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DEPARTMENT OF CIVIL ENINEERING

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590014

PROJECT REPORT

ON

"EXTENSIVE SURVEY PROJECT-18CVEP68"

(From 29/03/2021 to 12/04/2021 Held at Kempegowda Layout, Bengaluru)

Submitted in the partial fulfillment of the requirement for the 6th semester

BACHELOR OF ENGINEERING

In

CIVIL ENGINEERING

Submitted by

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2020-2021

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CERTIFICATE

This is to certify that **SATHISH CHOUDARY(1DB16CV038),RANJAN GOWDA M(1DB18CV425), MD SHUKRULLA KHAN(1DB18CV019), SANDESH K GOWDA(1DB18CV031), SUVARNA(1DB18CV039), POORVIKA M R(1DB19CV406), SATHISH T C(1DB19CV408)** have successfully completed the **"EXTENSIVE SURVEY PROJECT-18CVEP68" from 29/03/2021 to 12/04/2021** held at Kempegowda Layout, Bengaluru, prescribed by the Visvesvaraya Technological University as a **partial fulfillment of academic requirement for6th semester of Bachelorof Engineering in Civil Engineeringcurriculum for the year 2020-2021.**

Mr. Sadashivaiah Assistant Professor (Camp Officer)	Dr. R L Ramesh Professor & HOD	Dr.HemadriNaidu T Principal

Examiner-1……..

Examiner-2……..

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DECLARATION

We **SATHISH CHOUDARY(1DB16CV038), RANJAN GOWDA M(1DB18CV425), MD SHUKRULLA KHAN(1DB18CV019), SANDESH K GOWDA(1DB18CV031), SUVARNA(1DB18CV039), POORVIKA M R(1DB19CV406), SATHISH T C(1DB19CV408)** Students of sixth semester, **B. E in Civil Engineering, Don Bosco Institute of Technology,**hereby declare that the entire work embodied in this **"EXTENSIVE SURVEY PROJECT-18CVEP68"**has been carried out by usand submitted in partial fulfilment of the 6th semesterAcademic requirement of **B. E. in Civil Engineering, Visvesvaraya Technological University, Belagavi,** during the academic year **2020-2021**. Further the matter embodied in this report,has not been submitted previously by anybody or to any other university.

Signature of the Candidate

SATHISH CHOUDARY(1DB16CV038) **RANJAN GOWDA M(1DB18CV425)**

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NEW TANK PROJECT (NTP)

Project In-charge: Prof. Raghavendra D

CONTENTS

1.Introduction

New tanks are constructed to provide water for multipurpose. Tanks and reservoirs requires careful planning, design, and operation for which certain observations relating to selection of site, relative merits of different types of tanks, storage capacity, coordinated use of storage for different purposes etc. are studied in detail.

The formation of new tank near **SHREE KSHETRA MUKTHI NAGA TEMPLE** has taken up as mini project work as per university regulations.

2.Object of New Tank Project

The main object of the new tank is to construct an earthen dam across the steam for the purpose of irrigation. Since the land to be irrigated is very small and population of the town is very less, it is not necessary to construct a major work but it is sufficient to provide minor tank project.

The new tank project (NTP) involves three major operations.

- The Selection of site for proposed dam
- The selection of site for waste weir
- The selection of site for canal alignment

3. Study of Toposheet

This sheet gives the topographical features of the locality like alignment of a railway line, roadway, streams and its distributaries and permanent structures located in that locality. This map helps in selecting the site for a new tank and also gives clear picture of transportation to the proposed area in proposed site for the transportation of men and material for their construction. From this we can know the approximate catchment area of site. This map has to be study before reconnaissance survey.

4.Reservoir

A storage structure for irrigation is formed by an embankment or dam across a natural water course or river and the water collected on the upper side of the structure. Water is drawn by means of the sluices in the dam, through the channels which supply water to the irrigation land.

- **Necessity:**

Storage reservoirs are very much necessary for the following reasons;

- When in an area, the usual rainfall is not enough for the crops; water is stored in reservoirs and allowed to lands whenever necessary.
- In some areas, the rainfall may be confined to certain parts of the year, and even here water will have to be first stored and then distributed to the lands during the other periods of the year.
- In the places like Baluchistan and Rajasthan, where the streams flow like torrents for only a few days in the year, storage is a necessity to endure the proper water supply to the crops.

- **Requirements of A Storage Reservoir**

An ideal reservoir should satisfy the following conditions:

- It should have a channel bringing down an ample supply of water
- There should be a board expense of nearly level ground in front of embankment or dam to form the bed of the reservoir, having a slight dip towards the bund.
- The land to the rear or the downstream side of the bund should be much greater extent than the bed and slightly lower in level, in order that every portion of it may be commanded by the tank and the water to the fields.
- Rock or other foundation, impervious to water, should be met at only a small depth from the surface.

- Stone, fuel, lime and other materials required for the construction should be available within a reasonable distance for a masonry dam and good suitable earth, as well as stones for pitching, for an earthen dam.
- The soil for the construction of earthen dam for the reservoir should be retentive nature.
- Valuable garden lands or wells or village sites submerged under the reservoir contour.
- The site selected should give the required storage with the shortest length of the dam.
- The site should be favourable to locate the waste weir preferably in a saddle, so as to pass off all the flood water into the natural drainage steam without artificial ones and protects the embankment.

5.Dam

A Dam is an impregnable and impervious barrier thrown across a natural drainage line to impound water up to a certain limiting height which is usually lower than the top of the dam on its upstream side. Its main function is to store water either for irrigation or water supply or produce power.

Choice of the type of the dam: -

- **Classification of Dams**

Dams are usually classified as

Rigid dams.

1. Gravity dam
2. Arched dam
3. Arched buttress dam
4. Steel dam
5. Timber dam
6. Reinforced cement concrete panel and buttress dams.

Non – rigid dams

1. Earthen dams.
2. Rock fill dams.

- **Earthen Dams**

Earthen dams and earthen embankments are the most ancient type of embankments as they can be built with the natural materials with a minimum of processing and with primitive equipment. Earthen dams are classified as follows:

Type A – Homogeneous embankment type

Type B – Zoned embankment type

Type C – Diaphragm type

- **Homogeneous embankment:**

The simplest type of earthen embankment consists of a single material and is homogeneous throughout sometimes a blanket of impervious material may be placed on the upstream face. A purely homogeneous section is used when only one type of material is economically or locally available such sections is used for low to moderately high dams and for large dams are designed as homogeneous embankment.

- **Zoned embankment:**

Zoned embankments are usually provided with a central previous core, covered by a comparatively previous transition zone which is finally surrounded by much more previous outer zone. The outer zone gives stability to the central impervious fill and also distributes the load over a layer area of foundation.

- **Diaphragm embankment: -**

Diaphragm type embankment has a thin impervious core, which is surrounded by earth or rock fill. The impervious core called diaphragm is made up of impervious soil, concrete, steel, timber or any other materials. Its acts as a water barrier to prevent escape through the dam. The diaphragm may be placed either at the central or at the upstream face as a blanket.

The commonly adopted standards used for finding the dimension of tank bund in the south India.

Sl No	**Depth of deep bed level below F.T.L(m)**	**Free board(m)**	**Width of top of bund (m)**
1	1.5 to 3.0	0.9	1.2
2	3.0 to 4.5	1.2	1.5
3	4.5 to6.0	1.5	1.8
4	Over 6.0	1.8	2.7

The favourable soil, such as red and white gravel, red and black looms, etc… the slide slope of the bund may be kept as 1.5:1 for smaller tanks with water depth not exceeding 2.5 and 2.1 for larger ones above 5m depth. In tight sandy soil pr black cotton or clay soil however the slope may be kept between 2.1 and 2.5:1. The upstream face of the tank bund is generally lives bed against stone apron or so as to protect it against erosion and if this is done then the upstream face is generally adopted and 1.5:1 even up to 6m depth for inferior soils are greater depth however the riveted slope may be flatter, say 2:1

- **Core (Hearting):**

Core or Hearting is clay type of material provided mainly to prevent seepage through the body of the dam. The different types of clay silt for suitability of construction or core is provided in Table No.1 under the heading **"Rolled Earth Dams."**

Tank Irrigation

Tank irrigation may be defined as the storage irrigation scheme which utilize the water stored on the upstream side as a smaller earthen dam called as "Bund"

These earthen bunds reservoirs are thus in fact called as "Tanks".

Especially in south India, where such works are very common. This terminology is limited to India only. There is no technical relationship between the reservoir and tank except that a large sized tank will be termed as reservoirs. More over a reservoir will be generally formed by dam of any materials such as masonry dam. Concrete dam, earthen dam (tank) is generally said to be formed to earthen dam as earthen bund. Most of the existing tank in South India passes a maximum depth of 4.5m while a few is as deep as 7.5m to 9.5m and only a few are exceptional one which exceeds 11m depth. When the depth of the tank exceeds 12m or so then the tank is generally said to be reservoir.

Like all earthen bunds, tank bunds are generally provided with sluice or outlets for discharging water from the tank for irrigation and other purposes. These tank sluice may be pipes or rectangular as arched opening passing near the base of the bund. For carrying the water to the dam downstream side channel below the bund transporting at distance where required through pipes or canals. Sometimes these supply sluices may not be carried adjacent to it through hill side one end of the bond.

Similarly, tanks are provided with the arrangements for the spilling the excess, surplus water that may be enter into the tank so as to avoid over lapping of the tank bund. These surplus escape arrangements may be in the form of the tank bund or some other arrangements like siphon spillway may be provided in the case of the earthen dam project. The surplus escape weir in a masonry weir with its top i.e. crest level equal to full tank level [F.T.L] when the tank is full of up to F.T.L and extra water come in, then it is discharged over the surplus escape weir, surplus escape weir will also be designed that water level in the tank never exceeds the maximum water level, the top of the tank bund will be kept at a level so as provided a suitable free board and the maximum water level [M.W.L].

Since the surplus escape weir is a masonry weir then it will have to be properly connected to the earthen bund by suitably designed tank connection.

Types of Levelling

Direct levelling

Indirect levelling

Direct Levelling

1. **Simple Levelling:**

   When the difference of the level between two points is determined by setting the levelling instrument between the points. This process is called as simple levelling. Suppose it is required to know the difference of level between A and B. The instrument is setup at 'O' exactly mid in between A and B after proper adjustment. The staff reading on A and B are taken. The difference of these reading gives the difference in level between A and B.

2. **Differential Levelling**:

   This is adopted when The points are at a great distance apart.

   - The difference of elevation between the points is large.
   - There are obstacles between the points.

This method is also known as a compound levelling or continuous levelling. In this method, the level is setup at several comfortable positions and staff readings are taken at these points.

3. **Fly levelling:**

When the differential levelling is done in order to connect a benchmark to the starting point of alignment of any project is called as fly levelling.

In such levelling only, back sight and fore sight readings are taken at every setup of the level and known distances are measured along the direction of levelling. The level should setup just mid where between back sight and fore sight.

4. **Longitudinal or Profile Levelling**:

The operation of taking levels along the centre line of any alignment (Roadway, Railway, Central) at regular intervals is known as longitudinal levelling or profile levelling.

In this operation, the back sight, intermediate and fore sight readings are taken at regular intervals at every setup of the instrument. The chainage of points is noted in the level book. This operation is carried out in order to determine the undulation of the ground surface along the profile line.

5. **Cross – Sectional Levelling:**

The operation of taking levels transverse to the direction of the longitudinal level is known as cross – sectional levelling.

The cross – sectional are taken at regular intervals along the alignment.

Cross - sectional levelling done in order to know the nature of the ground across the centreline of any alignment.

6. **Check Levelling:**

The fly levelling is done at the end of the day's work to connect the finishing point with the starting point on that particular day is known as check levelling.

It is undertaken in order to check the accuracy of the day's work.

Irrigation:

Irrigation may be defined as the process of artificial supply of water to soil for raising crop. It is a science of planning and designed of effective low cost, economical irrigation system tailored to fit the natural conditions. It is the engineering process of controlling the various natural sources of the water by the construction of dam and reservoir, canal and headwork and finally distributing the water to the agricultural field. Irrigation engineering involves the study and design of work in connection with river-controlled drainage of water logged areas and generation of the hydroelectric power.

Methods of Irrigation

Irrigation is classified as two methods;

1. Flow irrigation
2. Lift irrigation

1.Flow irrigation:

Flow irrigation is the method of taking water to the land to be irrigated by the flow of gravitation. The water is stored at such a level in reservoirs, tanks that it can be easily transmitted to the irrigating lands by gravitation through canals.

The classifications of flow irrigation are:

- Perennial irrigation
- Inundation irrigation
- Direct irrigation or River canal irrigation
- Tank irrigation or Storage irrigation

2.Lift irrigation:

When the water available for irrigation is at a lower level than the land, then it has to be lifted by pumps or other water lifting devices and this method is known as lift irrigation. This water is sometimes stored in the tanks and then distributed to the lands by gravity system.

6.CANAL:

Canal is passage for the flow of the water from reservoir or tank to an irrigational field or any other field necessary. Water in a canal flow under gravity and the upper most surface of the water is sometimes stored in the tanks and then distributed to the lands by gravity system.

➢ Classification of Canal

1.Based on The Canal Alignment

- Contour canal
- Water shed canal
- Side slope canal

2.Based on Distribution System

- Main canal
- Branch canal
- Major distributary □Minor distributary □Water courses.

➢ Guidelines for Aligning A Canal

- The alignment should follow a falling contour and shall be in 'cutting'. □The depth of the cutting should be minimum.
- Alignment should be straight.
- Curve should be long, minimum radius should be twenty times the bed width of the canal.
- Number of cross drainage works should be minimum.
- Longitudinal slope of the canal bed should provide non – silting and non – scoring velocity of flow.
- Alignment shall progress as far away from natural drain to yield large command area.

1.Longitudinal Slope for Canal

Longitudinal slope shall be as possible and guided by minimum permissible velocity in the channel should neither be silting non – scoring. The value generally varied from 1 in 2500. It depends on natural terrain and type of the canal.

2.Slide Slope of The Canal

Slide slope of the canal is an important feature in canal generally steeper slope section, narrower, deeper, increased velocity and discharge permits width. It also decreases evaporation and percolation loss. Slide slope is falling 1.5:1 is generally used in the hard and rocky soils.

3.Type of Canal Cross - Section

1.Fully embankment

2. Partial cutting and partial filling
3. Fully cutting

7.Surveys Conducted for The New Tank Project

Reconnaissance

A site for the new project will be fixed based on the following preliminary investigations.

- Catchment area of a place
- Average rainfall of a place
- Suitable site for the bunds, weirs and sluice Extent land to be irrigation with nature of the crop.
- Available of the construction materials.
- Financial feasibility of the project.

Longitudinal and Cross Section Along the Centre Line Of The Bund

- From the permanent benchmark fly levels are carried out to establish a benchmark on the left bank or right bank wherever the work is to be started.
- The end points of the bund are fixed and the wooden pegs are driven at regular intervals.
- The centre line bearing is noted using prismatic compass
- From both the ends of bund bearing to the permanent object such as transformer, electric pole, building etc...
    - Above the centreline of the bund already fixed longitudinal section at every 15m interval on centreline and cross section at 30m interval up to or beyond the embankment cases on either side taken 5m interval.

Height of the bund = tank bund level = ground level base = width of the bund =

[U/S slope X Height + Top width + D/S slope X height] .....(1)

The day's work is constructed at temporary benchmark established.

- **Bench Levelling at Waste Weir**
  - The top of the weir should be at FTL. Fix the centreline and mark left and right points.
  - Construct a block of 60m length on U/S side and 40m length D/S side.
  - Carry out block levelling at every 5m interval.
  - Work is started and closed at established bench mark.

- **Block Levelling at Tank Sluice**
  - RL of the canal at tank, take a point on the centre line of the bund.
  - Construct a block of 30m along the centre line and 60m on side of the centreline.
  - Divide this entire area into smaller block of 5m X 5m Carryout the block levelling along the point.
  - Start and close down the work with respect to the permanent benchmark.

- **Survey for The Capacity Contour**

In order to plot the contour FTL, LWL, MWL, surveying for water spread contours was conducted due to certain physical constraints, indirect levelling is adopted.

Radial levelling is carried out at U/S side using the following procedure:

- Prismatic compass was fixed on the centreline of the bund such that main area could be covered on the U/S side.
- Radial lines at an angle of 0,30,60,90,120,150 and 180 were set out from the compass point.
- Fly levelling was adopted to carry benchmark from permanent benchmark to compass point.
- Staff readings were taken along the radial lines at 15m interval.

- Cross – section were taken along with radial lines at 15m intervals.
- The cross section was increased along the radial lines such that the whole upstream side is covered.
- The work is closed by the fly levelling on established benchmark.

➢ Impartment Definition

- **Crop Period**:

  it is the time taken by crop from the instant of its sowing to harvesting.

- **Base Period:**

It is the period during which the water supplied to the crops to bring the crop to maturity. The base period is slightly less than the crop period. It is donated by the letter B.

- **Duty of Water:**

It is defined as number of hectares brought to maturity by a constant flow of water per second during the crop period or it is the relationship between the volume of water and area of crop brought to maturity. It includes both cultivable and non-cultivable area. It is given by the formula

D= 864 B/Δ

Where,

Δin Cm. [delta]

B in days [Base period]

D in hectares /cumecs. [Duty]

- **Delta:**

Each crop requires certain quantity of water at regular intervals of time throughout its period. If this total quantity of water is made to stand without any lose on an area, the depth of water required per hectare for the full growth of crop is called as delta. It is expected by a symbol.

Delta = depth of each watering X number of watering

- **Water Requirement of Crops**

For the successful growth of the crops, every crops require a definite quantity of the water, suitable agricultural soil, good irrigation and the proper method of cultivation. The total quantity of water required by a crop from the instant of sowing till it comes to the harvesting is known as water requirement of crops. It depends upon the following.

- The season in which the crop is growing
- Its period of the growth i.e., its crop period
- The climate condition of the region
- The rainfall in the season
- The water requirement of a crop varies from the place to place from season to season

8. Investigation for The Reservoir Planning

The following investigations are required for reservoir planning;

1. Engineering survey
2. Geological investigation
3. Hydrological survey

1.Engineering Survey: - The area of the tank site is surveyed in detail and a control point is prepared from the plan. The following physical characteristics are obtained.

- Area of elevation curve
- Storage elevation curve
- Map of the area
- Suitable site selection for tanks

2.Geological Investigation: - In almost all civil engineering projects geological advice is most essential. Geological investigation cost very little in the comparison to the total cost of the project. Geological investigations are required to give detailed information about the following points.

- Water tightness of reservoir basis
- Suitability for foundation of the bund.
- Geological and structural features as floods and faults Type and depth of the rocks at basin.
- Location of permeable and soluble rocks if any.

3.Hydrological Investigation: The hydrological investigations are very important aspects of reservoir planning. These investigations may be designed in two needs.

- Study of run – off patterns at the proposal bund site to determine the storage capacity corresponding to the given demand.
- Determination of hydrograph of the worst flood at reservoir site to determine the spillways capacity and design'.

➢ Storage Zones of Reservoir

- **Dead Storage**:

It is the volume of the space provided for the deposition of the sediments in a reservoir. It is the level below which water is not stored. It is not of much use in the operation reservoir.

- **Live Storage:**

The volume of the water stored between dead storage and full tank level is called the live storage. Live storage assures the supply of water for specified period of time to meet the demand.

- **Maximum Water Level**:

The maximum level to which the water level rises during high flood is known as maximum water level. During floods, the maximum water level run – off will take place and water level rises to this level.

- **Full Tank Level**:

It is the maximum elevation to which the reservoir water surface rises during normal operation condition.

- **Sill Level of Sluice**:

It is provided at the minimum storage as dead storage level.

- **Top of the bund level**:

It is fixed considering the aspects of the free board to prevent overtopping of the dam.

9. Selection of Site for The Reservoir

The final selection if site for a reservoir depends upon the following factors;

1. The geological conditions of the catchment area should be such that percolation losses are minimum and maximum runoff is obtained.
2. The reservoir site should be such that quantity of the leakage through it is minimum, reservoir site having the presence of the highly permeable rocks reduce the tightness of the reservoir.
3. Suitable dam site must exist. The dam should be founded on water tight rocks base and percolation below the dam should be minimum. The cost of the dam is often a controlling factor in selection of the site.
4. The reservoir basin should make narrow opening in the valley so that length of the dam is less.
5. The cost of the real estate for reservoir including road, soil, road welling, etc.., must be less as for as possible.
6. The topography of the reservoir site should be such that it has adequate capacity without submerging excessive properties.
7. The reservoir site should be such that it avoids as excludes water from these tributaries which carry high percentage of silt in the water.
8. The reservoir should be such that the water stored in it, suitable for the purpose for which the project is undertaken.

10. Weir

Weir is a structure constructed at right angles to the direction of the flow. Its purpose is to raise the water level and then divert it into the canal. As the tanks are the small storage works constructed to meet the local requirements obvious by attempting is not made to contain full run off coming down from the catchment area. It is therefore necessary to make suitable arrangement to pass from the excess water beyond F.T.L. The structure constructed to provide passage to excess water is called as "escape weir". It is also called as a "Tank surplus weir".

The Water starts spilling over the weir as soon as tank is filled up to its crest. However temporarily due to rush of incoming water. The level in the tank raises above F.T.L., the new level is reached is called as "maximum water level" [M.W.L.]. It depends on the extent of the flood for the design purpose M.W.L is calculated taking into the account maximum flood discharge likely to carry and water may be available at the site for escape weir. The surplus as spill way water is carried down through a channel which is generally a natural discharge and has an enough capacity. As weir may be constructed in the masonry, rock fill, cement concrete etc.

- **Types of Weir**

Escape weir constructed in the tank irrigation system is similar to a diversion weir are constructed across the river channel.

It may be classified as following types;

1.Masonry Weir

- Masonry with the horizontal floor.
- Masonry weir with depressed floor.
- Masonry weir with stepped floor.

2.Rock Fill Weir

3.Concrete Weir

11. Selection of Site for A Weir

Following are the point may be taken into consideration while selecting a site for a tank weir.

- Tank weir performs the function of the surplus excess flow therefore it is preferable to locate the weir in a natural saddle away from the tank bund.
- To carry surplus flow existence of a well-defined escape channel is very necessary at a site selected for the construction of a weir.
- The saddle where natural surface level us approximately same as tank level [FTL] should be given first performance.
- Hard foundation if available at the site reduces the cost of the construction.
- When a site is away from the tank bund is not available as for as possible weir may be located on one end of the tank bund.
- Surplus weir may be hosed in the body of the tank bund only as a last resort.
- Care should be taken to see that escape channel surplus water is not likely to damage cultivated land.

12. Lining of Canal

The impervious layer which protects the beds and sides of the canal is called canal lining.

- **Necessity of Canal Lining**

Following are the necessity of the canal lining.

- To minimize the seepage losses in the canal.
- To increase the discharge in canal selection by increasing the velocity.
- To prevent erosion of the bed and sides due to high velocity.
- To reduce maintenance of canal.

- **Requirement of Canal Lining Materials**
  - The materials used for lining should provide the water tightness The materials chosen should be strong and durable.
  - The materials should withstand the high velocity.
  - The materials used should resist to the growth of weeds and attack of animals.
  - The material should permit the construction of the required slope easily.

Types of Canal Lining

The Canal lining are of following types:

- Cement concrete lining.
- Brick lining
- Cement mortar lining
- Asphaltic lining
- Soil – Cement lining
- Sodium – carbonate lining
- Precast concrete block lining

- **Reservoir Sedimentation**

The deposition of sediment in the reservoir is known as “reservoir silting” or “reservoir sedimentation”. Every river carries certain amount of sedimentation load. The sediment particles try to settle down at the bottom of the reservoir due to gravitational force that may be kept in the suspension due to upward currents in the turbulent flow which may overcome the gravity force. These sediments will settle down in the reservoir because of less velocity inside the reservoir.

The deposition of the sediment will automatically reduce the storage capacity of the reservoir and if this process of deposition continues longer stage like to reach when the whole reservoir gets silted up and becomes useless.

In order to see the capacity of reservoir does not fall short for requirements even during the design period. The silting should be taken into the account, the total volume of the silt likely to be deposited during the designed life period of the dam, therefore estimated approximately that much of volume is left as unused to allow the silting, it is known as a dead storage.

- **Silting of Canal**

Silt is allowed into the canal causes much annoyance and expense. Instance are not rare, where the silt, etc… carried into the canal during high floods, so depleted its capacity, that it could not carry the water needed for irrigation and it becomes necessary to close the canal and clean it during the height of irrigation season at great expenses and to the great injury to the crops. Hence measures should be adopted to prevent the entrance of silt and sand into the canal. Water carrying capacity of the canal gets reduced due to the deposition of the silt.

Silts Are of Two Types-

- **Bed Silt-**
  which is also called which is also called the dragged or rolled silt

- **Suspended Silt** –

The nature of silt depends upon topography of the area and rainfall. Silt must be prevented as far as possible from entering into the canal, but it is impractical to do so, measures should be adopted to remove the same from the canal.

Following are the measures adopted to remove the silt-

- When the canal is not carrying the water, the silt is removed by the manual labour
- Silt is removed by increasing the velocity of the water Using dredges silt can be removed

1. Silt entry into the canal can be prevented by the silt excluder

2. Silt ejector is used to remove the silt that has entered into the canal

13. Selecting A Suitable Preliminary Selection of An Earthen Dam Bund

In this new tank project, it is proposed to have a homogeneous earthen bund across the stream. The stored water is used to irrigate the nearby lands with the help of canal.

The selection of bund is made considering the following factors:

1. The site selected is such that there is a narrow opening to reduce the length of the dam.
2. The land selected is such that it is unimportant and submergence of Roadways or Railways are unobjectionable.
3. The proposed site is located at about 1.0kms from Kaiwara temple.
4. A V-shaped valley is capable of storing the maximum amount of water for the catchment and has good runoff at the proposed site.
5. The saddle between the hillocks is the best suited since it is suited for surplus water works with a minimum cost of construction. A preliminary design of an earthen dam is done on the basis of existing dams of similar characteristics and the design is finalized by checking the adequacy of the selected section from the worst loading condition. Empirical rules are frequently used in these designs. A few recommendations, for selecting suitable values of top width, free board, upstream and downstream slopes, drainage arrangements, etc., are given below for preliminary designs.

- **Freeboard:**

Free board or minimum free board is the vertical distance between the maximum reservoir level and the top bund level (i.e., the crown or crest of dam). The dam vertical distance between normal pool level or spillway crest and the top of the dam is termed as normal free board. The minimum height of the free board for wave action is generally taken to be equal to 1.5Hw where. Hw= Maximum height of wave

- **Width:**

The top width of large earthen dams should be sufficient to keep the seepage line well within the dam, when the reservoir is full. It should also be sufficient to withstand earthquake shocks and wave action. For small dams, this top width is generally governed by minimum roadway width requirements.

