RAJARSHI SHAHU COLLEGE OF ENGINEERING, BULDANA

DEPARTMENT OF CIVIL ENGINEERING

CERTIFICATE

This is to certify that Mr/Miss ____

Roll No. _______________ Sixth Semester Civil Engineering has completed the term work in **MINI PROJECT** by Sant Gadge Baba Amravati University Amravati during the academic session 2021-2022.

Prof. N. G. Deshmukh
Class In-charge

Prof. N. S. Payghan
H.O.D

Dr. J. P. Kaware
Principal

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ACKNOWLEDGEMENT

It is indeed a great pleasure and proud privilege for us to complete this minor project entitled “GRID CONTOUR SURVEY ON MALVIHIR DAM”. We are thankful to hon’ble Principal Dr. J. P. Kaware Sir and Head of the Department Prof. N. S. Payghan Sir and our faculties who gave us a great guidance regarding Grid Contour Survey in the 6th Semester. We are especially thankful to Prof. N. G. Deshmukh and Prof. K. S. Sarode to guide us about the survey and how it is useful in the field of civil engineering.

GROUP DETAILS

Group Members:

1. Rushikesh Sanjay Jadhao (Group Leader)
2. Mangesh Ramdhan Gaykwad
3. Manish Ganesh Avchar
4. Mohammad Mujahid Shaikh Farooque
5. Mohd Aheteshaar Khan Mujeeb Khan
6. Mukund Shrikrushna Gavhale
7. Nikhil Nandu Dhanwate
8. Nikhil Raju Nawale
9. Nikhil Suhas Suryawanshi
10. Nilesh Sanjay Narkhede
11. Om Arun Adhav
12. Onkar Balasaheb Jadhav
13. Pavan Dnyaneshwar Surse
14. Pavin Ramesh Patil
15. Pawan Prabhakar Adel
16. Pooja Ganesh Chankhore
17. Praddyumn Shrikrushna Kinge
18. Prajwal Ramesh Tekale
19. Prasad Ganesh Karhale
20. Prathamesh Sanjay Autkar
21. Quazi Salahoddin Adnan Quazi Fareedoddin
22. Ranjeet Rajendra Gawai
23. Robinsingh Premsing Rajput
24. Rushikesh Gajanan Solanke

INTRODUCTION

A contour line may be defined as "An imaginary line passing through points of equal reduced levels". A contour line may also be defined "as the intersection of a level surface with the surface of the earth". Thus, contour lines on a plan illustrate the topography of the area.

The department of civil Engineering has organized a grid contour survey dated on 4^{th} April 2022 to 6^{th} April 2022 at site of Malvihir dam, District Buldana. The Minor project is confined in 3 days. On first day we have completed our reconnaissance survey before starting the work.

Then the all the students were divided into three groups at different stations. The three groups have different instruments and students who had a good observing dumpy level skill took readings.

The indirect method of grid contour survey was adopted. In this method, some grid points were selected along a system of straight lines and their elevations were found.

LOCATION

The location of proposed survey was decided at Malvihir dam situated near Malvihir village. The total distance of malvihir dam from our college is nearly 6.7 km and distance from Buldana City is nearly about 8.5 km.

Taluka	:	Buldana
District	:	Buldana
Date	:	4th to 6th April 2022
Time	:	11:30 am
Latitude	:	N 20.499893 E
Longitude	:	S 76.210142 W

PROJECT WORK

Day 01

All the students were gathered at Malvihir dam with all the necessary instruments required for this project at 9:00 am then we were distributed in three groups. Each group has occupied 24 students. Firstly we had completed reconnainasance survey of that site. Then we distributed complete site in three parts whereas first part of area covered by group C, second and third part area covered by group A and B respectively.

After distribution of site in three equal parts we carried bench mark from Data Record Room which was situated on Dam Site.

On Day 1, 70m x 50m of survey work was executed and TBM was left at 50m & its RL was 93.45m.

