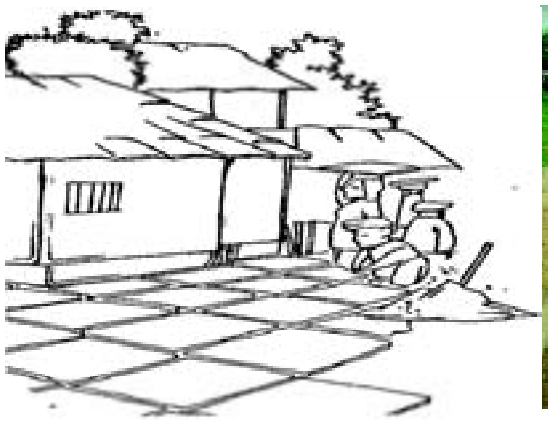
Sand, boulder: The moorum base is prepared with 40mm: 20 mm ration of boulder and cement. The surface is then levelled at the worksite.

Procedure for construction of C.C Road:

Before the construction of C.C Road, land should be properlycleaned by uprooting grass, bushes and weeds. Moorum should be filled to increase the height of the road above the surface level. The width of the road should be 3 meters. There should be provision for drainage system for outlet of water. After side shuttering, a 15cm concrete base should be constructed using 40 mm aggregates in the ratio of 1:3:6 of cement, sand and aggregate, for adequate height and level. The quality of the road depends upon the correct proportion of materials used. The qualityhampers in case of compromisein quantity. The upper layer is prepared with a mix of 1:2:4 (1cement: 2sand: 4chips) using 20mm chips for a thickness of 10cms. This layer is cast in patches of 3.0 meters centre to centre.

Precautions to be taken during the construction of C.C Road:

- During the construction of C.C road, Curingshould be done for 28 days so that the road lasts long. For curing with water either compartments with mud on the surface are made or jute bags are spread followed by watering.
- The concrete mix for the construction of road should be done with the help of mixing machines and not with hand.
- The materials used for construction of roads should be collected from places near the site otherwise the cost of lead would be more.



Valuation of C.C Road

To get the cost of construction of C.C road, we multiply the length, width and thickness with the applicable rate of materials to obtain the total expenditure.

Cost of material with lead and labour charges are included in the C.S.R. Levelling of the surface should always be taken into consideration.

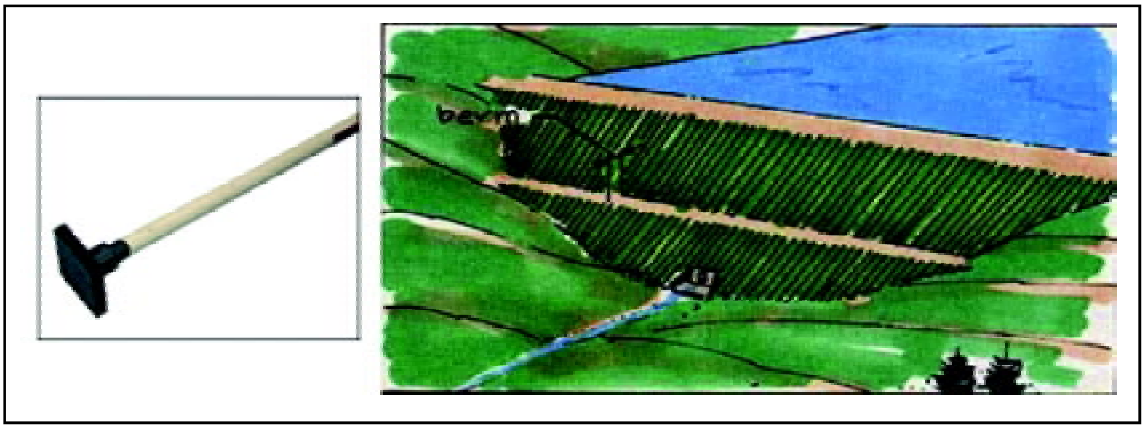
Berm Constructions

Berm constructions are usually done where the surface is on a slope. In C.C and WMB road constructions on slopes, there are chances of skidding and of breakages on the surface of the road. Before Berm constructions, the surface is levelled either by digging or by spreading a layer of moorum. While using moorum, care should be taken to avoid water logging. This should be followed by ramming.

After moorum work, a layer of boulder is spread and levelled and the Berm is constructed. Care should be taken during boulder spreading so that the broad surface of the boulder faces down and the pointed diamond shape faces upwards.

The surface of the boulder should be joined with cement concrete. There should be drains for water to flow out; otherwise there are chances of the Berm getting peeled off.

After construction of the Berm, curing should be done for minimum 10 days.



Road Paving

This type of work is usually done in the narrow lanes of rural areas, where movement of heavy vehicles is restricted and where stone plates are available.

Before levelling, the surface is cleaned and the out flow of water is facilitated. Water is sprinkled over moorum and rammed.

Over the moorum, sand and cement mortar in the ratio of 1:6 is spread slabs stone are laid on top to facilitate bonding. The thickness of the stones should be 3-4 inches. All the stones should be of the same shape. Jointing of stones should be done in 1:3 ratios of cement and sand. Curing should be done continuously for 10 days.

Properdrainagesystem in a slope shouldbe provided eitheron therightor leftsideof theroad.

Construction of Bridges and Culverts

During road constructions bridges and culverts are constructed for easy and safe movement across the drains, streams and rivers. Prior to constructions a proper technical

survey of the area should be done. The following should be taken into consideration during the survey:

- Catchment area in acres (the area of incoming water in the drains)
- The cross-section of the site and the L-section of 200 metres on both the sides of the drain.
- For more than 100 acre catchment area of the bridge, an L-section of 200 meter upstream and 200 downstream of drain should be taken. This is required in deciding whether the straighteningof the drain is required or not and the right place where the culvert should be constructed.
- Trial pit- inspection hole for inspection of the soil layer
- H.F.L - highest flow level, O.F.L. - ordinary level flow
- Road surface level

Usuallywater flows in less than 30 cubic meters per seconds in Culverts, for which 150mm clearance should be kept. Clearance depends upon spacing of piers which is kept as 1 to 1.5m. For 300 ml a spacing of 2-2.5 meters should be provided. For 450 mm a spacing of 3-4 metres should be provided. For 600 mm, the spacing should be of 4-6 meters.

Bridges are always constructed on a straight road. A bridge is constructed in case the drain is not in a 90 degree angle, so that the flow of water slows down. If there is a scope of financially feasibility then it is advisable to change the direction of the flow of water.

The construction of the bridge is usually done simultaneously with the road constructions so that the surface of the road and the bridge are in the same level, and to check any unnecessary expenditure in construction work.

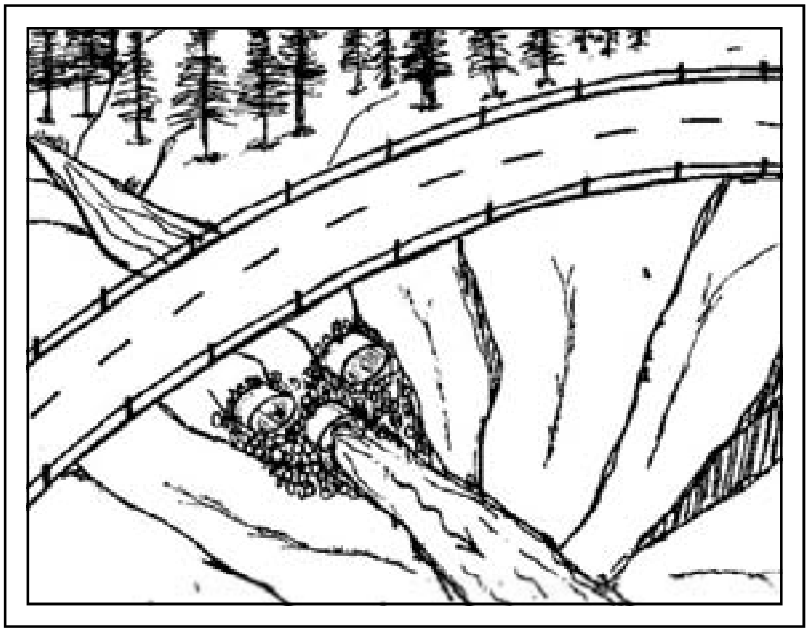
For maintenance, the spacing between the culverts and the diameter of the pipe should both be 900 mm. If the spacing is less, then it gets filled with silt and hence becomes difficult to maintain. The culvert which is constructed on the inter-section of two roadsshould have a spacing of 600 mm that joins the main road to the connecting roads. However the slope of the river and drain should be not less than 1/100.

Pipe Culverts

NP2 Pipes (Cement Pipe) are used on rural roads. For NP2 pipe culverts, the bed level should be as follows:

- For 900 mm pipe it should be a 1.75 meter
- For 1200 mm pipe it should be 2.15 meter.

The pipe should be laid on a base concrete of 1:4:8 or 1:5:8 mix. Otherwise this would result in a collapse of the pipe culvert.



