Digital Formulation of Muchkundi Left Bank Canal for Earthworks & Structures

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Abstract:- **Irrigation engineering is most important in India because India is an agricultural country. Hence irrigation engineering play vital role in agricultural field. A case study of dam site in selected which is located at khorninko village, Ratnagiri, Maharashtra, India For the digital formulation of earthwork and various canal structure. A contour survey is carried out for the muchkundi left bank canal with help of total station. The Microsoft Excel (MS-Excel) and SW-DTM software are used for the quantity survey and estimation on earthwork activities of left bank canal. During the earthwork estimation the Longitudinal section (L-Section) and Cross section (X-Section) are plotted by using MS-Excel and SW-DTM (connectivity with AutoCAD software).The obtained results from MS-Excel and SW-DTM provides that the results of SW-DTM are better than MS-Excel and very time efficient. This study will be helpful to the execution process of the muchkundi left bank canal. Also overviewed on the G.L and formation level.**

Keyword:- Left Bank Canal, Contour survey, Total station, SW-DTM, MS-Excel, AutoCAD, earthwork quantity.

1. INTRODUCTION

Irrigation engineering is the solicitation of artificial supply of water to the plants. Irrigation engineering include the design and study of controlling and harnessing various natural sources of water.

Canal is an artificial channel that is constructed to carry out water to the fields for irrigation. Canal irrigation is the most important form of irrigation in India and it is also a cheaper form. India includes a network of major and minor canals from Indian rivers, groundwater well based systems, tanks, and other rainwater harvesting projects for agricultural activities. Most of the canals in India today are perennial. The net area under canal irrigation is about 15.8 million hectares. The main canal irrigated areas are in the northern plains of India where Uttar Pradesh, Punjab, Haryana, Rajasthan and Bihar account for about 60 per cent of the canal irrigated area of the country. Canal are basically of two types, The Waterways which are the canal used for carrying and transporting goods, people and the other The Aqueducts where water is supplied and conveyed through canal for the human consumptions, municipal uses, hydro power generations and for agriculture. Indian states are full of canals where some of the canals are Agra Canal, Indira Gandhi canal, Eastern and Western Yamuna canal, Buddha Nullah, sirhind canal etc. Where Indira Gandhi Canal is the longest in India which is 649 km long and consists of Rajasthan feeder canal and Rajasthan main canal.

The objectives of Canal irrigation is to ensure enough moisture essential for the plant growth, provide crop insurance against short duration drought, cool the soil and atmosphere to provide a suitable surrounding.

2. LITERATURE REVIEW

Lee Y. et al. investigated and analyzed the volume of water loss in irrigation canals considering condition of actual farm land [1]. Palaka R. et al. developed the alignment for a canal is critical in terms of cost and execution time. They concluded that several alignments may be possible between the source and destination of a canal, also the command area and cost of work is most important factor [2]. Elyamany A. and El-Nashar W. introduced a new approach to evaluate and design alternatives of Improved Field Irrigation Canals (IFIC) using Life Cycle Cost (LCC) methods [3]. Clemmons A. and Burt C. evaluated the actual irrigation system performance which should rely on an accurate hydrologic water balance over the area considered [4].

3. METHODOLOGY

The methodology adopted for this study is shown by figure 1.

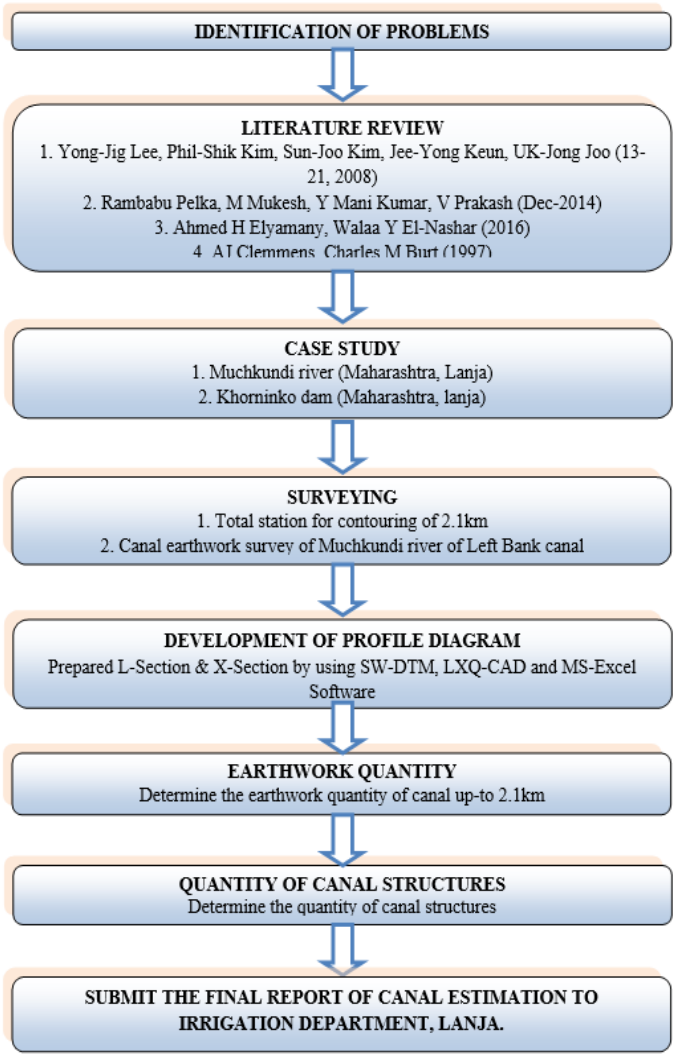

Fig. 1. Flowchart for adopted methodology

4. IDENTIFICATION OF PROBLEMS

A dam site in selected which is located at khorninko village, Ratnagiri, Maharashtra, India For the digital formulation of earthwork and various canal structure. This site located at forest region, so some problem are there to conduct survey. There are different instrument are available to conduct contour survey for canal work but we are select the Total Station for more accuracy & less time consuming.

5. CASE STUDY

A dam site in selected which is located at khorninko village, Ratnagiri, Maharashtra, India For the digital formulation of earthwork and various canal structure. A contour survey is carried out for the muchkundi left bank canal with help of total station. The Microsoft Excel (MS-Excel) and SW-DTM software are used for the quantity survey and estimation on earthwork activities of left bank canal. During the earthwork estimation the Longitudinal section (L-Section) and Cross section (X-Section) are plotted by using MS-Excel and SW-DTM (connectivity with AutoCAD software). Table 1 how the detail description of the location of case study.