- **Upstream and Down Stream Slopes:**

The side slopes depend upon various factors such as the type and nature of dam and foundation materials, height of dam etc., The various dimensions of low earth dams for preliminary section may be selected from the recommendations of **strange**, as given in the following table:

Height of dam In meters	**Maximum Freeboard in meters**	**Top width(A) in meters**	**Upstream slope (H: V)**	**Down stream Slope (H: V)**
Up to 4.5	**1.2 to 1.5**	**1.85**	**2:1**	**1.5:1**
4.5 to7.5	**1.5 to 1.8**	**1.85**	**1.5:1**	**1.75:1**
7.5 to 15	**1.85**	**2.50**	**3:1**	**2:1**
15 to 22.5	**2.1**	**3.0**	**3:1**	**2:1**

14. Design and Calculation

A) Design of Earthen Bund: -

By plotting the Area – Elevation-Curve for the given site, the FTL is obtained. The top width, free board required and side's slopes are fixed based on Strang's recommendations for earthen dam. The nature of foundation, body wall and its dimension etc. are depending upon the

geological formation at the site, availability of construction materials. It is decided to have the following features:

- Top Level of Bund(**TBL**) = 781.960 m
- Full Tank Level (**FTL**) = 779.390 m
- Maximum Water Level (**MWL**) = 780.395m
- Deepest Bed Level (**DBL**) =788.150 m
- Maximum Depth of Water Storage = FTL – DBL
  =779.395–778.105 = 2.29 m
- Maximum Height of The Bund = TBL– DBL
  = 781.960 –778.105= 3.885 m
- Height of Free Board Is Taken As **1.85m** (According to Strang's recommendation) Top width of the bund is taken as **3m.**

Considering stability of dam and from Strang's recommendation provide

Upstream slope = 3:1 Downstream slope = 2:1

CHAINAGE	RL OF GROUND	PROPOSED TBL	DEPTH (D)	MEAN DEPTH (M)	CENTRAL AREA B*D (A1)	U/S AREA (A2) (SD^2)	D/S AREA (A3) (SD^2)	TOTAL AREA (A1+A2+A3)	LENGTH (L)	VOLUME OF EARTH WORK IN
0	782.035	781.96	0							
5	781.985		0.05	0.025	0.075	0.001875	0.00125	0.078125	5	0.390625
10	781.805		0.23	0.14	0.42	0.0588	0.0392	0.518	5	2.59
15	781.735		0.3	0.265	0.795	0.210675	0.14045	1.146125	5	5.730625
20	781.525		0.51	0.405	1.215	0.492075	0.32805	2.035125	5	10.17562
25	780.685		1.35	0.93	2.79	2.5947	1.7298	7.1145	5	35.5725
30	780.025		2.01	1.68	5.04	8.4672	5.6448	19.152	5	95.76

35	779.495		2.54	2.275	6.825	15.52687	10.35125	32.70312	5	163.5156
40	778.965		3.07	2.805	8.415	23.60407	15.73605	47.75512	5	238.7756
45	778.455		3.58	3.325	9.975	33.16687	22.11125	65.25312	5	326.2656
50	778.305		3.73	3.655	10.965	40.07707	26.71805	77.76012	5	388.8006
55	778.105		3.93	3.83	11.49	44.0067	29.3378	84.8345	5	424.1725
60	777.785		4.25	4.09	12.27	50.1843	33.4562	95.9105	5	479.5525
65	777.135		4.9	4.575	13.725	62.79187	41.86125	118.3781	5	591.8906
70	777.405		4.63	4.765	14.295	68.11567	45.41045	127.8211	5	639.1056
75	777.735		4.3	4.465	13.395	59.80867	39.87245	113.0761	5	565.3806
80	777.885		4.15	4.225	12.675	53.55187	35.70125	101.9281	5	509.6406
85	777.51		4.525	4.3375	13.0125	56.44172	37.62781	107.082	5	535.4102
90	777.11		4.925	4.725	14.175	66.97687	44.65125	125.8031	5	629.0156
95	777.345		4.69	4.8075	14.4225	69.33617	46.22411	129.9828	5	649.9139
100	777.545		4.49	4.59	13.77	63.2043	42.1362	119.1105	5	595.5525
105	777.43		4.605	4.5475	13.6425	62.03927	41.35951	117.0413	5	585.2064
110	777.42		4.615	4.61	13.83	63.7563	42.5042	120.0905	5	600.4525
115	777.395		4.64	4.6275	13.8825	64.24127	42.82751	120.9513	5	604.7564
120	778.395		3.64	4.14	12.42	51.4188	34.2792	98.118	5	490.59
125	779.835		2.2	2.92	8.76	25.5792	17.0528	51.392	5	256.96
130	780.395		1.64	1.92	5.76	11.0592	7.3728	24.192	5	120.96
135	779.895		2.14	1.89	5.67	10.7163	7.1442	23.5305	5	117.6525
140	781.96		0.075	1.1075	3.3225	3.679669	2.453112	9.455281	5	47.27641

SIDE SLOPE ALONG U/S =3:1

SIDE SLOPE ALONG D/S = 2:1

WIDTH OF BUND = 3M

The total quantity of earth required for construction of new tank of top width 3m wide ,U/S 3(h):1(v) and D/S 2(h):1(v) is=9711.066m^3

DESIGN OF HOMOGENOUS EARTHEN DAM

SL NO:	DETAILS OF BUND	
1	Type of bund	HOMOGENOUS EARTH DAM
2	Length of bund	140m
3	Top width of bund	3.00 m
4	Maximum height of bund	9.89m
5	Top level of bund (TBL)	781.960m
6	Maximum water level(MWL)	780.395m
7	Full tank level (FTL)	779.895m
8	Dead storage level (DSL)	778.105m
9	Lowest bed level (LBL)	777.295m
10	Free board	2.1m
11	Upstream slope	3.0H : 1V
12	Downstream slope	2.0H : 1V
13	Rock toe	PROVIDED
14	Upstream pitching	60cmthickstonerevetmentwithgravelbacki
15	Sluice sill level	778.105M

CAPACITY OF RESERVIOR

SL NO	CONTOUR	REDUCE LEVEL (m	DISCRIPTION	WATER SPREA AREA (m^2)
1	Contour 1	784.51	DSL	6703 m^2
2	Contour 2	783.570	MWL 0.65m	8103 m^2
3	Contour 3	782	FTL 9.39m	7234m^2

- **Using Trapezoidal Rule**

1.Volume of Water B/W Contour 1 & 2

Volume of tank $V1 = [\frac{A_1+A_2}{2}] \times h$

V1=12543.3 m^3

2. Volume of Water B/W Contour 2 & 3

Volume of tank $V^2 = [\frac{A_2+A_3}{2}] \times h$

V2=13803.3 m^3

Total Capacity of Reservoir=V1+ V2= 26346.6 m^3

B) Design of Waste Weir Surplus Weir

The excess surplus water is spilled from a tank, into the downstream channel. To avoid the rise of water in the tank, above the maximum water level (MWL). In fact, the water will generally starts spilling over the crest of this escape weir, as when it rises above full tank level(FTL), the discharging capacity of this weir will be designed such as to pass the full maximum flood discharge with a depth over the weir equal to the difference between FTL and MWL. Although the effective storage capacity of a tank is limited by FTL, the area submerged by the tank bund and revetment is dependent on MWL and hence, in order to restrict the dimensions of this, it is desirable to keep the

difference between FTL and MWL to a smaller value. The usual difference between FTL and MWL is 1m or smaller value.

Design Data and Assumptions

TBL - 869.913 m

MWL – 868.063 m

FTL – 867.413 m

lowest bed level – 856.020 m

Foundation level – 855.520 (assuming that the good foundation is available at 0.5 m below the lowest bed level)

Estimation of flood discharge entering the tank

$Q= (CM^{2/3}) -(cm^{2/3})$

Where **C** – Combined catchment constant – varies from 6.8 to 15 assume 9.0

c – Intercepted catchment constant – varies from 1/3 to 1/6 of **C**, take 1/6 of **C**

m – Intercepted catchment area in km^{2-} assume 5.0 km^2

M – Combined catchment area in km^2 – assume 7.825 km^2

Therefore, the flood discharge **Q = 31.08 m^3 /s**

1. Length of Surplus Weir

$Q= (2/3) \times C_d \times L_1 \times \sqrt{(2g)} \times H^{3/2}$

Head of discharge over weir H = MWL – FTL

= 868.063-867.413

=0.65 m

Assume C_d – 0.60

Therefore, the clear length of weir **L_1 = 33.47 m say as 35 m**

Assume interval between dam stones as 1.0 m, therefore no. of dam stones =L_1 – 1 35-

1=**34 No's** and Assume size of dam stone 0.20 x 0.20 hence overall length of weir L =

[L1+ (width of dam stone x no's of stones)]

L=[35+(0.20 X 34)] = **41.80 m.**

2. Dimensions of Weir

Structural height of weir

Crest level- 867.413 m (FTL)

Top of dam stone – 868.063 m(MWL)

Ground level – 856.020 m

Downstream-

Top of foundation concrete TFL – 855.520 m

Height of weir above foundation H = (FTL – TFL) = 11.890 m

Structural height of weir = H + (top of dam stone level – crest level) = **12.543 m**

Crest width / top width

a =0.55(√ (H) +√ (h))

Where: h = head over weir = (MWL – FTL) = 0.65m

Therefore, top width of weir **a** =2.34say as **2.4m**

Base width

$b = (H+h)/\sqrt{(S-1)}$

Where:

specific weight of masonry, S = 2.4kN/m3

Therefore, base width of weir **b = 10.60 m**

3. Protection Work

Abutment

Height of abutment above foundation (TBL-TFL) $\mathbf{H_a}$= 14.393m

Top width = 0.50 m (min)

Bottom width ($0.4xH_a$) = **5.75 m** Provide **6.00m**

Upstream Wing Wall and Return Wall

Height of U/S wing wall above foundation

$H_{U/S}$ = (MWL+0.3) -(TFL) = 12.843m

Top width = 0.50 m (min)

Bottom width ($0.4XH_{U/S)}$ = **5.13 m** say 5.2 m

Provide a splay of 3: 1

Downstream Wing Wall and Return Wall

Height of D/S wing wall above foundation

$H_{D/S\ W}$ =(MWL)-(TFL) = 12.543 m

Top width = 0.50 m (min)

Bottom width ($0.4X\ H_{D/S\ W}$) = 5.00 **m**

Provide a splay of 5:1

Design of Apron

1. Upstream apron

The apron is designed based on the seepage theory therefore the max seepage

pressure is given by

Max seepage pressure (Total uplift head acting) = (MWL-GL) = **12.043 m**

Assuming hydraulic gradient (HG) = **5.0**

Length of apron = uplift head x HG = 39.02 m say as **60.215m** since the length of apron is too long from structural consideration provide length of apron about half the value

i.e., **length of apron = 30.10m**

Provide two stepped apron of length L_1**= 15m** and $\mathbf{L_2}$ **= 15m**

Thickness of solid apron = residual seepage pressure / (S_c – 1)

Where: residual seepage pressure = max seepage pressure – seepage pressure lost

= max seepage pressure – (seepage length / HG)

Note: Seepage length = length of apron therefore residual seepage pressure = 2.005

S_c= specific gravity of concrete = 2.25

Therefore, thickness of 1st apron = **1.604 m**

Hence provide thickness of 2nd apron of about 50% of 1st apron i.e.=**0.802 m**

Downstream Apron

Generally, no aprons are required on D/S side of weir however, cement grouting and sheet piling is done on the area immediately above weir to avoid percolation of water into soil

C) Determination of Discharge Required

Assume,

Culturally Commanded Area= 600 hectares

Area under Crop 1 (Ragi) = 60 % of CCA

Crop 2 (Vegetables) = 40 % of CCA

The major crops grown in this region and necessary data are calculated and tabulated below

CROPS	**RAGI**	**VEGETABLES**
AREA UNDER[A] CROP - hectares	402	268
BASE PERIOD[B]- days	120	90
AMOUNT OF WATER REQUIRED (Δ - m)	0.30	0.20
DUTY[D] D = 3.64 x (B / Δ) (hectare/cumecs)	3456	3888
DISCHARGE[Q] Q = A / D (m^3/sec)	**0.1163**	**0.0689**

Total Discharge Q =0.1163 + 0.0689 **= 0.1852 m³/s**

Considering 20% conveyance losses therefore discharge **Q = 1.2 x 0.1852 = 0.222 m³/s**

Also, Assuming Time Factor as 1.7therefore the discharge **Q = 1.7 x 0.222 = 0.3774 m³/s**

For future expansion of water supply etc. assuming the discharge as 2Q therefore the **Total discharge to which canal is to be designed is Q = 0.3774 x 2 = 0.7548 m³/s say as 0.80 m³/s**

D) Design of Plug Sluice

Sluice Vent Way:

The area of vent way of the sluice must be such that it can draw normal supplies of water when the tank is at a low water level or a level at which the tank supply will always be available to be drawn during the normal crop period.

Assuming a minimum driving head of 0.3 m i.e. **h=0.3m** above the centre of sluice barrel we get discharge by using the formula-

$Q=C_d \times A \sqrt{(2 \times g \times h)}$

Q=discharge in cumecs = **0.80m³/s**

C_d=coefficient of discharge= 0.60

g=acceleration due to gravity = 9.81 m / sec^2

h=driving head = 0.30 m

From above equation **A= 0.549 m^2 ,**therefore providing circular vent Diameter **D** = 0.836 say as **D=0.85 m**

- **Sluice Barrel:**

The sluice barrel is buried under the tank bund. The barrel will have masonry side walls. The roof can be either of RC slabs laid in-situ or precast RC slabs with levelling course of concrete laid over it.

Since the vent way is 0.85 m the size of barrel can be adopted as **90cm x 100cm.** The sluice barrel consists of two masonry walls covered by an RC roof slab. The thickness of roof slab may be assumed to be **15 cm.**

Top level of barrel = Sill level of sluice + Height of barrel wall +Thickness of slab =858.02 + 1.0 + 0.15= **859.17 m**

- **Design of Head Wall:**

In order to easy facilities to operate the sluice gearing etc. a head wall in front of the sluice opening with its top level at least 0.50m above MWL is necessary. The head will be resting on the roof slab directly

Top level of head wall = MWL + 0.5 = **868.563 m**

Height of head wall = Top level of head wall – Top level of barrel = 9.393m say =**9.5m**

Bottom width of head wall = 0.40 x height of head wall = **3.8m**

Minimum top width of head wall = **0.50 m**

E)Design of Canal.

Let us adopt **LACEY'S METHOD** of silt theory for design of Canal to suite following data: Discharge Q = 0.80 m^3 / s

Assume silt factor f = 1

Side slope n = 1(H): 1(V)

(a) Critical Velocity **V** $= \left(\frac{Qf^2}{140}\right)^{(1/6)} =$ **0.423 m / s**

(b) From Q = A x V, we have A **= 1.89 m^2**

(c) By Lacey's perimeter equation, P = 4.75 √Q, we have **P = 4.25 m** and also**,**

$P = B + 2D \sqrt{(1+n^2)}$

Where: n = 1 therefore by solving **B = 4.25 – 2.83D**

(d) According to Lacey's theory the cross-sectional area of canal for Side slope = 1(H): 1(V) is given by $A = BD + nD^2$

1.89= (4.25-2.83D) D + 1xD^2 solving for D we have **D** = 0.599m say as **0.60 m** thus by Providing 0.30 m free board total depth of canal is **0.90 m.**

Therefore, the bed width of canal is **B** = 4.25 – 2.83x0.9 = 1.703 say as **1.70 m**

(e) Bed slope S = $f^{5/3}$ / (3340 x $Q^{1/6)}$

Therefore **S** = 1 in 3218 say as **1 in 3200**,

- **Check for Design**

W.k.t Hydraulic mean depth R= A / P i.e. **R = 0.444 m**

Also, from Lacey's equation we have hydraulic mean depth R = 5V^2 / 2f, i.e. **R = 0.447mSince the hydraulic mean depths from two equations are same. Hence the above design values of canal [from (a) to (e)] based on Lacey's silt theory is correct.**

Earthwork Calculation of Canal

BED WIDTH =	2 M
SLOPE=	1:1
LENGTH	10M

					CENTRAL AREA B*D		TOTAL AREA		EARTH WORK IN CUTTING
CHAINAGE	RL OF GROUND	RL OF FL	DEPTH OF CUTTING (D)	MEAN DEPTH (M)	(A1)	(SD^2)	(A1+A2)	LENGTH (L)	
0	778.755	777	1.755						
10	779.285	777.05	2.235	1.995	3.99	3.98	7.97	10	79.70025
20	779.31	777.1	2.21	2.2225	4.445	4.94	9.38	10	93.84506
30	779.675	777.15	2.525	2.3675	4.735	5.61	10.34	10	103.4006

40	779.035	777.2	1.835	2.18	4.36	4.75	9.11	10	91.124
50	778.845	777.25	1.595	1.715	3.43	2.94	6.37	10	63.71225
60	779.505	777.3	2.205	1.9	3.8	3.61	7.41	10	74.1
70	780.465	777.35	3.115	2.66	5.32	7.08	12.40	10	123.956
80	780.865	777.4	3.465	3.29	6.58	10.82	17.40	10	174.041
90	781.585	777.45	4.135	3.8	7.6	14.44	22.04	10	220.4
100	781.905	777.5	4.405	4.27	8.54	18.23	26.77	10	267.729
110	781.48	777.55	3.93	4.1675	8.335	17.37	25.70	10	257.0306
120	783.48	777.6	5.88	4.905	9.81	24.06	33.87	10	338.6903
130	783.765	777.65	6.115	5.9975	11.995	35.97	47.97	10	479.6501
140	784.2	777.7	6.5	6.3075	12.615	39.78	52.40	10	523.9956
150	784.355	777.75	6.605	6.5525	13.105	42.94	56.04	10	560.4026
160	784.255	777.8	6.455	6.53	13.06	42.64	55.70	10	557.009
170	785.43	777.85	7.58	7.0175	14.035	49.25	63.28	10	632.8031
180	784.85	777.9	6.95	7.265	14.53	52.78	67.31	10	673.1023
190	784.95	777.95	7	6.975	13.95	48.65	62.60	10	626.0063
200	785.5	778	7.5	7.25	14.5	52.56	67.06	10	670.625
210	785.755	778.05	7.705	7.6025	15.205	57.80	73.00	10	730.0301
220	786.29	778.1	8.19	7.9475	15.895	63.16	79.06	10	790.5776
230	786.47	778.15	8.32	8.255	16.51	68.15	84.66	10	846.5503
240	786.595	778.2	8.395	8.3575	16.715	69.85	86.56	10	865.6281
250	787.715	778.25	9.465	8.93	17.86	79.74	97.60	10	976.049
									10820.16

The total quantity of earth required for construction of canal is **=10820.16 cum**

CANAL DROP

Design a canal drop (notch type) for the following data:

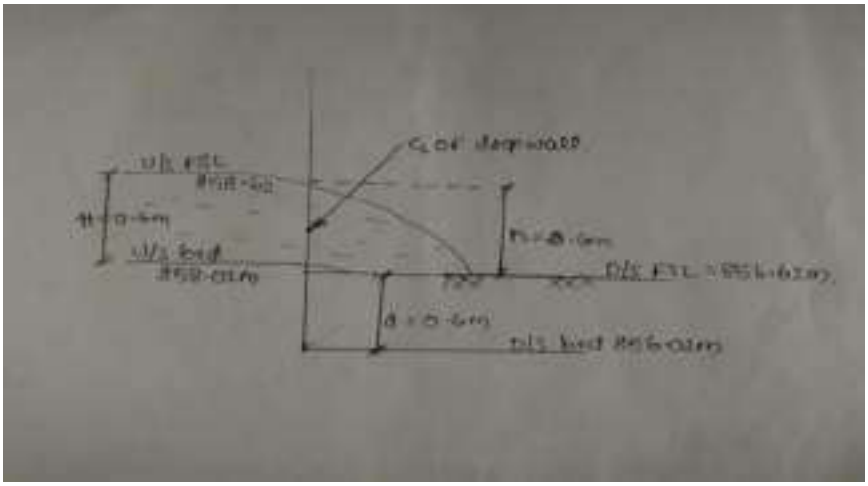
Particulars	**U/s canal**	**D/s canal**
Full supply discharge	0.8m^3/s	0.8m^3/s
Bed level	858.020m	856.02m
Full supply level	858.62m	856.62m
Bed width	1.7m	1.7m

TBL	858.920m	856.92m
Top width of embankment	3m	3m
Side slope cutting	1:1	1:1
Average ground level	856.920m	856.920m
Hard soil for foundation available at	856.52m	856.52m
Half supply depth	0.45m	0.45m
specific gravityof concrete/masonry		2.25

C_d for the notches 0.7

Bligh's crap co-efficient 5

First of all it is necessary to know whether the drop is free or submerged, this can be done by comparing the upstream bed level with the downstream full supply level. If the upstream bed is above the d/s full supply level, the drop is free, otherwise it is submerged.



NOTCHES:

Fully supply discharge in the canal=0.8m^3/s

Assuming 2 notches

Fully supply discharge per month Q=0.8/2=0.4m^3/s

Fully supply depth over the notch H=upstream FSL-upstream bed level

=858.62-858.02=0.6m

Fully supply discharge per notch Q_1=Q/2=0.4/2=0.2m^3/s

Half supply depth over the notch H_1=0.45m(given)

For a trapezoidal notch

$Q=\{2/3\ cd\sqrt{2g}LH^{3/2} + 8/15\ cd\sqrt{2g}H^{5/2}\ \tan\theta\}$

Substituting the full supply and half supply conditions For **full** supply condition,

$0.4=(2/3*0.\overline{7}*\sqrt{2}*9.81*L*(0.6)^{(3/2)})+(8/15*0.7\overline{*}\sqrt{2}*9.81*(0.6)^{(5/2)}\tan\theta)$

$0.4=0.96L+0.46\tan\theta \rightarrow$eqn1

For half supply condition,

$0.2=(2/3*0.\overline{7}*\sqrt{2} * 9.81*L*(0.45)^{(3/2)})+(8/15*0.\overline{7}*\sqrt{2} * 9.81*(0.45)^{(5/2)}\tan\theta$

$0.2=0.623L+0.22\tan\theta \rightarrow$ eqn2

Solving equations 1 & 2,

L1=0.291m

Tanθ=0.0823

Top width=(L+2Htanθ)

=(0.5+(2*0.6)*0.0823) =0.598m

Drop wall

L_d=length=$\frac{7}{8}$ × band width of upstream canal

=(7/8)*107

=1.488m

Top width a={full supply depth/2 +0.15 to 0.3} metres

a= ((0.6/2)+0.2)

a=0.5m

depth of water cushion(X)

$(X+d)=0.9\bar{H}\sqrt{h}$

Where, d = D/s full supply depth =0.6m

H = U/s full supply depth =0.6m

h = height of drop =2m

X = depth of water cushion

$(x+0.6)=0.9*0.\bar{6}*\sqrt{2}$

X=0.1636m

Top of apron=Downstream bed level-x

=856.02-0.1636

=855.856m

Height of drop wall H_d = (U/s bed level-top of apron)

=858.02-855.85

=2.16m

Bottom width of drop wall b = $\{H_d+H\}/\sqrt{S}$

$=(2.16=0.6)/\sqrt{2.25}$

=1.84m

Notchpier:

Length of the notch pier = length of drop wall=1048m

Width of notch pier = U/s full supply depth/2 =0.6/2 =0.3m

Apron:

1) Length ofapron

$$L_d=\{0.6 + 2\sqrt{d} \times h\}$$

$=(0.6+2\sqrt{0.6 * 2})$

=3m

2) thickness(t_s)

Impact criterion $t_s=\{1/2 \sqrt{(H+h)}\}$

$=0.5*\sqrt{0.6 * 2}$

=0.54m=0.5m

Uplift criterion

Max. Uplift = U/s FSL-D/s FSL

=858.62-856.62

=2m

Protection works

a) abutment(A)(B)

Height = 858.92-855.856=3.046m

Bottom width =0.4*height=1.2256m

Top width=0.5m (min)

a) U/s wing wall(B)(C)

Height of wing wall=858.92-

856.52=2.4m Bottom width

= 0.4*2.4=0.96m

Top width =0.5m (min)

Splay 1:1

b) D/s wing wall(A)(D)

Section of wing wall at A will be same as the abutment

(heights are same) Height of the wing wall at D

=856.92-855.856=1.046m

Bottom width

=0.4(height)=0.42

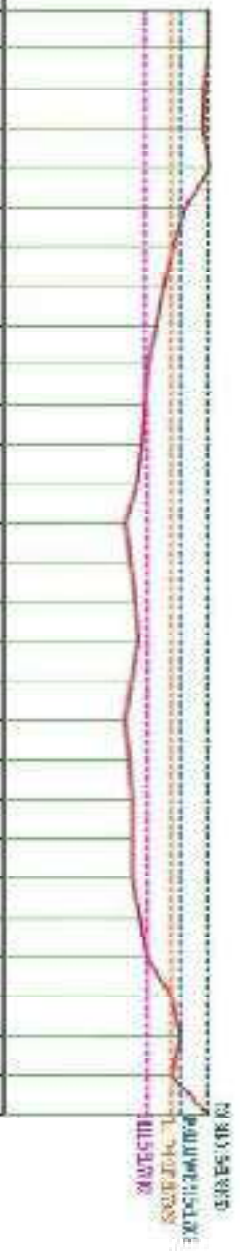
5m Top width

=0.5m (min)