The instruments we were selected for this Minor Project are as follows,

1. Dumpy level and Accessories
2. Ranging rods
3. Measuring tape
4. Chain (30Meter)
5. Levelling staff

1. About Dumpy Level

The dumpy level is an optical instrument used for surveying and levelling operations. It comprises of a telescope tube, firmly held between two collars and adjusting screws. The complete instrument is staged by the vertical spindle. The telescope placed on the dumpy level can be rotated amongst the horizontal plane. Relative elevation of survey points on the land can be determined through the dumpy level. The dumpy level operates on the principle by establishing a visual relationship between two or more points, through an inbuilt telescope and a bubble level. The desirable level of accuracy can be achieved through steps. For better understanding the parts of Dumpy level and their functions provided are as follows-

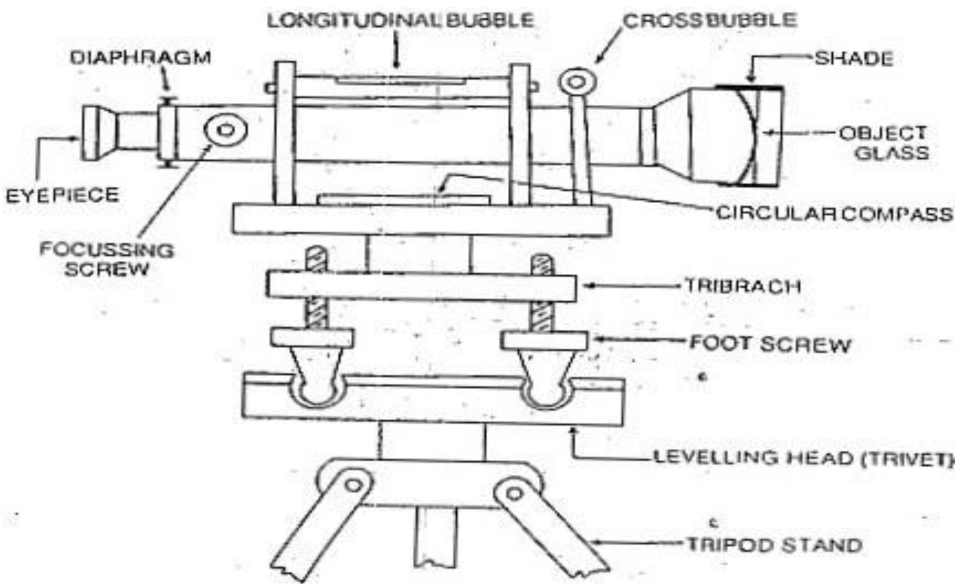


Figure No. 1.1 Components of Dumpy Level

1.1 Telescope

Telescope is used to observe the distant object through line of sight provided by its arrangement. In general, the telescope is fixed to the vertical spindle of dumpy level so that it can be rotated along with vertical spindle.

1.2 Objective Lens

Objective lens is provided at the other end of the telescope. The objective lens consists of two parts, the front part consist convex type lens and the back part consists concave lens. So, the image obtained from the objective lens is always inverted.

1.3 Eyepiece

Eye piece is used by the observer’s eye to view the distant object. It contains magnifying glass which magnify the observing image and also the cross hairs of diaphragm. So, accurate reading can be obtained. Erecting eyepiece is used to view the normal image which is generally inverted by objective lens.

1.4 Focusing Screw

Focusing screw is used to adjust the focus if cross hairs and the image clarity. The magnification of eye piece is managed by this focusing screw.

1.5 Ray Shade

Ray shade is used to prevent the objective lens from sunlight or any other light rays which may cause disturbance to the line of sight.

1.6 Bubble Tube

Bubble tubes are provided to check the level of the instrument. Two bubble tubes are provided in a dumpy level which is arranged perpendicular to each other on the top of the telescope. One tube is called as longitudinal bubble tube and another is called as cross bubble tube. The instrument is said to be in perfect position when both the bubbles of the tubes are at centre or middle of the tube.

1.7 Compass

Compass is used to determine the magnetic bearing of line. In case of dumpy level, circular compass is provided just under the telescope. The compass contains a pointer in it and readings are marked inside it. The pointer is set to zero when it faces the north line from which the magnetic bearings are measured.

1.8 Vertical spindle

Vertical spindle is located at the centre of the whole instrument. The telescope can be rotated in horizontal direction with respect to vertical spindle. The instrument is connected to the tripod stand using vertical spindle.

1.9 Tribrach

Tribrach plate is parallel to the levelling head or trivet. It is connected to trivet by levelling screws or foot screws which can adjust the tribrach plate. The horizontal level of the instrument can be achieved by adjusting this tribrach plate.

Fig No. 1.2 Tribrach

1.10 Foot Screws

Foot screws are provided to regulate the tribrach position and hence the instrument can be levelled which is known by observing the bubble tube. The tribrach plates can be lowered or raised using foot screws. The position of tribrach is said to be correct when the bubble in bubble tube is at centre.