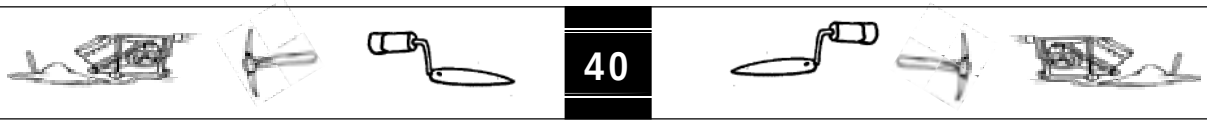
CHAPTER - 3 CONSTRUCTIONS FOR WATER CONSERVATION

The present day scenario of increase in population the world over, is affecting our natural resources such as forests and water. In some of the districts of Orissa shortage of water has already been started, to avoid reaching a day when it would be sold in gallons like petrol and diesel.

The excess run-off can be stored in different structuresto provide supplementalirrigation for survival of horticulture and agriculture crops in drought prone areas having low and erratic rainfall. For this, excess rain has to be stored in soil profiles and different storage structures. Some of the structures used to conserve excess water is as follows:

Site selection

- Ayacut of the proposed WHS should not have any other sources of assured irrigation.
- It should be constructed on upper reaches of the village such that it can irrigate all the agriculture lands below it.
- Maximum beneficiaries should be covered
- Maximum beneficiaries should be of SC/ST and from small and marginal farmers.
- The site should be cost effective and acceptable to the community
- It should not submerge more private land and forestland.
- It should not affect the wild life and environment
- Construction materials should be available at nearby area of proposed site
- Communication should be approachable to the working site
- It should be constructed for multi use
- Labours should be from beneficiaries



Components

- Embankment or Dyke (minimum top width 2.0M)
- Core wall (Puddle, Masonary, Concrete)
- Stone pitching (it should be done upto the F.S.L)
- Grass-turfing
- Canal sluice (It should be minimum 0.6M below the surplus outlet)
- Surplus outlet
- TBL (It should be minimum 1.2m to 1.5m above the F.S.L)
- HFL
- Dead storage level
- Free board (1.2m to 1.5m)
- Side slope (U/S 3:1 and D/S 2:1)
- H.G.L should be within the bund section (4:1)

Various constructions for water conservation (like ponds, tanks, stop dams, etc) with provisions of sanction under the Employment Guarantee Scheme are discussed in detail here in this chapter. The instructions provide an in-detaildescription of the proceduresfor such construction work.

1.Pit/Pond

Water flows through a greater speed in normal land than it flows in a cultivated land. Pit or ponds are most beneficial where there is no facility available for conservation of water.

In a year, nearly 100cu.m water can be recharged into the ground with the help of pits of 3m diameter with 3m depth. Pits made in a land help increase the moisture and the water level in wells and tube wells. On the bottom of the pit a layer of 0.3m thick sand or small stones should be spread.

It is not necessary to make permanent pits or small wells. Shape of the pits or ponds can vary from circular,square or any other shape depending upon how the waterflows through the land. Pits or ponds should be made at those places where the water enters the land or leaves it.

Farm POND

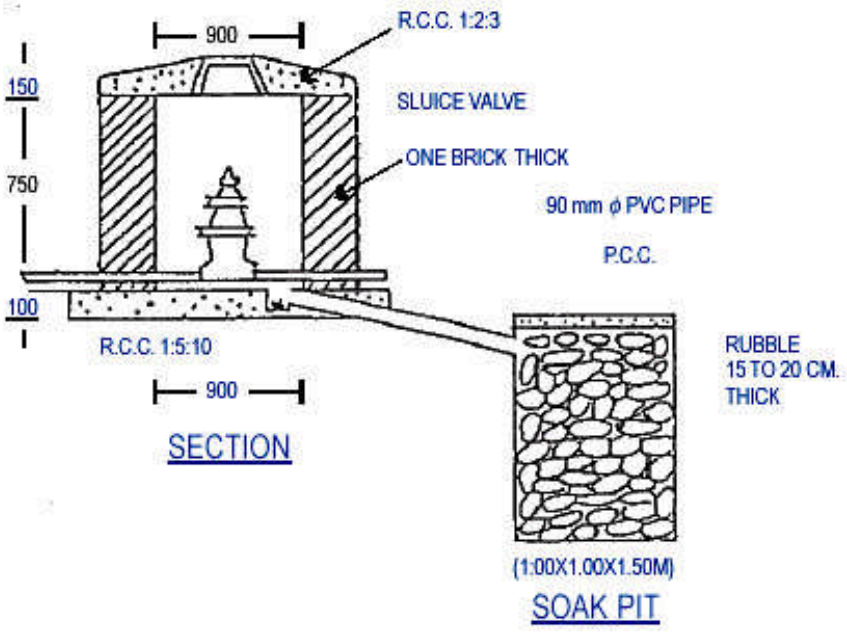
- Embankment type
- Dugout or excavated type
- Dug-out with embankmenttype

Farm Ponds:

Farm ponds are bodies of water made either by constructing an embankment across a watercourse or by excavating a pit or the combination of both.

2. Soak Pit

Soak pit is very useful for every house for conservation of rain water and used water. Depending on the amount of rain and used water, length width and depth of the pit varies. Depending on the flow of water the pit can be of square, circular or of any other shape.



On an average 4 soak pits can be made around a house. The length, width and depth of these soak pits can be kept 3m each. On the bottom of the 3m soak pits, 1.5m layer of boulder and a layer of bajri and coarse sand is spread, followed by a final layer of soil. On the top a net or a mat of palm leaves are kept over the pit to protect the water from dust and dirt.

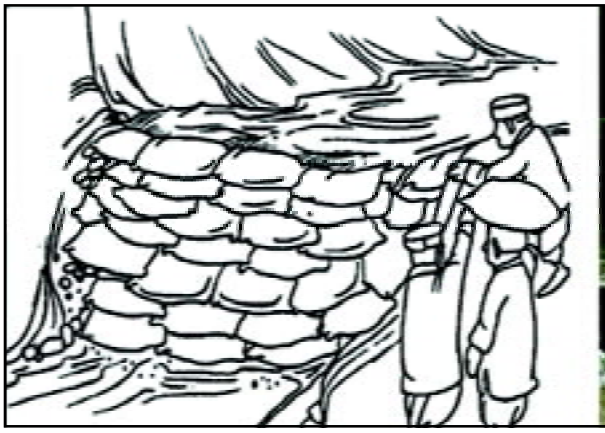
This soak pit will increase ground water levels through collection of unused rain water from the rooftops, flood water and water from the gardens. Large soak pits build in every house in a village would help increase ground water levels.

3. Sand Bag Dam

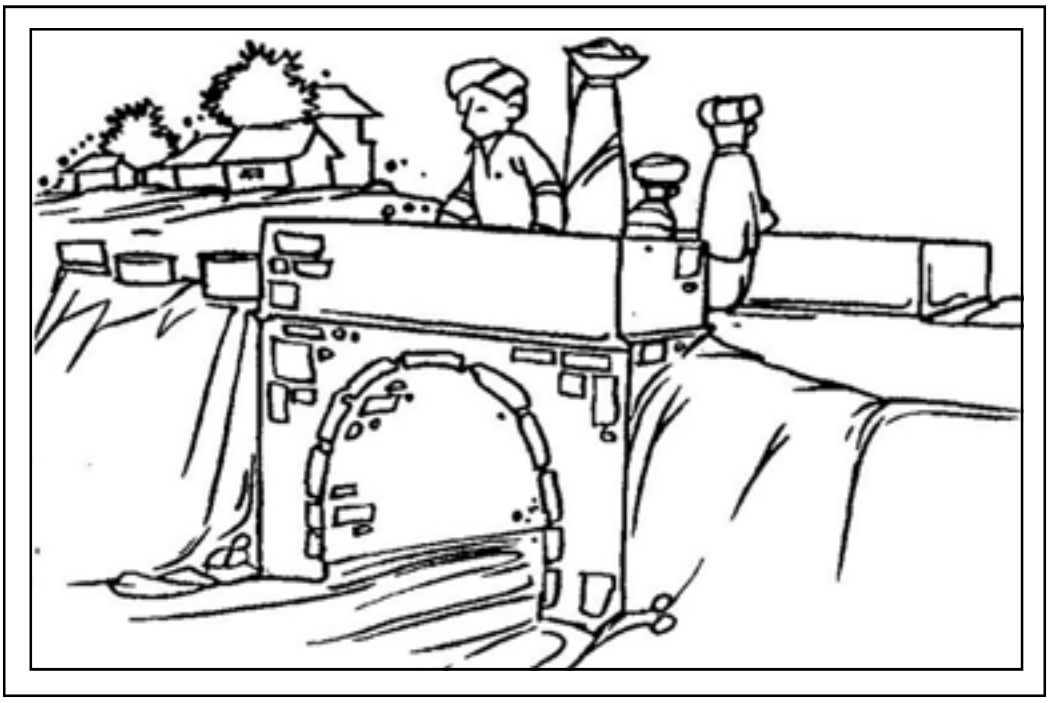
Building of small dams by stopping the flow of water flowing in rivers or streams is rather costly due to which water conservation is not possible, as a result of which there is always scarcity of water in those places.

After the rainy season, to conserve every drop of water flowing in river or streams temporary dams are constructed by fillingof soil, sand or any other non destructive item in empty cement, fertilizer/urea plastic bags. This technique is easy, economical, affordable and effective.