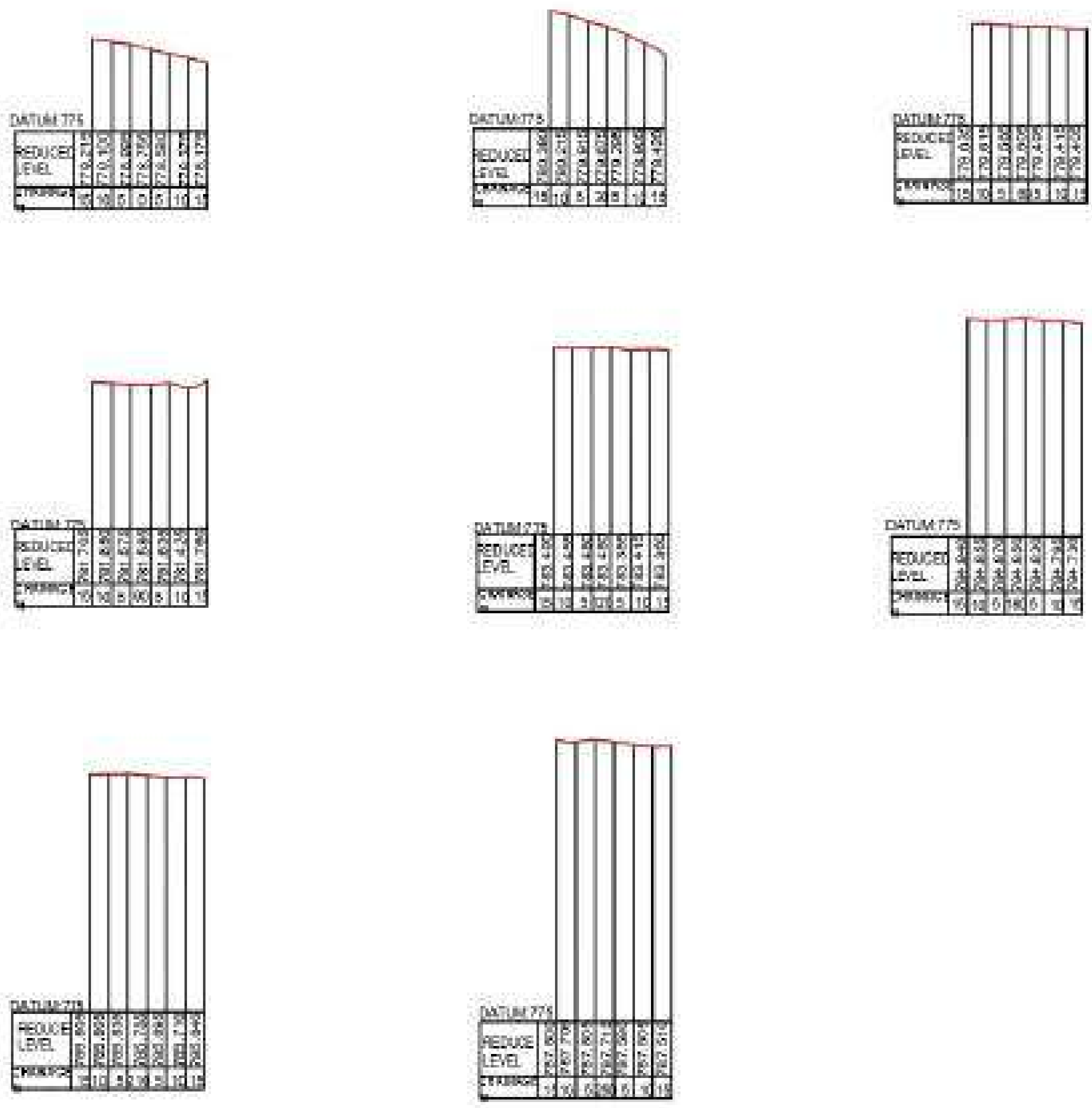
LONGITUDINAL SECTION

DATUM : 770m

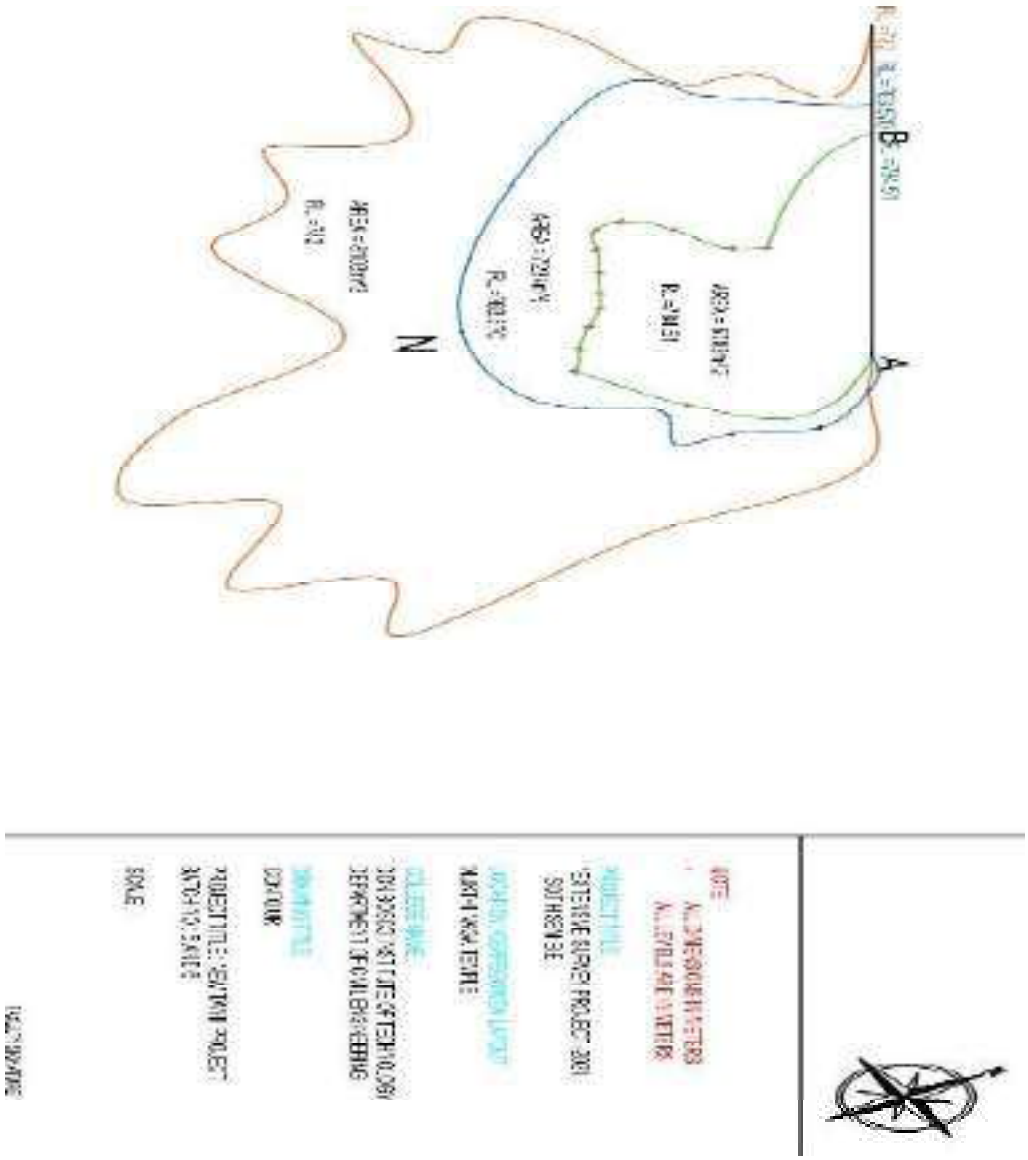
Distance,m	RL,m
0	782.035
5	781.985
10	781.605
15	781.735
20	782.085
25	780.685
30	780.025
35	779.495
40	778.965
45	778.455
50	778.305
55	778.105
60	777.785
65	777.135
70	777.405
75	777.735
80	777.885
85	777.510
90	777.110
95	777.345
100	777.545
105	777.430
110	777.420
115	777.995
120	778.395
125	779.835
130	780.395
135	779.895
140	781.960



CROSS SECTION OF NEW TANK PROJECT



CONTOUR

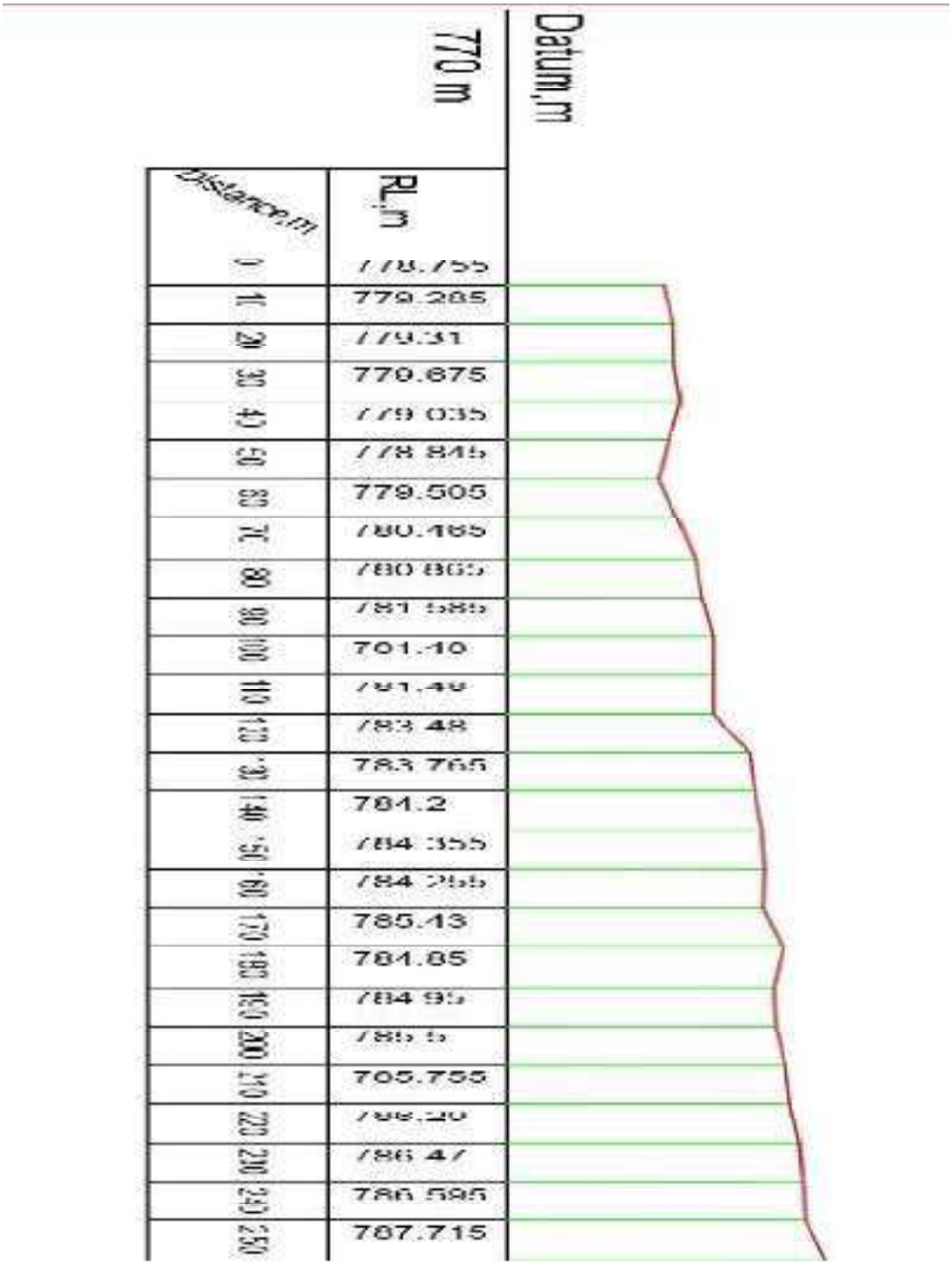


BLOCK LEVELLING AT CONTOUR

777.59	777.36	777.61	777.62	777.73	777.14	778.82	778.65	778.55
777.84	777.915	777.66	777.73	778.68	778.745	778.94	778.72	778.82
778.12	778.04	777.9	778.05	777.6	778	778.394	778.94	778.18
778.7	778.725	778.715	779.25	779.24	779.42	778.67	778.72	778.91
779.645	779.05	780.01	778.445	779.83	779.83	778.85	779.22	779.13
778.37	779.67	779.75	780.16	780.69	780.05	780.49	779.75	779.48
779.2	779.81	780.17	780.56	780.95	781.03	780.44	779.74	779.42
780.03	780.1	780.33	780.45	780.48	781.08	780.44	779.62	779.82
779.505	780.38	780.465	780.12	781.235	781.36	781.18	780.67	780.57

BLOCK LEVELLING AT WASTE WEIR

771.505	771.445	771.493	771.495	771.530	771.625	771.445		
771.665	771.465	771.625	771.375	771.305	771.255	771.245		
771.485	771.650	771.665	771.905	771.345	771.275	771.355		
771.155	771.105	771.210	771.045	771.735	771.760	771.870		
771.710	771.790	771.730	771.920	771.695	771.800	771.815		
771.390	771.280	771.185	771.385	771.425	771.675			
771.856	771.530	771.666	771.615	771.370	771.450	771.360		


770 m
Datum,m
Distance,m
RL,m
0
778.755
10
779.285
20
779.31
30
779.675
40
779.035
50
778.845
60
779.505
70
780.165
80
780.805
90
781.585
100
781.10
110
781.49
120
783.48
130
783.765
140
784.2
150
784.355
160
784.285
170
785.13
180
784.85
190
784.95
200
785.55
210
785.755
220
786.20
230
786.47
240
786.595
250
787.715

CONCLUSION

1. The Survey carried out at “SHREE KSHETRA MUKTHI NAGA TEMPLE” near ramohalli was effective as the site is suitable for the proposal of dam and reservoir.

2. Carrying out the survey work with the help of necessary instruments, the dam and reservoir can be effectively and successfully designed.

3. The project carried out involving various surveys is helpful in estimating and calculating various data like runoff, total reservoir capacity, ground feature etc, for the dam or reservoir to be economical and effective.

4. A new communication road over the dam is proposed to connect right bank and left bank.

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• Irrigation Engineering and Hydraulic Structures	Santosh Kumar Garg
• Surveying	Dr. B.C. Punmia
• Surveying	Dr. K.R. Arora
• Soil Mechanics & Foundation Engineering	Dr. B.C. Punmia
• Soil Mechanics & Foundation Engineering	Prof. V.N.S. Murthy
• Engineering Hydrology	K. Subramanyam

WATER SUPPLY & SANITARY PROJECT

Project In-Charge: 1. Prof. Gobinath S

2. Prof. Savitha A L

CONTENTS

INTRODUCTION:

DETAILS OF EXISTING WATER SUPPLY PROJECT AREA:

The project area is located around the mukti naga temple in ramohalli villege .villege is located in Bangalore.the project area is locted around 1kilometer away from the temple. Village is located on a terrain.

Ramohalli is an in Bangalore west, Bangalore,Bangalore Urban District, Karnataka, India, 560074. Kengeri hobli(4.68km), Anchepalya(6.95km),Kumbalgodu(7.03km),Kengeri satellite town(8.33km), Thavarekere(8.37km) are the nearby areas to Ramohalli.

DIAMETER OF THE MAIN PIPE	7.5 cm
DIAMETER OF THE DISTRIBUTION PIPE	2.5 cm

Present population is average…..

The source of water supply is from overhead tank through borewell to all over layout.

OBJECTIVES:

- Examining the sources of water supply and calculation of required quantity of water based on existing and projected population.
- Preparing village map and locating sites for ground level overhead tanks

- To formulate and design water supply scheme to , considering water available from borewell which is the main source of supply.

- To ensure treated water availability at all times of year at adequate pressure.

SURVEYS CONDUCTED FOR THE PROJECT:

1. MAP STUDY

2. RECONNAISSANCE

3. PRLIMINARY SURVEY

FOLLOWING ARE THE SURVEYS WORK TO BE CONDUCTED:

a) Longitudinal section and cross section of transmission main.

b) Village traverse.

EQUIPMENT USED IN PROJECT:

a) Chain
b) Tape
c) Arrows
d) Ranging rod
e) Plane table
f) Plumbing fork and plumb bob
g) Level and staff
h) Alidade
i) Compass
j) Spirit level
k) Drawing papers with a rain proof cover

POPULATION FORECAST:

Based on the census report , of 2021 population of ……. Was found to be about……. The future population of……. In 2061 is estimated from the available data, got from local authorities. The following are population details of ……..for the past four decades.

Sl. No	YEAR	POPULATION
1	1971	200
2	1981	300
3	1991	450
4	2001	500
5	2011	600

ARITHMETIC INCREASE METHOD :

SL.NO	YEAR	POPULATION	INCREASE IN POPULATION
1	1971	200	-
2	1981	300	100
3	1991	450	150
4	2001	500	50
5	2011	600	100
TOTAL INCREASE IN POPULATION			400

Number of decades :

Average increase per decade : 400/4 = 100

Population at end of 2021 = 400 + 1* 100 = 500

Population at end of 2031 = 400 +2*100 = 600

Population at the end of 2041 = 400 + 3*100 = 700

Poplation at the end of 2051 = 400 + 4*100 = 800

GEOMETRIC INCREASE METHOD :

SL.NO	YEAR	POPULATI - ON	INCREASE IN POPULATION	%INCREASE IN POPULATION
1	1971	200	-	-
2	1981	300	100	(100×100)/200=50%
3	1991	450	150	(150×100)/300=33.33%
4	2001	500	50	(50×100)/450 = 11.11%
5	2011	600	100	(100×100)/500=20%
TOTAL			**400**	

Average growth rate of population is given by,

r = 28.61% = 0.28

Population at end of 2021 = $600 \times (1+0.28)^1 = 768$

Population at end of 2031 = $600 \times (1 + 0.28)^2 = 983$

Population at end of 2041 = $600 \times (1 + 0.28)^3 = 1258$

Population at end of 2051 = $600 \times (1 + 0.28)^4 = 1611$

INCREMENTAL INCREASE METHOD :

SL.NO	YEAR	POPULATION	INCREASE IN POPULATION	% INCREASE IN POPULATION
1	1971	200	-	-
2	1981	300	100	50
3	1991	450	150	-100
4	2001	500	50	50
5	2021	600	100	-
TOTAL			400	0

AVERAGE DECADE = 400/4 = 100

AND = 0/3 = 0

Population at end of 2021 = 600 +1× 100+(1×(1+1)/2)×0

= 700

Population at end of 2031 = 600 + 2×100 + (2×(2+1)/2)×0

= 800

Population at end of 2041 = 600 + 3×100 + (3 ×(3+1)/2)×0

= 900

Population at end of 2051 = 600 + 4×100 + (4×(4+1)/2)×0

= 1000

The population of Ramohalli layout can be taken as 1000 in the year of 2051

FLOATING POPULATION :

DAILY PILGRIMS	100
MARRIAGE PARTY	5
EDUCATION CAMP	3
TOTAL	108

CATTLE POPULATION = 100 (ASSUMED)

DESIGN OF RISING MAIN

PER CAPITA RATE OF SUPPLY

Human	130 liters/day/person
Cattle	50 liters /day/capita
Quantity required per day	
Human	[1000+108] × 130 =144040
[100 × 50]	5000 liters/day
Total quantity of water	144040 liters/day (144.04m^3/day)

Assuming maximum daily water demand to be 1.8time average demand	1.8 ×144.04 =259.279m^3/d Say 260m^3/day 260/(24×60×60) = 0.0030 m^3/s
Assuming that the pump is operated only for 8 hours a day	
Therefore maximum daily demand	0.0030(24/8) = 0.0090m^3/s
Economical diameter of pipe is given by, D = 0.97 to 1.22 Q ,(taking 1.22)	0.1157m say 130mm
Actual velocity of flow	1.146 m/s

DESIGN OF PUMP

Distance from clear water borewell to overhead tank	**L = 5.5m**
Distance from overhead tank to distribution source connected to road	**L_1 = 2.3m**
RL at overhead tank	**801m**
Assuming that the foot valve is always below the water surface, RL of foot valve,	**801-2.0 = 799m**
Static head ,H_{st}	**801 – 799 = 2m**

- **From borewell to overhead tank**

Assuming coefficient of friction as 0.0067

Head loss due to friction in pipe given by DARCY-WEISHBACH

$H_t = 4Flv^2/2Gd$

$H_t = 4\times0.0067\times2.3\times1.146^2/(2\times9.81\times0.30)$

$H_t = 0.0135$

Velocity head ,

$$V_h = V^2/2g = 1.146^2/2\times9.81 = 0.067m$$

Total Head loss , H = 2 – (0.0135+0.067) = 1.91m

Assuming pump efficiency as 70% power required to run the pump

$$P = Q\ w\ H/\ 75\ \eta$$

$$BHP = 0.0090\times1000\times1.91/(75\times0.70)$$

$$BHP = 0.327\ HP$$

Therefore provide 2 units of 0.165HP.One unit of 0.327HP may be provided a stand by unit.

- To find gradient
  Using Hazen's Williams formula

$$V = 0.85\ C_H\ R^{0.63}\ S^{0.54}$$

$$S^{0.54} = V/(0.85\ C_H\ R^{0.63}$$

$$S^{0.54} = 1.2/(0.85 \times 130 \times 0.075)$$

$$S^{0.54} = 0.0555$$

Where , C_H = Coefficient of hydraulic capacity (For concrete pipe C_H = 130)

R = Hydraulic mean depth D/4 for circular pipes i.e 0.30/4 = 0.075

V = velocity of flow (assume 1.2m/s)

S = SLOPE OF ENERGY LINE.

Therefore provide a gradient of 1 in 20

DESIGN OF TREATMENT UNITS

The layout of the treatment plant is shown in drawing. Care has been taken that gravity flow occurs from one unit to the other.

Design of screens

Intake is designed to work for 8 hours per day and screens are designed for maximum daily demand.

Flow through intake ,

$$260/(24\times60\times60) = 0.0030 m^3/s$$

Assuming V = 0.1m/sec

Area of screens , Q / V = 0.039/0.1 = 0.27 m^2

Provide 2 screens for each penstock entance
Area of each screen , 0.27/2 = 0.135m^2

Diameter of each circular screen

$$\sqrt{(0.135\times4)/\pi} = 0.415m$$
$$\sim 0.425 m$$

Design of sedimentation tank

Max. Water to be treated in 24 hours = $260*10^3$ lit/d

Quantity of water to be treated during the detention period of 6 hours

$$260*10^3/24*6=65*10^3$$

$$=65m^2$$

Velocity of floe to be maintained through the tank = 0.2 m/minute

The length of the tank required = velocity of floe X detention period

= 0.2 x (6 x 60) = 72 m

Cross sectional area of the required = (65 / 72) = 0.902 m^2

Assuming water depth in the tank to be 3 m

Width of the tank = 0.902 / 3 = 0.03 m

Using a free board of 0.5 m

The overall size of the tank = 72 x 2.75 x 3.5 m

DESIGN OF RAPID SAND FILTER:

Max.Water to be treated in 24 hours = 260 m^3/d

Assuming 5% of water is required for washing of filters, we have filtered water required per day
120+260 = 380m^3/d

Assuming that 0.5 hours lost every day , total filtered
Water required per hour 380/23.5 = 16.17m^3/hr

Assuming rate of filtration = 3000/hr/m^2
Therefore area of filter provided, =16.7×1000/(3000)
= 5.5 m^2
Let,
L = 1.5 B

1.5 B^2 = 5.5 m^2

B = 1.91 ~ 2m

L = 1.5 × 2 = 3m

Hence a tank of dimension (2m×3m) is provided.

DISINFECTION :

Bleaching powder is used as a disinfectant.

Dosage of chlorine is 0.3mg/liter

Amount of chlorine required = 0.3×260×1000/(10^6)

= 0.078 kg/day

The chlorine content in bleaching powder = 30%

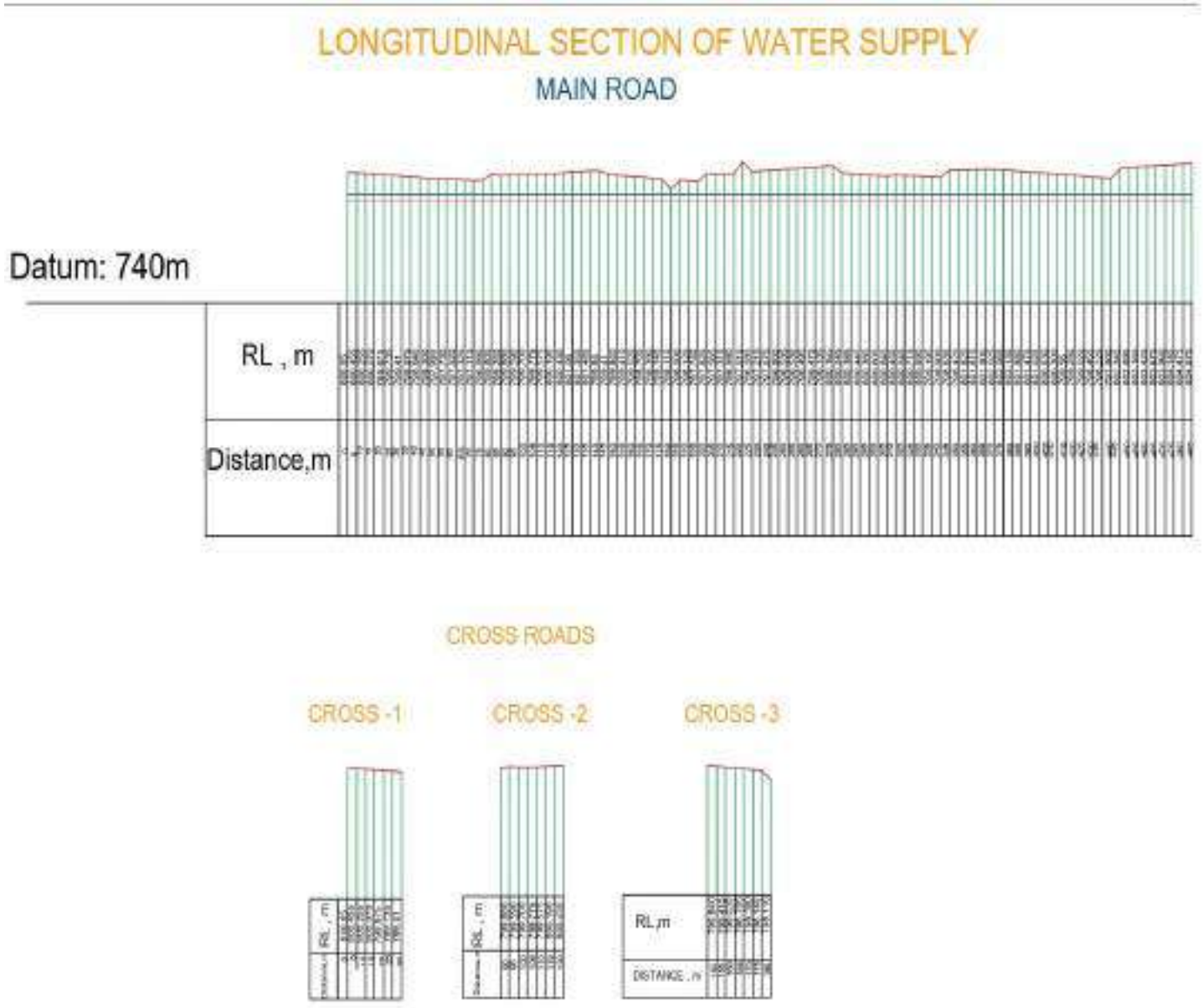
Amount of bleaching powder required =0.078 × 1000/30

= 2.6 kg/day

Amount consumption of bleaching powder

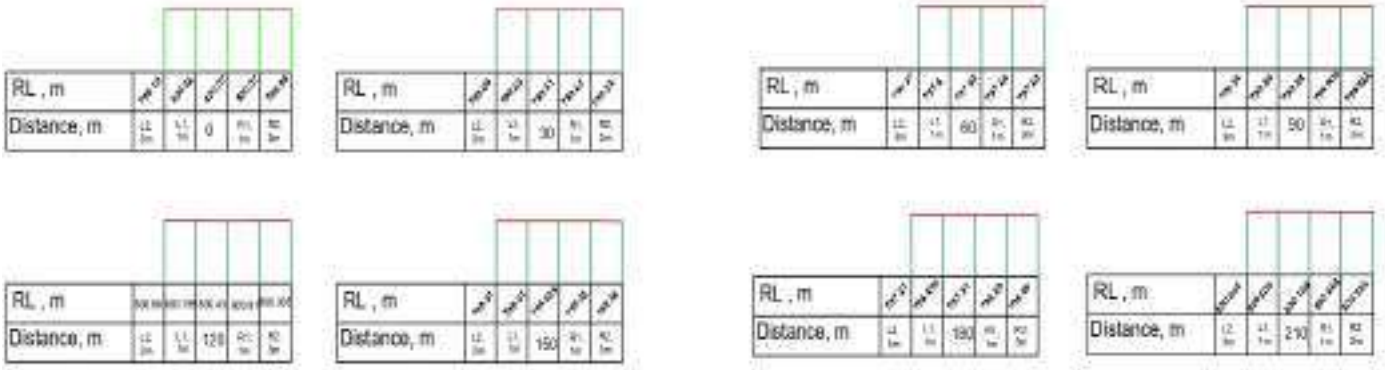
$2.6 \times 360 = 936$kg/year

Hence annual bleaching powder consumption is 936 kg.