1.11 Levelling head

Levelling head is also called as trivet. It contains two triangular shaped plates which are arranged parallel to each other. Three groves are provided at the three corners of the plates in which foot screws are supported.

1.12 Tripod

Tripod is used to support the whole levelling instrument on its top. It consists three legs which can be adjustable to required position. The legs are of same height and they may be solid or hollow. Steel shoes are provided at the bottom of each leg to hold the ground in a fixed position.

Fig 1.3 Tripod

2. Procedure

2.1 Mounting the Dumpy Level

Find a benchmark location near the spot you want to measure. A benchmark location is a spot that you already know the height of thanks to previous land surveys. In order to get the most accurate data out of your dumpy level, you’ll need to search online and find a benchmark location located close to the spot you want to measure. Set your tripod up near the spot you want to measure. Place your tripod on a patch of flat, clear ground that sits between your benchmark location and the spot you want to measure. Then, undo the latches on your tripod's legs and extend each leg out. Adjust the legs until your tripod is completely level, and then close each latch. Connect your device to the tripod and position it over 2 levelling screws. Screw your dumpy level onto the tripod's base plate, and then connect the base plate to the main tripod body. Once the instrument is securely attached, turn the dumpy level's telescope so that it sits parallel with 2 of the device's levelling screws.

2.2 Levelling the Dumpy Level

Level the device by adjusting the 2 levelling screws. Look for a traditional bubble level located somewhere on your device. When you find it, grab the 2 levelling screws that are parallel to the device's telescope and twist them in opposite directions. Do this until the bubble sits in the exact centre of the level. Turn your telescope 90 degrees and adjust the third levelling screw. After adjusting your first 2 levelling screws, turn your telescope approximately 90 degrees so that it sits parallel to the device's third levelling screw. Then, adjust this screw until the bubble once again sits in the centre of the level. Check your level's calibration by turning it 180 degrees. After making your initial levelling adjustments, return your telescope to its starting position and check that the bubble still sits in the centre of the level. If it does, turn the telescope 180 degrees and check the level again. You can focus the device once all 3 positions show the bubble in the centre of the level.

2.3 Focusing the Dumpy Level

Remove your dumpy level's lens cap. The lens cap protects your device's lens from unwanted dirt, grime, and debris. To avoid damaging your instrument, leave the lens cap on until you're ready to use the device. Adjust the eyepiece until you can see the device's crosshairs. Place a sheet of paper or a similar object directly in front of your device's lens to occupy its entire field of vision. Then, turn the eyepiece's focusing knob until you can clearly see the dumpy level's crosshairs. Twist the device's focusing knob until the image is clear. Once you can see the crosshairs, point your device's telescope toward your benchmark spot. Look for a large, distinct object in the area, such as a tree or hilltop, and then twist your device's primary focusing knob until the object comes into focus.

3. Working

We had started our further work from bridge which connects data record room and intake well. We first plot the horizontal base line and with the help of auto level we plot the progress line or centre line in centre of our cross section at 35 m from starting. We extend the progress line by direct ranging. Then we make grids of 5m apart in horizontal and 10 m intervals apart in vertical direction.

Then we set the dumpy level at proper interval by which a proper area can be measured and maximum grid points can be observed. On 4th April a proper area of 70m X 50 m is observed and reading was taken by auto level and levelling staff. At the end of the day a T.B.M. is left having RL of 93.45m at the site and overall work is checked by check levelling.

Day 02

On second day work is started by dividing the groups in further groups for different works such as plotting further grid points and ranging and taking readings of grid points . The work is started by setting the dumpy level by taking the BS from T.B.M set in previous day and further readings are taken with reference to T.B.M and in overall work the auto level is transferred to 1 positions means 1 change points are occurred in all work.

On second day the total work done is 70 m X 120 m, the work is checked by check levelling and T.B.M. is left at the site for further work.

We are going to elaborate the source of error in dumpy level work.