In villages where small streams flow and the catchment area of water is between 0.1Sq mile to 4 or 5Sq miles, sand bag dam is an ideal source of water. Each project of building of sand bag dams is different for different types of river or streams. Each community has to incorporatethe necessary changes according to their locality, in constructing sand bag dams. For instance,



- If the stream is wider and shallow, it means that the water current is less which means an ordinary sand bag dam would suffice.
- Water should be available at the selected place.
- The selected place should be such that maximum amount of water gets collected with the minimum required length of the dam.
- The walls of the dam should be strong and the stream should not be curved near the dam.
- There should be a minimum deposit of sand and soil at the selected place, for prevention of seepage of water.
- The stream should be plain or with a slope towards the dam so that it results in an increased level of water at the dam.
- The selectedplace should be away from road, bridgesor houses so that these places are never damaged or submerged.



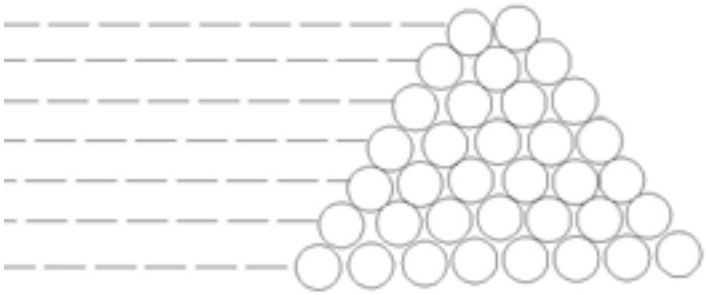
The height of the dam depends on many factors such as the area of the dam and the slope of the dam. Generally, 2 meters is a considerably safe height. For a dam of height 2 meters, the width should be 3 meters, and width above should be 0.9 meters.

Procedure for construction of a Dam

Sand, moorum or sandy soil of any kind should be filled in the strong gunny bags, properly stitched with plastic threads after being filled, and kept in the dam construction site.

Of the decided width of 0.9 meters, mud, sand, sandy soil etc. should be cleaned and cleared to the depth of about 1feet.

The bags should be kept over the empty spaces between the two bags. The longer side of the bags should be put along the flow of water.



4. Boulder Check Dams

Temporary stone dams on local streams are known as boulder check dams. These types of dams are built on streams of area 100 hectare and a depth of less than 3m.

Advantages of Boulder Check Dam:-

- Soil erosion is checked.
- It checks the mud flowinginto the stream preventing mud and other items from going into the pond.
- With the help of boulder check dam, maximum amount of water can be directed into the ground.
- Due to the boulder check water stays in the dam for a longer period which helps the villagers to use water for a longer period. This also preventsdrying of ponds and dams which are connected to it.

- Making one after another boulder check dams in a stream divides the stream into small parts which makes it possible for using the water effectively.

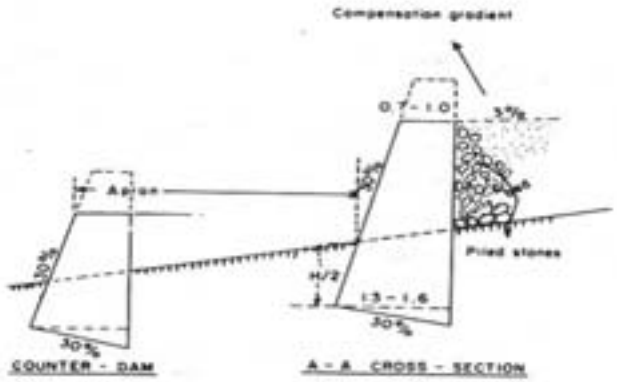


Fig. 17B A-A cross-section of the first boulder check dam and counter-dam.

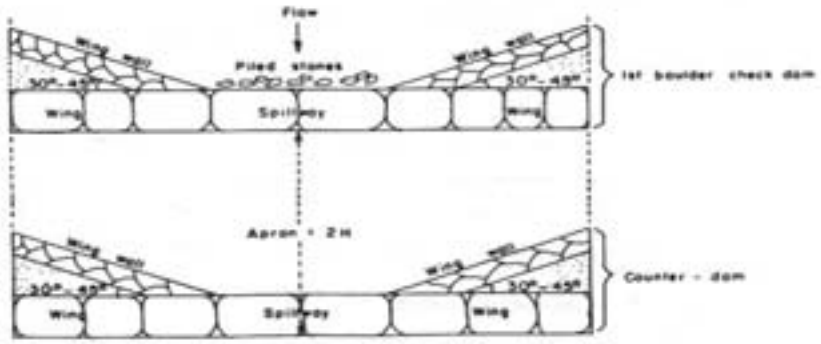
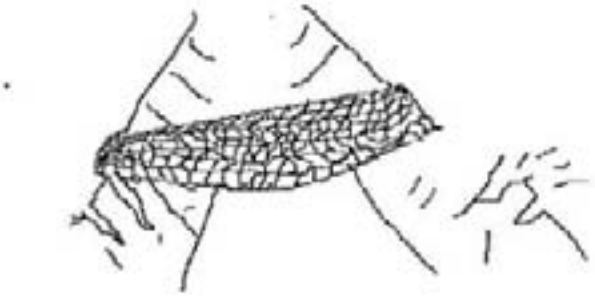


Fig. 17C Top view of the first boulder check dam including counter-dam.

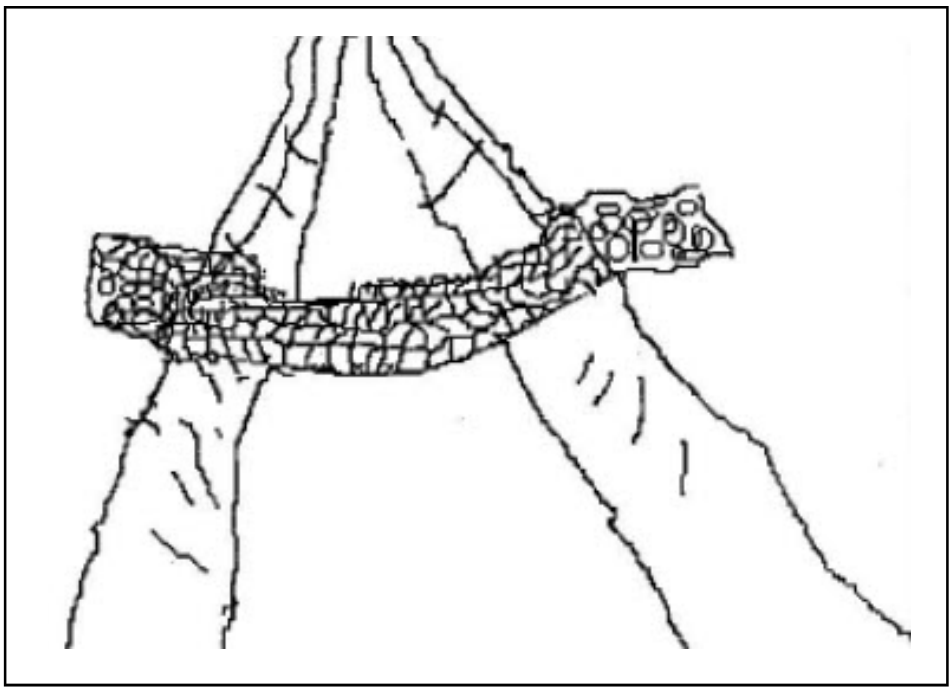


Precautions for constructing Boulder Check Dams

- Area of each boulder check should not be more than 1-2 hectare.
- Boulder check should not be made where the slope of the stream is more than 20 percent.
- Boulder check should be made where boulders are available in plenty.
- It should be made at that place where the banks of the stream are strong and have considerable height such that even with maximum flow of water, it does not flow over the walls.
- The most amount of water can be collected by the dam when the slope of the stream is the least.
- It should be in such a place where the water should seep inside the ground thus increasingground water level.
- The minimum distance between two dams should be of the height of the boulder check dam so that water stored in the lower dam reaches the ground level of upper dam. If we decrease the distance, boulder check cannot be fully utilized. If we increase the distance we cannot save the water to the capacity of the dam.

Suggestions for choosing the ideal distance between two Boulder Check Dams

1. In streams where there is more slope the minimum distance between two dams should be 15m.
2. If the slope is less, then the distance between two checks can be increased but it should not exceed 60m.



Generallyit is decided that the height of centre of boulder check activity should be 1m and width should be 40cm. As the angle of repose for stones is more, so upstream should be 1:1 and according to the flow of water downstream should be between 1:2 and 1:4. If the speed of the flow of water is more, then the slope of the bouldercheck should be the least.

For the protection of boulder check dam it is important that maximum water should pass from the centre of the dam. If more amount of water comes in contact with the soil then there is more danger of soil erosion. For this reason the centre of the dam should be low and sides of the dam high, but height of the walls should not be more than 1.5m. If height of the walls of the stream is less than 1.5m then the height of the dam should be same as height of stream.

The Check should be a minimum of 100cm. 1/3rd of the length of the dam should be fixed inside the soil for preventing soil erosion near the ends. The foundation should be of 30cm; however if the bottom of the stream is rocky then no special foundation is necessary.

On the selected place for the dam a line of lime should be drawn from one bank of the stream to another bank of the stream to that place where the height of the stream is 1.5m. Draw two lines, one measuring 20cm upwards and the other measuring 20 cm downwards about this line. These two lines indicate the width of the check.