LONGITUDINAL SECTION OF WATER SUPPLY
MAIN ROAD
Datum: 740m
RL , m
Distance,m
CROSS ROADS
CROSS -1
CROSS -2
CROSS -3
RL,m
DISTANCE ,m

CROSS SECTION

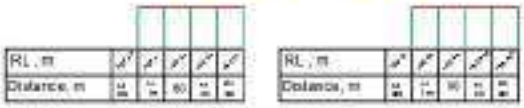
MAIN ROAD



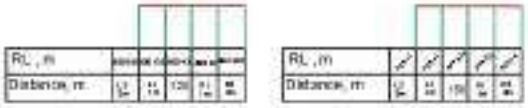
CROSS ROAD

1st CROSS

2nd CROSS

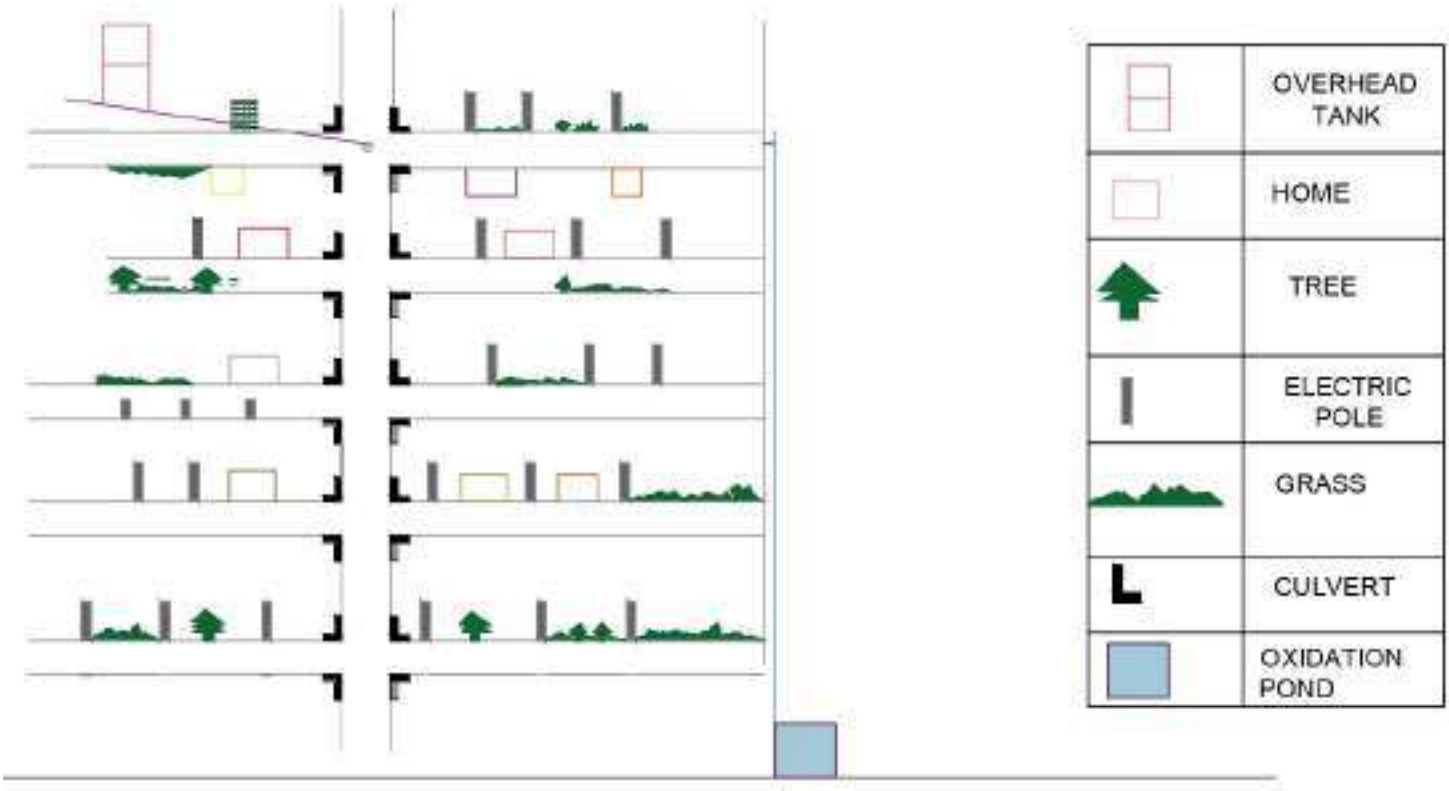


3rd CROSS

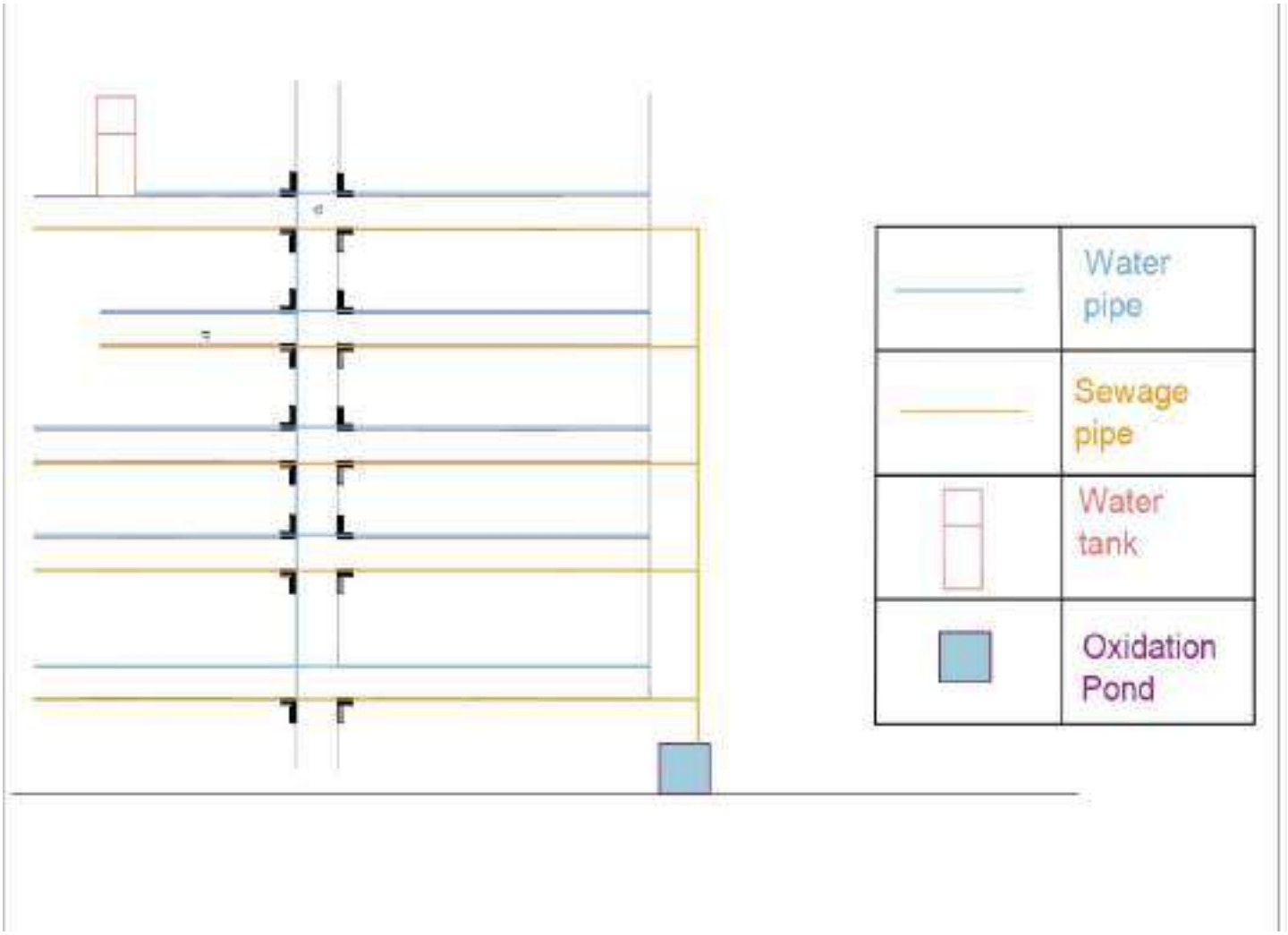


4th CROSS

LAYOUT PLAN


OVERHEAD TANK
HOME
TREE
ELECTRIC POLE
GRASS
CULVERT
OXIDATION POND

WATER PIPE AND SEWAGE PIPE PLANING



CONCLUSION

Every village, town or city needs water and sanitary supply system and that's what we did Extensive Survey Project. The water is carried to an overhead tank near MUKTHI NAGA TEMPLE in Ramohalli.

Then the water is supplied to a distribution system which distributes the water to every place in the layout whenever required. A sanitary system was also established to take away the waste water from different places.

BIBILOGRAPHY: -

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Publications, 2009.

- Santosh Kumar Garg "Irrigation Engineering and Hydraulic Structures", Khanna Publications, 2006.
- Dr. B. C. Punmia," Surveying", Laxmi Publications, 2005.
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K. Subramanya "Engineering Hydrology", Tata McGraw-Hill Education, 2008.Dutt "Estimation and costing".

HIGHWAY PROJECT

Project In-Charge: 1. Prof. Sudha K

2. Prof. Bushra Era

1. INTRODUCTION

ROLE OF TRANSPORTATION

India is a developing Country. Transportation plays a huge role in development, among all the mode of transport, road transport is nearest to the people. The passengers and the goods have to be first transported by road before reaching a railway station, a port or an airport. The road network can serve the remotest villages of a vast country like ours.

In the present era, planning is considered as a pre-requisite before attempting any developmental program. This is particularly true for any engineering work, as planning is the basic requirement for any new project or an expansion program. Thus, highway planning is also a basic need for highway development, particularly when the funds available are limited.

Transportation contributes to the economic, industrial, social and cultural development of any country. Transportation is vital for economic development of any region since every commodity produced whether it is food, clothing, industrial products or medicines needs transport at the production and distribution stages. In the production stage, transportation is required for carrying raw materials like seeds, manure, coal, steel etc. in the distribution stage, transportation is required from the production centres viz. farms and factories to the marketing centres for distribution to the retailers and consumers. The inadequate transportation facilities retard the process of socio-economic development of the development.

The main advantages of transportation can be summarized as follows…

• Transportation is for the advancement of the community.

• Transportation is essential for the economic prosperity and general development of the country.

• Transportation is essential for the strategic movement in emergency for defence of the country and to maintain law and order.

In developing countries like India, 80% of the population is living in villages. As a result of this, development cannot be brought about developing urban centres alone, but also the rural areas with the help of a good transportation system.

HIGHWAY ENGINEERING:

Highway engineering is a branch of engineering that deals with the development of a system of roads, which can used by vehicles and peoples, for the transportation of peoples and materials.

The road pavements are generally constructed on small embankment, slightly above the general ground level wherever possible, in order to avoid the difficult drainage and maintenance problems. The term 'road' or 'roadways' has therefore been termed 'Highway' and the science and technology dealing with road engineering is called 'Highway engineering'.

In a nutshell, highway engineering deals with various phases like development, planning, alignment, highway geometric design and location, highway traffic operation and its control, materials, pavement design, constructing and maintenance, finance and administration of a road system.

Characteristics of Road:

• For short distance it saves time.

• Speed of movement is directly related with casualty.

• It is the only means of transport that offers itself to the whole community alike.

Classification of Road:

• National highway (NH)

• State highway((SH)

• Major district roads(MDR)

• Other district roads(ODR)

• Village roads(VR)

HIGHWAY GEOMETRIC DESIGN:

The geometric design of a highway deals with the dimensions and layout of visible features of the highway such as alignment, sight distance and intersections.

The geometric of highway should be designed to provide optimum efficiency in traffic operations with maximum safety at reasonable cost. Geometric design of highways deals with the following elements:

• Cross section elements

• Sight distance considerations

• Horizontal and vertical alignment details

□□Intersection elements

Highway geometrics are greatly influenced by the topography, locality, traffic characteristics and the requirements. The factors which control the geometric design requirements are speed, road user and vehicular characteristics, design traffic, traffic capacity and benefit cost considerations. However, speed is the one factor which is important, governing most of the geometric design elements of roads.
The geometric design of highways depends on several factors, the most important of which are:

□□Design speed

□□Topography

□□Traffic factors

□□Design hourly volume and capacity

□□Environmental and other factors

HIGHWAY CROSS-SECTION ELEMENTS:

□□**PAVEMENT SURFACE CHARACTERICS:**

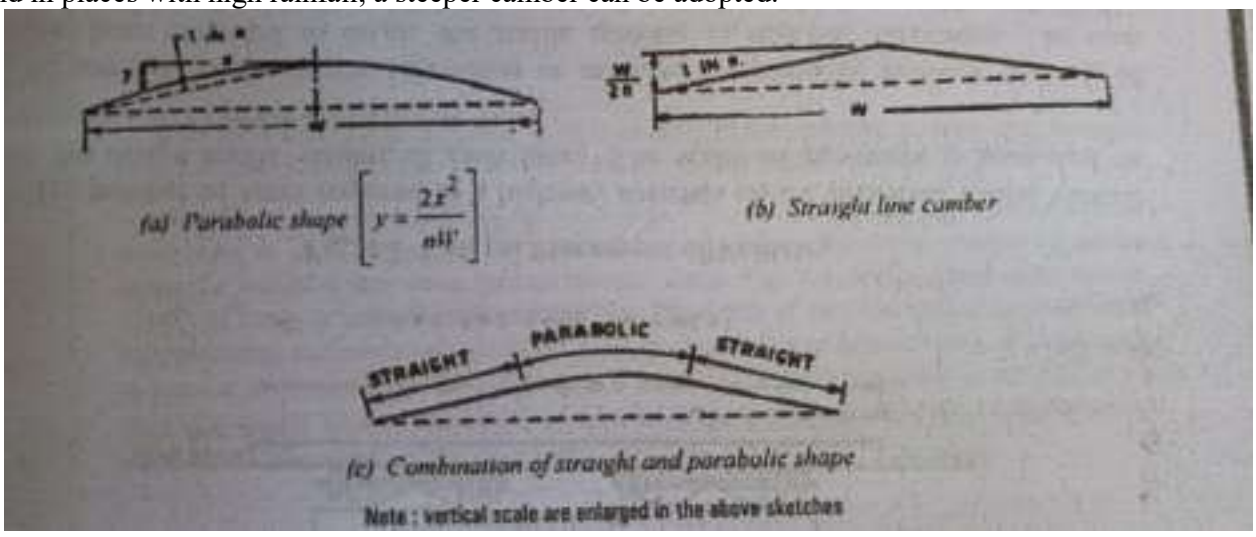
The pavement surface depends on the pavement type which is based on the availability of materials and funds, volume and composition of traffic, sub grade and climatic conditions, construction

facilities and cost consideration. The important surface characteristics of the pavement are friction, unevenness, light reflecting characteristics and drainage of surface water.

CROSS SLOPE OR CAMBER:

Cross slope or camber is the slope provided to the road surface in the transverse direction to drain off the rain water from the road surface. Usually the camber is provided on the straight roads by raising the centre of the carriageway with respect to the edges, forming a crown or highest point along the centre line.

The values of camber recommended by the IRC for different types of road surfaces are given in the below table. A range of values are given with a view that in localities with lower rainfall, a flatter camber and in places with high rainfall, a steeper camber can be adopted.



Shapes of Cross Slope

Table(4.1): Recommended values of camber for different types of road surfaces (page No 77) :

Sl. No.	Type of road surface	Range of camber in areas of	
		Heavy rain fall	Low rain fall
1.	Cement concrete and high type bituminous surface	1 in 50 or 2.0%	1 in 60 or 1.7%
2.	Thin bituminous surface	1 in 40 or 2.5%	1 in 50 or 2.0%
3.	Water bound Macadam and gravel pavement	1 in 33 or 3.0%	1 in 40 or 2.5%
4.	Earth road	1 in 25 or 4.0%	1 in 33 or 3.0%

Width of Pavement or carriageway:

The pavement or carriageway width depends on the width of traffic lane and the number of lanes. The lane width is determined based on the width of the vehicle and the minimum side clearance which may be provided for safety. Keeping these and other factors in view, the width of the carriageway for various classes of roads has been standardized by the Indian Road Congress.

Medians/Traffic separators:

In highways with divided carriageway, a median is provided between two sets of traffic lanes intended to divide the traffic moving in opposite directions. The main function of the median is to prevent head-on collision between vehicles moving in opposite directions on adjacent lanes. The median is also called as traffic separator.

Kerbs:

Kerb indicates the boundary between the pavement and median or foot path or island or shoulder. It is desirable to provide kerbs on urban roads. Kerbs may be mainly divided into three groups based on their functions they are 'Low kerb' or 'mountable type kerb', 'Semi-barrier type kerb' and 'Barrier type kerb'.

Road Margins:

The various elements included in the road margins are shoulder, guard rail, foot path, drive way, cycle track, parking lane, bus bay, lay-bye, frontage road and embankment slope.

Width of Formation or Roadway:

Width of formation or roadway is the sum of widths of pavement or carriageway including separators, if any and the shoulders. Formation or roadway width is the top width of the highway embankment or the bottom width of highway cutting excluding the side drains.

Right of Way and Land Width:

Right of way is the area of land acquired for the road, along its alignment. The width of the acquired land for right of way is known as 'land width' and it depends on the importance of the road and possible future development.

DESIGN OF HORIZONTAL ALIGNMENT:

Often changes in the direction are necessitated in highway alignment due to various reasons such as topographic considerations, obligatory points, etc. The geometric design elements pertaining to horizontal alignment of highways should consider safe and comfortable movement of vehicles at the designated design speed of the highway. It is therefore necessary to avoid sudden changes in direction with sharp curves or reverse curves which could not be safely and conveniently negotiated by the vehicles at design speed. Improper design of horizontal alignment of roads would necessitate speed changes resulting in higher accident rate and increase in vehicle operation cost.

Various design elements to be considered in the horizontal alignment are design speed, radius of circular curve, type and length of transition curves, superelevation, widening of pavement on curves and required set-back distance for fulfilling sight distance requirements.

Design Speed:

The design speed is the main factor on which geometric design elements depends. In other words, the geometric details of a highway mainly depend on the design speed. All the important geometric elements such as sight distances, radius of horizontal curve, length of horizontal transition curve, rate of superelevation, extra widening of pavement at horizontal curve, length of summit and valley curves are dependent on the design speed.

The ruling and minimum design speed values standardized by the IRC for different classes of roads on different terrains in rural(non-urban) areas are given in table below.

Table(4.8): Design speeds on rural highways(Page No:104):

Classification of road	Design speed in kmph for various terrains							
	plain		rolling		mountain		steep	
	Ruling min	Abs min	Ruling min	Abs min	Ruling min	Abs min	Ruling	min
Expressways	120	100	100	80	80	60	80	60
National & State Highways	100	80	80	65	50	40	40	30
Major District Roads	80	65	65	50	40	30	30	20
Other District Roads	65	50	50	40	30	25	25	20
Village Roads	50	40	40	35	25	20	25	20

Horizontal Curves:

A horizontal curve is a curve in plan to provide change in direction to the centre line of a road. A simple circular curve may be designated by either the radius, R of the curve in metres or the degree, D of the curve.

When a vehicle traverses a horizontal curve, the centrifugal force acts horizontally outwards through the centre of gravity of the vehicle. This centrifugal force is counteracted by the transverse frictional resistance developed between the tyres and the pavement.

Superelevation:

In order to counteract the effect of centrifugal force and to reduce the tendency of the vehicle to overturn or skid, the outer edge of the pavement is raised with respect to the inner edge, thus providing a transverse slope throughout the length of the horizontal curve. This transverse inclination to the pavement surface is known as 'Superelevation' or cant or banking.

Super elevation to be provided on curves is calculated from the following equation.

$$e = V^2/127R-f$$

Where,

e = super elevation

V = design speed, kmph

R = radius of horizontal curve, m

Radius of Horizontal Curve:

Horizontal curves of highways are generally designed for the specified ruling design speed of the highway. However if this is not possible due to site restrictions, the horizontal curves may be designed considering the specified minimum design speed of the highway. For a particular speed of vehicle the centrifugal force is dependent on the radius of the horizontal curve.

The ruling minimum and absolute minimum values of radii of horizontal curves for different classes of roads in different classes of roads in different terrains as per the IRC specifications are given in Table below:

Table(4.10): Minimum radii of horizontal curves for different terrain condition(Page No:119):

Classification of road	plain terrain		rolling terrain		mountain terrain				steep terrain			
					Area not affected by snow		snow bound area		Area not affected by snow		snow bound area	
	Ruling min	Abs min	Ruling min	Abs min	Ruling min	Abs min	Ruling min	Abs min	Ruling min	Abs min	Ruling min	Abs min
NH &SH	360	230	230	15	80	50	90	60	50	130	60	33
MDR	230	155	155	90	50	30	60	33	30	14	33	15
ODR	155	90	90	60	30	20	33	23	20	14	23	15
VR	90	60	60	45	20	14	23	15	20	14	23	15

Widening of Pavement on Horizontal Curves:

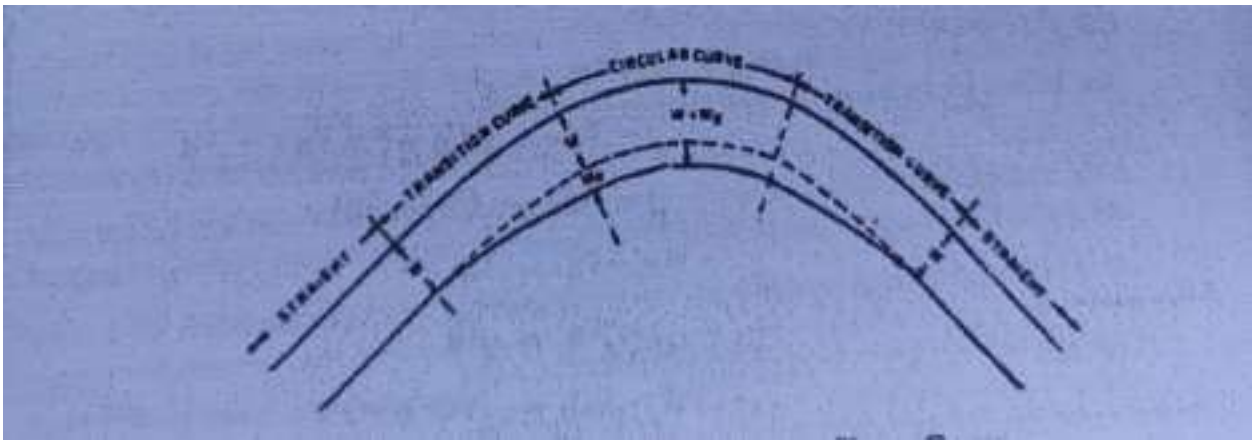
On horizontal curves, especially when they are not of very large radii, it is a common practice to widen the pavement slightly more than the normal width. The extra widening of pavement on horizontal curves is divided into two parts (1) mechanical and (2) psychological widening.

The extra width recommended by the IRC for single and two lane pavements are:

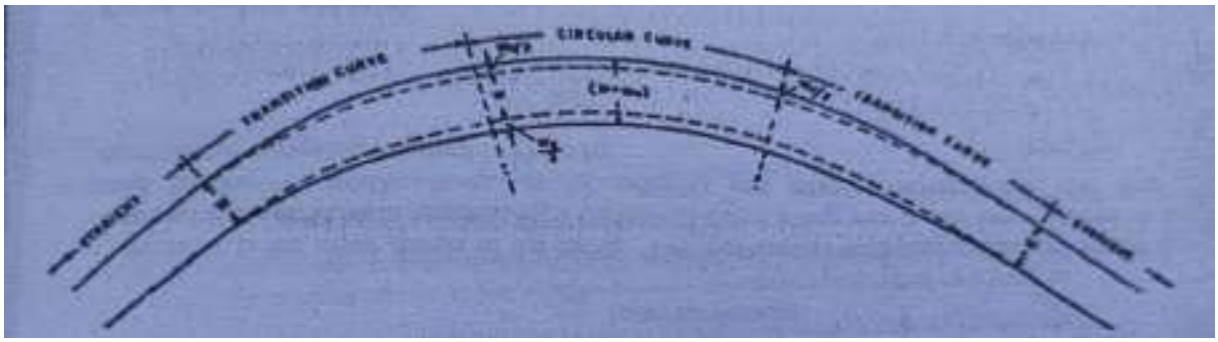
Table(4.11): Extra width of pavement at horizontal curves(Page No 122):

Radius of curve, m	Up to 20	20 to 40	41 to 60	61 to 100	101 to 300	Above 300
Extra width on two-lane pavement, m	1.5	1.5	1.2	0.9	0.6	Nil
Extra width on single lane pavement, m	0.9	0.6	0.6	Nil	Nil	Nil

Note: For multi-lane roads, the pavement widening is calculated by adding half the extra width of two-lane roads to each lane of the multi-lane road.



Widening of Pavement on Sharp Curve



Extra Widening of Pavement on Horizontal Curve

Horizontal Transition Curves:

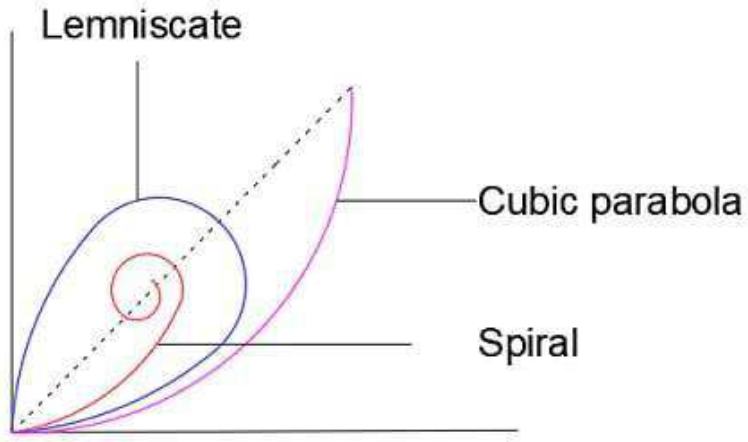
There is a necessary for smooth entry of vehicles from a straight into circular curve. Therefore a transition curve has a radius which decreases from infinity at the tangent point to a designed radius of the circular curve. When a transition curve is introduced between a straight and circular curve, the radius of the transition curve decreases and becomes minimum at the beginning of the circular curve. The rate of change of radius of the transition curve will depend on the shape of the curve adopted and the equation of the curve.

The transition curves also improve the aesthetic appearance of the road, besides permitting gradual application of the super elevation and extra widening at curves. The types of transition curves commonly adopted in horizontal alignment of highways are:

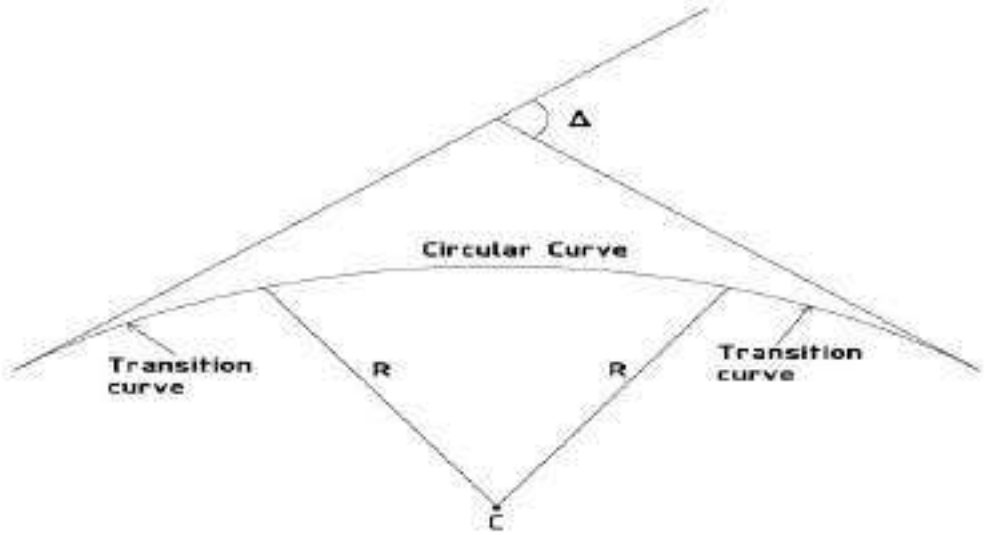
a) Spiral

b) Lemniscate

c) Cubic parabola



The minimum length of transition curves for various values of radius of curve and design speeds recommended by the IRC for plain and rolling terrains and also for mountainous and steep terrains



Transition Curve in Horizontal Alignment

Table(4.12): Minimum length of transition curve for different speeds and radii(Page No:129):

Curve radius R(m)	plain and rolling terrain						Mountainous and steep terrain					
	Design speed(kmph)						Curve radius R(m)	Design speed(kmph)				
	100	80	65	50	40	35		50	40	30	25	20
45	-	-	-	-	NA	70	17	-	-	-	NA	30
60	-	-	-	NA	75	55	20	-	-	-	35	20
90	-	-	-	75	50	40	25	-	-	NA	25	20
100	-	-	NA	70	45	35	30	-	-	30	25	15
150	-	-	80	45	30	25	40	-	NA	25	20	15
170	-	-	70	40	25	20	50	-	40	20	15	15
200	-	NA	60	35	25	20	55	-	40	20	15	15
240	-	90	50	30	20	NR	70	NA	30	15	15	15
300	NA	75	40	25	NR	-	80	55	25	15	15	NR
360	130	60	35	20	-	-	90	45	25	15	15	-
400	115	55	30	20	-	-	100	45	20	15	15	-
500	95	45	25	NR	-	-	125	35	15	15	NR	-
600	80	35	20	-	-	-	150	30	15	15	-	-
700	70	35	20	-	-	-	170	25	15	NA	-	-
800	60	30	NR	-	-	-	200	20	15	-	-	-
900	55	30	-	-	-	-	250	15	15	-	-	-
1000	50	30	-	-	-	-	300	15	NR	-	-	-
1200	40	NR	-	-	-	-	400	15	-	-	-	-
1500	35	-	-	-	-	-	500	NR	-	-	-	-
1800	30	-	-	-	-							
2000	NR	-	-	-	-							

Stopping Sight Distance(SSD):

The minimum sight distance available on a highway at any spot should be of sufficient length to stop a vehicle traveling at design speed, safely without collision with any other obstruction. The absolute minimum sight distance is therefore equal to the stopping sight distance, which is also sometimes called non-passing sight distance.