TABLE 1. Detail of Khorninko Dam

Sr. No.	Village	Khorninko
1	Taluka	Lanja
2	District	Ratnagiri
3	State	Maharashtra
4	Country	India
5	Continent	Asia
6	Time Zone	IST (UTC + 05:30)
7	Language	Marathi
8	Time difference	35 minutes
9	Latitude	16.886319
10	Longitude	73.74311

Khorninko is a village panchayat located in the Ratnagiri district of Maharashtra state, India. Mumbai is the state capital for Khorninko village. It is located around 250.4 kilometer away from Khorninko. The Muchkundi River is shown by figure2

Fig. 2. Muchkhundi River (Google Map Image)

Khorninko is a village panchayat located in the Ratnagiri district of Maharashtra state, India which I hown in figure 3. Mumbai is the state capital for Khorninko village. It is located around 250.4 kilometer away from Khorninko.

Fig. 3. Khorninko Dam

5. CONTOUR SURVEYING

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.

Uses of contour maps:

A) A civil engineer studies the contours and finds out the nature of the ground to identify. Suitable site for the project works to be taken up.

B) By drawing the section in the plan, it is possible to find out profile of the ground along that line. It helps in finding out depth of cutting and filling, if formation level of road/railway is decided.

C) Intervisibility of any two points can be found by drawing profile of the ground along that line.

D) The routes of the railway, road, canal or sewer lines can be decided so as to minimize and balance earthworks.

A contour survey is carried out for the muchkundi left bank canal with help of total station. Total 2.16 KM survey conducted by Total Station (Trimble-M-3). Table 2 Show the earthwork quantity for cutting and filling of the left bank canal. The canal bed level (CBL) and width of bed (B) are 99 m and 0.50 m respectively. The Side slope (S) for the cutting is 1:1 while 1 in 600 the longitudinal slope is provided.

6. DEVELOPMENT OF PROFILE DIAGRAM

The profile diagram of canal such as Longitudinal section & Cross section of canal plotting by SW-DTM software by connectivity of Auto Cad and also in MS-Excel and LXQ-CAD software.

6.1. X-Section by using SW-DTM software

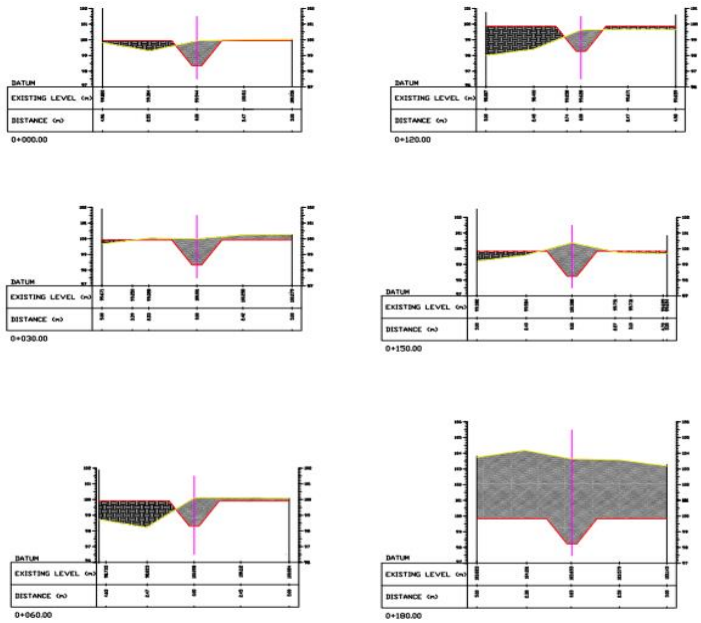

Fig. 4. X-Section Ch.0m to 150m (By using SW-DTM software)

6.2. X-Section by using MS-Excel software

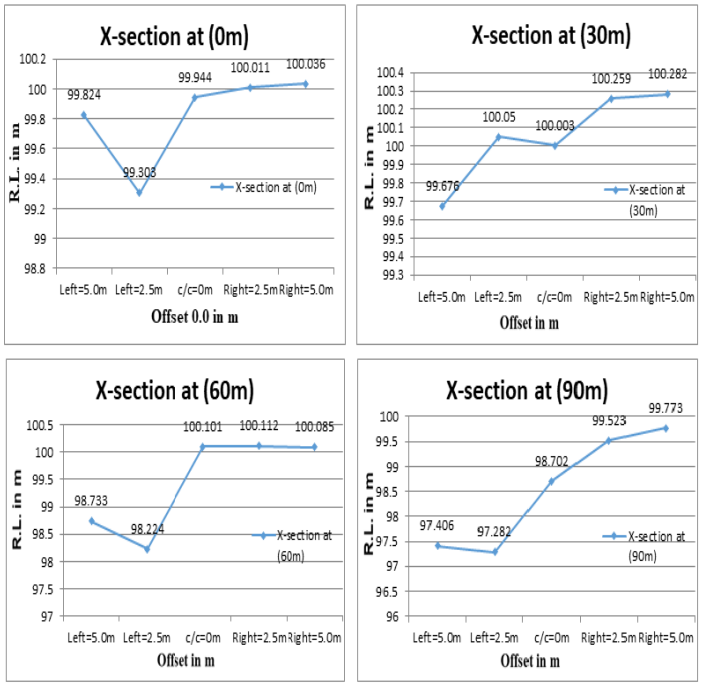

Fig 5. X-Section Ch.0m to 90m (By using MS-Excel software)

6.3. X-Section by using LXQ-CAD software

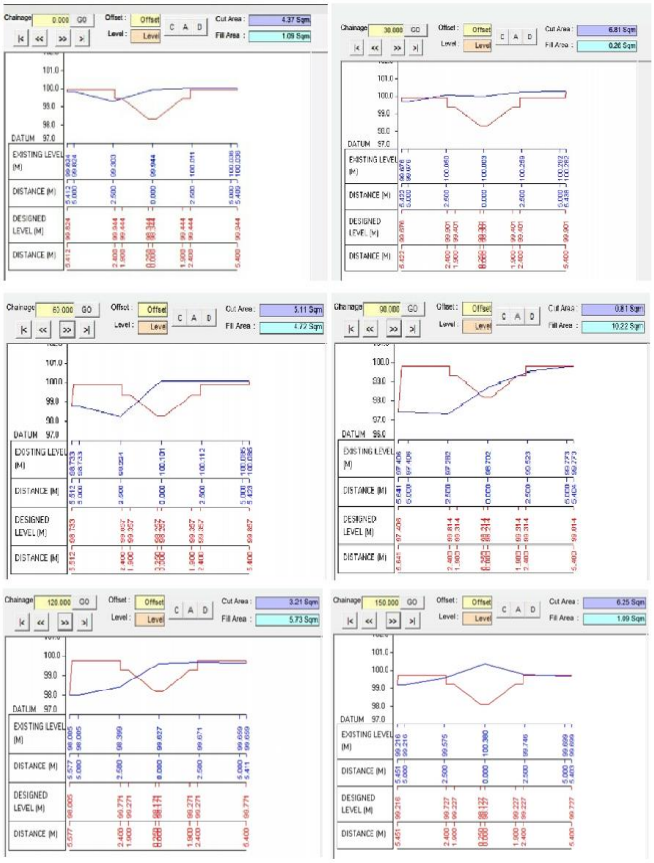

Fig 6. X-Section Ch.0m to 150m (By using LXQ-CAD software)