These may be classified into three groups:-

1. **Instrumental Errors**

Instrumental errors are classified in following points

a) Imperfect Adjustment: The error due to the imperfect adjustment of the instrument is one of the most common types of error in levelling. The levelling equipment must be properly adjusted before the readings are taken. The temporary adjustment is done such that the line of Collimation is horizontal. When the adjusting is done properly, the line of collimation lies exactly parallel to the bubble axis of the instrument such that it becomes perfectly horizontal when the bubble is centred. On the other hand, when the instrument is not adjusted properly, the line of collimation is inclined even though the bubble is centred. Thus errors may be encountered. The errors due to the imperfect adjustment can be eliminated by adopting the steps like proper adjustment and testing of the instrument before use. Equalization of the back sight and foresight distances.
b) Defective Level Tube: Sometimes, if the bubble is sluggish, it tends to remain in the centre even when the bubble axis is not perfectly horizontal. The over sensitive tube may also pose significant difficulty in levelling the instrument. Hence, it must be checked beforehand that the level tube of the instrument has the required suitable sensitiveness only.

c) Incorrect Graduation of the Staff: The errors may be encountered when the levelling staffs is incorrectly graduated. The graduations of the new staff must be checked utilizing an invar tape to ensure that the graduations are correct.

d) The Line of Collimation and the Axis of Telescope Level not Being Parallel to Each Other: If the line of collimation and the axis of telescope level are not parallel to each other, the zero line of the vertical verniers is not a true line of the reference and as a result, an error is introduced in the measurement in the measurement of vertical angles. The error can be eliminated by taking two observations of the angles, one with the telescope normal and the other with the telescope inverted, and taking the mean of the two values.

e) Shaky Tripod: When a shaky tripod is used, it makes the instrument unstable and the readings taken may contain many errors i.e. the possibility of erroneous readings increases. To prevent this, the tripod must be properly checked and tested before use. If loose joints are present in the tripod, they must be tightened properly.

2. Observational and Personal Errors

Observational and personal errors are classified in following points:-

a) Inaccurate Centring: This is very common error and is introduced in all angles measured at a given station. Its magnitude depends upon the length of the sight. It varies inversely as the length. The error is much reduced by carefully centring the instrument over the station-mark.

b) Inaccurate Levelling: The effect of this error is similar to that of the error due to non-adjustment of plate levels. The error is serious when horizontal angles between points at considerably different elevations are to be measured. The error can be minimized by levelling the instrument carefully with reference to the altitude level.

c) Slip: The slip may occur if the instrument is not firmly screwed to the tripod-head or the shifting head is not sufficiently clamped or the lower clamp is not properly tightened. As a result, the observations will be in errors. This can be prevented by proper care.

d) Working Wrong Tangent Screw: This is a common mistake on the part of a beginner. This can be avoided by proper care and experience. Always operate the lower tangent screw for a back sight and the upper tangent screw for a fore-sight.

e) Parallax: This error arises due to imperfect focusing. The parallax can be eliminated by proper focusing the eye-piece and the object glass.

f) Inaccurate Bisection of the Point Sighted and Non Vertically of the Ranging Rod: Care should be taken to bisect the lowest point visible on the ranging rod. In case of short sights, the point of a pencil or the plumb-line may be used instead of a ranging rod. The error varies inversely with the length of sight.

3. Natural Errors

Natural errors are classified in following points:

a) High temperature causing irregular refraction.

b) Wind storm causing vibration of the instrument.

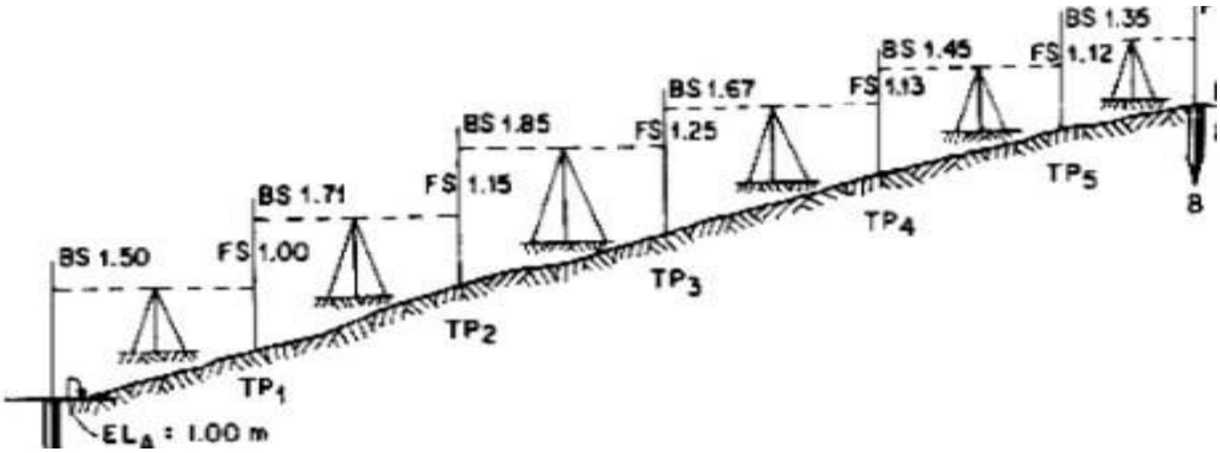
c) The sun shining on the instrument.