The sight distance available on a road to a driver at any instance depends on

1) Features of the road ahead,
2) Height of the driver's eye above the road surface
3) Height of the object above the road surface

Table (4.5): Recommended stopping sight distance values for different speeds(Page No 92):

Design speed, kmph	20	25	30	40	50	60	65	80	100
Safe stopping sight distance for design, m	20	25	30	45	60	80	90	120	180

DESIGN OF VERTICAL ALIGNMENT:

In order to have smooth vehicle movements on the roads, the changes in the gradient should be smoothened out by the vertical curves. The vertical alignment is the elevation or profile of the centre line of the road. The vertical alignment consists of ***grades and vertical curves***. The vertical alignment of a highway influences: 1) vehicle speed 2) acceleration and deceleration 3) stopping distance 4) sight distance 5) comfort while travelling at high speeds and 6) vehicle operation cost.

Gradient:

Gradient is the rate of rise or fall along the length of the road with respect to the horizontal. It is expressed as a ratio of 1 in *x* (1 vertical unit to *x* horizontal units); the gradient is also expressed as a percentage, such as n%, the slope being *n* vertical units to 100 horizontal units.

While aligning a highway, the gradients are decided for designing the vertical curve. Very steep gradients are avoided as it is not only difficult to climb the grade, but also the vehicle operation cost is increased. The highway engineer has to consider all aspects such as construction costs, practical problems in construction at the site and the vehicle operation cost while considering different alternative alignments before finalizing the gradients and vertical alignment of the highway.

Types of gradient:

Gradients are divided into four categories: (1) Ruling gradient (2) Limiting gradient (3) Exceptional gradient and (4) Minimum gradient.

The maximum values of ruling, limiting and exceptional gradients recommended by the IRC in different terrains are given in Table below:

Table(4.13): Gradients for roads in different terrains(Page No 142):

Type of terrain	Ruling gradient	Limiting gradient	Exceptional gradient
Plain or rolling	3.3 percent (1 in 30)	5 percent (1 in 20)	6.7 percent (1 in 15)
Mountainous terrain, and steep terrain having elevation more than 3,000 m above the mean sea level	5 percent (1 in 20)	6 percent (1 in 16.7)	7 percent (1 in 14.3)
Steep terrain up to 3,000 m height above mean sea level	6 percent (1 in 16.7)	7 percent (1 in 14.3)	8 percent (1 in 12.5)

From the drainage point of view, it is desirable to have a certain 'minimum gradient' on roads provided topography favours this. The minimum gradient would depend on the amount of rain fall, type of soil, run off, topography and other site conditions. A minimum gradient of about 1 in 500 may be sufficient to drain water in concrete drains or gutter; but on inferior surfaces of drains a slope of 1 in 200 or 0.5 percent may be needed where as on kutcha open drains or soil drains, steeper slopes up to 1 in 100 or 1.0 percent may be needed depending on the soil type.

Vertical Curves:

Due to changes in grade in the vertical alignment of highway, it is necessary to introduce vertical curve at the intersections of different grades to smoothen out the vertical profile and thus ease off the changes in gradients for the fast moving vehicles.

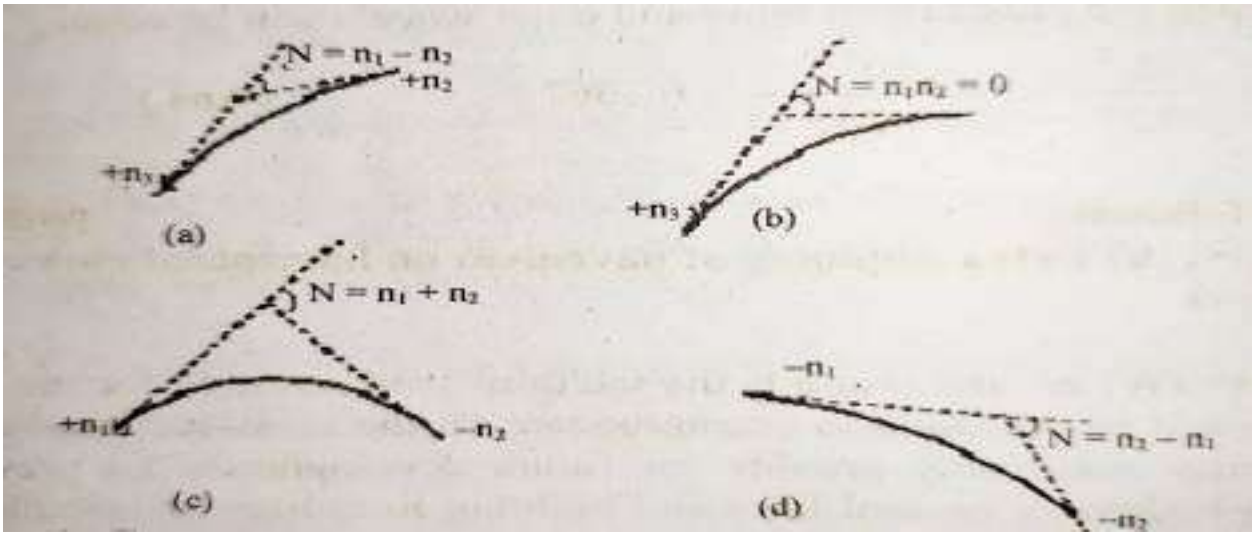
The vertical curves used in highway may be classified into two categories:

a) Summit curves or crest curves with convexity upwards

b) Valley curves or sag curves with concavity upwards

a) Summit curves:

Summit curves with convexity upwards are formed in any one of the case illustrated in fig. The deviation angle between the two interacting gradients is equal to the algebraic difference between them. Of all the cases, the deviation angle will be maximum when an ascending gradient meets with a descending gradient i.e $N=n_1 - (-n_2) = (n_1 + n_2)$.

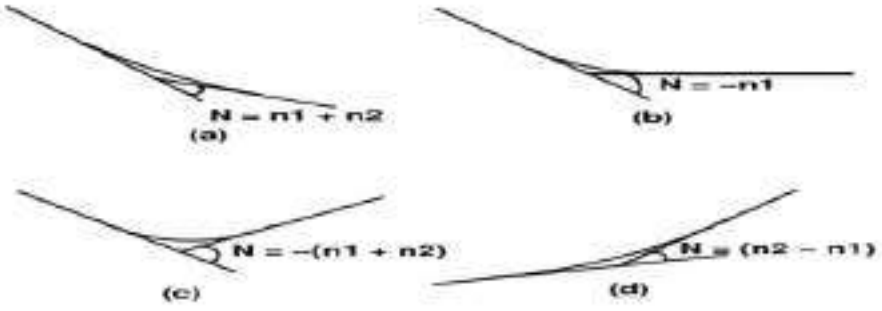


Summit Curve

b) Valley curves:

Valley curves or sag curve are formed in anyone of the cases illustrated in fig. In all the cases the maximum possible deviation angle is obtained when a descending gradient meets with an ascending gradient.

There is no problem of restriction to sight distance in valley curves during day light, However , during night driving under head lights of the vehicles, the sight distance available at valley curve decreased.



Valley Curve

Table(4.14): Minimum length of vertical curves(page No 147):

Design speed, kmph	Maximum grade change(percent) not requiring a vertical curve	Minimum length of vertical curve, m(for higher grade change values)
35	1.5	15
40	1.2	20
50	1.0	30
65	0.8	40
80	0.6	50
100	0.5	60

PAVEMENT DESIGN:

Based on the structural behavior, road pavements are generally classified into two categories, namely:

1) Flexible pavement

2) Rigid pavements

Other types of pavement structure include (a) 'semi-rigid pavement' or 'composite pavement' and (b) Interlocking cement Concrete Block Pavement (ICBP). However these types of pavements are less common when compared to flexible and rigid pavements.

1) Flexible pavements:

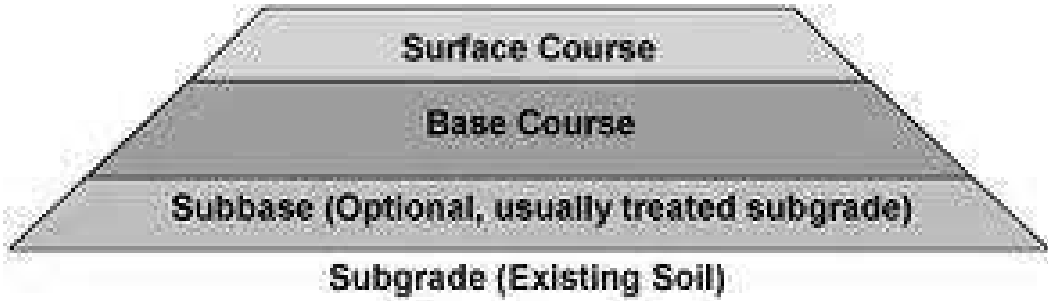
Flexible pavements are those, which on the whole have low or negligible flexural strength and are rather flexible in their structural action under the loads. The components of a typical flexible pavement structure (from the bottom to the top) consist of:

a) Prepared soil sub grade

b) Granular sub-base cum drainage layer

c) Granular base course

d) Bituminous binder and/or surface course



Flexible pavements

2) Rigid pavements:

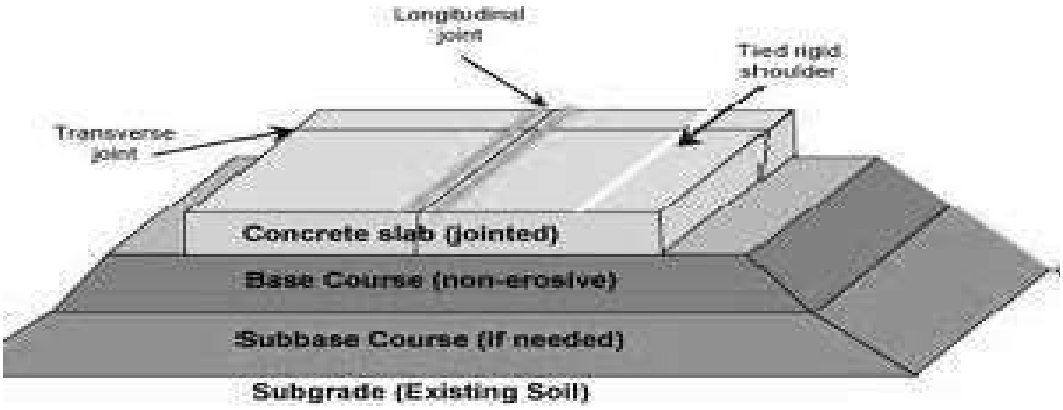
Rigid pavements are those which possess noteworthy flexural strength or flexural rigidity. The rigid pavements are generally made of Portland cement concrete (CC) and are therefore called 'CC pavements'. The components of a typical rigid pavement or cement concrete (CC) pavement structure (from bottom towards the top) consist of:

a)Compacted soil sub grade at the bottom or lower layer

b) Granular sub-base(GSB) course and drainage layer

c) Base course

d) CC/PQC pavement slab



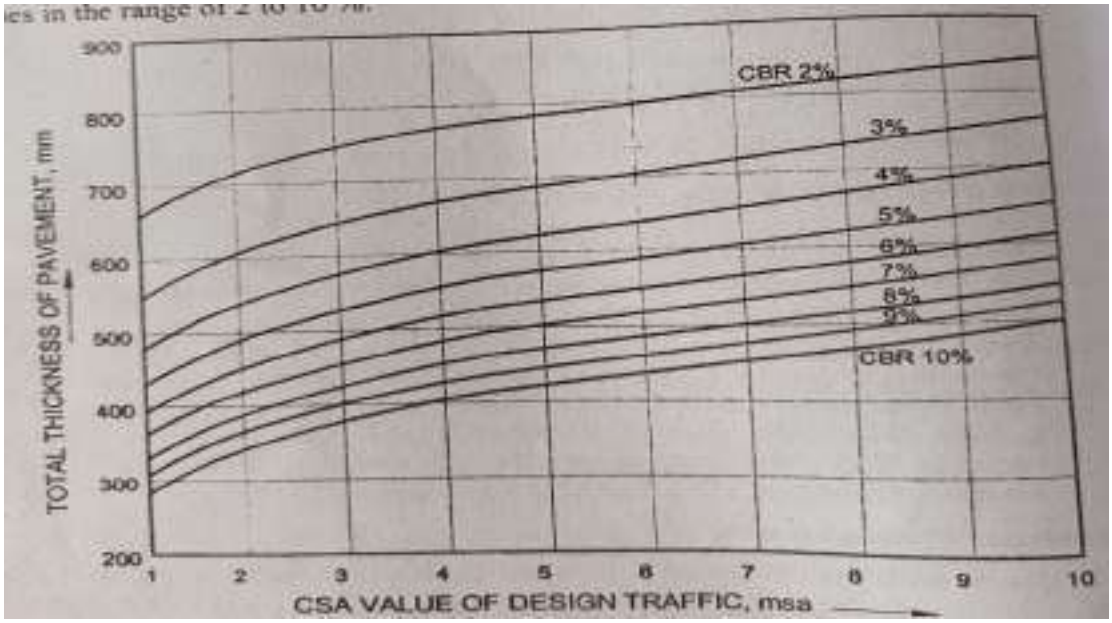
Rigid pavements

CBR TEST

Flexible pavement design usig CBR design charts

Indian roads congress, vide IRC 37-2001 'Guidelines for the design if Flexible Pavements'(second revision) has presented two design charts for the determination of total thickness of the flexible pavements, considering use of subgrade soil with CBR values in the range of 2 to 10%.

The first design chart is usefull to design flexible pavements of roads with low to moderate flow of heavy vehicles for design CSA values of 1 to 10 msa. In this chart the CSA value are plotted on the X axis and the total pavement thickness on the Y axis, both in arithmetic scale. Nine different curves are given for different subgrade CBR value in the range of 2 to 10%



CBR design chart for determination of total pavement thickness for traffic with CSA of 1.0 to 10 msa

DRAWINGS AND REPORT:

- ***Drawings***:

The following drawings are usually prepared in a highway project:

• Key map

• Index map

• Preliminary survey plans

• Detailed plan and longitudinal section

• Detailed cross section

• Land acquisition plans

• Drawings of cross drainage and other retaining structures

• Drawings of road intersections

• Land plans showing quarries, etc.

- ***Estimates:***

The project estimates should consist of general abstract of cost and detailed estimates for each major head. If the project work is proposed to be executed in stages, the estimate should be prepared for each stage separately.

- ***Project Report:***

The first phase of project report soon after completing the preliminary surveys, feasibility and EIA studies is to prepare a 'Feasibility Report'.

The Detailed Project Report (DPR) should be prepared after completing all the detailed studies including final location survey, preparation of longitudinal and cross sections, soil and material surveys, drainage studies, etc...The design details of the pavements and all CD structures including major bridges should be carried out and the relevant drawings prepared as specified in term of reference for the project preparation.

DESIGN OF HIGHWAY

DESIGN DETAILS OF ALIGNMENT OF VILLAGE ROAD

Design speed (v) = 60 km/h

Rate of super elevation (e) = 0.07

Co-efficient of friction (f) = 0.15

Ruling radius $R= v^2/127(e+f)$

$=60^2/127(0.07+0.15)$

= 57.26 m say 60m

Ruling radius of 60**m** at horizontal is to facilitate any vehicle to negotiate the curve at design speed.

CHECK FOR SUPER ELEVATION

Super elevation e = $V^2/225R$

=$40^2/225*60$

= 0.1185> 0.07

Therefore, the value of Super Elevation is greater than the maximum 'e' of 0.07. So super elevation to be provided is **0.07**

CHECK FOR FRICTION DEVELOPED

e + f =$V^2/127R$

0.07 + f =0.21

f = 0.139>>0.14 < 0.15

Therefore the value of friction is lesser than the maximum 'f' of 0.15
So it is safe to provide f = 0.14

WIDENING AT CURVES

Widening at curves = psychological widening+ extra width for mechanics

$W_e=W_m+W_{PS}$

W_{ps} = $V/9.5\sqrt{R}$ = $40/9.5\sqrt{60}$= 0.543

$W_m=nl^2/2R$= 0.6

No. of lanes n = 2

Maximum length of vehicle L = 6m

Widening at curves, W_e = 0.543+0.6
= 1.143m

The IRC recommends extra widening of 1.2 m when the radius of curve is 41-60

DESIGN OF CAMBER

Width of carriage way = 5.5

Width of road way = 7.5m

Right of way = 18m

DESIGN OF PAVEMENT THICKNESS

Value of CBR=8%

From IRC code book page no 27 total thickness of pavement=450mm

Granular base=250mm

Granular subbase=150mm

Bituminous course=50mm

Carpet wearing course=20mm

STOPPING SIGHT DISTANCE (SSD):

Design speed V = 60 km/h =60/3.6 = 16.66 m/sec

Acceleration due to gravity g = 9.81m/s^2

As per IRC longitudinal co-efficient of friction f = 0.35 to 0.40

Assume co-efficient of friction f = 0.37

Drivers reaction time t = 2.3 sec

SSD = Lag distance + Breaking distance

= V*t +$V^2/2gf$

= 16.66* 2.5 +16.66^2/2(9.81) 0.37

= 80.96m, say 80 m

SIGHT DISTANCE (SD):

SD = lag distance + break distance

SD = 0.278 V*t + v^2/254(f-0.01)n

Where; V in kmph ; n in %

SD = 0.278 x 60x2.5+ 6^2/254(0.36-0.01)3.33

SD = 54 m

OVER TAKING SIGHT DISTANCE (OSD)

OSD = d_1+ d_2+ d_3(For two way traffic)

OSD = (0.28v_b t) + (0.28 v_bT + 2.5) + (0.28 V T)

V = Design speed = 60 km/h

V_b = Speed of overtaking vehicle = V – 16 = 44 km/h

t = Reaction time of driver = 2.3 s

A = Acceleration = 4.45km /s^2

s = Spacing of vehicles = 0.2 v_b+ 6 = 0.2 x 44 + 6 = 14.8m

T = √14.4(s)/A = √14.4(14.8)/4.45

T = 6.92

OSD = (0.28 x24 x 2.5) + (0.28 x44 x 6.92 + 2.5) + (0.28 x60 x6.92)

OSD = 234.8 m, say 235m

OVERTAKING ZONE

Minimum length of overtaking zone = 3 x OSD

= 3 x 235

=705 **m**

Desirable length of overtaking zone = 5 x OSD

= 5 x 705
=3525 **m**

DESIGN OF DRAINS

Maximum quantity of water expected (Q) = 0.3 m^3/sec

Allowable velocity (V) = 1.2 m/sec

Manning's roughness co-efficient (n) = 0.02

Slope of the trapezoidal drain = 1(V): 1.5(H) assumed

Bottom width of drain = 0.3 m

Cross sectional area of drain (A) = Qv= 0.31.2= 0.25 m^2

For the trapezoidal section with bottom width 0.3m and side slope 1:1.5, when the depth of flow is dm, the top width would be (0.3 + 3d)

The cross section area of the drain = (0.3+0.3+3d) x d^2

This area has been found to be 0.5 m^2

(0.3+0.3+3d)d^2= 0.5

d = 0.32m or320mm

Provide depth of drain = 0.32m

DESIGN OF CURVE:

Curve – 1

Radius of curve (R) = 60m

Length of long chord (L) = 40m

$L/2=40/2=20mm$

Consider 5 peg intervals
40/5=8m

Mid Ordinate (O_o)

O_o=R-$\sqrt{(R^2- (L/2)^2)}$

$O_o=60-\sqrt{(60^2-(40/2)^2)}$ = 3.431 m

X distance =5m from mid ordinate

$X=\sqrt{(R^2-x^2)} - \sqrt{(R^2- (L/2)^2)}$

$= \sqrt{(60^2-8^2)} - \sqrt{(60^2- (40/2)^2)}$ = 2.895m

$= \sqrt{(60^2-16^2)} - \sqrt{(60^2- (40/2)^2)}$ = 1.25m

$= \sqrt{(60^2-24^2)} - \sqrt{(60^2- (40/2)^2)}$ = - 0.59m

$= \sqrt{(60^2-32^2)} - \sqrt{(60^2- (40/2)^2)}$ =-2.11 m

$= \sqrt{(60^2-40^2)} - \sqrt{(60^2- (40/2)^2)}$ = -4.14m

Same for other side.

Curve - 2

Radius of curve (R) = 30m

Length of long chord (L) = 45m

$L/2=45/2=22.5mm$

Consider 5 peg intervals
22.5/5=4.5m

Mid Ordinate (O_o)

O_o=R-$\sqrt{(R^2-(L/2)^2)}$

$O_o=40-\sqrt{(40^2-(45/2)^2)}$ =10.156 m

X distance =4.5m from mid ordinate

$X=\sqrt{(R^2-x^2)}-\sqrt{(R^2-(L/2)^2)}$

$4.5=\sqrt{(30^2-4.5^2)}-\sqrt{(30^2-(45/2)^2)}$ = 9.82m

$9=\sqrt{(30^2-9^2)}-\sqrt{(30^2-(45/2)^2)}$ = 8.778m

$13.5=\sqrt{(30^2-13.5^2)}-\sqrt{(30^2-(45/2)^2)}$ = 6.950m

$18=\sqrt{(30^2-18^2)}-\sqrt{(30^2-(45/2)^2)}$ = 4.16m

$22.5=\sqrt{(30^2-22.5^2)}-\sqrt{(30^2-(45/2)^2)}$ = 0m

Same for other side.

EARTH WORK CALCULATION

Chainage	RL of GL(m)	FL(m)	Height	Bd	Sd^2	Bd+Sd^2	L	Q=(Bd+Sd^2)L	
0	791	780	-11	-39.6	121	81.4		Cutting	Banking
10	792.12	780.003	-12.117	-43.6212	146.8217	103.2005	10	1032.005	
20	789.61	780.0033	-9.6067	-34.5841	92.28868	57.70456	10	577.0456	
30	789.29	780.0063	-9.2837	-33.4213	86.18709	52.76577	10	527.6577	
40	789.08	780.0066	-9.0734	-32.6642	82.32659	49.66235	10	496.6235	
50	788.895	780.0096	-8.8854	-31.9874	78.95033	46.96289	10	469.6289	
60	788.74	780.0099	-8.7301	-31.4284	76.21465	44.78629	10	447.8629	
70	788.59	780.0129	-8.5771	-30.8776	73.56664	42.68908	10	426.8908	
80	788.42	780.0132	-8.4068	-30.2645	70.67429	40.40981	10	404.0981	
90	788.25	780.0162	-8.2338	-29.6417	67.79546	38.15378	10	381.5378	
100	788.12	780.0165	-8.1035	-29.1726	65.66671	36.49411	10	364.9411	
110	788.03	780.0195	-8.0105	-28.8378	64.16811	35.33031	10	353.3031	
120	787.94	780.0198	-7.9202	-28.5127	62.72957	34.21685	10	342.1685	
130	787.845	780.0228	-7.8222	-28.1599	61.18681	33.02689	10	330.2689	
140	787.725	780.0231	-7.7019	-27.7268	59.31926	31.59242	10	315.9242	
150	787.61	780.0261	-7.5839	-27.302	57.51554	30.2135	10	302.135	
160	787.415	780.0264	-7.3886	-26.599	54.59141	27.99245	10	279.9245	
170	786.145	780.0294	-6.1156	-22.0162	37.40056	15.3844	10	153.844	
180	786.865	780.0297	-6.8353	-24.6071	46.72133	22.11425	10	221.1425	
190	784.86	780.0327	-4.8273	-17.3783	23.30283	5.924545	10	59.24545	
200	786	780.033	-6	-23.0508	40.99841	17.94761	10	179.4761	
210	786.31	780.036	-6.274	-22.5864	39.36308	16.77668	10	167.7668	
220	786.26	780.0363	-6.2237	-22.4053	38.73444	16.32912	10	163.2912	
230	786.14	780.0393	-6.1007	-21.9625	37.21854	15.25602	10	152.5602	
240	785.955	780.0396	-5.9154	-21.2954	34.99196	13.69652	10	136.9652	
250	785.735	780.0426	-5.6924	-20.4926	32.40342	11.91078	10	119.1078	
260	785.495	780.0429	-5.4521	-19.6276	29.72539	10.09783	10	100.9783	
270	785	780.0459	-5.0491	-18.1768	25.49341	7.316651	10	73.16651	
280	784,340	780.0462	-7.835	-28.206	61.38723	33.18123	10	331.8123	
290	781.5	780.0492	-1.4508	-5.22288	2.104821	-3.11806	10	-31.1806	
300	784.02	780.0495	-3.9705	-14.2938	15.76487	1.47107	10	14.7107	
310		790			0	0	10	0	
310	786	790.0047	4	14.4	16	30.4	10		304
320	783.11	790.0094	6.8994	24.83784	47.60172	72.43956	10		62.43956
330	782.97	790.0141	7.0441	25.35876	49.61934	74.9781	10		749.781

340	783	790.0188	7.3888	26.59968	54.59437	81.19405	10		71.19405
350	782	790.0235	7.5635	27.2286	57.20653	84.43513	10		844.3513
360	782.3	790.0282	7.7282	27.82152	59.72508	87.5466	10		77.5466
370	782.25	790.0329	7.7829	28.01844	60.57353	88.59197	10		885.9197
380	781.88	790.0376	8.1576	29.36736	66.54644	95.9138	10		85.9138
390	781.63	790.0423	8.4123	30.28428	70.76679	101.0511	10		1010.511
400	781.53	790.047	8.517	30.6612	72.53929	103.2005	10		93.20049
410	781.53	790.0517	8.5217	30.67812	72.61937	103.2975	10		1032.975
420	781.545	790.0564	8.5114	30.64104	72.44393	103.085	10		93.08497
430	781.66	790.0611	8.4011	30.24396	70.57848	100.8224	10		1008.224
440	781.9	790.0658	8.1658	29.39688	66.68029	96.07717	10		86.07717
450	782.08	790.0705	7.9905	28.7658	63.84809	92.61389	10		926.1389
460	782.3	790.0752	7.7752	27.99072	60.45374	88.44446	10		78.44446
470	782.8	790.0799	7.2799	26.20764	52.99694	79.20458	10		792.0458
480	783.35	790.0846	6.7346	24.24456	45.35484	69.5994	10		59.5994
490	783.4	790.0893	6.6893	24.08148	44.74673	68.82821	10		688.2821
500	784.67	790.094	5.424	19.5264	29.41978	48.94618	10		38.94618
510	785.35	790.0987	4.7487	17.09532	22.55015	39.64547	10		396.4547
	0	780			0	0	10		0
520	786.94	780.00769	-6.93231	-24.9563	48.05692	23.10061	10	231.0061	
530	785.41	780.01538	-5.39462	-19.4206	29.10192	9.681293	10	96.81293	
540	785.04	780.02307	-5.01693	-18.0609	25.16959	7.108639	10	71.08639	
550	784.8	780.03076	-4.76924	-17.1693	22.74565	5.576386	10	55.76386	
560	783.94	780.03845	-3.90155	-14.0456	15.22209	1.176512	10	11.76512	
570	781.49	780.04614	-1.44386	-5.1979	2.084732	-3.11316	10	-31.1316	
580	784.21	780.05383	-4.15617	-14.9622	17.27375	2.311537	10	23.11537	
590	783.7	780.06152	-3.63848	-13.0985	13.23854	0.140009	10	1.400087	
600	783.49	780.06921	-3.42079	-12.3148	11.7018	-0.61304	10	-6.1304	
610	783.25	780.0769	-3.1731	-11.4232	10.06856	-1.3546	10	-13.546	
620	783.04	780.08459	-2.95541	-10.6395	8.734448	-1.90503	10	-19.0503	
630	782.99	780.09228	-2.89772	-10.4318	8.396781	-2.03501	10	-20.3501	
640	783.28	780.09997	-3.18003	-11.4481	10.11259	-1.33552	10	-13.3552	