Suppose it is decided that upstream slope is 1:1 and downstream slope is 1:3 then from the centre of the upper line draw a perpendicular and mark a point on 1.2m then join the

points with the points on the bank of the stream.

If the bottom of the stream is rocky then foundation is not necessarybut it is necessaryon the banks for fixing the check dam to the ground.

It is important to dig a pit of 30cm at the bottom of stream while excavating the foundation of the stream. This pit should be 50cm wide and 50 cm in depth. The pit should be dug till 50cm from the place where the upper part of the check dam meets the bank of the stream. Then start filling stones in the pit layer by layer. Careful filling with stones should be done, keeping the slopes in mind. Another important task is that of fixing big stones on the outside layer by digging 25cm and using small stones inside the dam.

Stones of diameter less than 15cm and weighing less than 1kg should not be used. Circular stones should be used for setting of angular stones. Soft stones should not be used as they get dissolved in water. Do not dig out stones for use in Dam since digging out further increases soil erosion.

5. Earthen Dams

Earthen Dams are of two types:-

1. Ponds for ground water recharge.
2. Agricultural Ponds

Site Selection for construction of Earthen Dams:

For choosing of appropriate place following care should be taken:

- Dams should be made in the place where the water should be available to its capacity not more or less.
- The banks should be strong and nearer to each other.
- Near the dam the width of the dam should ideally be less.
- In agricultural ponds if the soil is impervious than it will be helpful for storage of water. However, in ponds filled with pervious soil helps for recharge of Ground water through it.

- If at all the above conditions are fulfilled yet building tools are not available near the selected place then the construction work should be stopped.

Size:

Full tank level (FTL):

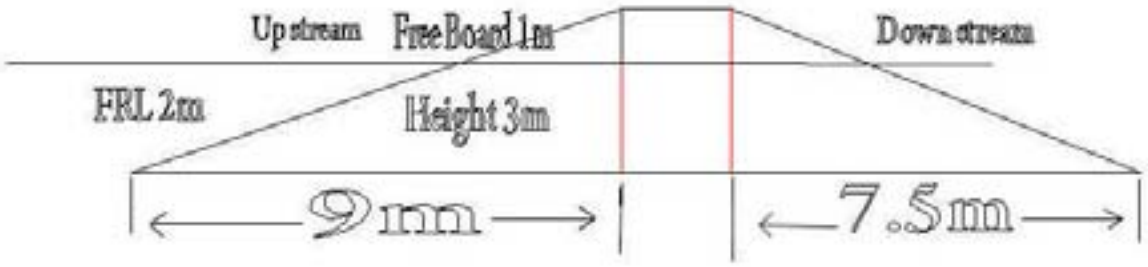
For deciding this level a relation should be made between ideal capacity of the dam and ideal flow of water. A line shouldbe drawnfrom the ideally full levelto the point wherewater enters the pond. The maximum point to which the water can be filled should be decided for the maximum level of water. Capacity of the pond depends upon the area where the pond exists.

Drainage:

Overflow of water should not be allowed from any of the earthen dams. There should always be a proper facility for drainage of excess water.

Free Board:

Even after proper drainage system water overflows in the rainy season due to excess water. This is when and why freeboard should be fixed above the FTL. It is necessary to check the overflow during rainy season. In a dam of about 5m, freeboard of 1m is considered appropriate.



Width of top of the dam:

The width of the top of the dam should be maximum 2m and minimum 1m, for a dam of about 3-6m height.

Different types of Bunds:

Earthen dams are of three types depending on the availability of clayey soil.

- At the places where clayey soil is not available bunds are made up of normal soil. Supports should be considerably bigger and ideally with a thin layer of clayey soil at top. The bund should be filled with thoroughly compacted soil. Moreover, the foundation of the dam should be of hard rock.

- An impermeable core wall should be made up of clayey soil, in places where clayey soil is not plentily available. Further, it should be filled with normal soil. The soil is set in such a way that the fine grains of the soil are inside and the coarse grains are on the outer surface.

- At the places where smooth soil is available in abundance the heart of the dam should be made of smooth soil. It is not necessary to fill the wall with soil balls. To support the heart normal soil should be thoroughly filled in such a way that smoother grains are nearer to heart and coarse grains are on the surface of the outer wall.

Slope:

The upper slope of the dam is in danger of soil erosion by rainfall and overflow of water. The downstream slope of the dam is in danger of soil erosion from heavy rainfall and flowing water. Slope of the dam depends on the angle of repose. On the basis of rainfall the upstream slope should vary between1:2.5 to 1:4 and the downstream slope of the dam should be 1:2 to 1:3.

Settling of soil:

For bunds of the ponds, soil is compacted. Since by the weight of the dam, rain water presentin the pond and the soil on the wallsmixed up with water, settleat the bottom of the pond, margin should be kept from the beginning for the soil to settle. This can be done by increasing the height of the bunds by 10-25%. Moreover, since soil settles at the centre of the wall where it has maximum height, the dam should always be in the shape of a bow.

Cut off trench:

For prevention of seepage of water from the bottom of the dam a pit is constructed where balls made up of clay are filled in. Generally the depth of the pit is 25% of the height of the wall. Digging should be stopped when impervious soil is met.

Stone Pitching:

The upper slope of the dam is generally covered with a layer of stones to protect it from soil erosion due to heavy rainfall. This technique can also be used for the downstream slope. Growing of grass on the slope is much more affordable and is as effective as pitching.

Toe Wall:

Any dam, ever made with impervious soil, has a seepage line. If this line comes out from the bottom and goes towards the top it can be a reason for soil erosion, which is a danger for the dam. For this reason toe walls are placed at the bottom of the dam. A reverse filter is made in which, first fine than grained soil are filled followed by stones. Toe walls do not allow the seepage line to cross the dam.

Process of building earthen dams:

- First finalise the Full Tank Level.
- Draw a line from one end of the stream to the other end on the place selected. Estimate the height of the Dam with free board with the help of dumpy level. Decide the height for settlement of soil. If the upper width of the dam is 2m then draw two parallel lines at 1m distance one in upward direction and one in downward. According to the slope of the dam mark the points then join the points.
- Dig out holes in 3-4 places for test pits. Fill the holes with water and measure how fast water seeps into the soil. If the speed is more, then it is necessary to increase depth.

- Dig a trench of about the estimated depth and a 1m wide. Join the channel to both sides of the stream where the bund would be made.

- Bunds should be constructed in case of availability of clayey soil. Make all the sides of the bund simultaneously. Build the impervious support and outer portion (casing) simultaneously. Every layer should be about 6-8 inches thick. Keep the fine soil near the heart and grainy/course soil away from the heart.

- The drainage system should not be neglected. It should be made in such a place where digging would not be necessary and where soil erosion is the least. Fix a layer of stones on the bottom and sides of the drain.

- Width and depth of the drain should be in such a way that maximum amount of water could come out properly.

- The drainage should be attached to a natural stream such that the water will not be wasted. It can also be attached to the same stream where the dam is made.

- The height of the heart should not be more than 50-75cm of height of Dam. The heart should end before starting of free board, as water is not stored up to the free board. Gradually the width of the casting should be decreased to get the pre defined slope.

Chapter - 4 Construction of Pond and Stop Dam

Construction of Pond

Preliminary Survey for Site Selection:

- Pond should be constructed in such a place where water is available in plenty and a water-filling area (when constructed) is available.
- Theselected place should be ableto collectmaximum amount of water thatcould be helpful for irrigation purposesif needbe, facilitating the cultivation of lands.
- Areas with slope are not feasible for constructing ponds as collection of water in these areas is very less compared to the amount spent on it.
- On the selected location appropriate place for waste wear should be present. Waste wear level should not be less than full tank level otherwise all the water will flow out.

- During the selectionof place for making of dam every aspect should be kept in mind such as length, width, height, area, water catchment area of the dam, availabilityof land for waste wear, and the type of basin should be kept in mind.

- For small dams, the embankment shouldnot be long or wide.The basinshould be plain and saucer shaped so that it will be economical.

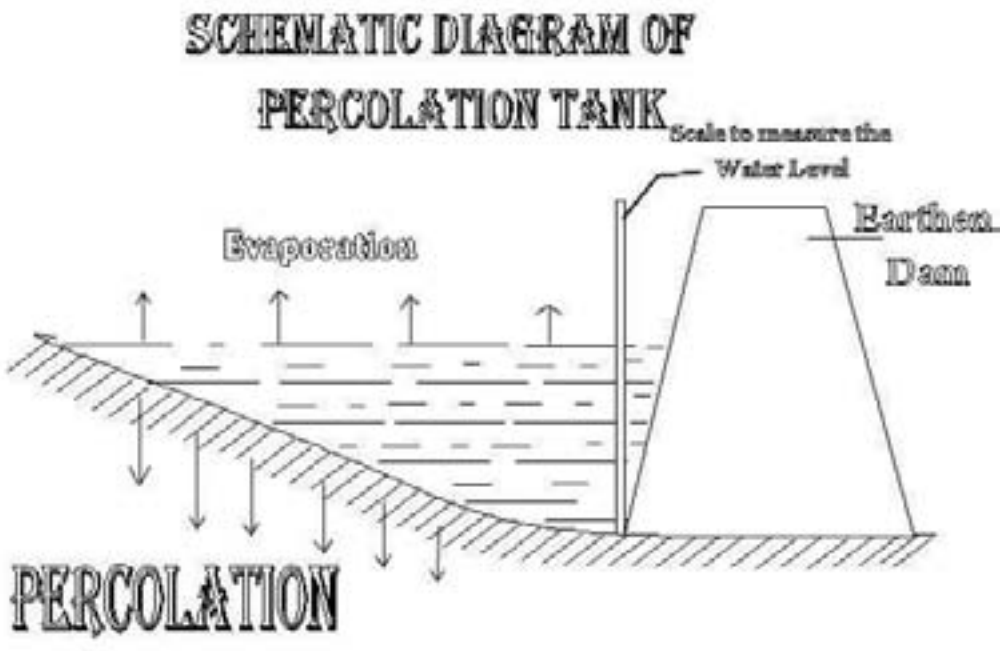
- Generally ponds are made at places where there is normal soil. Construction of ponds in a stony area will be costly.