7. EARTHWORK QUANTITY

7.1. By using SW-DTM software

TABLE 2. Earthwork Quantity calculated by using SW-DTM software

Chainage	Area of Embankment Portion	Total Mean Area of Embankment Portion	Distance(L)	Embankment Quantity	Area of Cuitting Portion	Total Mean Area of Cutting Portion	Distance(L)	Cutting Quantity
m	Sq.m	Sq.m	m	Cu.m	Sq.m	Sq.m	m	Cu.m
1	2	3	4	5	6	7	8	9
0	1.5438	-	-	-	2.551	-	-	-
30	2.2755	1.90965	30	57.2895	3.715	3.1326	30	93.978
60	4.6547	3.4651	30	103.953	3.236	3.4751	30	104.252
90	11.5489	8.1018	30	243.054	0.262	1.7488	30	52.464
120	6.5066	9.02775	30	270.8325	1.683	0.9726	30	29.1765
150	1.5945	4.05055	30	121.5165	3.479	2.581	30	77.43
180	0	0.79725	30	23.9175	41.59	22.535	30	676.052
210	0	0	30	0	51.7	46.644	30	1399.31
240	0	0	30	0	45.9	48.8	30	1464
270	0.5236	0.2618	30	7.854	4.01	24.957	30	748.71
300	3.3515	1.93755	30	58.1265	1.878	2.944	30	88.3185
330	5.577	4.46425	30	133.9275	0.684	1.2811	30	38.4315
360	8.5631	7.07005	30	212.1015	0.354	0.5189	30	15.567
390	6.3836	7.47335	30	224.2005	0.458	0.406	30	12.18
420	6.3679	6.37575	30	191.2725	0.417	0.4377	30	13.131
450	6.406	6.38695	30	191.6085	0.771	0.5942	30	17.826
480	8.1759	7.29095	30	218.7285	0.4	0.5858	30	17.5725
510	8.8979	8.5369	30	256.107	0.263	0.3316	30	9.948
540	11.6578	10.27785	30	308.3355	0.263	0.2629	30	7.8855
570	4.1906	7.9242	30	237.726	1.697	0.98	30	29.3985
600	0	2.0953	30	62.859	9.288	5.4924	30	164.772

630	0	0	30	0	6.318	7.8026	30	234.077
660	1.5359	0.76795	30	23.0385	1.966	4.1419	30	124.256
690	1.4721	1.504	30	45.12	1.692	1.8291	30	54.873
720	0	0.73605	30	22.0815	6.994	4.343	30	130.289
750	0	0	30	0	6.46	6.7269	30	201.806
780	0	0	30	0	6.897	6.6786	30	200.357
810	0	0	30	0	15.98	11.437	30	343.097
840	0	0	30	0	26.83	21.402	30	642.048
870	0	0	30	0	3.663	15.245	30	457.358
900	18.6264	9.3132	30	279.396	0	1.8316	30	54.948
930	32.2157	25.42105	30	762.6315	0	0	30	0
960	21.3836	26.79965	30	803.9895	0	0	30	0
990	21.5588	21.4712	30	644.136	0	0	30	0
1020	28.0808	24.8198	30	744.594	0	0	30	0
1050	34.6798	31.3803	30	941.409	0	0	30	0
1080	44.8381	39.75895	30	1192.7685	0	0	30	0
1110	50.065	47.45155	30	1423.5465	0	0	30	0
1140	40.7616	45.4133	30	1362.399	0	0	30	0
1170	30.2521	35.50685	30	1065.2055	0	0	30	0
1200	31.8128	31.03245	30	930.9735	0	0	30	0
1230	27.3685	29.59065	30	887.7195	0	0	30	0
1260	10.9729	19.1707	30	575.121	0.181	0.0907	30	2.721
1290	16.5698	13.77135	30	413.1405	0	0.0907	30	2.721
1320	31.0095	23.78965	30	713.6895	0	0	30	0
1350	40.317	35.66325	30	1069.8975	0	0	30	0
1350	23.517	31.917	30	957.51	0	0	30	0
1380	25.7744	24.6457	30	739.371	0	0	30	0
1410	24.4275	25.10095	30	753.0285	0	0	30	0
1440	23.4885	23.958	30	718.74	0	0	30	0
1470	24.0944	23.79145	30	713.7435	0	0	30	0
1500	25.781	24.9377	30	748.131	0	0	30	0
1530	28.3168	27.0489	30	811.467	0	0	30	0
1560	37.5888	32.9528	30	988.584	0	0	30	0
1590	30.8964	34.2426	30	1027.278	0	0	30	0
1620	27.2026	29.0495	30	871.485	0	0	30	0
1650	24.3085	25.75555	30	772.6665	0	0	30	0
1680	31.9854	28.14695	30	844.4085	0	0	30	0
1710	57.392	44.6887	30	1340.661	0	0	30	0
1740	30.9207	44.15635	30	1324.6905	0	0	30	0
1770	34.9754	32.94805	30	988.4415	0	0	30	0
1800	34.5355	34.75545	30	1042.6635	0	0	30	0
1830	30.7993	32.6674	30	980.022	0	0	30	0
1860	33.2269	32.0131	30	960.393	0	0	30	0
1890	34.0363	33.6316	30	1008.948	0	0	30	0
1920	24.0177	29.027	30	870.81	0	0	30	0
1950	18.879	21.44835	30	643.4505	0	0	30	0
1980	28.5182	23.6986	30	710.958	0	0	30	0
2010	33.5193	31.01875	30	930.5625	0	0	30	0
2040	34.1737	33.8465	30	1015.395	0	0	30	0
2070	24.5069	29.3403	30	880.209	0	0	30	0
2100	9.6268	17.06685	30	512.0055	0.175	0.0874	30	2.6205
2130	29.6525	19.63965	30	589.1895	0	0.0874	30	2.6205
2160	10.9074	20.27995	30	608.3985	0.237	0.1186	30	3.5565
				41177.478 Cu.m				7517.75 Cu.m