Day 03

On third day the fly levelling is done which is started from initial point to end of work and work is checked which was correct and no errors were occurred in progress work.

1. Fly Levelling:

Fly levelling is conducted when the benchmark is very far from the work station. In such case, a temporary bench mark is located at the work station which is located based on the original benchmark. Even it is not highly precise it is used for determining approximate level.



2. Contour calculations:

Contouring in surveying is the determination of elevation of various points on the ground and fixing these points of same horizontal positions in the contour map.

To exercise vertical control levelling work is carried out and simultaneously to exercise horizontal control chain survey or compass survey or plane table survey is to be carried out.

If the theodolite is used, both horizontal and vertical controls can be achieved from the same instrument. Based on the instruments used one can classify the contouring in different groups.

3. Methods of Contour Surveying:

There are two methods of contour surveying:

- Direct method
- Indirect method

3.1 Direct Method of Contouring

It consists in finding vertical and horizontal controls of the points which lie on the selected contour line. For vertical control levelling instrument is commonly used. A level is set on a commanding position in the area after taking fly levels from the nearby bench mark. The plane of collimation/height of instrument is found and the required staff reading for a contour line is calculated.

The instrument man asks staff man to move up and down in the area till the required staff reading is found. A surveyor establishes the horizontal control of that point using his instruments. After that instrument man directs the staff man to another point where the same staff reading can be found. It is followed by establishing horizontal control. Thus, several points are established on a contour line on one or two contour lines and suitably noted down. Plane table survey is ideally suited for this work.

After required points are established from the instrument setting, the instrument is shifted to another point to cover more area. The level and survey instrument need not be shifted at the same time. It is better if both are nearby to communicate easily.

For getting speed in levelling some times hand level and Abney levels are also used. This method is slow, tedious but accurate. It is suitable for small areas.

3.2 Indirect Method of Contouring

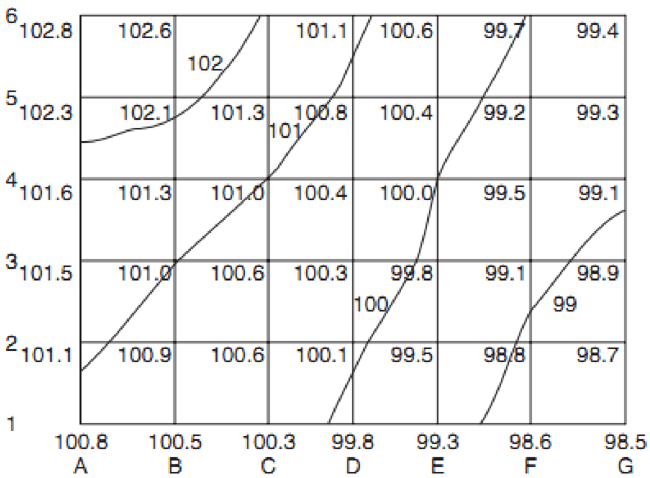
In this method, levels are taken at some selected points and their levels are reduced. Thus in this method horizontal control is established first and then the levels of those points found after locating the points on the plan, reduced levels are marked and contour lines are interpolated between the selected points.

For selecting points any of the following methods can be used:

- ❖ Method of squares
- ❖ Method of cross-section
- ❖ Radial line method

a) Method of Squares

In this method area is divided into a number of squares and all grid points are marked



Commonly used size of square varies from 5 m × 5 m to 20 m × 20 m. Levels of all grid points are established by levelling. Then grid square is plotted on the drawing sheet. Reduced levels of grid points marked and contour lines are drawn by interpolation.

b) Method of Cross-Section

In this method cross-sectional points are taken at regular interval. By levelling the reduced level of all those points are established. The points are marked on the drawing sheets, their reduced levels (RL) are marked and contour lines interpolated.