- In places for big ponds small ponds should not be constructed and vice-versa.

Detailed Survey:

Mark the proposed stream on the topo-sheet, then select the place and draw a ridge line for showing the area for conservation of water. If the area for water conservation is less than 1sq mile then survey on the ground should be done for marking up the area. If the area of conservation is more than 1sq mile then the area can be marked directly on the topo-sheet.

Percolation tanks



Percolation tanks are constructed across higher slopes of catchment/foot hills to harvest the excess run-off and allow it to percolate into ground. It will enhance the ground water table and soil moisture regime in lower areas of catchment. It will increase the drought resistant of crops and enhance production.

Purposes:

- To impound surface run-off coming from the catchment and to facilitate percolation of stored water into the substrata with a view to raise ground water level in the zone of influence of the percolationtank.
- To hold the silt flow which would otherwise reach th4e multipurposereservoirs and reduce their useful life.

Pisci-culture tank: It is constructed in the water logging area or low depression area for pisci-culture purpose to add extra income.

Multipurpose tank: If the farm pond will be used for more than one use than it is called multipurpose tank.

Site selection

- No alternate sources of water for use
- It should be constructed for multi use
- It should be constructed in water logged or valley area
- Maximum beneficiaries should be benefited
- Maximumbeneficiaries should be of SC/ST and fromsmall andmarginal farmers
- It should be cost effective

Components

- Embankments

- Stone pitching
- Grass turfing
- Canal sluice
- Core wall
- Inlet
- Outlet

Construction process

- Excavation should be done in stepping or sloping
- Proper slope should be maintained (Minimum 2:1)
- Berm should be left (Minimum 1.5 M)
- Straight dead man should be left and it should be in 1% of the excavated area
- TBL should be maintained properly (Top width should be 2.0 M)
- Free board should be maintained (Minimum 1.2 M to 1.5 M)
- Sluice and surplus should be provided at suitable place

L- Section of the Dam:

Before the survey an identification point is marked on a temporary benchmark, which is taken as a standard throughout the survey. For finding out the L-section of the dam stand facing towards the direction of the flow then towards your left side decide a point '0' of the dam. Then take 10 levels (reading) from the point zero. For finding out the L-section a longer length survey such that the predefined height of the pond comes under the surveyed height.

Survey for the Spill Channel:

Spill channel is decided in such a way that it is less than the top level of the dam but more or less near the full water level of the dam. From the centre line, measure a distance of 10-10m to both sides, at that place fix pegs to 20-20m for selection of the selected place for the spill channel. Finally do a survey for 10m X 10m grids.

Survey for basin plan:

For estimating the water filling capacity of the pond the survey for basin plan is carried out. Here also from the centre line of the dam a line is drawn towards upstream where a grid surveyof 30 X 30m is done in such a way that the full basin is nearlyequal to top water level of the dam. For small water basins survey of basin plan can be left out.

Survey of proposed irrigated area:

If irrigation is to be done from the dam water then the area for irrigation should be estimated and a survey should be carried out for irrigation purpose.

Material survey:

For the building of dam a survey for proper use of necessary materials should be carried out.

CHECK DAM / DIVERSION WEIR

Stop dams are permanent engineering structures constructed in the 'nala' for raising the water level and divert for providing life saving irrigation in surrounding fields.

Purpose:

- To store the surface runoff during the run-off availability period for subsequent irrigation.
- To hold some of the flood water, so that there is no damage at the downstream.
- To provide adequate infiltration opportunity for rain water for recharging the ground water level.

Site Selection

- It should be constructed at shallow & narrow section of the stream, so that it can be cost effective.
- It should irrigate more lands.

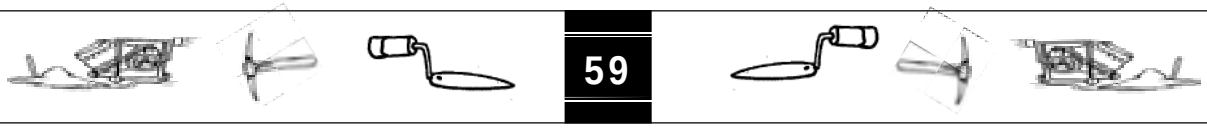
- Maximum beneficiaries should be ST/SC and Small & Marginal Farmers.
- It should not submerge more area in its backwater.
- It should notsubmerge forest areashouldnot affect thewild lifeand environment.
- Communication should be approachable to the site.
- Laborers should be from the beneficiaries
- Rainfall intensity
- Stream Velocity
- Water availability period
- Stream Length

Components

- Head wall (Bottom width should be minimum 2/3rd of the height)
- Side Wall
- Wing Wall
- Turn Wall
- Cut off wall
- Toe wall
- Apron (Minimum 2 to 3 times the height of the head wall)
- Distillation Valve
- Canal outlet
- Spillway

LBS (Loose Boulder Structure)

- It is constructed across the stream as speed breaker
- It is constructed for conservation of soil and water.
- Upstream and Down Stream slope should be 3:1 or 2:1
- Central portion should be lower as compared with the ends to check over top-pling of flowing water.
- It should be constructed in series in drainage line treatment
- Stones should be set in such a way that it should not roll down to the Down Stream with flowing water.



Drawings for building of dam:

❖ **Catchment Area Plan:**

Detailed survey of the dam should be done so that on the basis of bearing and length drawingscan be made. If area of the conservation is marked through the topo-sheet then we can mark the catchment area on that topo-sheet itself.

❖ **L-section of the dam:**

On the basis of levels on different distances L-section can be drawn of the proposed area. A mark should be made for digging of puddle on the basis of proposed maximum water level including free board level.

❖ **Grid plan of Spill Channel:**

If a saddle is present on the dam line, spill channel can be built. If saddle is not present then to extract extra water in rainy season from the nearby area of maximumwater level,a

length wise 10-10m grid survey is carried out and finally a grid plan is made.

❖ **L-section and Cross Section of spill Channel**:

After marking the alignment of the proposed spillchannel on the grid plan,L-section should be made on the center line and then on every 10m cross section should be made. With the help of the cross section spill channels can be made without calculation and with very less mistakes.

❖ **Drawing of Flush Bar or Waste weir:**

If strong strata are present in spill channel then flush bar is proposed. In case of presence of weak strata waste weir is proposed.

❖ **Basin Plan:**

If survey is done then drawingshould also be made for the basin plan. On the basis of the survey, grid plan can be made, on which contours are drawn. With the help of tracing paper and graph sheet, area between each contour can be calculated. Water volume capacity can then be calculated easily.

❖ **Maximum Height of Dam:**

75% of water in the catchment area is rainwater. The level of maximum height in which maximum capacity is gained, is considered to be the full capacity of the dam. The depth which is kept for drainage of extra water in the rainy season is higher than full water level. This level is known as maximum capacity of the dam. Free boards of 1.20m-1.50m are fixed for wave thrust and abnormal flood conditions. This level is called top level.

There are 3 levels for each dam:

- Full water level
- Maximum water level
- Top level of dam

Example of building of pond in 1sq mile catchment area:

With the help of topo-sheet, area of the catchment can be found out. It is on this basis height of bund of the pond is decided.

- For a catchment area of 1sq mile, the height of the bund of the pond should be 3-3.5m.
- The bund should be 200m in length.
- Height of the pond should be 2/3rd of the depth of dam.
- Upper width of the puddle should be 2.10m and lower width should be 1.50m and height should be 1.8m.
- The puddle should be filled with black soil and compacted.
- Height of the hearting zone should be 2/3rd of height of bund. It will be filled with good soil.
- The width of the waste weir shall be 1/8th of length of bund equal to the width of the waste wear.
- A pitching with 22cms should be provided on upstream.