7.2 By using MS-Excel software

TABLE 3. Earthwork Quantity calculated by using MS-Excel software

Chainage	Depth (d)	Area of central portion =Bd	Area of sides=Sd²	Total sectional area=Bd+Sd²	Total mean sectional area	Distance(L)	Quantity=L(Bd+Sd²)	
							Embankment	Cutting
m	m	Sq.m	Sq.m	Sq.m	Sq.m	m	Cu.m	Cu.m
1	2	3	4	5	6	7	8	9
	RL-CBL	Bd	Sd^2	Bd+Sd^2				
0	1.6	0.8	3.84	4.64	-	-	-	-
30	1.679	0.8395	4.22856	5.06806	4.85403	30		145.6209
60	1.797	0.8985	4.84381	5.74231	5.40519	30		162.1556
90	0.418	0.209	0.26209	0.47109	3.1067	30		93.20099
120	1.363	0.6815	2.78665	3.46815	1.96962	30		59.08859
150	2.136	1.068	6.84374	7.91174	5.68995	30		170.6985

180	5.409	2.7045	43.8859	46.5904	27.2511	30		817.5325
210	6.07	3.035	55.2673	58.3023	52.4464	30		1573.392
240	8.032	4.016	96.7695	100.786	79.5439	30		2386.318
270	1.673	0.8365	4.19839	5.03489	52.9102	30		1587.306
300	1.2	0.6	2.16	2.76	3.89745	30		116.9234
330	0.784	0.392	0.92198	1.31398	2.03699	30		61.10976
360	0.384	0.192	0.22118	0.41318	0.86358	30		25.90752
390	0.545	0.2725	0.44554	0.71804	0.56561	30		16.96832
420	0.257	0.1285	0.09907	0.22757	0.47281	30		14.18416
450	0.414	0.207	0.25709	0.46409	0.34583	30		10.37501
480	0.571	0.2855	0.48906	0.77456	0.61933	30		18.57983
510	0.368	0.184	0.20314	0.38714	0.58085	30		17.42546
540	0.601	0.3005	0.5418	0.8423	0.61472	30		18.44156
570	0.096	0.048	0.01382	0.06182	0.45206	30		13.56188
600	1.497	0.7485	3.36151	4.11001	2.08592	30		62.57756
630	1.968	0.984	5.80954	6.79354	5.45177	30		163.5532
660	1.453	0.7265	3.16681	3.89331	5.34342	30		160.3027

690	1.05	0.525	1.65375	2.17875	3.03603	30		91.08095
720	1.241	0.6205	2.31012	2.93062	2.55469	30		76.64057
750	2.002	1.001	6.01201	7.01301	4.97181	30		149.1544
780	1.507	0.7535	3.40657	4.16007	5.58654	30		167.5962
810	1.65	0.825	4.08375	4.90875	4.53441	30		136.0324
840	3.41	1.705	17.4421	19.1471	12.0279	30		360.8385
870	4.669	2.3345	32.6993	35.0338	27.0905	30		812.7149
900	1.316	0.658	2.59778	3.25578	19.1448	30		574.3444
918.41	0	0	0	0	1.62789	18.4		29.98577
930	-0.828	0.414	1.02838	1.44238	0.72119	11.6	8.351357	
960	-2.15	1.075	6.93375	8.00875	4.72556	30	141.7669	
990	-1.161	0.5805	2.02188	2.60238	5.30557	30	159.167	
1020	-1.015	0.5075	1.54534	2.05284	2.32761	30	69.82829	
1050	-0.938	0.469	1.31977	1.78877	1.9208	30	57.62405	
1080	-1.507	0.7535	3.40657	4.16007	2.97442	30	89.23259	
1110	-2.375	1.1875	8.46094	9.64844	6.90426	30	207.1277	
1140	-3.857	1.9285	22.3147	24.2432	16.9458	30	508.3742	
1170	-3.055	1.5275	13.9995	15.527	19.8851	30	596.5532	
1200	-1.676	0.838	4.21346	5.05146	10.2893	30	308.6775	
1230	-1.784	0.892	4.77398	5.66598	5.35872	30	160.7617	
1260	-1.69	0.845	4.28415	5.12915	5.39757	30	161.927	
1290	-0.359	0.1795	0.19332	0.37282	2.75099	30	82.52957	
1294.9	0	0	0	0	0.18641	4.9	0.915277	
1320	1.836	0.918	5.05634	5.97434	2.98717	25.1		74.94815
1335.7	0	0	0	0	2.98717	15.7		46.80899
1350	-1.68	0.84	4.2336	5.0736	2.5368	14.3	36.35234	
1350	0	0	0	0	2.5368	14.3	36.35234	
1380	-0.249	0.1245	0.093	0.2175	0.10875	30	3.262522	

1410	-1.586	0.793	3.77309	4.56609	2.3918	30	71.75393	
1440	-0.963	0.4815	1.39105	1.87255	3.21932	30	96.57971	
1470	-1.663	0.8315	4.14835	4.97985	3.4262	30	102.7861	
1500	-0.773	0.3865	0.89629	1.28279	3.13132	30	93.93971	
1530	-1.063	0.5315	1.69495	2.22645	1.75462	30	52.63871	
1560	-1.489	0.7445	3.32568	4.07018	3.14832	30	94.44953	
1590	-2.27	1.135	7.72935	8.86435	6.46727	30	194.018	
1620	-2.623	1.3115	10.3202	11.6317	10.248	30	307.4407	
1650	-1.416	0.708	3.00758	3.71558	7.67364	30	230.2092	
1680	-1.356	0.678	2.7581	3.4361	3.57584	30	107.2753	
1710	-0.777	0.3885	0.90559	1.29409	2.3651	30	70.95296	
1740	-2.826	1.413	11.9794	13.3924	7.34325	30	220.2976	
1770	-4.887	2.4435	35.8242	38.2677	25.83	30	774.901	
1800	-1.998	0.999	5.98801	6.98701	22.6273	30	678.8199	
1830	-2.198	1.099	7.24681	8.34581	7.66641	30	229.9922	
1860	-2.243	1.1215	7.54657	8.66807	8.50694	30	255.2082	
1890	-1.451	0.7255	3.1581	3.8836	6.27584	30	188.2751	
1920	-1.968	0.984	5.80954	6.79354	5.33857	30	160.1571	
1950	-2.194	1.097	7.22045	8.31745	7.5555	30	226.6649	
1980	-1.629	0.8145	3.98046	4.79496	6.55621	30	196.6862	
2010	-0.311	0.1555	0.14508	0.30058	2.54777	30	76.43315	
2040	-1.367	0.6835	2.80303	3.48653	1.89356	30	56.80673	
2070	-1.894	0.947	5.38085	6.32785	4.90719	30	147.2158	
2100	-2.235	1.1175	7.49284	8.61034	7.4691	30	224.0729	
2130	-1.727	0.8635	4.47379	5.33729	6.97382	30	209.2145	
2155.1	0	0	0	0	2.66865	25.1	66.9857	
2160	0.337	0.1685	0.17035	0.33885	0.16943	4.9		0.830022
							7695.592 Cu m	10215.37 Cu.m