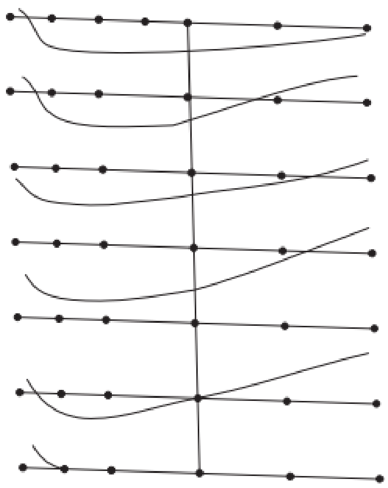
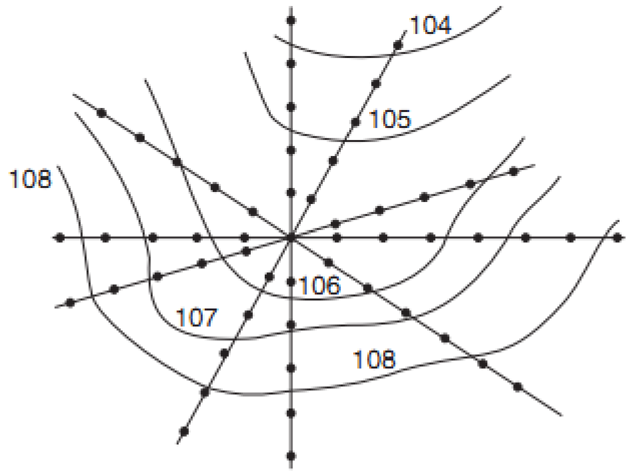


Figure 2 shows a typical planning of this work. The spacing of cross-section depends upon the nature of the ground, scale of the map and the contour interval required. It varies from 20 m to 100 m. Closer intervals are required if ground level varies abruptly. The cross- sectional line need not be always being at right angles to the main line. This method is ideally suited for road and railway projects.

c) Radial Line Method

In this method several radial lines are taken from a point in the area. The direction of each line is noted. On these lines at selected distances points are marked and levels determined. This method is ideally suited for hilly areas. In this survey theodolite with tacheometry facility is commonly used.



For interpolating contour points between the two points any one of the following method may be used:

(a) Estimation

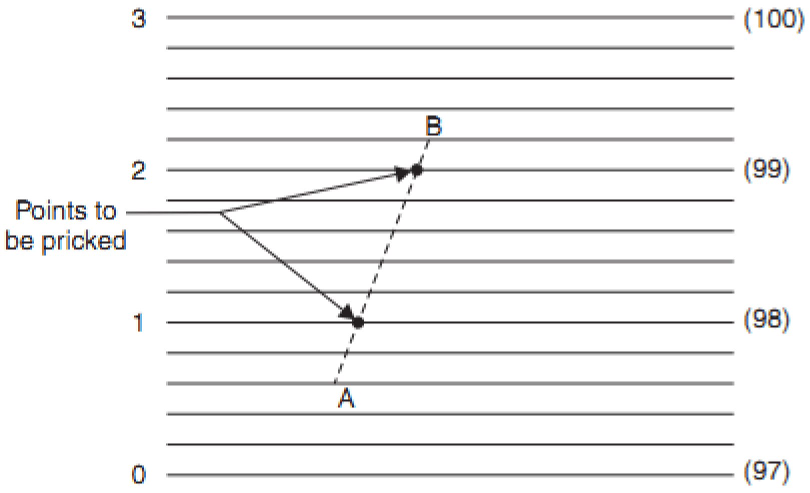
(b) Arithmetic calculation

(c) Mechanical or graphical method.

Mechanical or graphical method of interpolation consists in linearly interpolating contour points using tracing sheet:

On a tracing sheet several parallel lines are drawn at regular interval. Every 10th or 5th line is made darker for easy counting. If RL of A is 97.4 and that of B is 99.2 m. Assume the bottom darkest line represents 97 m RL and every parallel line is at 0.2 m intervals. Then hold the second parallel line on A.

Rotate the tracing sheet so that 100.2 the parallel line passes through point B. Then the intersection of dark lines on AB represents the points on 98 m and 99 m contours, similarly the contour points along any line connecting two neighbouring points may be obtained and the points pricked. This method maintains the accuracy of arithmetic calculations at the same time it is fast.