Sample of an Estimate: (Rates are not actual)

Digging of walls 50m long X (2.10+1.50) / 2 X 1.60 height= 162 cu. m

162 cu. m @30.70 = Rs 4973.40

Filling of bunds (Black soil and hay) = 162 cu. m

162 cu. m @ 32.30 = Rs 5216.40

Hearting Zone of pond 50m long X (2.10+3.30) / 2 X 2 = 270 cu. m

270 cu. m @30.70 = Rs 8269.00

Building of Bund 200m X (8.50+3) / 2 X 3.20 = 3680 cu. m

3680 - 270 = 3410 cu. m @23.20 = Rs 79112.00

Pitching of 22cm boulder on the slope

Length of bund X height of bund X height of boulder

200m X 4.21 X 0.22 = 185.24 cu. m @70.15 = Rs 12994.58

Waste Wear (drainage)

50m long X 25m wide X 1m deep = 1250 cu. m

1250cu. m @ 30.70 = Rs 38375

Technical Help Nearly 1060

Total cost for pond

Rs. (4973.40 + 5216.40 + 8269.00 + 79112.00 + 12994.58 + 38375 + 1060) = Rs 150000.38

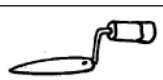
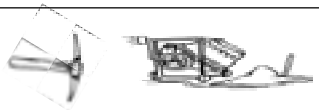
Thus it can be rounded off to Rupees One Lakh Fifty Thousand.

Important information:

- For construction of bund 3410 cu. m soil will be required which means 1196.49 pits or chowka are needed.
- If a labourer digs a pit in one day then for digging 1196 pits we need 1200 labour days.
- Red soil is best for bund.
- Digging a pit (10 ft wide, 10 ft long and 1foot deep) costs Rs 70.00

Procedure for Dam construction in chronological order:

- Make a layout of the centre line of a dam.
- Draw a layout of the dam site according to the report.
- Jungle clearing
- Benching
- Excavation of puddle trench
- Collect soil for filling the puddle with it.
- The collected soil should be immersed in water for 48 hours.
- Lumps should be made out of the soil paste which is to be used to fill the trench.
- Puddle core should be built up to a height of 0.60m above ground level.
- Excavation of filter foundation.
- Putting sand gravel layers in filter.
- Building of boulder toe and inclined filter.
- Metal and soil consolidation should be done over the dam (except the stream area).
- Digging for spill channel and earthwork for the dam should be done simultaneously. Good soil excavated from spill channel must be used in dam work. (Digging for spill channel should be done before the channel enclosure.)
- Closing of the stream.
- Use the soil from upstream slope cutting in top level of the dam.
- At a depth of 0.15m put quail spalls.
- Pitching should be done (0.22m).
- In order to drain excess water flush bar or waste weir should be made.

Stop Dam

Building a stop dam is completely a technical work. For this reason presence of a technical advisor is very important.

Preliminary Survey and Site Selection:

For building a stop dam we have to choose such a place that even in the month of December flow of water will be present. In order to make the foundation the bottom of the stop dam should be very hard. The banks of the stream should be high and strong.

The selectedplace should be such that maximum water can be stored which can be used for irrigation purposes also. Stop dam should be made along the flow of water. A place which is both suitable for building of rapta and stop dam then both may be made in the same place.

It is generally not suitable to build stop dam in excess sloppy areas or hilly areas. Due to excess slope capacity for conservation of water decreases. A site for stop dam should not be selected where the flow of the stream is curved. A site for stop dam should be chosen such that other stop dam and conservations are not affected by it.

Detailed survey:

On the topo-sheet mark the ridge line is to be marked for getting the area of conservation on the proposed stream.

If the area of conservation is less than 1 sq mile than actual survey should be done for finding out the area. If the area of conservation is more than 1sq mile, then with the help of toposheet we should look for another place.

As building of stop dam is highly technical, a senior engineer should be kept in charge of planning of the project for longevityof the dam.

As a result of blasting, cracks and gaps develop even in strong foundations. In these cases excavations should be done using chisel or hammer and impervious foundation should be built. Chisel and hammer should be used for digging of bottom (15 - 30cm) of the stream.

At places where strong rocky surfaces is available at shallow depth 20mm diameter rod, may be embedded 60cms in concrete and 60 cm in masonry. For this, holes of 35 mm should be drilled at the required distances. They should be properly cleaned. Then 200 rods (min length of 1.20m) should be grouted in these holes with the help of 1:1 cement mortar. This procedure will protect the dam from sliding, overturning and will also take care of tension.

If stones of same size are not available then big stones should be used near foundation and small stones should be used towards the top of the dam.

In order to protect the banks from side cuts, on the basis of HFL from the wing wall concrete structure should be made 50cm from HFL.

The height of stop dam should be lower than height of the banks as a result of which approach will not be damaged.

Chapter - 5 Techniques for Treatment of land

The flow of water and capacity to damage the soil increases without any obstruction, when rain water falls on a ridge. This water, eroding the soil reaches the bottom flat area of the area of conservation filling it with soil. Hence construction of dams on rivers and streams on low lands are useless unless proper arrangements are made for stopping erosion at the upstream.

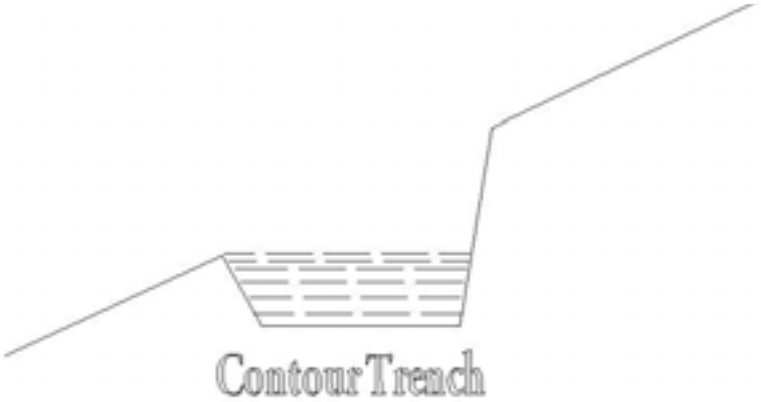
Methods of treatments differ according to the slope:

- If the slope is more than 25% then plantation of grass, bushes and trees is the simplest t procedure.
- If the slope lies between 10% - 25% then contour trench is more effective.
- If the slope is less than 10% then contour wall is more effective.

Contour Trench

Trench constructed along the contour lines is called contour trench. The line connecting points of equal levels is called contour line. Trench dug in these types of lines can store more water. Contour trench is a simple and economical solution for prevention of flow of water and soil erosion. If the slope of the ridge area is between 10% - 25% then it is the best solution for the treatment of that area.

Due to construction of contour trench speed of water is reduced. It also prevents soil erosion. Due to rain flow of water in ridges speeds up, but as contour trenches are dug along the ridge the water gets collected in these trenches.

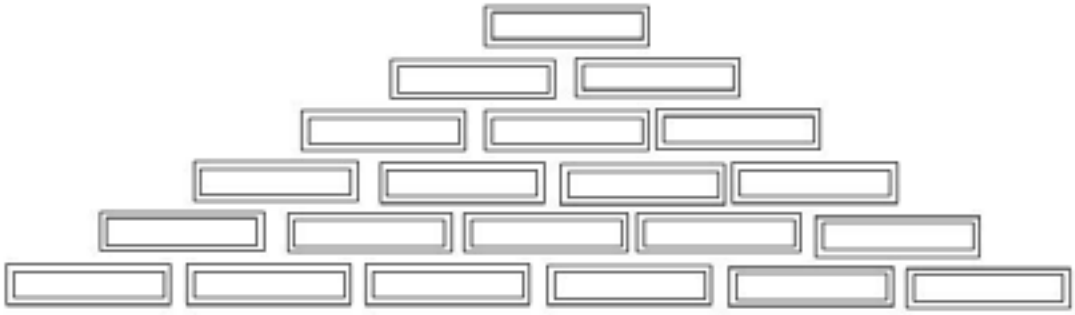


In this way when water gets collected in the trench the amount of moisture increases in the soil. Useful soil which comes along the flow of water also gets deposited in the trench.

For these reasons contour trenches should be built along with plantation. In one hand it helps in prevention of soil erosion and in other hand it helps for making fertilizers and comes in great use while plantation.

The distance between two consecutive trenches depends upon intensity of rain, water absorption capacity of soil, slope, and plantation. If an area has heavy rainfall then distance between two trenches will be less and vice-versa. If an area has fewer plantations then the distance between two trenches will be less.

The distance between two trenches should be 10m at minimum for higher slopes. The distance between two trenches should be 30m at maximum for lower rising slopes. Generally trenches are 50cm deep and 50cm wide. The soil dug out from the trench is kept 20cm away from the trench so that the trench doesn't get filled by the soil again. If grass plantation is to be done then make a square layer of 10cm height of the dugout soil and if tree plantation is to be done then repeat the same thing on both sides of the trench.



Contours

If we are making a continuous trench then it will be dug till we face a stream or a tree. These types of trenches are considerablylong. It is very difficult to find out that the trench is being dug at the same level.

If the trench is not dug at the same level then water flows from the higher region to lower region. This results in soil erosion and formation of small streams.

For this reason trenches should not be made continuous instead it should be made in pieces. In this case digging of trench is stopped after a distance then it is again started after some distance. To make sure that water doesn't flow away from the plain area a seriesof trenches are dug out at the next downstream contour. Dig the downstream trench in such a way that it is just alternate of upstream (dig a downstream trench where there is no upstream trench and vice-versa so that water is not wasted). In this way trenches are dug one by one.