7.3. By using LXQ-CAD software

TABLE 4. Earthwork Quantity calculated by using LXQ-CAD software

Chainage	Cut Area	Avg Cut Area	Fill Area	Avg Fill Area	Length	Cut Volume	Fill Volume
	Sq.m	Sq.m	Sq.m	Sq.m	m	Cu.m	Cu.m
1	2	3	4	5	6	7	8
0	4.372	-	1.089	-	-	-	-
30	6.608	5.49	0.308	0.6985	30	164.7	20.955
60	4.788	5.698	4.911	2.6095	30	170.94	78.285
90	0.619	2.7035	10.796	7.8535	30	81.105	235.605
120	2.854	1.7365	6.407	8.6015	30	52.095	258.045
150	5.68	4.267	1.789	4.098	30	128.01	122.94
180	47.88	26.78	0	0.8945	30	803.4	26.835
210	60.548	54.214	0	0	30	1626.42	0
240	79.82	70.184	0	0	30	2105.52	0
270	8.215	44.0175	0	0	30	1320.53	0
300	4.062	6.1385	1.731	0.8655	30	184.155	25.965
330	1.483	2.7725	3.29	2.5105	30	83.175	75.315
360	0.424	0.9535	7.896	5.593	30	28.605	167.79
390	0.745	0.5845	6.196	7.046	30	17.535	211.38
420	0.779	0.762	5.633	5.9145	30	22.86	177.435
450	0.572	0.6755	6.531	6.082	30	20.265	182.46
480	0.84	0.706	5.875	6.203	30	21.18	186.09
510	0.393	0.6165	8.268	7.0715	30	18.495	212.145
540	0.872	0.6325	6.662	7.465	30	18.975	223.95
570	0.054	0.463	15.69	11.176	30	13.89	335.28
600	11.696	5.875	0	7.845	30	176.25	235.35

630	10.537	11.1165	0	0	30	333.495	0
660	8.768	9.6525	0.015	0.0075	30	289.575	0.225
690	1.939	5.3535	3.055	1.535	30	160.605	46.05
720	5.247	3.593	0.385	1.72	30	107.79	51.6
750	8.177	6.712	0.186	0.2855	30	201.36	8.565
780	10.505	9.341	0	0.093	30	280.23	2.79
810	10.114	10.3095	0	0	30	309.285	0
840	21.648	15.881	0	0	30	476.43	0
870	34.19	27.919	0	0	30	837.57	0
900	3.893	19.0415	0.35	0.175	30	571.245	5.25
930	0	1.9465	20.985	10.6675	30	58.395	320.025
960	0	0	35.731	28.358	30	0	850.74
990	0	0	22.228	28.9795	30	0	869.385
1020	0	0	20.815	21.5215	30	0	645.645
1050	0	0	24.127	22.471	30	0	674.13
1080	0	0	35.783	29.955	30	0	898.65
1110	0	0	43.534	39.6585	30	0	1189.76
1140	0	0	56.852	50.193	30	0	1505.79
1170	0	0	47.638	52.245	30	0	1567.35
1200	0	0	31.606	39.622	30	0	1188.66
1230	0	0	33.505	32.5555	30	0	976.665
1260	0	0	32.019	32.762	30	0	982.86
1290	0	0	18.926	25.4725	30	0	764.175
1320	7.85	3.925	1.458	10.192	30	117.75	305.76
1350	0	3.925	30.847	16.1525	30	117.75	484.575
1380	0	0	13.811	22.329	30	0	669.87
1410	0	0	30.487	22.149	30	0	664.47
1440	0	0	24.538	27.5125	30	0	825.375
1470	0	0	31.113	27.8255	30	0	834.765
1500	0	0	20.101	25.607	30	0	768.21
1530	0	0	26.82	23.4605	30	0	703.815
1560	0	0	26.924	26.872	30	0	806.16
1590	0	0	37.678	32.301	30	0	969.03
1620	0	0	39.742	38.71	30	0	1161.3
1650	0	0	25.767	32.7545	30	0	982.635
1680	0	0	27.81	26.7885	30	0	803.655
1710	0	0	20.661	24.2355	30	0	727.065
1740	0	0	45.065	32.863	30	0	985.89
1770	0	0	69.763	57.414	30	0	1722.42
1800	0	0	32.636	51.1995	30	0	1535.99
1830	0	0	36.812	34.724	30	0	1041.72
1860	0	0	36.563	36.6875	30	0	1100.63
1890	0	0	31.449	34.006	30	0	1020.18
1920	0	0	34.177	32.813	30	0	984.39
1950	0	0	36.953	35.565	30	0	1066.95
1980	0	0	30.116	33.5345	30	0	1006.04
2010	0	0	14.061	22.0885	30	0	662.655
2040	0	0	27.084	20.5725	30	0	617.175
2070	0	0	34.16	30.622	30	0	918.66
2100	0	0	37.83	35.995	30	0	1079.85
2130	0	0	30.093	33.9615	30	0	1018.85
2160	0.322	0.161	9.963	20.028	30	4.83	600.84
						10924.4 Cu.m	41393 Cu.m

8. QUANTITY OF CANAL STRUCTURE

In this project we have different canal structure are used for the different purpose like economical construction, avoid any obstacle and any other condition. Different structure are provide in canal construction such as canal fall, cross drainage work etc.