4. Drawing Contours

To create contour lines

1. In Display Manager, right-click a surface layer, and select Create Contour Layer.
2. In the Generate Contour dialog box, enter a name for the new Display Manager layer that will contain the contour lines.
3. In the Contour Elevation Interval list, select the difference in elevation between contour lines, for example, 10, 20, or 50.
4. Select the units (meters or feet) used to measure the elevation in your surface.
5. In the Major Contour Every list, select the interval between major (bold) contour lines. For example, if you choose 5, every fifth contour line will be bolded.
6. To label the major contour lines with the elevations they represent, select the Label the Elevation check box.
7. For Create Contour As, select the type of feature to use when creating contour lines (polyline or polygon).
8. For Save Contours into Filename, enter a name for the new SDF file that will store your contour line features.
9. Click OK.

The new contour line features are added to your map. They are placed on a new Display Manager layer with the layer name you specified, and stored in an SDF file.

To edit the line styles and labels used for the contour lines

1. In Display Manager, click the contour layer and click Style in the tool strip.
2. In the Style Editor, modify the line styles and labels, as you would for other features.

To delete a layer of contour lines

1. In Display Manager, select the contour layer.
2. Click Remove.

OBSERVATIONS

Sr.No.	CHAINAGE	BS	IS	FS	HI	RL	REMARK
0		1.02			95.08	**94.06**	**BM**
1	0/R35		2.39			92.69	
2	R30		2.375			92.705	
3	R25		2.11			92.97	
4	R20		2.225			92.855	
5	R15		2.465			92.615	
6	R10		2.475			92.605	
7	R5		2.625			92.455	
8	**0**		2.745			92.335	
9	L05		2.725			92.335	
10	L10		2.665			92.415	
11	L15		2.76			92.32	
12	L20		2.76			92.32	
13	L25		2.81			92.27	
14	L30		2.82			92.26	
15	L35		2.745			92.335	
16	10/L35		2.9			92.18	
17	L30		2.875			92.205	
18	L25		2.825			92.255	
19	L20		2.795			92.285	
20	L15		2.725			92.355	
21	L10		2.69			92.39	
22	L5		2.66			92.42	
23	**10**		2.595			92.485	
24	R05		2.66			92.42	
25	R10		2.805			92.275	
26	R15		2.74			92.34	
27	R20		2.85			92.23	
28	R25		2.545			92.535	
29	R30		2.61			92.47	
30	R35		2.82			92.26	
31	20/R35		2.5			92.58	
32	R30		2.565			92.515	
33	R25		2.34			92.74	
34	R20		2.59			92.49	
35	R15		3.38			91.7	
36	R10		2.68			92.4	
37	R5		2.71			92.37	
38	**20**		2.565			92.515	
39	L05		2.57			92.51	
40	L10		2.615			92.465	

41	L15		2.675			92.405	
42	L20		2.73			92.35	
43	L25		2.805			92.275	
44	L30		2.84			92.24	
45	L35		2.87			92.21	
46	30/L35		2.8			92.28	
47	L30		2.76			92.32	
48	L25		2.71			92.37	
49	L20		2.63			92.45	
50	L15		2.54			92.54	
51	L10		2.415			92.665	
52	L5		2.46			92.62	
53	**30**		2.46			92.62	
54	R05		2.265			92.815	
55	R10		2.205			92.875	
56	R15		2.235			92.845	
57	R20		2.245			92.835	
58	R25		2.23			92.85	
59	R30		2.11			92.97	
60	R35		2.105			92.975	
61	40/R35		2.015			93.065	
62	R30		2.32			92.76	
63	R25		2.305			92.775	
64	R20		2.34			92.74	
65	R15		2.39			92.69	
66	R10		2.4			92.68	
67	R5		2.465			92.615	
68	**40**		2.32			92.76	
69	L05		2.34			92.74	
70	L10		2.415			92.665	
71	L15		2.505			92.575	
72	L20		2.58			92.5	
73	L25		2.71			92.37	
74	L30		2.765			92.315	
75	L35		2.805			92.275	
76	50/L35		2.72			92.36	
77	L30		2.64			92.44	
78	L25		2.475			92.605	
79	L20		2.37			92.71	
80	L15		2.235			92.845	
81	L10		2.15			92.93	
82	L5		2.14			92.94	
83	**50**		2.015			93.065	
84	R05		1.915			93.165	