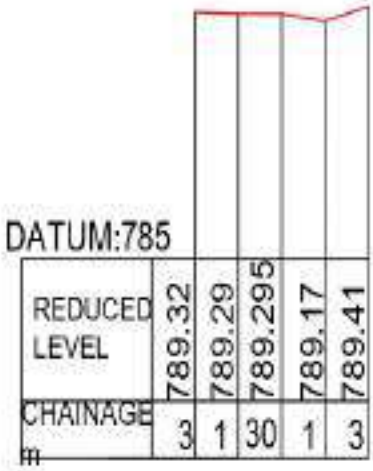
650	783.03	780.10766	-2.92234	-10.5204	8.540071	-1.98035	10	-19.8035	
	0	790			0	0	10	0	
660	783.1	790.006	6.906	24.8616	47.69284	72.55444	10		725.5444
670	783.26	790.012	6.752	24.3072	45.5895	69.8967	10		698.967
680	783.38	790.018	6.638	23.8968	44.06304	67.95984	10		679.5984
690	783.73	790.024	6.294	22.6584	39.61444	62.27284	10		622.7284
700	783.39	790.03	6.64	23.904	44.0896	67.9936	10		679.936
710	782.98	790.036	7.056	25.4016	49.78714	75.18874	10		751.8874
720	782.93	790.042	7.112	25.6032	50.58054	76.18374	10		761.8374
730	782.98	790.048	7.068	25.4448	49.95662	75.40142	10		754.0142
740	783.18	790.054	6.874	24.7464	47.25188	71.99828	10		719.9828
750	783.1	790.06	6.96	25.056	48.4416	73.4976	10		734.976
760	722.86	790.066	67.206	241.9416	4516.646	4758.588	10		47585.88
770	783.29	790.072	6.782	24.4152	45.99552	70.41072	10		704.1072
780	783.66	790.078	6.418	23.1048	41.19072	64.29552	10		642.9552
790	783.92	790.084	6.164	22.1904	37.9949	60.1853	10		601.853
800	784.38	790.09	5.71	20.556	32.6041	53.1601	10		531.601

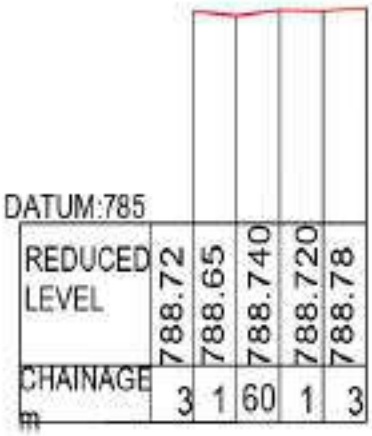
B=3.6	m	
S=1, banking and cutting		

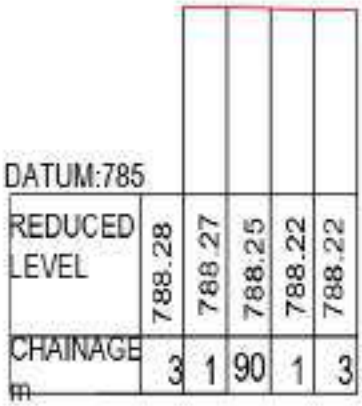
LONGITUDINAL SECTION

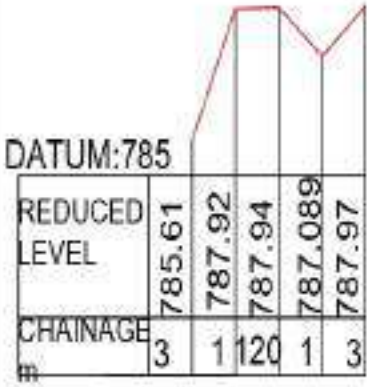

FORMATION LEVEL
Gradient and vertical curve
Nature of soil
CLAYEY SOIL
Gravel
Sandy
Datum 750.00
Depth of cutting
Height of bank
Formation level
Ground levels
DISTANCE m

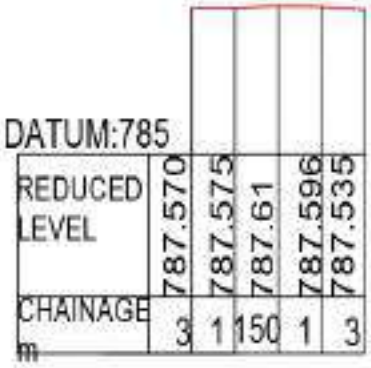
CROSS SECTION OF HIGHWAY ALIGNMENT

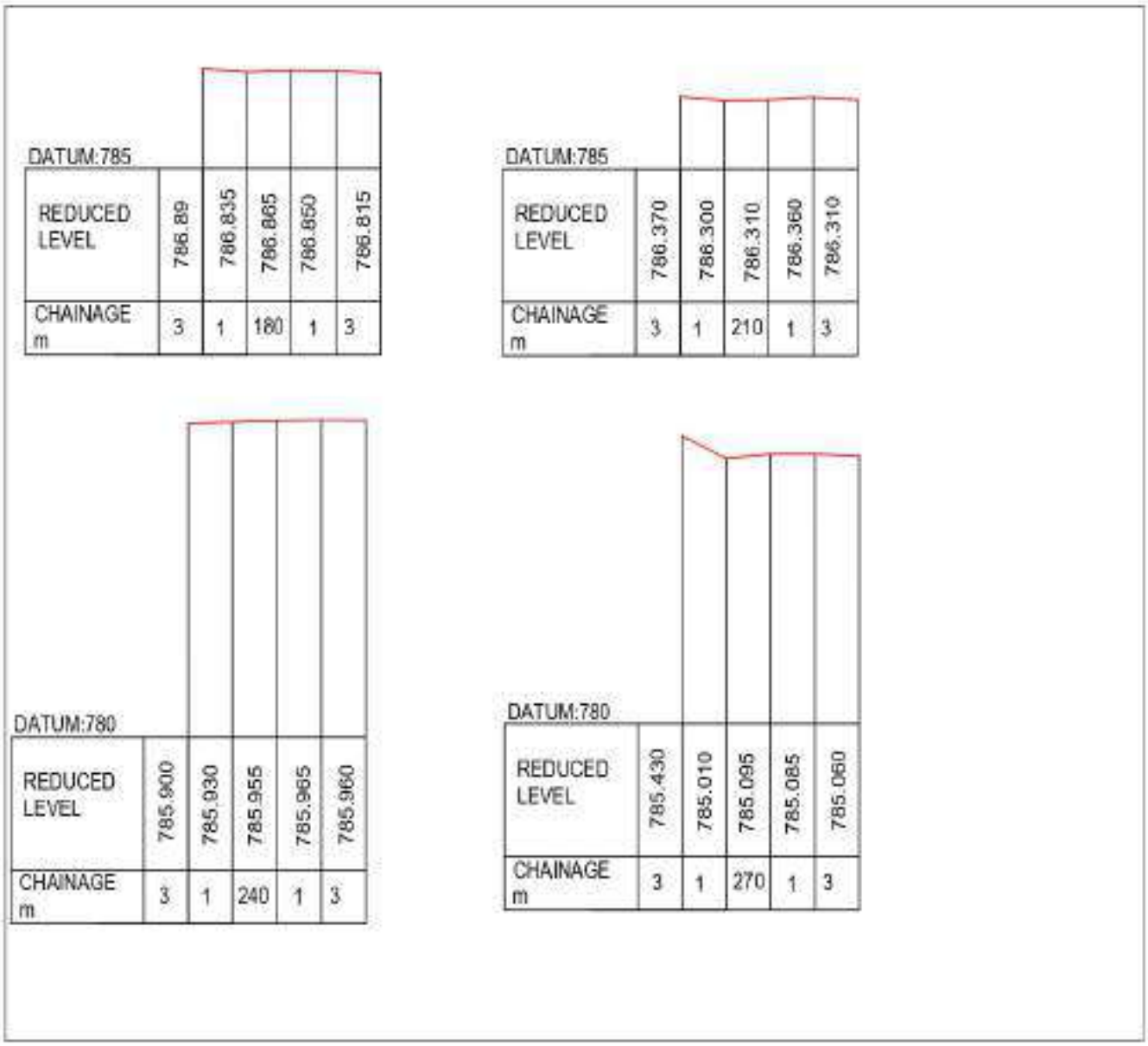


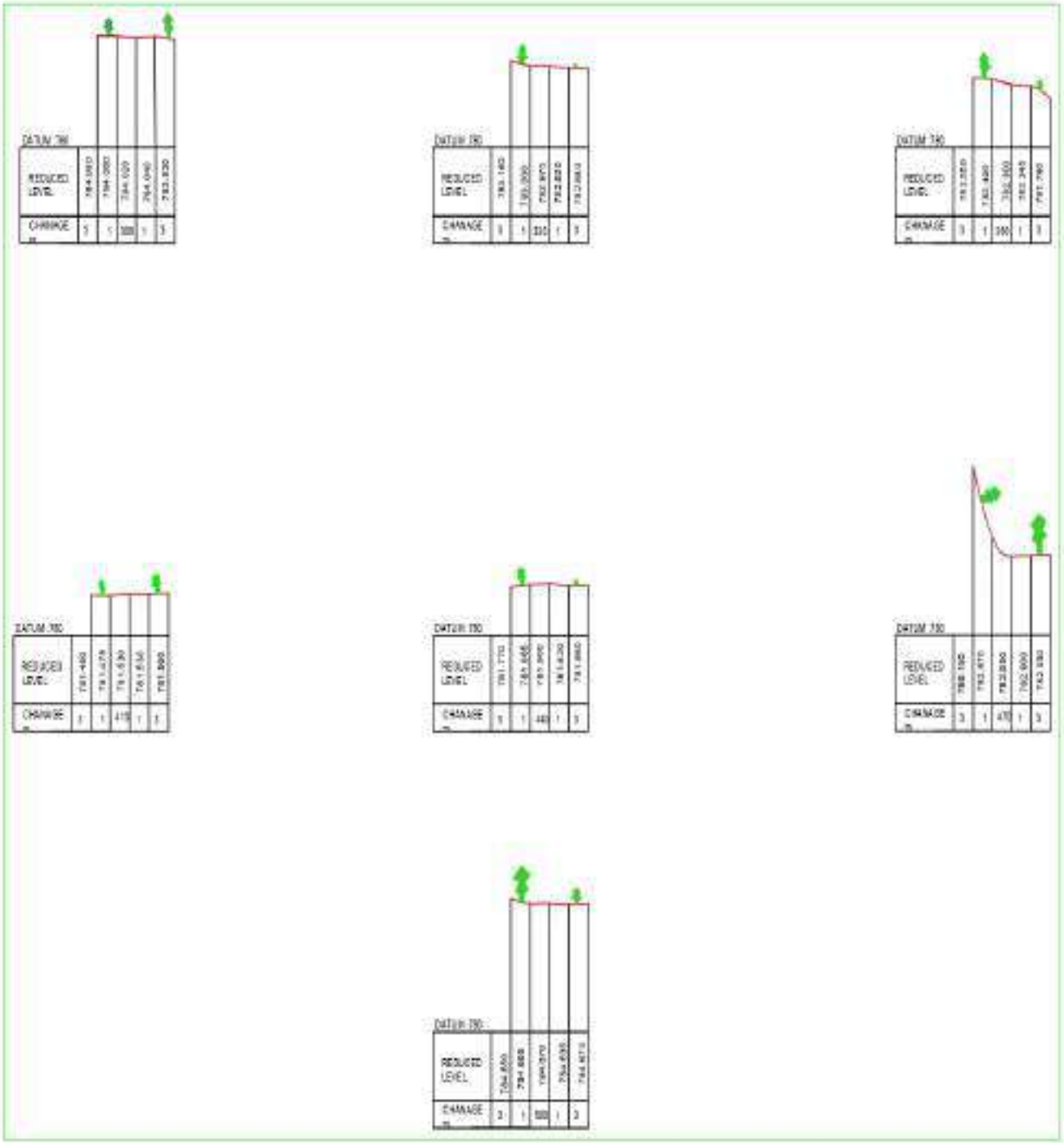


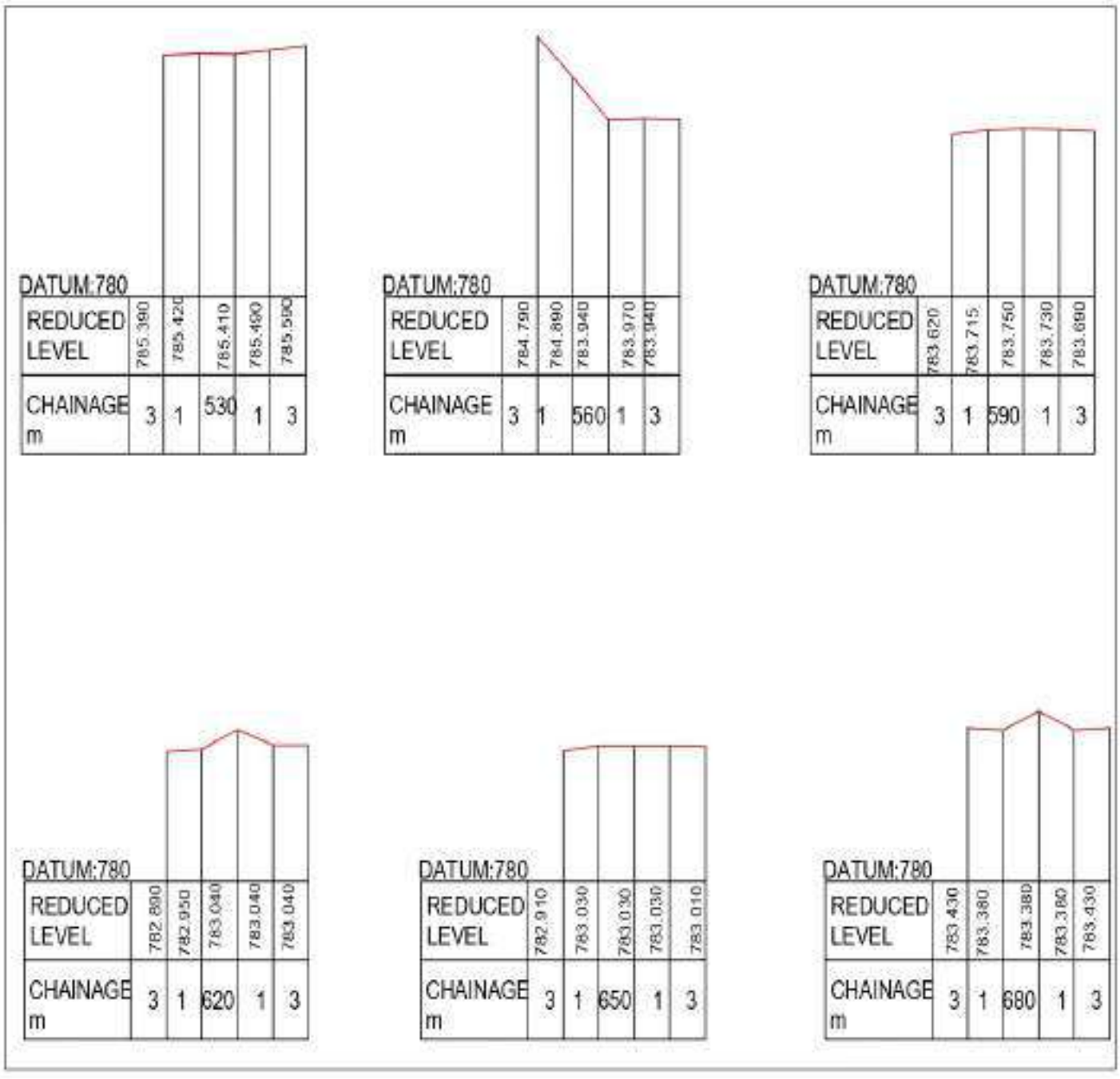







DATUM:785
REDUCED LEVEL
786.89
786.835
786.865
786.850
786.815
CHAINAGE m
3
1
180
1
3
DATUM:785
REDUCED LEVEL
786.370
786.300
786.310
786.360
786.310
CHAINAGE m
3
1
210
1
3
DATUM:780
REDUCED LEVEL
785.900
785.930
785.955
785.965
785.960
CHAINAGE m
3
1
240
1
3
DATUM:780
REDUCED LEVEL
785.430
785.010
785.095
785.085
785.060
CHAINAGE m
3
1
270
1
3





DATUM:780

REDUCED LEVEL	785.390	785.420	785.410	785.490	785.590
CHAINAGE m	3	1	530	1	3

DATUM:780

REDUCED LEVEL	784.790	784.890	783.940	783.970	783.940
CHAINAGE m	3	1	560	1	3

DATUM:780

REDUCED LEVEL	783.620	783.715	783.750	783.730	783.690
CHAINAGE m	3	1	590	1	3

DATUM:780

REDUCED LEVEL	782.890	782.950	783.040	783.040	783.040
CHAINAGE m	3	1	620	1	3

DATUM:780

REDUCED LEVEL	782.910	783.030	783.030	783.030	783.010
CHAINAGE m	3	1	650	1	3

DATUM:780

REDUCED LEVEL	783.430	783.380	783.380	783.380	783.430
CHAINAGE m	3	1	680	1	3

CROSS SECTION

DATUM:780

REDUCED LEVEL	782.960	782.960	782.980	782.980	782.930
CHAINAGE m	3	1	710	1	3

DATUM:780

REDUCED LEVEL	783.080	783.060	783.180	783.200	783.180
CHAINAGE m	3	1	740	1	3

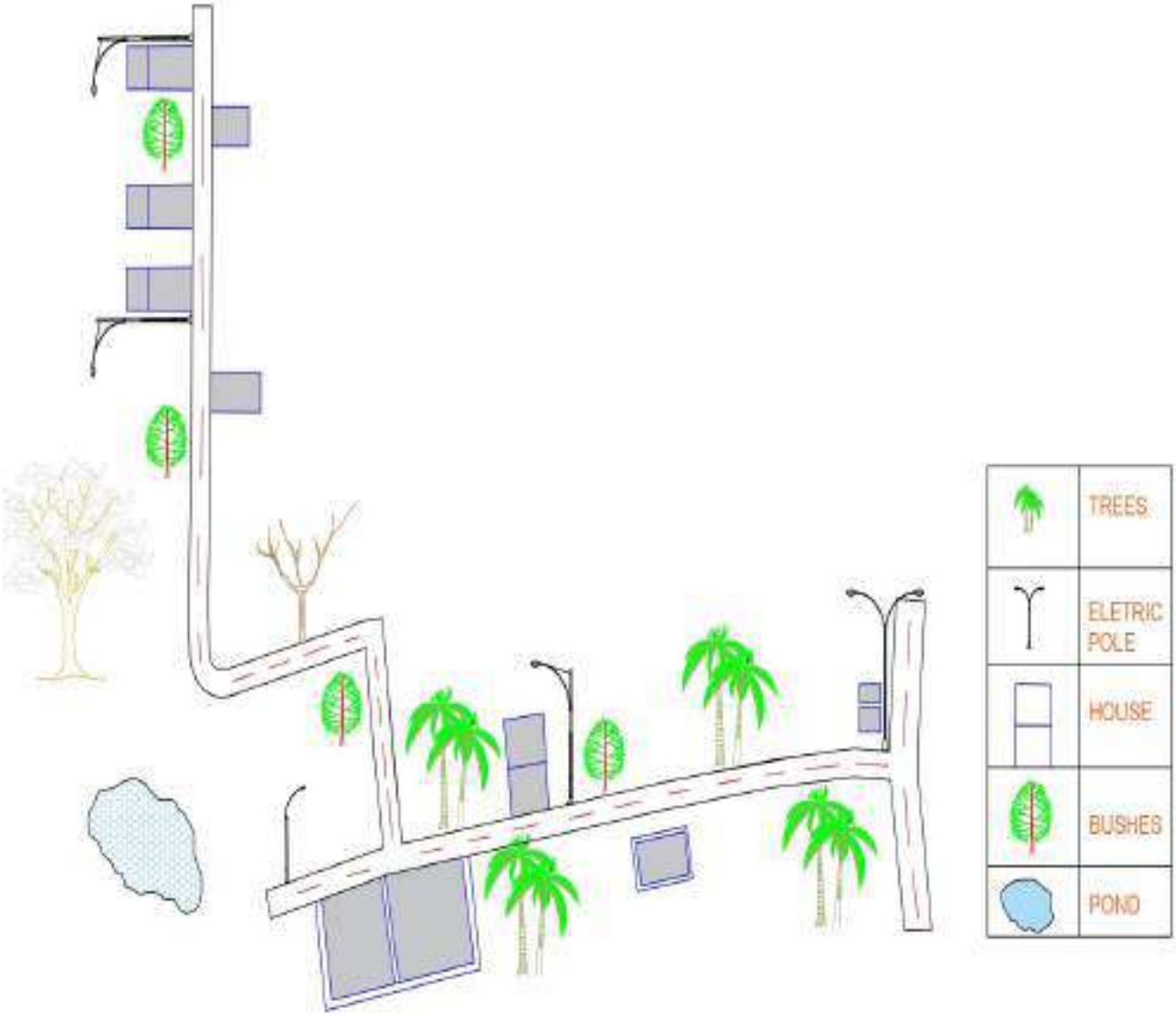
DATUM:780

REDUCED LEVEL	783.260	783.290	783.295	783.250	783.260
CHAINAGE m	3	1	770	1	3

DATUM:780

REDUCED LEVEL	784.370	784.400	784.380	784.375	784.310
CHAINAGE m	3	1	800	1	3

HIGHWAY ALIGNMENT



OLD TANK PROJECT (OTP)

Project In-Charge: 1. Prof. Manjularani P

2. Prof. Sandhya Rani G M

CONTENTS

1.Introduction:

Tanks are very small storage reservoir created on the upstream of a small earthen dam, construction across the stream. The depth of water in the tank is usually less than 4m. However, in exceptional cases; it may be more than but not greater than 12m. When the depth of water exceeds 12m, the tank is termed as reservoir.

An irrigation tank generally consists of the following

- An earthen bund across the valley creating storage.
- A surplus weir to dispose of hard storage.
- Sluice to feed the channel to feed the command area.

The general problems of an irrigation tank are

- Reduction in the gross storage capacity of the tank due to silting.
- Reduction in the safety of the bund due to working out of standard dimensions of the bund.

The above problem can be overcome by restoring the tank. Restoration of the tank is done by raising the height of existing bund, thereby allowing increasing the storage and improving the safety of the bund.

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- **Aim:**

Restoration of old tanking is necessary to improve the capacity of the tank which is reduced by silting and also to improve the conditions of the bund.

- **Necessity for Restoration of Tank:**

Construction of old tank bund across the stream at a river would facilitate in creating a reservoir on the upstream of the bund. The water gets arrested within the barrier their by tapping the sediment in the reservoir. Due to progressive silting in the reservoir its storage capacity gets reduced. The demand for irrigation water cannot be met due to the reduced storage.

Further, in future there may be demand for water cultivation of large area. In view of these two factors it becomes necessary to restore the storage capacity of the reservoir to a value equal to its original value.

The storage capacity is increased in two ways;

- Raising F.T.L of the reservoir after making suitable modifications in the profile of the existing one.
- De-silting the reservoir: This would require the employment of sophisticated equipment such as hydraulic dredges. Before taking up the project, it is necessary to study whether the proposal would yield minimum cost to restore the original capacity of the reservoir.

Weir or Barrage

Weir is a solid obstruction placed across the river. Its main function is to raise the water level so that water can be diverted by canal to crop field due to difference of head. Barrage practically a low weir with an adjustable gate over this low weir. Heading up of water is affected by the gate.

Types of Weir

Weir may be of different types based on materials of construction, design features and types of soil foundation as:

Vertical Drop Weir:

It is a vertical drop weir without a crest gate. A crest gate may be provided to store more water during flood period. At the upstream and downstream ends of impervious floor cut off piles are provided. Launching aprons are provided both at upstream and downstream ends of floor to safe guard against scouring action. A graded filter is provided immediately at the downstream end of impervious floor to release the uplift pressure. This type of weir is suitable for any type of foundation.

Sloping Weir of Concrete

This type is suitable for soft sandy foundation. It is used where difference in weir crest and downstream river bed is not more than 3m. Hydraulic jump is formed when water passes over the sloping glacis. Weir of this type is of recent origin.

Parabolic Weir

A parabolic weir is almost similar to spillway section of dam. The weir or body wall for this weir is designed as low dam. A cistern is provided at downstream.

Dry Stone Sloping Weir

It is a dry stone or rock fill weir. It consists of body wall and upstream and downstream dry stones are laid in the form of glacis with some intervening core wall. This weir is constructed in Yamuna River (near Delhi) at Okhla.

Surplus Weir:

The excess water is spilled from tank into the downstream channel so as to avoid the raise of water above the maximum water level. In fact, the water will generally spill over the crest of this escape weir, as and when it rises above full tank level and discharge capacity of this weir will be designed such as to pass the full maximum flood discharge with the depth over the weir equal to the difference between full tank level and maximum water level. Although the effective the storage capacity of the tank is limited by full tank level, the area submerged by the tank bund and revetment is dependent on maximum water level. And hence in order to restrict the dimensions of these, it is desirable to keep the difference between full tank level and maximum water level to a smaller value which is kept from 0.3m to 0.6m and it is rarely allowed to exceed 0.9m.

Tank Sluice:

A tank sluice is an opening in the form of a culvert or a pipe running through or under the tank bund and supplying water to the tank and to the distributor channel below to meet the irrigation and other water requirements as and when needed. The size of the culvert will depend on maximum quantity of water. It is required to covey, but in no case should be less than 0.6m wide and 0.75m high, so as to allow the man to enter it for examination and repairs or removal of obstructions.

Types of Sluice:

- **Flap Sluice Gate:**

A fully automatic type, which is controlled by the pressure head across it; operation is similar to that of check valve. It is a gate hinged at the top. When pressure is from one side, the gate is kept closed; a pressure from other side opens the sluice when a threshold pressure is surpassed.

- **Vertical Rising Sluice:**

A plate sliding in the vertical direction, controlled by machinery.

- **Rising Sector Sluice:**

Also, a part of cylindrical surface, which rests at the bottom of the channel and rises by rotating around its centre.

- **Radial Sluice:**

A structure, where a small part of cylindrical surface serves as a gate, supported by radial constructions going through the cylinders radius. On occasion, a counter weight is provided.

- **Needle Sluice:**

A sluice formed by number of thin needles held against a solid frame through pressure as in a needle dam.

Survey to Be Carried Out:

- Longitudinal sectioning and cross section along the existing bund.
- Details of existing and waste weir and sluice points including block levelling of waste weir.
- Water spread contour to explore the quantity.

Longitudinal and Profile Levelling:

The process of determining the elevations of a series of points at measured intervals along a line such as the centre line of the proposed ditch or road or the central line of a natural feature such as a stream bed is called PROFILE LEVELLING.

- In this operation levels are taken along the centre line of any alignment (roads, railways etc.) at regular intervals.
- The back sight, intermediate sight and fore sight readings are taken at regular intervals at every setup of the instruments. The chainages of the points are noted in the level book.
- This operation is under taken to determine the undulation if the ground surface along the profile line.
-

Cross Sectional Levelling:

Cross sectioning is defined as determining the elevations of points on a succession of lines running at right angles to the length wise line of the highway.

- Here the levels are taken under the transverse direction.
- The cross section are taken at regular intervals (3m,6m, 9m etc) along the alignment.
- This operation is done in order to know the nature of the ground across the centre line of any alignment.

Contour:

A contour is defined as an imaginary line of constant elevations on the ground surface.

A contour line joins points of equal elevation (height) above the given level, such as mean sea level.

Capacity Contour Survey:

Objective:

To draw the capacity contour map of the catchment and estimate the quantity of water that can be stored.