8.1. Quantity of Canal Fall at Ch.3750/4060

TABLE 5. Quantity of Canal Fall at Ch.3750/4060

Item No.	Description of item of work	No.	L	B	H	Quantity	Total Quantity
			m	m	m	Cu.m	Cu.m
1	PCC	1	10.1	8.73	0.3	26.4519	26.4519
2	U/S Bottom Portion 1.Triangle Portion Area=1/2 X 2.79 X 4.644 = 6.47838 Sq.m	1	9.5	6.47838		61.5446	
	2.Rectangle Portion	1	9.5	0.6	4.644	26.4708	88.01541
3	U/S Top Portion	2	4.2	0.6	1.6	8.064	8.064
4	D/S Bottom Portion 1.Triangle Portion Area=1/2 X 1.89 X 3.143=2.970135 Sq.m	1	9.5	2.97014		28.2163	
	2.Rectangle Portion	1	9.5	0.6	3.143	17.9151	43.1313
5	D/S Top Portion	2	4.2	0.6	1.6	8.064	8.064
6	Base Portion 1.Triangle Portion Area=1/2 X 0.45 X 2.25=0.50625= Sq m	2		0.50625	1.644	1.66455	
	2.Rectangle Portion	2	2.25	3.75	1.644	27.7425	29.40705
7	Side Wall 1.Triangle Portion Area=1/2 X 2.25 X 1.501=1.688625 Sq.m	2	1.68863	0.45		1.51977	
	2.Rectangle Portion	2	2.25	0.45	3.099	6.27548	7.795245
							213.9676 Cu.m

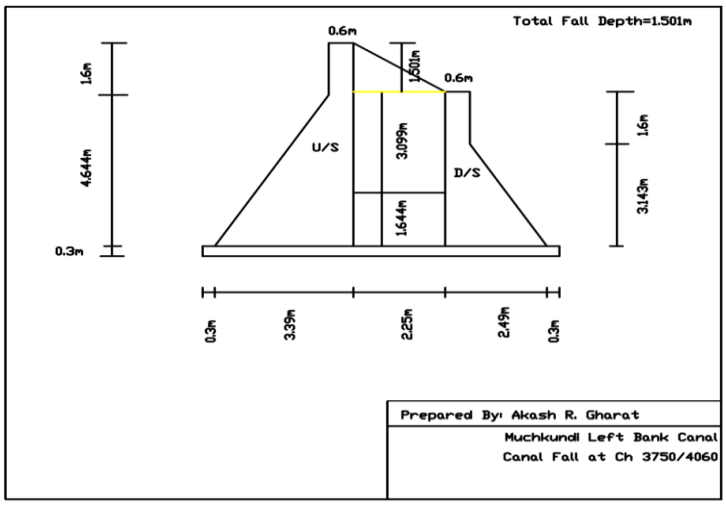

Fig 7.Section of Canal Fall at Ch.3750/4060

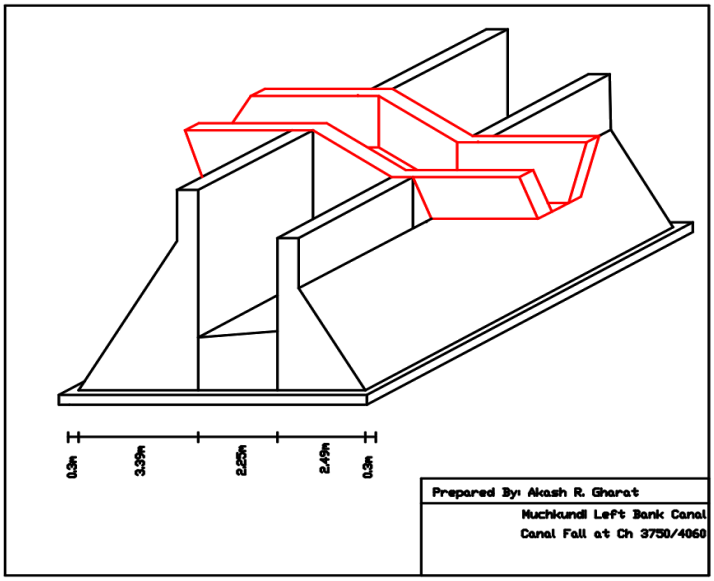

Fig. 8. 3D View of Canal Fall at Ch.3750/4060

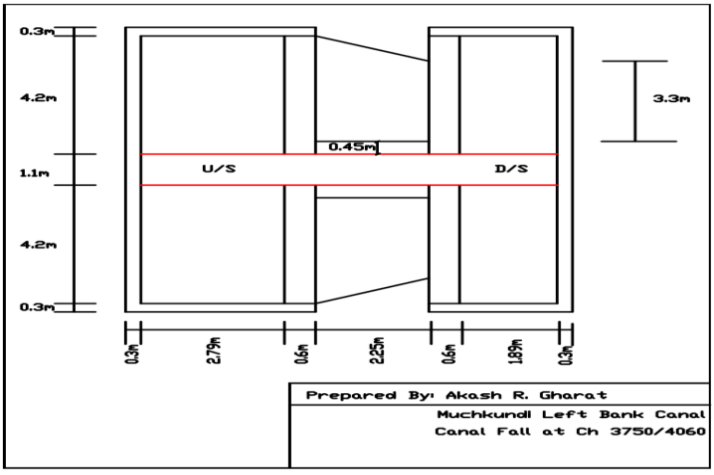

Fig. 9. Plan of Canal Fall at Ch.3750/4060

8.2 Quantity of Canal Fall at Ch.4150

TABLE 6. Quantity of Canal Fall at Ch.4150

Item No.	Description of item of work	No.	L	B	H	Quantity	Total Quantity
			m	m	m	Cu.m	Cu.m
1	PCC	1	8.12	6.7	0.3	16.3212	16.3212
2	U/S Bottom Portion 1.Triangle Portion Area=1/2 X 1.8 X 3.006 = 2.7054 Sq.m	1	7.52	2.7054		20.344	
	2.Rectangle Portion	1	7.52	0.6	3.006	13.5631	33.907
3	U/S Top Portion	2	3.21	0.6	1.6	6.1632	6.1632
4	D/S Bottom Portion 1.Triangle Portion Area=1/2 X 1.2 X 2.008=1.2048 Sq.m	1	7.52	1.2048		9.0601	
	2.Rectangle Portion	1	7.52	0.6	2.008	9.0601	18.1201
5	D/S Top Portion	2	3.21	0.6	1.6	6.1632	6.1632
6	Base Portion 1.Triangle Portion Area=1/2 X 0.15 X 1.9=0.1425 Sq.m	2		0.1425	1.156	0.32946	
	2.Rectangle Portion	2	1.9	3.06	1.156	13.442	13.7715
7	Side Wall 1.Triangle Portion Area=1/2 X 1.9 X 0.998=0.9481 Sq.m	2	0.9481	0.45		0.85329	
	2.Rectangle Portion	2	1.9	0.45	2.452	4.19292	5.04621
							99.49241 Cu.m