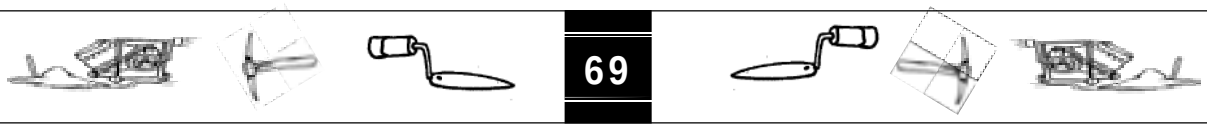
Things to remember while digging a Contour Trench:

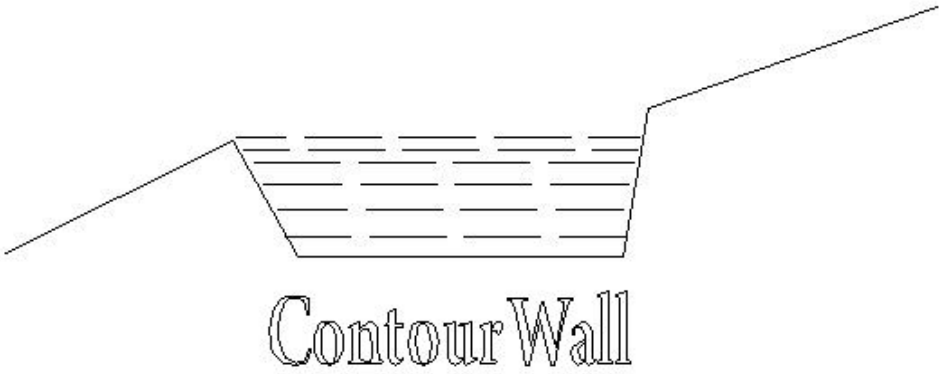
- Don't dig a contour trench if the slope is more than 25%.
- Don't dig a contour trench if the slope is less than 10%.
- Don't dig a contour trench where there is a heavy plantation.
- Do not do plantation inside the trench.
- Stop digging the trench if a big root of a tree is encountered.
- Don't dig a contour trench through a stream.

Contour Wall

If the slope of the ridge is 10% or less it will be proper to build a contour wall. Contour wall proves to be more efficient than contour trench for stopping water and soil. When wall is made at a contour then it is known as contour wall. In contour wall not only the trench retains the water but also the wall helps in stopping water.

The distance between two walls depends upon intensityof rain, capacityof water absorption of soil, slope and greenery.





absorption of water of soil is less than the distance between two walls will be less. If an area has fewer plantations then the distance between two walls will be less.

The minimum distancebetween two walls should be 30m for high risingslopes. The maximum distance between two trenches should be 60m at for low rising slopes.

Things to remember while digging a Contour Wall:

Height:

Height of the wall can be 60cm for pervious soil.

If a wall has been made in impervious soil there is a danger of overflow of water, as the water gets very less time for getting into the soil. If the water stands then there is a danger for wall and the area also becomes slushy. So the height of the wall should be 50cm less for impervious soil. An opening should also be present to make sure that excess water doesn't stand. There should be a distance of 20-50m between two consecutive walls.

Settlement of soil:

Every soil has its own behaviour, in which it contracts. When we build big earthen reservoirs and do not keep in mind the behaviour of the soil then the conservation can be in danger. So generally in earthen works a settlement allowance (settling of soil) is kept.

For pervious soil settlement allowance should be 20-25%.

For impervious soil settlement allowance should be at least 25%.

Width of top:

Width of top of pervious soil should be between 20 - 30cms

Width of top of impervious soil should be between 30 - 40cms. When the soil dries cracks develop in this type of soil. Making a turf is most essential, so that the roots can strengthen the wall.

Frontal Slope:

Front slope for pervious soil should be 1:1

Front slope for impervious soil should be 1.5:1

Back Slope:

Back slope for pervious soil can be 1.5:1

Back slope for impervious soil should be 2:1. Frontal slope of impervious soil should be less than back slope. This will help in reducing soil erosion, as water cannot pass through a large width.

Drainage:

It is not important to have a drainage system for plain pervious soil, but it is most essential to have an opening for the wall or else it may break. Fast moving water can break the wall. So there should be an opening. The opening should always be made up of stones. The height of the opening should always be lesser than the height of wall, so that there will be no overflow.

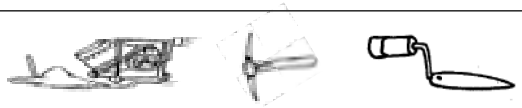
For impervious soil the drainage should be in the front. Excess water should be drained in this way. Give a passage which utilizes the slope and water is discharged to a natural stream.

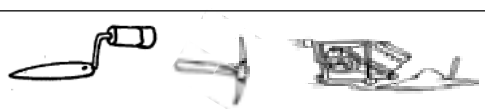
Excavation of soil for building of wall:

Digging of soil should not be continuous otherwise a channel will be formed which will erode the soil. A solution to this would be to make small excavations so that water and soil will be stored. After excavating for 10m leave a gap of 1m. The width of the holes should be 1m.

At the end of excavation it is essential to make a 90 degree projected teeth coming out of wall. The teeth should be almost 2m long and 30cm high. If stones are available complete the teeth with stones. Otherwise openings with stone should be kept in the teeth, made up of soil.

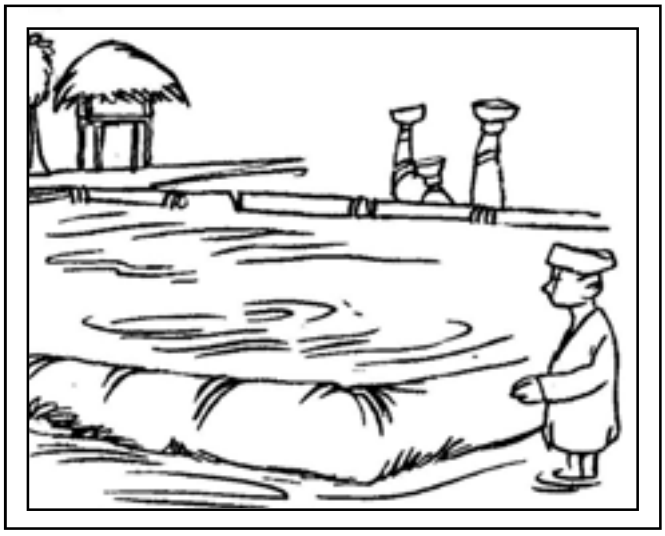
The distance between the dugout area and wall should be at least 30cm, so that the soil will not enter the dugout area again. Turf should be made properly such that it would provide strength to the wall.





Small walls around farming land

Small walls are made around the farming land to prevent it from soil erosion and also for controlling moisture. In our countrythe rain water flows away from the farminglands in just few hours. The rain water flows away the fertilized soil to the streams and then to the rivers.For this reason big cracks develop in the farming land. Every year in India 533crore ton soil is wasted due to soil erosion and nearly 50 - 80 ton minerals are wasted. It needs about 10000 years for creation of 2.5cm cultivable soil. If we can prevent soil erosion we can increase the food production by nearly 30 - 40%.



Creating small walls around the farming land helps in maintaining moisture, creating a balance and betterment of situation. The main aim of creating walls around a pervious sandy land is for conservation of required water for moisture control.

The main aim of creating walls around an impervious land is for creating a proper drainage. In one way we are thinking for creating a stock of water in the land and in anotherway we are thinking of drainage of excess water so that plants are not affected by extra water. Creation of walls is a must for rice farms whatever may be the land condition.

Planning for construction of walls in agricultural land:

Creation of walls around a land is not made for a single land only.As water comes down to the lower lands from the upper lands and the water again gets away from the lower lands through openings, so planning should be done taking the slope in consideration.

If the farmer from the upper land does not agree for making of wall then we can make an opening in our wall. In this way we can make our own wall without asking the farmer of upper lands. But if the farmer below our farm land does not agree for making a wall then we can't make a wall as excess drained water can destroy the crops. So for this reason we have to consult the farmers of lower lands before making a wall.

Distance between the walls:

The consecutive distance between two walls should be 30 - 80m. This distance depends solely upon the slope of the land. If the slope is more than 30 - 80m then distance will be less and vice-versa. In slope area we have to make more number of walls.

Procedure to make walls:

- **Height:**

For pervious soil the height can be 60cm. For making walls on impervious soil there is always a danger for overflowing of water, as the soil takes more time to absorb water. If the water stands on the soil for a longer period then the area becomes slushy. So the height of walls should be 50cm. To make sure that excess water is drained out make an opening. The distance between two walls should be 20 - 50m.

❖ **Settlement of soil:**

Every soil has its own behaviour, in which it contracts. When we build big earthen conservation areas and do not keep in mind the behaviour of the soil then the conservation can be in danger. So generally in earthen works a settlement allowance (settling of soil) is kept. For pervious soil settlement allowance should be 20-25%. For impervious soil settlement allowance should be at least 25%.

❖ **Width of top:**

Width of top of pervious soil should be 20 - 30cm.

Width of top of impervious soil should be between 30 - 40cms, when it dries, cracks develop in this type of soil. Making a turf is most essential, so that the roots can strengthen the wall.

❖ **Frontal Slope:**

Front slope for pervious soil should be 1:1. For sandy soil slope should be 0.75:1.

Front slope for impervious soil should be 1.5:1

❖ **Back Slope:**

Back slope for pervious soil can be 1.5:1

Back slope for impervious soil can be 2:1. Frontal slope of impervious soil should be less than back slope. This will help in reducing soil erosion, as water cannot pass through a broader width.