Following are the aspects to be considered while fixing the capacity of the reservoir:

- The catchment at the site proposed receives sufficient rain to cater the demand and if the proposed site can hold the required quantity of water then required height of the bund can be constructed.
- The catchment at the site proposed receives sufficient rain to cater the demand and if the proposed site cannot hold the required quantity of water then required height of the bund shall be restricted to the site conditions.
- The catchment at the site proposed receives less rain which cannot cater the demand and any height of the bund can be constructed, then the height of the bund is fixed to store maximum water. The catchment at the site proposed receives less rain which cannot cater the demand and any height of the bund can be restricted because of the site condition, then the height is fixed taken the site condition. In all the above cases it is necessary to compute the yield of catchment

Existing and Proposed Features of Old Tank Project:

Existing Features:

Length of bund =95 m

Top of bund level=785.265 m

Maximum water level=784.225 m

Full tank level=783.755 m

Dead storage=783.225 m

Slope (U/S & D/S) =1:1

Width of bund=2m

Height=1.5 m

Proposed features:

Proposed full tank level=784.255 m

Proposed maximum water level=785.655 m

Proposed top bund level=786.255 m

Width of bund=5m

Rise of bund=2m

Slope (U/S & D/S) =1:1

Contour Areas:

- Area of contour at RL 784.255 = 3676 m^2

(**Proposed full tank level after rising the bund)**

- Area of contour at RL 783.755 =2128 m^2

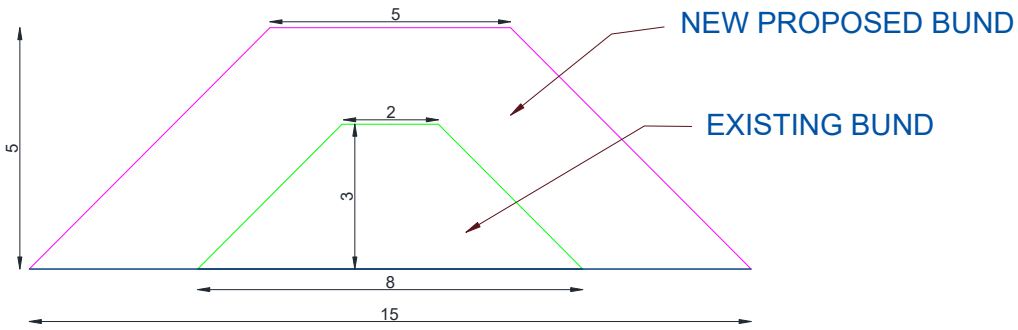
(Full tank level of existing bund)

- Area of contour at RL 783.255 = 701 m^2

(Existing waste weir level)

- Area of contour at RL817.890= 3562.580m^2

(**Below existing waste weir)**



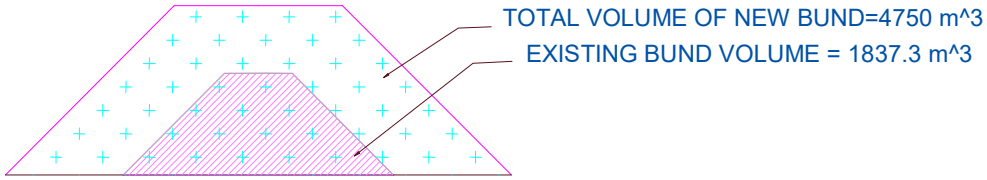
Calculation of Rise Bund Volume

Total volume of 5m bund

$V = (Bd+Sd^2)\ L$

$= (5*5+1*5^2)*95$

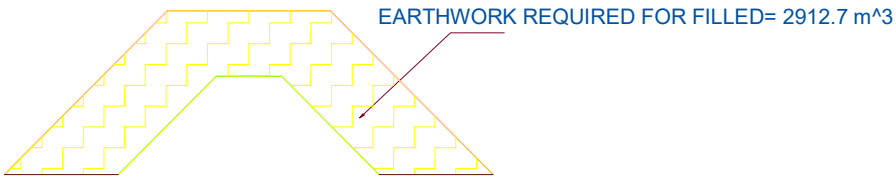
$= 4750\ \mathbf{m^3}$



Volume of Earthwork Required for Filling

=4750-1837.3

=2912.7 $\mathbf{m^3}$


EARTHWORK REQUIRED FOR FILLED= 2912.7 m^3

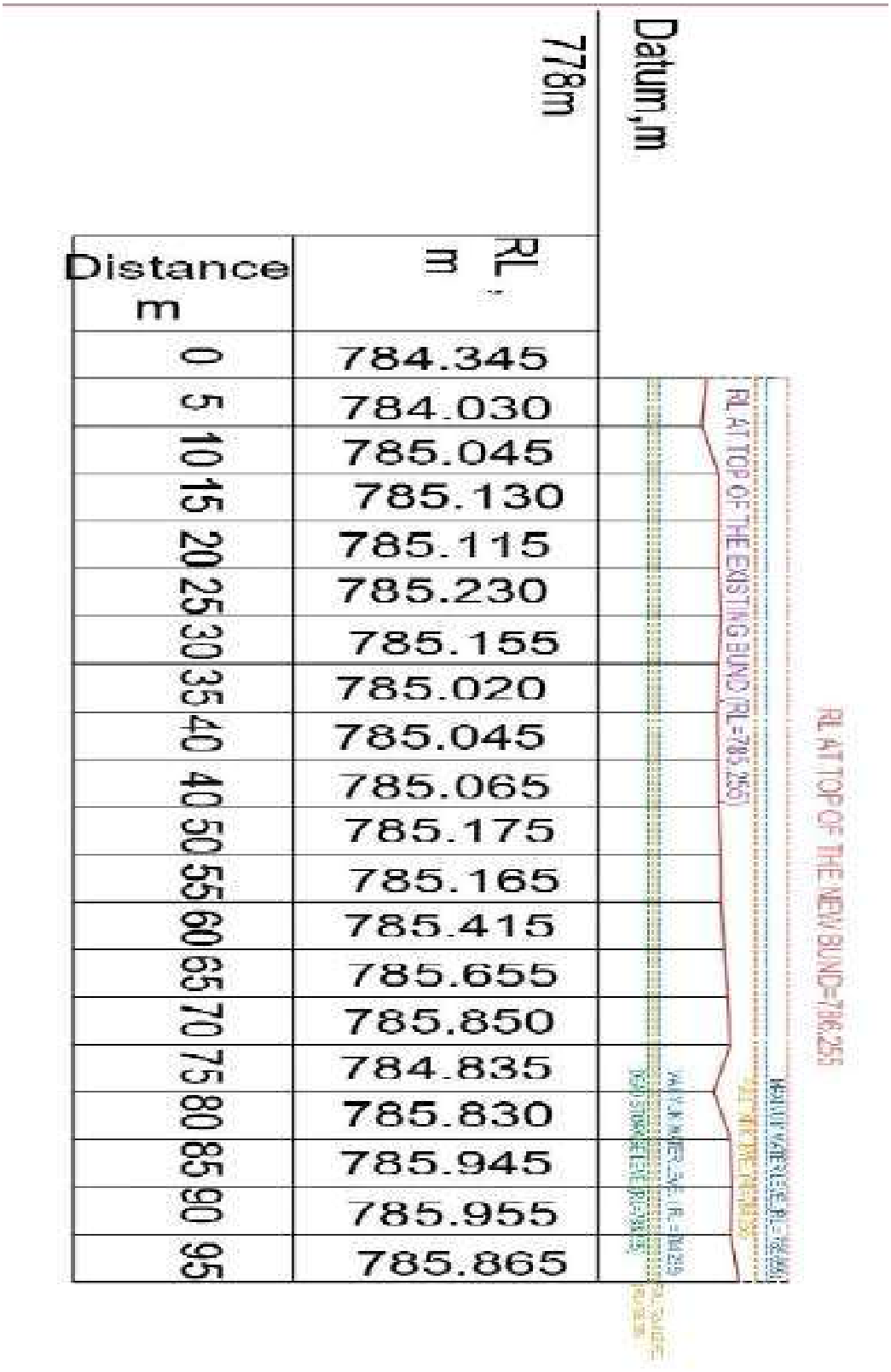
CALCULATION OF EXISTING BUND VOLUME

Chainage in(m)	RI of ground level (m)	FL of existing bund (m)	Height (m)	Top width d (m)	Central area bd (m^2)	side slope	side area sd^2	Total sectional area ($Bd+Sd^2$) m^3	Length in m	Volume in m3 ($Bd+Sd^2$) L
0	784.34	782	2.34	2	4.68	1	5.47	10.15	5	50.75
5	784.93	782	2.94	2	5.86	1	8.93	14.79	5	73.95
10	785.04	782	3.04	2	6.09	1	9.24	15.33	5	76.65
15	785.13	782	3.13	2	6.26	1	9.79	16.05	5	80.25
20	785.11	782	3.11	2	6.23	1	9.70	15.93	5	79.65
25	785.23	782	3.23	2	6.46	1	10.43	16.89	5	84.45
30	785.15	782	3.155	2	6.31	1	9.95	16.26	5	81.3
35	785.05	782	3.05	2	6.1	1	9.30	15.40	5	77
40	785.04	782	3.04	2	6.09	1	9.24	15.33	5	76.65
45	785.06	782	3.06	2	6.12	1	9.36	15.48	5	77.4
50	785.16	782	3.16	2	6.44	1	10.36	16.8	5	84
55	785.22	782	3.22	2	6.82	1	11.62	18.44	5	92.2
60	785.41	782	3.41	2	7.3	1	13.32	20.62	5	103.1
65	785.65	782	3.65	2	7.7	1	14.82	22.52	5	112.6
70	785.85	782	3.85	2	5.66	1	8.0	13.66	5	68.3
75	784.83	782	2.83	2	7.66	1	14.66	22.32	5	111.6
80	785.83	782	3.83	2	7.66	1	15.52	23.4	5	117
85	785.94	782	3.94	2	7.9	1	15.60	23.5	5	117.5
90	785.99	782	3.95	2	7.9	1	14.89	22.61	5	113.05
95	785.86	782	3.85	2	7.7	1	14.8	22.5	5	112.5

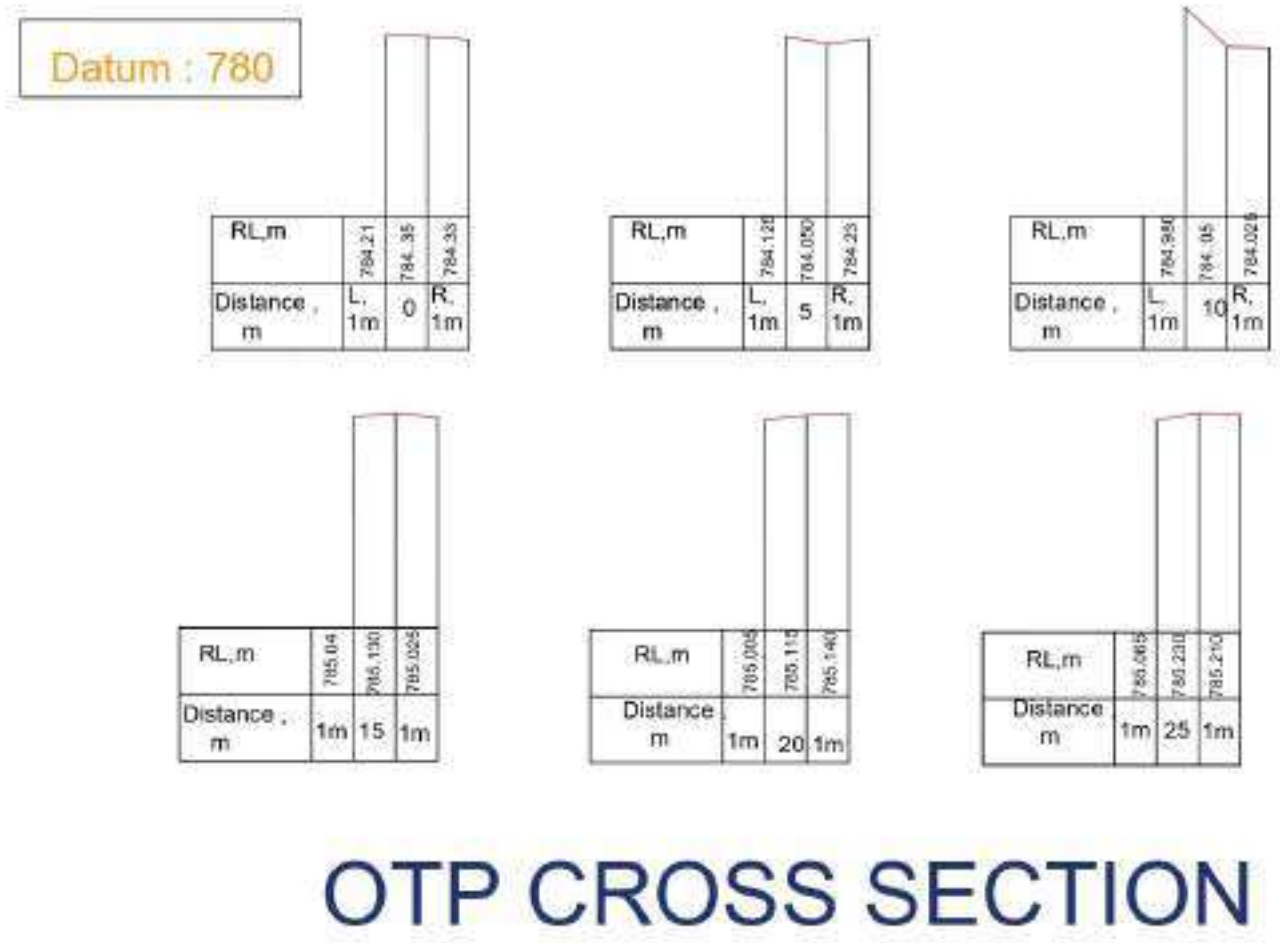
Waste Weir Block Levelling: -

784	784.3	783.69	783.5	783.11	783.235	783.8	783.515	782.995	782.21	783.1
783.33	783.835	783.84	783.29	783.47	782.99	782.39	782.18	782.1	781.98	783.05
783.24	783.46	783.5	783.5	782.705	782.35	782.14	782.21	782.725	782.9	783.45
783.54	783.615	782.615	783	783.14	782.65	782.5				

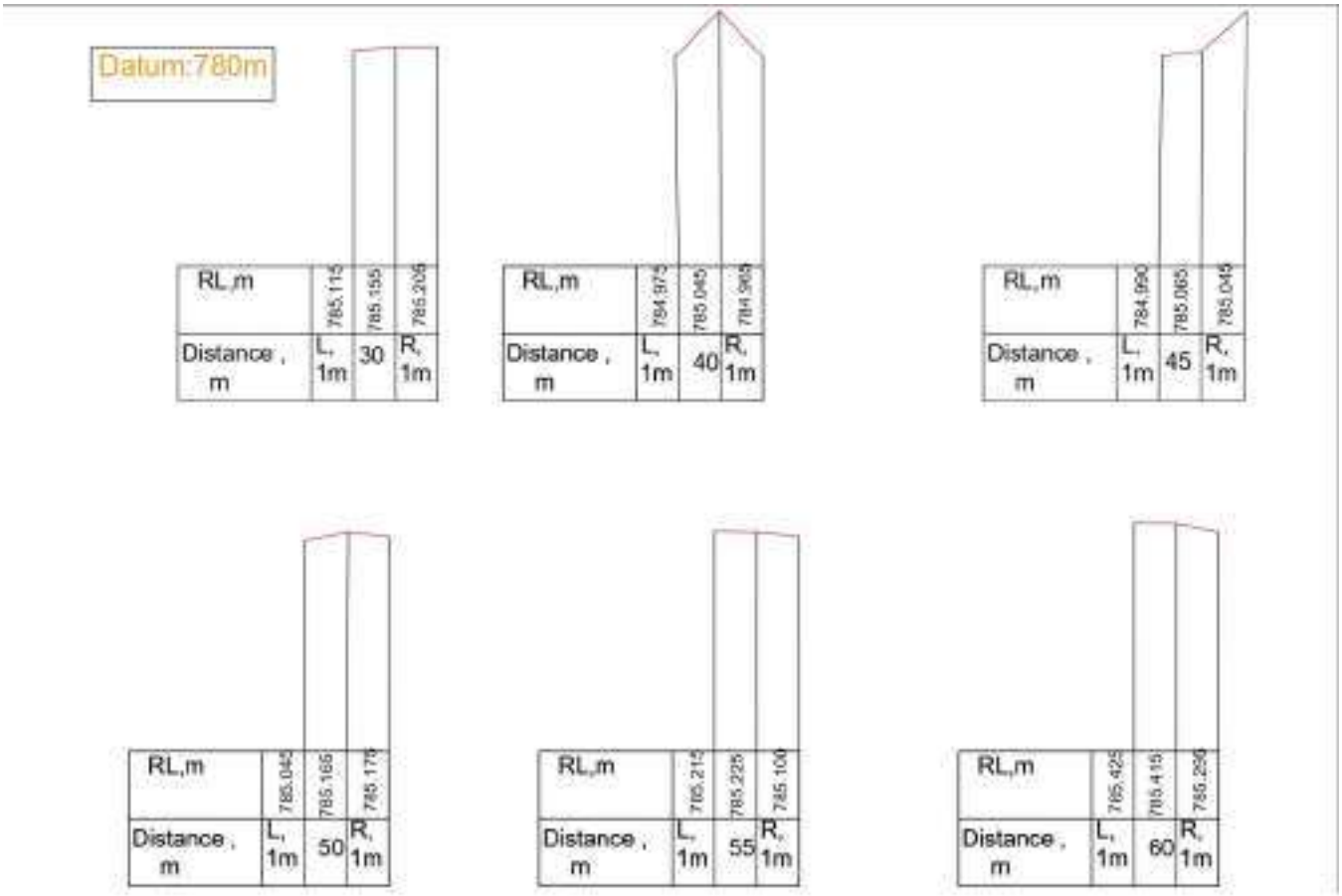
Old tank longitudinal section

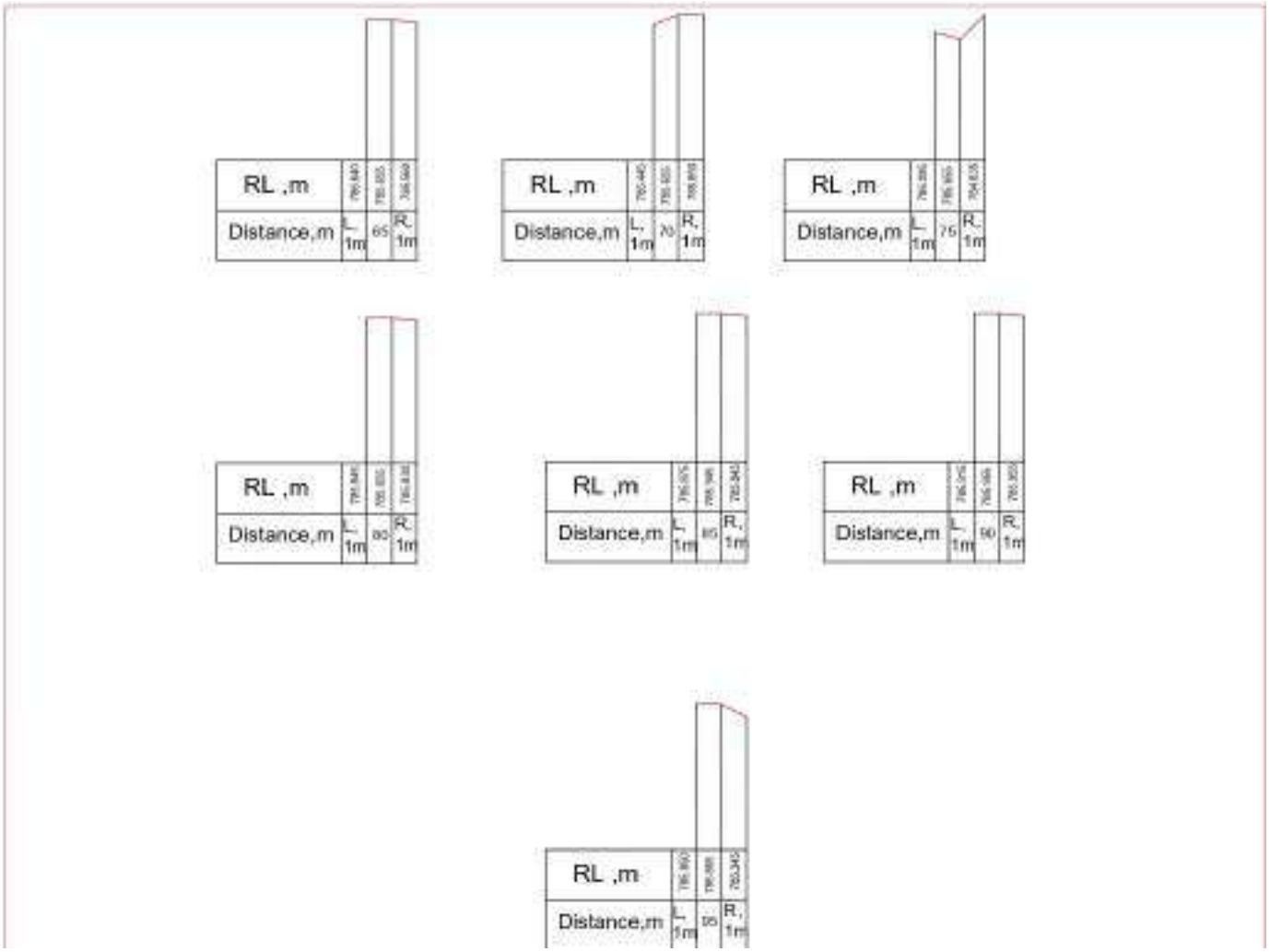


Distance m	RL m
0	784.345
5	784.030
10	785.045
15	785.130
20	785.115
25	785.230
30	785.155
35	785.020
40	785.045
40	785.065
50	785.175
55	785.165
60	785.415
65	785.655
70	785.850
75	784.835
80	785.830
85	785.945
90	785.955
95	785.865



OTP CROSS SECTION


Datum:780m
RL,m
785.115
785.155
785.205
Distance , m
L, 1m
30
R, 1m
RL,m
784.975
785.045
784.965
Distance , m
L, 1m
40
R, 1m
RL,m
784.990
785.065
785.045
Distance , m
L, 1m
45
R, 1m
RL,m
785.045
785.165
785.175
Distance , m
L, 1m
50
R, 1m
RL,m
785.215
785.225
785.100
Distance , m
L, 1m
55
R, 1m
RL,m
785.425
785.415
785.230
Distance , m
L, 1m
60
R, 1m


RL ,m
Distance,m
L 1m
R 1m
65
RL ,m
Distance,m
L 1m
R 1m
70
RL ,m
Distance,m
L 1m
R 1m
75
RL ,m
Distance,m
L 1m
R 1m
80
RL ,m
Distance,m
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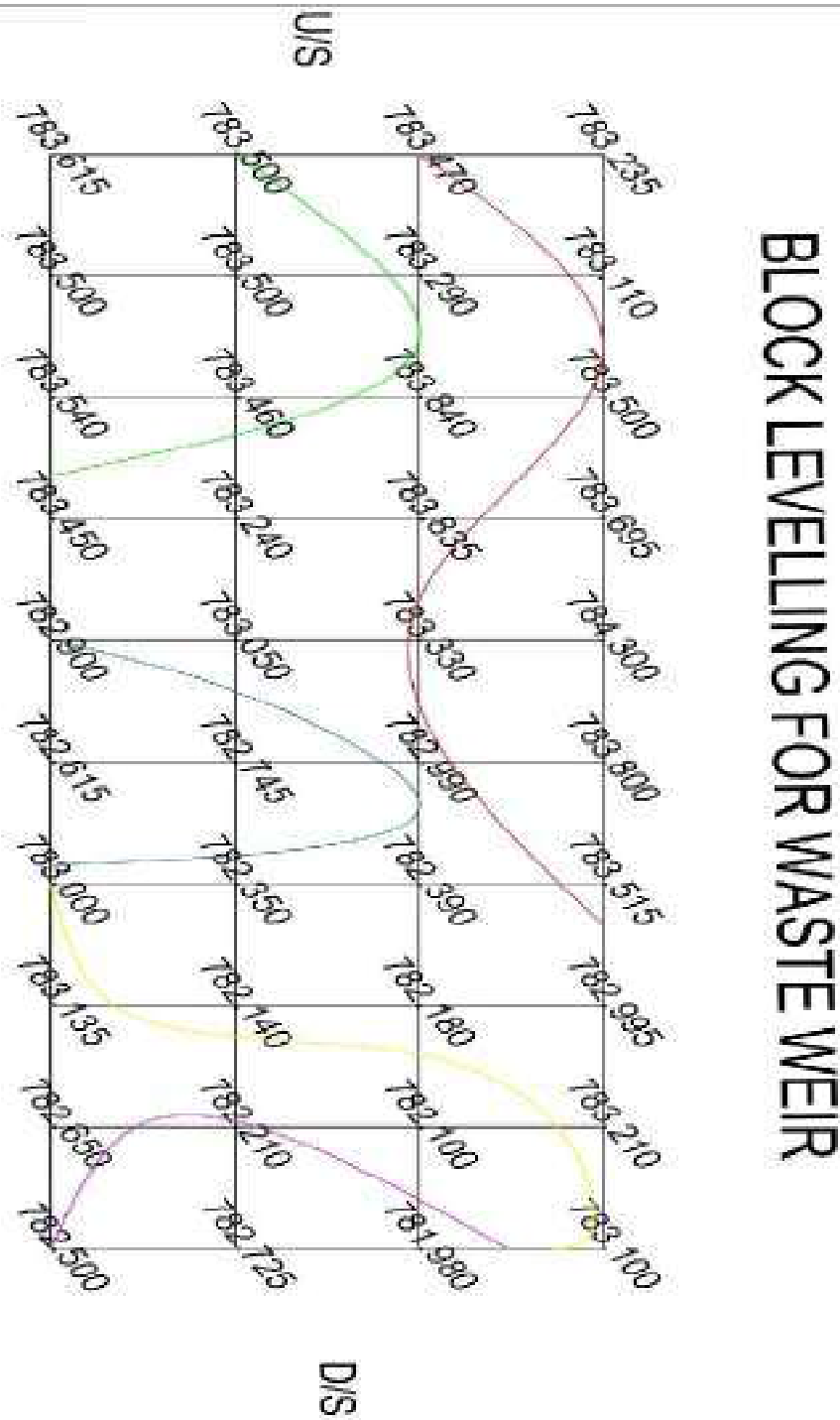
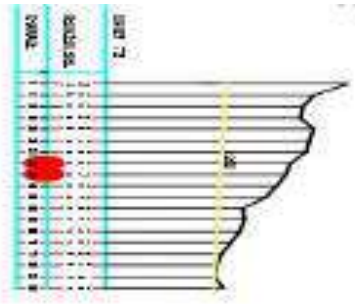
R 1m
90
RL ,m
Distance,m
L 1m
R 1m
95

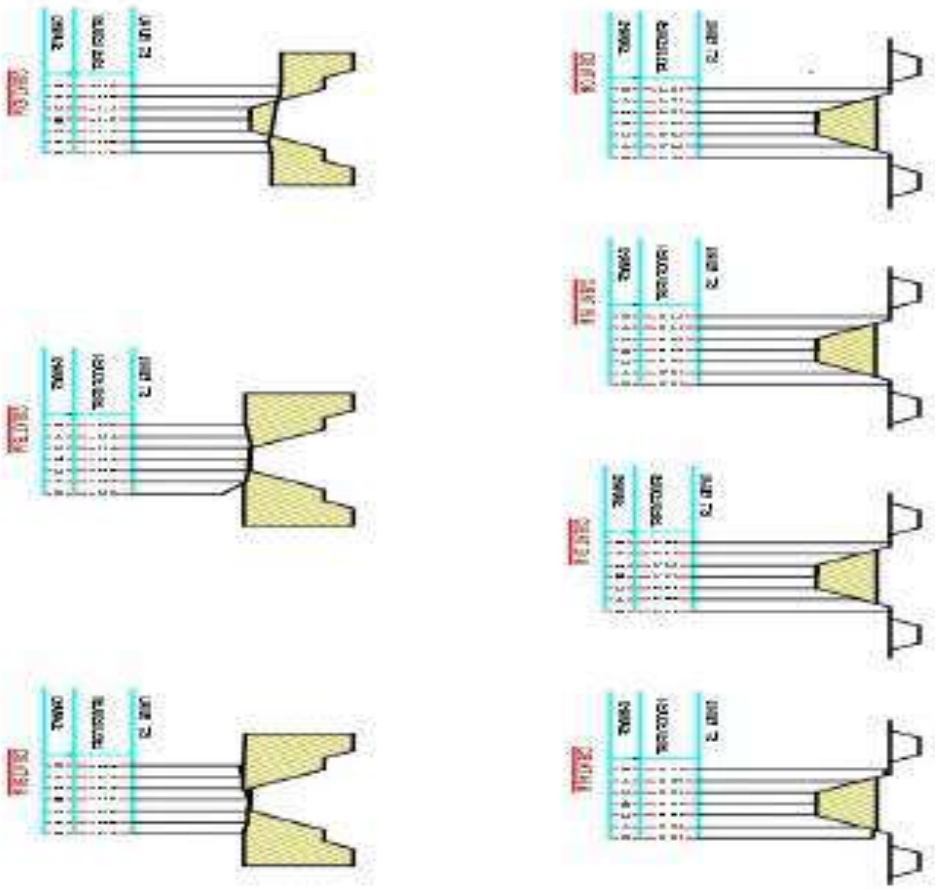

BLOCK LEVELLING FOR WASTE WEIR
U/S
D/S
183.615
183.500
183.470
183.235
183.500
183.500
183.290
183.110
183.540
183.460
183.840
183.500
183.450
183.240
183.835
183.695
182.900
183.050
183.530
184.900
182.615
182.145
182.990
183.800
183.000
182.550
182.390
183.515
183.135
182.140
182.160
182.995
182.650
182.210
182.100
183.210
182.500
182.125
181.980
183.100

CONTOUR MAP
Canal alignment
2 m
NOTE
ALL DIMENSIONS IN METER
ALL LEVELS ARE IN METERS
EXTENSIVE SURVEY PROJECT-2021
SIXTH SEM B.E
MUKTHINAGAR TEMPLE
DAYANANDA SAGAR INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING
CONTOUR
PROJECT TITLE : OLD TOWN PROJECT
BATCH NO: 5,6&8
SCALE
FACULTY SIGNATURE

L/S OF CANAL



C/S OF CANAL



CONCLUSION

1. The Survey carried out at “SHREE KSHETRA MUKTHI NAGA TEMPLE” near ramohalli was effective as the site is suitable for the proposal of restoring the old tank reservoir.