15

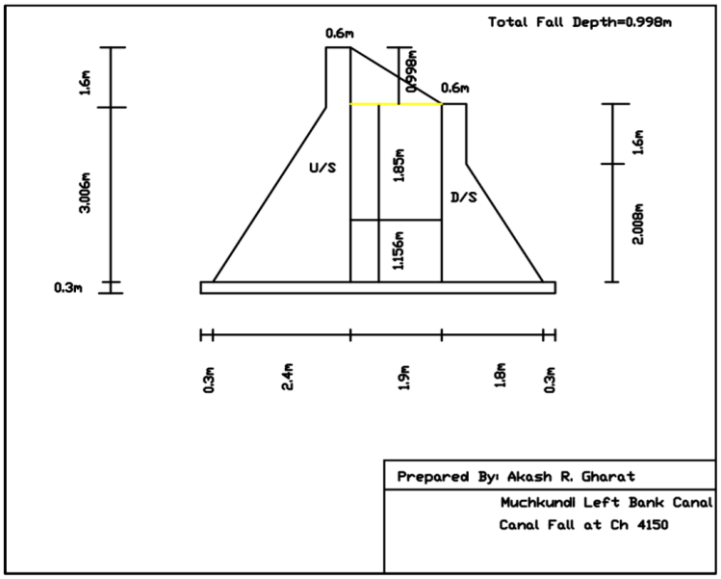

Fig. 10. Section of Canal Fall at Ch.4150

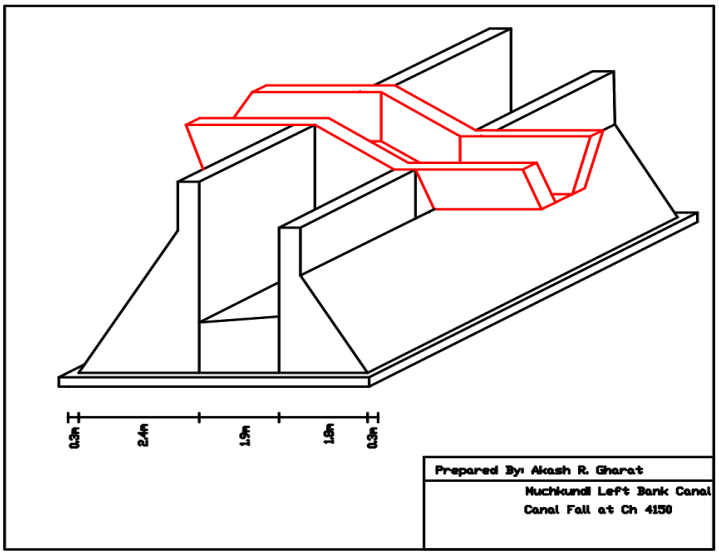

Fig. 11. 3D View of Canal Fall at Ch.4150

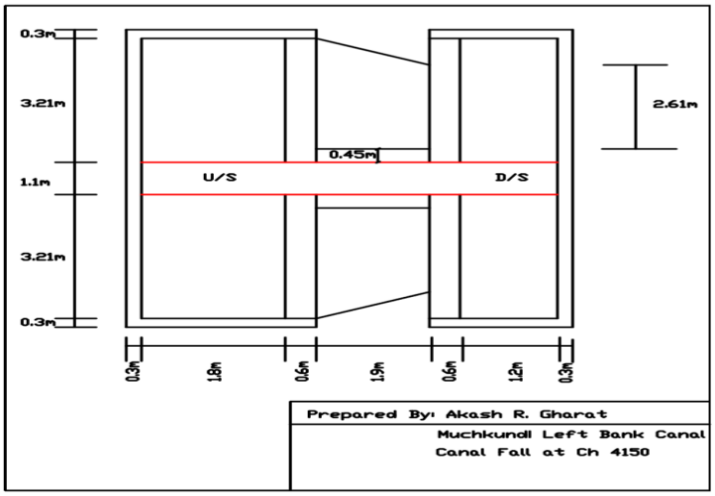

Fig.12. Plan of Canal Fall at Ch.415

8.3. Quantity of Super Passage at Ch.4105

TABLE 7. Quantity of Super Passage at Ch.4105

Item No.	Description of item of work	No.	L	B	H	Quantity	Total Quantity
			m	m	m	Cu.m	Cu.m
1	PCC 1.Main structure	1	10.058	4.6	0.3	13.8804	
	2.Retaining Wall (U/S)	1	8.3	3.76	0.3	9.3624	
	3.Retaining Wall (D/S)	1	8.3	1.88	0.3	4.6812	27.9236
2	Retaining Wall (U/S) 1.Triangle Portion Area=1/2 X 3.01 X 5.023 = 7.559615 Sq.m	1	8	7.55962	-	60.477	
	2.Rectangle Portion	1	8	5.823	0.45	20.9628	81.4398
3	Retaining Wall (D/S) 1.Triangle Portion Area=1/2 X 1.13 X 2.833=1.600645 Sq.m	1	8	1.60065	-	12.8052	
	2.Rectangle Portion	1	8	3.283	0.45	11.8188	24.6238
4	Main Structure 1.Tringle Portion Area=1/2 X 1.33 X 4.423=2.941295 Sq.m	2	4	2.9413	-	23.5304	
	2.Rectangle Portion	2	4	0.9	4.423	31.8456	
	3.Triangle Portion Area=1/2 X 2.5 X 1.668=2.085 Sq.m	2	4	2.085	-	16.68	
	4.Rectangle Portion	2	4	2.755	2.5	55.1	127.156
5	Bearing and slab 1.Bearing	2	4	0.9	0.38	2.736	
	2.Slab	1	4	6.8	0.3	8.16	10.896
6	Top Wall (Parapet Wall)	2	7.8	0.3	0.72	3.3696	3.3696
							275.4088 Cu.m