❖ **Drainage:**

It is not important to have a drainage system for plain pervious soil, but it is most essential to have an opening for the wall or else it may break. Fast moving water can break the wall. So there should be an opening. The opening should always be made up of stones. The height of the opening should always be lesser than the height of wall, so that there will be no overflow.

For impervious soil the drainage should be in the front for excess water. There should be

a provision for a passage that utilizes the slope and water is discharged to a natural stream. But to prevent soil erosion in this passage grass should be grown over it and trench should be dug at every 10 - 20m and filled with stones. These trenches will be protecting the stream from erosion as well as maintain the smooth flow of water.

For safety the opening should be at the bottom most area. To check all the water from flowing out of the wall, the opening should be made just above the bottom most point. Hence, it becomes important for us to strengthen the point just below the opening as the pressure of water will be maximum in this area.

Excavation of soil for making of small wall:

Never dig continuously as a drain is made. Water will flow away from this drain which will again cause soil erosion. So always stop after small distances so that small trenches are made that will check soil erosion. After digging for about 10m the digging should be stopped for 1m. Width of the trench should be 1m.

At the place where digging has been stopped teeth should be made as coming out from the wall. The teeth should be at an angle of 90degree. The teeth should be almost 2m long and 30cm high. If stones are available then the teeth should be made completely with stones. Otherwise openings with stones should be made in the teeth. A series of holes and teeth will hence be made in which water will be stored to minimize soil erosion. At his sweet will, a farmer can dig two types of trenches:

1. Deep and narrow

2. Shallow and wide.

By making shallow and wide holes the farmer can plant crops which can be grown in water e.g. rice. But by making deep and narrow holes lesser amount of land is used and hence more space is available for farming.

Digging of trenches completely depends on the farmer. He can dig any type of trench according to his wish. Holes may be dug in any style; it will still be filled with soil in a few years. Plantation of grass or crops on the walls around the field will strengthen the walls thus minimizing soil erosion.

While making the wall around the field, care should be taken to keep the surface of the wall uniform everywhere. The distance of the surface measured from the ground may vary from place to place.

UNIT - IV

Chapter - 1 Rate chart for materials

Rate chart for important works:

In this chapter we are showing the rate chart (Current Schedule Rate) for some of the important things decided by Rural Engineering Services.

This rate chart may vary from situation to situation, so before using this rate chart it is important to compare it with the chart available in your district. This rate chart was scheduled rate chart for 2001 circulated by Rural Engineering Services.

Rate for conveyance of materials:

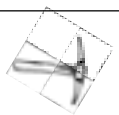
Distance to travelled	Rough stone, metal, khoa, and suriki, morum, laterite stone, gravel, fly ash and earth etc (per cum)	Brick, - 2500 nos, fly ash blocks	Iron Grills, cement, AC, GCI sheet 1000 KG/(per 1,25 cu		Bulky materials like machinery, conc...pipes & furniture (per truck)
1	2	3	4	5	6
Upto 5 km	85.00	583.00	92.00	90.00	775.00
Every extra KM beyond 5 km to 50 km	5.00	24.00	5.00	5.00	24.00
Every extra km beyond 50 km	3.00	18.00	4.00	4.00	18.00

Extra percentage allowed over the rates:

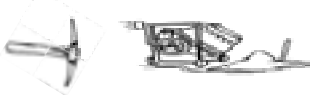
- For earth roads or village track or country tracks 20% may be allowed on the certification executive engineer after his inspection and dully approved by the superintending engineer.

- For declared ghat road add extra length of ghat road portion.

Serial No:	Item in C.S.R	Name of work	Rate/Unit
1	0301 B	Excavation in ordinary soil and disposal of soil within a lead of 50m and lift up to 1.5m with levelling of bottom of excavated pit.	Rs 23.20 / cu. m
2	0301 C	Excavation in hard moorum soil and disposal of soil within a lead of 50m and lift up to 1.5 m with levelling of bottom of excavated pit.	Rs 30.70 / cu. m
3	0303 B	Excavation in hard soil and filling in embankment more than 20cm thick layers, watering and compacting with earth rammers.	Rs 28.30 / cu. m
4	0303 C	Excavation in hard moorum filling in embankment more than 20cm thick layers, watering and compacting with earth rammers.	Rs 31.90 / cu. m
5	0302 A	Excavation in soft soil by manual means.	Rs 77.10 / cu. m
6	0302 B	Excavation in hard soil under the tunnel.	Rs 98.40 / cu. m
7	0302 C	Excavation in hard soil by manual means.(where tunnel is prohibited)	Rs 162.90 / cu. m
8	0321	Cleaning of dry soil in culverts and waterways	Rs 12.80 / cu. m
9	0101	Cleaning of construction site(dust, scrap, grass and bushes)	Rs 0.60 / sq m
		Concrete Work	
10	0401	Filling of available earth in trenches, foundation and plinth in layers not exceeding 20cm, watering and compacting with earth rammers up to a lead of 50cm and a height of 150m.	Rs 12.80 / cu .m
11	0402	Filling of hard moorum, watering and compacting with earth rammers.	Rs 51.80 / cu. m
12	0406	Laying of 40mm graded aggregates and moorum in foundation and plinth, watering and compacting with earth rammers.	Rs 302.20 / cu. m



Serial No:	Item in C.S.R	Name of work	Rate/Unit
13	0413	Cement concrete using 40mm graded aggregates	
14	0413 A	With 1:2:4 mix	Rs 1309.60 / cu. m
15	0413 B	With 1:3:6 mix	Rs 984.40 / cu. m
16	0413 C	With 1:4:8 mix	Rs 839.00 / cu. m
17	0413 D	With 1:5:10 mix	Rs 722.60 / cu. m
18	0413 E	With 1:6:12 mix	Rs 664.50 / cu. m
19	0416 A	Extra for using 20mm aggregate in place of 40mm graded aggregates.	Rs 75.20 / cu. m
20	0416 B	Extra for using 12mm aggregate in place of 40mm graded aggregates.	Rs 78.00 / cu. m
21	0418	Extra for removal of water or slush during concrete work.	Rs 28.00 / cu. m
		R.C.C (Reinforced Cement Concrete)	
22	0425	Cement concrete with 20mm aggregate and M.S reinforcements using Vibrator.	Rs1419.80 / cu. m
23	0433	Cement concrete with 20mm aggregate and M.S reinforcements using Vibrator.	Rs1315.80 / cu. m
24	0428	Shuttering work	Rs101.10 / sq m
25	0439	Filling brick bats in dry pits or trenches	Rs136.10 / cu. m
	0508	Stone masonry	
26	0508 A	With 1:4 mortar	Rs 924.90 / cu. m
27	0508 B	With 1:5 mortar	Rs861.90 / cu. m
28	0508 C	With 1:6 mortar	Rs807.90 / cu. m
	0605	Brick masonry	
29	0605(1)	With 1:3 mortar	Rs1042.10 / cu. m
30	0605(2)	With 1:4 mortar	Rs960.20 / cu. m
31	0605(3)	With 1:5 mortar	Rs916.10 / cu. m
32	0605(4)	With 1:6 mortar	Rs878.30 / cu. m
33	0903	M.S. doors and windows	Rs 28.80 / kg
	1007	15mm Cement Plaster	
34	1007 A	With cement mortar 1:4	Rs41.80 / sq m
35	1007 B	With cement mortar 1:5	
36	1007 C	With cement mortar 1:6	



Serial No:	Item in C.S.R	Name of work	Rate/Unit
	1009	20mm Cement Plaster	
37	1009 A	With cement mortar 1:4	Rs 66.30 / sq m
38	1009 B	With cement mortar 1:5	Rs 61.50 / sq m
39	1009 C	With cement mortar 1:6	Rs 57.30 / sq m
40	1272	22cm thick stone pitching(on pond embankment)	Rs 71.50 / sq m
41	1801	Collection of clay and making puddle at construction site.	Rs 32.20 / cu .m
42	1803	Collection of hard moorum at quarry site	Rs 37.50 / cu .m
43	1813	Collection of 20 – 25cm size stones for pitching	Rs 102.60 / cu .m
44	1819	Sieving of sand	Rs 9.70 / cu .m
45	1820	Washing of sand/ aggregate	Rs 26.80 / cu .m

Chapter-2 CPR Management under NREGA for Drought & Flood Control

The Common property resources of the villages are categorized as livelihood sources of the vulnerable communities. The areas like, Pasture, water bodies, drainage lines, Road and embankments, Institutional land, forest of all types, grave yard, temple lands, waste land, cultural wasteland, gullies, rocky area and reserved lands can be brought production Under NREGA planning .

Sl No.	Nature of land	Proposed works and production techniques under NREGA for CPR management
1	Forest land	Stone contour bunding, stone wall, water absorption contour trench. Crescent bund`V- trench,. Miscellaneous plantation, shelter plantation
2	Pasture	Protection trench, Contour stone /earth bunding, Silivi pasture Plantation
3	Road	Brass wood gabions, Avenue plantation.
4	Embankments	Grass turfing, stone turfing, repairing, breach of bunds ,
5	Waste land	Water harvesting structures, Contour stone /earth bunding, Land reclamation, Land levelling. Block plantation, Medicinal plants., Dry land orchards

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