2. Carrying out the survey work with the help of necessary instruments, the old tank reservoir can be effectively and successfully modified.

3. The project carried out involving various surveys is helpful in estimating and calculating various data like runoff, total reservoir capacity, ground feature etc, for the reservoir to be economical and effective.

4. A new communication road over the reservior is proposed to connect right bank and left bank.

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TOWN PLANNING / LAYOUT PLANNING

Project In-Charge: Prof. Sadashivaiah

CONTENTS

1.Introduction:

Town planning in India is not new. The planning of towns and villages was done in a scientific manner even in Vedic times. Some of the principles on which this was based, are valid even today. The science of ancient town planning is expounded in the Shilpa Shastras, Niti Shastras and Smriti Shastras and also in the treatises on astrology and astronomy. Descriptions of towns and villages occur very frequently in the Vedas. Vedic civilization recorded remarkable progress in village and town planning. The content of all treatises on Shilpa Shastras reveal that the problems of town planning and architecture were resolved scientifically. It reflects scientific knowledge, methodical treatment and implementation of Shastras in planning towns and building edifices. The Shilpa Shastras stressed on town planning schemes to be carried out according to its suitability and with reasons (Yukta). An individual was allowed full play for his imagination within the norms laid down by Shilpa Shastras. The profession of Sthapati (Architect, Town Planner) was well recognized and the Sthapati and his sub-ordinates were considered the upper crust of society.

The scope of ancient Indian town planning included all relevant requirements for a healthy civic life. It includes descriptions of temples (mandira, devalaya), market (apana), streets and lanes (path, vithi), royal palaces, housing of citizens (sarvajana-grihavasa), arched gateways, sheds for drinking water (prapa), pleasure garden (aram-griha), tanks and reservoirs, wells, city wall, moats, forts, etc.

HISTORY OF SHRI MUKTHI NAGA KSHETRA:

Shri Mukthi Naga Kshetra has long been home to the Serpent Deity. For the past 200 years, the residents of this region have been referring to this place as "JunjappanaBayalu" (Junjappa's Field). In accordance with Lord Subrahmanya's divine will, the construction of the Mukthi Naga Temple is being carried out at this place. This place, which is a veritable abode of serpents, is a heaven of peace and serenity to all who come here. Temple is situated at Ramohalli, 18 kilometers from the Bangalore bus stand. It is located 5 kilometers from the Bangalore-Mysore road, after one passes Kengeri, on the way to the Big Banyan Tree. One kilometer from the Ramohalli bus stand is the place where the place where Mukthi Naga Temple is present.

Definition:

Town planning is a technical and political process concerned with the development and use of land, planning permission, protection and use of the environment, public welfare, and the design of the urban environment, including air, water, and the infrastructure passing into and out of urban areas, such as transportation, communications, and distribution networks.

Urban planning is also referred to as urban and regional planning, regional planning, town planning, city planning, rural planning, urban development . It is considered an interdisciplinary field that includes social, engineering and design sciences.

Urban planning is closely related to the field of urban design and some urban planners provide designs for streets, parks, buildings and other urban areas.

Importance:

Planning the town involves the intricate details of understanding the requirements of the towns and its various divisions and utilizing the land to the best of benefit. It is like promoting development by implementing decisions and turning the town into a planned city, without interfering with the environmental features. The planners work in two ways to go about the planning. They either chalk out the structure of a brand new area of the town or inject suitable ways to reform the existing land to ensure spatial relief to the eyes, adequate light everywhere, proper drainage system and clean drinking water.

In broad terms Town Planning can be separated up into two parts; strategic planning and land use management. Strategic planning is a long term plan of what will be happening in a year, or two years etc. This is used for future developments in Town Planning for whole new towns and also, for redesigning or developing existing towns. Land use management is what each part of land will be used for, this is includes building restrictions, zoning, water systems, sewerage etc.

Town planning can be the most interesting subject for an architect or an engineer. It is one of those rare moments that you can cherish for life of being a part of something that's creative and fulfilling. The task of town planning will involve several aspects of modern life that have to be considered and even included within its purview as well as leave enough scope for the inclusion of newer developments with time for the betterment of its people.

If planning is not done then houses may emerged before installation of electricity grids and water supply systems. Hospitals can be raised at the unapproachable area and industries may raise before installation of the transportation system. And it is important to keep in mind that town planning is not limited to the development of streets and civic amenities. It's motto shall be encompassing all the facilities with aesthetic surroundings and to provide the better standards of living to the people.

- Environmental protection is also one of the reasons why companies offer urban planning services
- Sustainable infrastructure is one of the reason why most of the urban areas are seeking the services of urban planning companies
- There is need for urban areas to implement effective plans that aim to make the urban areas more conducive for human population
- Urban planning aims at reducing some of the problems such as pollution that is usually caused by human activities
- One of the importance of urban planning is to enable corrections of mistakes that had earlier being made in design of urban areas.

Objectives:

- To create and promote healthy conditions and environments for all the people.
- To make right use of the land for the right purpose by zoning.
- To ensure orderly development
- To avoid encroachment of one zone over the other social, economic, cultural and recreational amenities,etc.

- Recreational amenities - open spaces, parks, gardens & playgrounds, town halls stadiums community centers, cinema houses, and theatres.
- To preserve the individuality of the town.
- To preserve the aesthetics in the design of all elements of town or city plan.
- To promote planned, economic, scientific and artistic development of towns, cities and rural areas.
- To promote the general interests of those engaged in the practice in town and country planning.
- To foster the teaching of subjects related to town and country planning and assist in providing such teaching.

Types of survey:

These are broadly classified as

1. Socio-Economic Survey :
Demographic survey is concerned with collection of socio economic data regarding characteristics of human populations, such as growth, density, distribution, and vital statistics. This survey forms base for not only understanding current socio demographic characteristics of specific area but also projections of future population and related infrastructure.

2. Land Use / Utilization Survey :
Land use survey is commonly undertaken with the purpose to identifydeveloped and undeveloped areas for analysis of physical distribution andcondition of existing development for future projections. In case of ground verification of the land use map prepared by remote access or by various secondary sources.

3. Density Survey :
Density surveys are done to understand the relationship between built up area and population density. It is taken up for assessment of infrastructure
requirement to reduce congestion, appropriate availability of land for activities and services required by residents for good quality of life.

4.Infrastructure Surveys :
Infrastructure survey includes the survey of existing infrastructure within and surrounding the study area in terms of its population.
Physical infrastructure indicators: transportation, water supply, wastewater,sewerage, and solid waste management infrastructure.

Social infrastructure indicators: educational, civic and utilities, health care.

Zoning and importance of zoning:

Zoning is the process of dividing land in a municipality into zones (e.g. residential, industrial) in which certain land uses are permitted or prohibited. The type of zone determines whether planning permission for a given development is granted. Zoning may specify a variety of outright and conditional uses of land. It may also indicate the size and dimensions of land area as well as the form and scale of buildings. These guidelines are set in order to guide urban growth and development.

Areas of land are divided by appropriate authorities into zones within which various uses are permitted.[4] Thus, zoning is a technique of land-use planning as a tool of urban planning used by local governments in most developed countries. The word is derived from the practice of designating mapped zones which regulate the use, form, design and compatibility of development. Legally, a zoning plan is usually enacted as a by-law with the respective procedures. In some countries, e. g. Canada (Ontario) or Germany, zoning plans must comply with upper-tier (regional, state, provincial) planning and policy statements.

There are a great variety of zoning types, some of which focus on regulating building form and the relation of buildings to the street with mixed-uses, known as form-based, others with separating land uses, known as use-based or a combination thereof.

The reasons that good land use guidance is important can include preserving property values that might decline if someone pops an undesirable business down in the middle of a residential neighbourhood.

The regulation of matters such as setbacks (meaning the number of feet from a street or an adjoining property line that must be maintained free of structures) helps with a solid urban design. Two homes inappropriately close together in a neighbourhood where there is some real room to roam around each house would tend to detract from the neighbourhood and therefore property values.

IMPORTANCE :

- Provides stability for land market by predicting future land uses
- Fosters economic development
- Protects aesthetic and environmental resources
- Provides efficient provision of public services
- Protects community character
- The population is distributed throughout the town by zoning regulation so that there is no concentration of population in any one particular zone
- It prevents encroachment of one zone upon another adjacent to it
- Business or commercial areas are also separately located with their garages and service stations at a distance from the residential areas

2. Statutory Guidelines:

URDPFI GUIDELINES:[Urban And Rural Development Plans Formulation and Implementation]

Introduction: The first National level planning guidelines 'The Urban Development Plans Formulations and Implementation Guidelines' (UDPFI) were framed in 1996. Since then, many changes have taken place in the field of urban development especially in view of emerging needs and requirements of urban settlements due to rapid population growth and other reasons like globalization and liberalization. The towns and cities have been more dynamic in nature and are subject to unprecedented changes in terms of requirements of infrastructure and other basic services/ amenities. Besides, new emerging aspects like inclusive planning, sustainable habitat, land use and transport integration at planning stage, preparation of Comprehensive Mobility Plans (CMP) for

urban transport, Service Level Benchmarks, disaster management, environmentally sustainable transport and urban reforms have given a new dimension to the planning process. Therefore ,it necessitated to revisit the UDPFI Guidelines,1996.

Need of guidelines:

- System that is dynamic, flexible and efficient.
- Process that is less time consuming.
- Innovative ideas of land assembly and fiscal resource mobilization.
- Simple and effective form of laws, rules and regulations.

It consist of :

1.Perspective Plan - To develop vision and provide a policy framework for urban and regional development and further detailing

- 20-30 years & Long Term Perspective

2.Development Plan - To prepare a comprehensive Development plan for urban areas, peri urban areas under control of Development authority/ metropolitan planning Committee

- 20-30 years

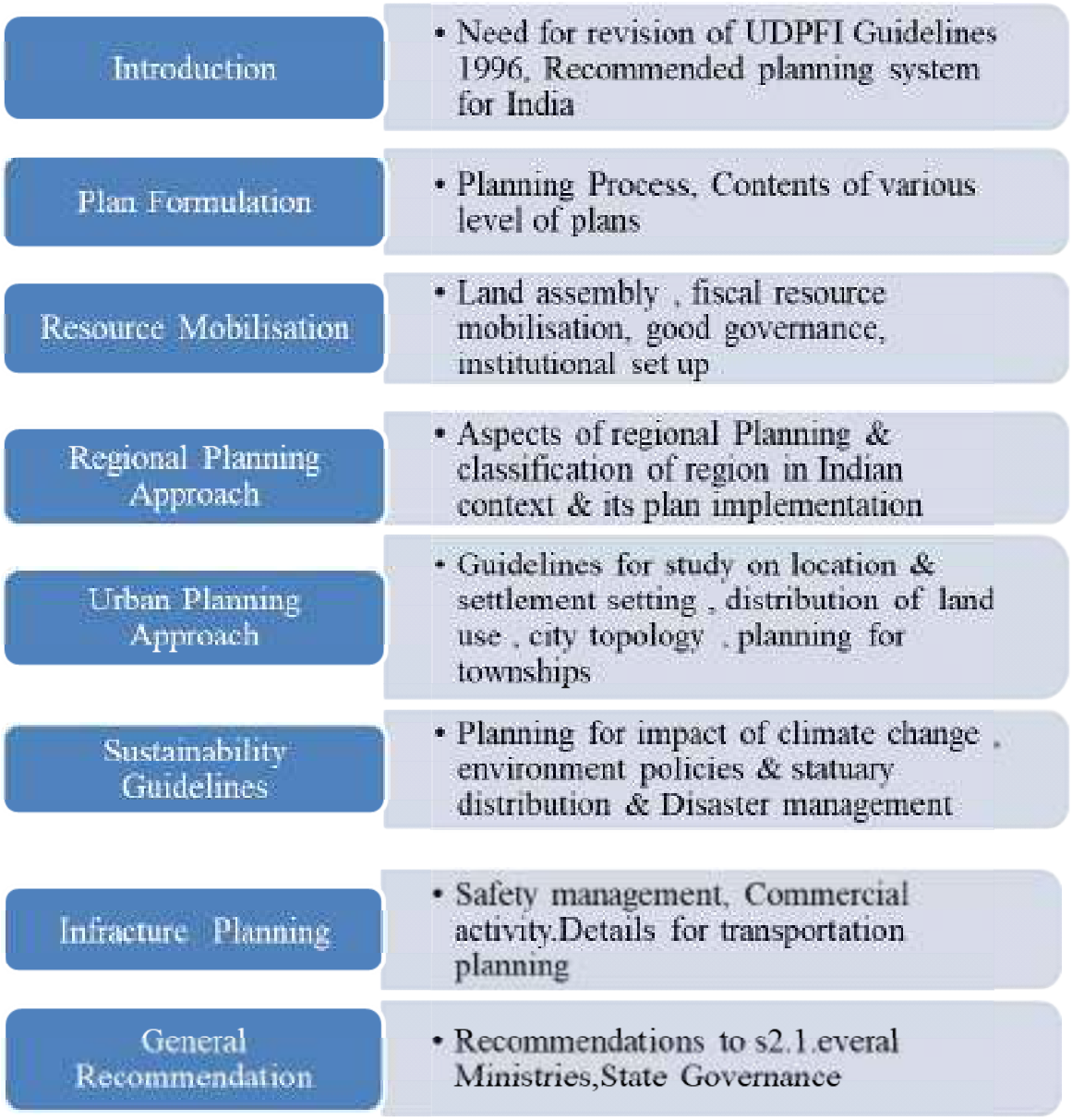
3.Annual plan - To translate Development Plan in the context of annual physical & fiscal resource requriment. To monitor plan implementation with performance milstone

- 1 year

4. Project/ Research - To focus on project related investments, Costing and returns & for the studies required to or post plan formulation. This should be a continous process to support planning and implemention

- 5-20 years.

STRUCTURE OF THE URDPFI GUIDELINES:



BBMP Byelaws:

Byelaw is the construction of any building, certain restrictions are laid down by municipal bodies, urban development authorities and other government departments as town planning trusts to clear open space to be left around the building.

Objectives of building byelaws:

- Allows systematic and disciplined growth of buildings and towns.
- Protect safety of public against fire, noise, health hazards and structural failures.
- Provides proper utilisation of space. Hence maximum efficiency in planning can be derived from these byelaws.
- They give guidelines to the architect or an engineer in effective planning and useful in pre-planning the building activities.
- They provide health, safety and comfort to the people who live in buildings
- Due to these byelaws, each building will have proper approaches light, air and ventilation which are essential for health, safety and comfort.

Some Terminologies :

- Amenities : It means the roads, open spaces, parks, recreational grounds, gardens, water supply, electric supply, lighting, sewerage and conveniences
- Apartment : It means a part of the property intended for any type of independent use including one or more rooms in building intended to be used for residential and other purposes
- Authority : It means the Commissioner of the Bangalore MahanagaraPalike to whom the power of sanction of building licenses are delegated by the Commisioner
- Balcony : It means a horizontal cantilever projection including a handrail or balustrade, to serve as passage or sit out place
- Building : It is a house, out-house, stable, privy, shed, well, verandah, fixed platform, plinth, door step and any other such structure whether of masonry, bricks, wood, mud, metal or any other material whatsoever
- Building line : It means the line upto which the plinth of buildings may lawfully extend within the plot on a street or an extension of a street and includes the line prescribed, if any, or in any scheme
- Common wall : It is a wall built on land belonging to two adjoining owners, the wall being the joint property of both owners.
- Corporation : It is the Bangalore MahanagaraPalike established under the Act, which is also called as the Bangalore MahanagaraPalike

- Covered area : It is the area covered by building / buildings immediately above the plinth level
- Floor area ratio(FAR) : It is the quotient obtained by dividing the total covered area of all floors by the area of the plot. Floor area includes the mezzanine floor also.
- Frontage : It is the width of the site abutting the access road
- Height of Building : It is the vertical distance measured, in the case of flat roofs, from the average level of the ground around and contiguous to the building up to the highest point of building
- High rise building or Multi-Storeyed Building : It is a building of a height of 24meters or more above the average surrounding ground level
- Licence :It is a permission or authorisation in writing by the Authority to carry out work regulated by the bye-laws
- Open space : It is an area forming an integral part of the plot, left open to sky.

BDA Master plan: [Bangalore Development Authority]

Introduction : A Master Plan is a comprehensive document which provides the broad framework and direction for the growth and development of the city

Aim :

- A Master Plan aims to integrate the various sectoral plans taking into consideration the overall requirements in terms of land, infrastructure services, physical and social amenities, environmental aspects etc. over a 10-20 year time frame
- The plan aims to project the population, lay down the overall space, and provide direction for the future growth and development of City keeping in view the larger perceptive

Contents :

- PART 1 - Legal Provisions, Scope, Content, Limitations and FAQs
- PART 2 - Extent Of Local Planning Area Op Bangalore Development Authority
- PART 3 - Population Projections
- PART 4 - Rationalization Of Jurisdictions Of Planning Districts For RMP 2031
- PART 5 - Transport Sector

- PART 6 - Water And Waste Weir
- PART 7 - Solid Waste Management
- PART 8 - Electricity/Powe Supply
- PART 9 - Development Scenarios
- PART 10 - Tentaive Schedule For Stakeholders Consultants

Karnataka municipalities model building byelaws-2017:

Karnataka Municipalities Model Building Bye where the Government of Karnataka proposes to make in exercise of the powers conferred by sub section 325 of the Karnataka Municipalities Act, 1964 (Karnataka Act 22 of 1964) is published as required by sub-section (1) of section 325 of the said Act. All mandatory Master Plan or Zonal Regulations regarding use, land use, coverage, FAR, setback or open space, height, number of stories, number of dwelling units, parking standards etc. for various categories of buildings including modification are available in these Bye-Laws

2.4.2 Contents :

- Title, Commencement, Application
- Definitions
- Jurisdiction/Applicability And Procedural Requirements For Obtained Building License
- Development Regulations
- General Building Requirements And Services
- Provisions For High Rise Development
- Provisions For Structural Safety
- Land Use Zones
- Provisions For Differently-Abled, Elderly Persons And Children
- Rain Water Harvesting
- Green Buildings And Sustainability Provision
- Fire Protection And Fire Safety Requirements
- Conservation Of Heritage Sites Including Heritage Buildings, Heritage Precincts And Natural Feature Areas
- Streamlining Of Building Plan Approvals
- Climate Resilient Construction – Integration Of Environmental Clearance With Sanction.

National building code (NBC-2016):

Introduction:

The Natinal Building Code of India is a national instrument providing guidelines for regulating the buiding construction activities across the country . The Code mainly contains administrative regulations, development control rules and general building requirements, fire safety requirements, stipulation regarding materials, structural design and construction and building and plumbing service

Salient Features of NBC :

- Inclusion of a complete philosophy and direction for successfully accomplishing the building projects through integrated multidisciplinary
  Approach right from conceptual stage through planning, designing, construction, operation and maintenance stages
- A series of reforms in building permit process
- Provision for ensuring safety of buildings against natural disaster & certificate of structural sufficiency by structural engineering
- Permission of two stage permit for high rise residential and special buildings
- Fire safety norms completely revamped through detailed provisions on fire prevention,life safety and fire protection.
- Promotion to new or innovative building materials or technologies
- Up gradation of provision of safety in construction
- Provision on rain water harvesting.

3.Surveys conducted:

Socio-Economic Survey :

Demography Survey -Demographic survey is concerned with collection of socio-economic data regarding characteristics of human populations, such as growth, density, distribution, and vital statistics.This survey is to be done in rare cases only as Census of India provides detailed information of demography.It includesƒ

- Population and its distribution, ƒ
- Population density
- Age-sex composition and literacy rate
- Growth of population (natural and migratory)
- Population projection based on scenarios

Human Population -The Shree kshetramukthinaga temple has population of 6106 of which 3103 are males while 3003 are females as per Population Census 2011. In Shree kshetramukthinaga temple population of children with age 0-6 is 645 which makes up 10.56 % of total population of village.

As per URDPFI Guidelines based on census classification and State experiences ,Small towns can be referred as 'transitional towns' mentioned in the 74th CAA where a Nagar Panchayat (as a municipality) is to be formed for an area in transition from a rural area to an urban area.

Religious/caste-Heritage or Religios areas and cities with historical and tangible or intangible cultural values ; preserved , conserved and

evolved by socialinteractions and changing economic factors have given shape to tourism in these ci ties.

As per URDPFI Guidelines, proposed land use structure of religious city.

SL.NO	LAND USE CATEGORY	PERCENTAGE OF DEVELOPABLE AREA
1	Residential	35-40
2	Commercial	5-7
3	Industrial	4 – 5
4	Public and Semi-Public	10-12
5	Transport and Communication	12-14
6	Recreational & water bodies	10-12

7	Special areas (including religious areas)	7-10
	TOTAL	**100**

Growth of population over last ten years:

The "population growth rate" is the rate at which the number of individuals in a population increases in a given time period, expressed as a fraction of the initial population. Specifically, population growth rate refers to the change in population over a unit time period, often expressed as a percentage of the number of individuals in the population at the beginning of that period.

Future projection for next 10 years:

Forecasting Of Future Populatoin Using Incremental Increase Method

Year	Population	Increase in Population	Incremental Increase in Population
1991	4880		
2001	5488	608	
2011	6106	618	10
		$\bar{x}$ = 613	$\bar{y}$ = 10

The Future Population ,$P_n = P_o + n\bar{x} + \frac{n(n+1)}{2}\bar{y}$

Where ,

P_n = Population after n decades from present (i.e. last known census)

$\bar{x}$ = Average increase of population of known decades

$\bar{y}$ = Average of incremental increase in population of the known decades

For 2021 ,

$P_{2021} = 6106 + (1X613) + \frac{1(1+1)}{2}X10$

$P_{2021} = 6729$

For 2031,

$P_{2031} = 6106 + (2X613) + \frac{2(2+1)}{2}X10$

$P_{2031} = 7362$

By Interpolating ,

Future Projection for next fifteen years is given by

$$P_{2026} = 7046$$

Land use/utilisation survey:

1. Reconnaissance Survey - This survey does not require direct contact with population of the study area.It is a quick overview of the area.Visual of Reconnaissance surveys are direct inspection

surveys, which are performed by survey teams moving in a vehicle or walking. This type of survey can be used in the initial stages of the investigation, often after preparing initial checklist. It performs variety of functions, such as:

- Familiarize with study area.
- Give initial impressions of the physical and social state of an area.
- Identify selected areas for further investigation.
- Generate ideas for development of checklist.

2. Contour map of selected property -The regions that have contours defined by seamless connectivity of people and economic activities.

3. Excavation Plan - Excavation is the process of removing earth to form a cavity in the ground.On small sites or in confined spaces, excavation may be carried out by manual means using tools such as picks, shovels and wheelbarrows. Larger scale excavation works will require heavy plant such as bulldozers and backactors.

4.Layout Plan (Conceptual & Working Plan) - They are a crucial part of construction management, as sites can be very complex places involving the co-ordination and movement of large quantities of materials as well as high-value products, plant and people. Effectively and accurately laying out a site can help ensure that the works are undertaken efficiently and safely. Careful sizing and positioning of temporary facilities can help reduce travel times, congestion, waiting times, and so on, and help to make the site a more effective workplace with better worker morale.

5.Block levelling - In this method, the whole area is divided into number of squares, the side of which may vary from 5m to 30m depending upon the nature of the ground and the contour. The square may not be of the same size throughout.

6.Infrastructure survey - Transport, utility and public services create unique demands on measurement survey requirements. How do you get what you need accurately and quickly, and still ensure that the infrastructure remains unaffected, Plowman Craven, with its experience and technical expertise, is well positioned to operate in these scenarios

Summary:

With the overall development of the economy increase in land price is inevitable. But, the galloping land prices is detrimental to the investment in housing and other economic activities and effective participation of individual household in such activities is also affected. The main factors influencing increase in the land price in urban areas are overall increase in the level of inflation, rise in the income level of the household or what we can say the rise in the paying capacity, scarcity of developed land, speculation by some sections of the society, black money, existing tax structure of the economy, legal problems, employment avenues for growing labour force, physical as well as geological aspects, development of service sector especially Information technology / information technology enabled services, etc.

The goal of a new integrated approach to planning the use and management of land resources is to make optimal and informed choices on the future uses of the land. It will be achieved through interactions and negotiations between planners, stakeholders and decision-makers at national, provincial and local levels. It will be on the basis of efficient, comprehensive data gathering and processing in a appropriate storage and retrieval system, through a network of nodal institutions.

The smooth flow of the resulting evaluation of the data will be output in an understandable, user-friendly format. The plan will enable all stakeholders to co-decide on the sustainable, equitable and economic use of the land and follow it through to successful implementation.

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9
10
11
12
13
14
15
16
17
30' Road
30' Road
30' Road
30'x40'
Odd
Park
Playground
Road
NOTE:
* ALL DIMENSIONS IN METERS.
* DRAWINGS ARE NOT TO BE SCALED
* ALL LEVELS ARE IN METERS
PROJECT TITLE:
"EXTENSIVE SURVEY PROJECT -2021
SIXTH SEM B.E
LOCATION:
MUKTHI NAGA TEMPLE
COLLAGE NAME:
DON BOSCO INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING
DRAWING TITLE:
TOWN PLANNING
BATCH NO : 5 and 6
FACULTY SIGNATURE :

CONCLUSION

Town planning is where a city's form and function converge. By implementing well conceived design principles,communities are not only beautifying their streets, they are encouraging their neighborhood to operate better, safer and more efficiently.

6.Reference:

- URDPFI Guidelines
- BBMP Byelaws
- BDA Master Plan
- Karnataka Municipalities Model Building Bye Laws – 2017
- National Building Code(NBC – 2016)
- Indian Roads Congress(IRC) Code 37