85	R10		1.8			93.28	
86	R15		1.78			93.3	
87	R20		1.735			93.345	
88	R25		1.715			93.365	
89	R30		1.59			93.49	
90	R35		1.59			93.49	
91	60/R35		1.485			93.595	
92	R30		1.505			93.575	
93	R25		1.535			93.545	
94	R20		1.505			93.575	
95	R15		1.52			93.56	
96	R10		1.6			93.48	
97	R5		1.705			93.375	
98	**60**		1.84			93.24	
99	L05		1.935			93.145	
100	L10		1.985			93.095	
101	L15		2.06			93.02	
102	L20		2.185			92.895	
103	L25		2.235			92.845	
104	L30		2.355			92.725	
105	L35		2.49			92.59	
106	70/R35		2.69			92.39	
107	R30		2.545			92.535	
108	R25		2.435			92.645	
109	R20		2.25			92.83	
110	R15		2.16			92.92	
111	R10		2.03			93.05	
112	R5		1.95			93.13	
113	**70**		1.85			93.23	
114	L05		1.53			93.55	
115	L10		1.37			93.71	
116	L15		1.285			93.795	
117	L20		1.145			93.935	
118	L25		0.905			94.175	
119	L30		0.81			94.27	
120	L35		0.72			94.36	
121	80/L35	1.425		0.55	95.955	94.53	**CP**
122	L30		1.715			94.24	
123	L25		1.715			94.24	
124	L20		2.005			93.95	
125	L15		2.105			93.85	
126	L10		2.19			93.765	
127	L5		2.275			93.68	
128	**80**		2.355			93.6	

129	R05		2.445			93.51	
130	R10		2.5			93.455	
131	R15		2.545			93.41	
132	R20		2.585			93.37	
133	R25		2.785			93.17	
134	R30		3.045			92.91	
135	R35		3.265			92.69	
136	90/R35		0.825			95.13	
137	R30		1.665			94.29	
138	R25		2.215			93.74	
139	R20		1.455			94.5	
140	R15		1.415			94.54	
141	R10		1.4			94.555	
142	R5		1.355			94.6	
143	**90**		1.315			94.64	
144	L05		1.255			94.7	
145	L10		1.17			94.785	
146	L15		1.095			94.86	
147	L20		0.96			94.995	
148	L25		0.715			95.24	
149	L30		0.505			95.45	
150	L35		0.615			95.34	
151	100/L35		0.41			95.545	
152	L30		0.45			95.505	
153	L25		0.61			95.345	
154	L20		0.74			95.215	
155	L15		0.93			95.025	
156	L10		1.13			94.825	
157	L5		1.12			94.835	
158	**100**		1.25			94.705	
159	R05		1.395			94.56	
160	R10		1.455			94.5	
161	R15		1.465			94.49	
162	R20		1.54			94.415	
163	R25		1.64			94.315	
164	R30		1.655			94.3	
165	R35		1.625			94.33	
166	110/R35		1.315			94.64	
167	R30		1.255			94.7	
168	R25		1.175			94.78	
169	R20		1.106			94.849	
170	R15		1.045			94.91	
171	R10		0.975			94.98	
172	R5		0.91			95.045	

173	**110**		0.93			95.025	
174	L05		0.98			94.975	
175	L10		0.82			95.135	
176	L15		0.76			95.195	
177	L20		0.63			95.325	
178	L25		0.525			95.43	
179	L30		0.43			95.525	
180	L35		0.2			95.755	
181	120/L35		0.275			95.68	
182	L30		0.075			95.88	
183	L25		0.155			95.8	
184	L20		0.27			95.685	
185	L15		0.42			95.535	
186	L10		0.45			95.505	
187	L5		0.535			95.42	
188	**120**		0.585			95.37	
189	R5		0.62			95.335	
190	R10		0.645			95.31	
191	R15		0.72			95.235	
192	R20		0.755			95.2	
193	R25		0.91			95.045	
194	R30		0.92			95.035	
195	R35			1.005		94.95	

Arithmetic check:

∑ BS - ∑ FS = 2.445 – 1.555 = **0.89**

Last RL – First RL = 94.95 – 94.06 **= 0.89**

DRAWING / MAPS

MALVIHIR SITE MAP

CONCLUSION

The conclusion of this report is as follows

1. The surface area of the dam has many up and downs.
2. The topography of catchment area is observed.
3. The total length of dam is 230 m
4. The catchment area can be increased by excavation further more as there is scope for further excavation.
5. The total area is 180710 m2 and catchment area is 128000 m2 and if proper excavation is done it can be increased up to 39900 m2.

The excavation should be per terrain category described in contour maps.

PROJECT GROUP PHOTOS