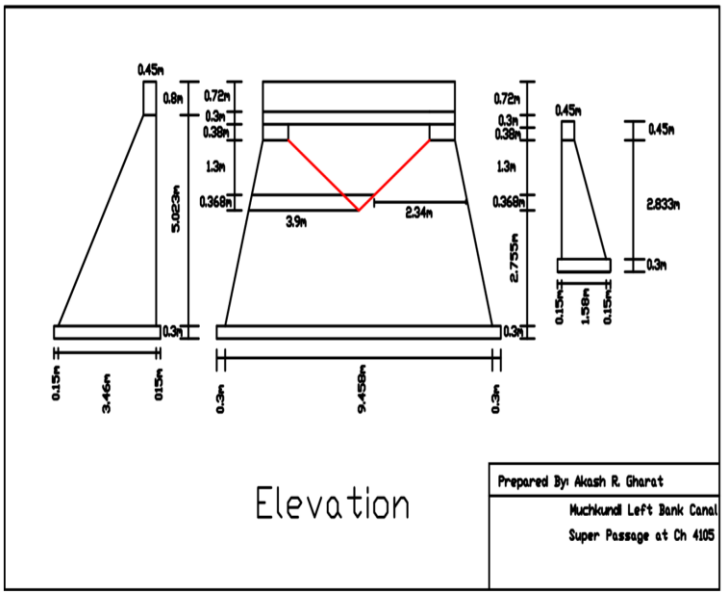

Fig 13. Section of Super Passage at Ch.4105

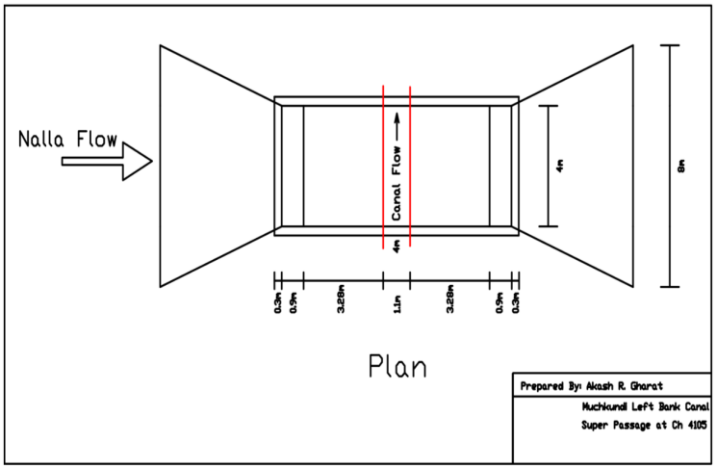

Fig 14 Plan of Super Passage at Ch.4105

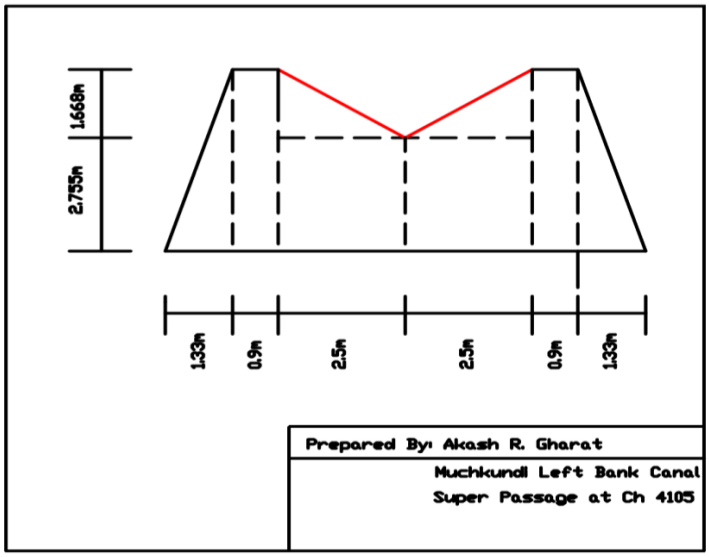

Fig 15. Elevation of Main Structure of Super Passage at Ch.4105

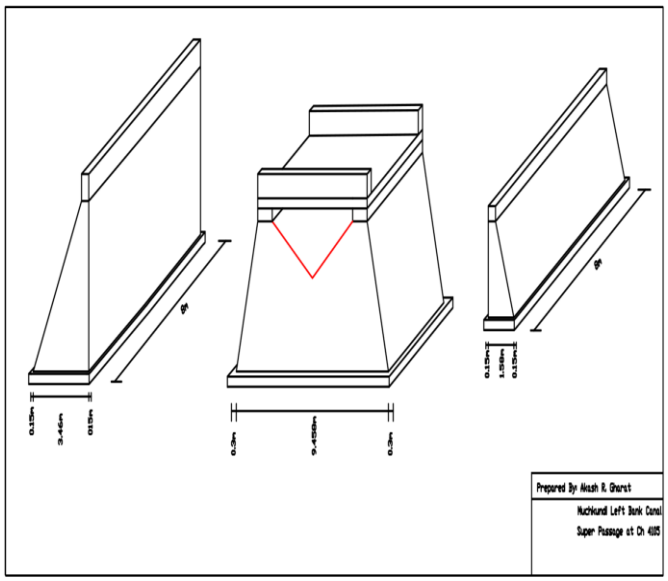

Fig 16. 3D View of Super Passage at Ch.4105

9.ESTIMATION

9.1 Rate analysis

In this project provides different canal structures are used for the different purpose like economical construction, avoid any obstacle and any other condition. In this project we have calculate the rate analysis of canal structures. Consider the grade of concrete is M30 (1:2.31:2.55). Input data denoted by yellow colure and output data denoted by light blue colure.

In this study this rate analysis prepared by IS method (IS10232:2009 and IS456:2000).

Grade of Concrete = M30 (1:2.31:2.55)

A)Quantity measurement of concrete materials

TABLE 8. Quantity measurement of concrete materials

Volume of wet concrete (1:2.31:2.55)	=	10	m³
Consider 52% of voids, wastage and allowance for compaction.			
Dry volume of concrete	=	52% more of wet volume	
	=	15.2	m³
Ratio of concrete: 1)Cement	=	1	
2)Sand	=	2.31	
3)Aggregate	=	2.55	
Sum of ratio of concrete (1:2.31:2.55)	=	5.86	
1)Quantity of cement	=	(Volume of dry concrete/ Sum of ratio of concrete)	
	=	2.59386	m³
Number of cement bags	=	74.1102	Nos
2)Quantity of sand	=	5.99181	m³
3)Quantity of aggregate	=	6.61433	m³
Metal 1	=	2.64573	m³
Metal 2	=	3.9686	m³
4)Quantity of steel	=	1% of volume of concrete	
	=	0.1	m³
	=	785	Kg
5)Binding wire	=	7.85	Kg

B)Cost of materials

TABLE 9. Cost of materials

Material	Quantity	Per	Rate	Amount
Cement	75	Bag	330	24750
Sand	5.991808874	m³	3000	17975.42662
Metal:1	2.645733788	m³	1165	3082.279863
Metal:2	3.968600683	m³	1165	4623.419795
Steel	785	Kg	50	39250
Binding Wire	7.85	Kg	65	510.25
		Total		90191.37628

C)Cost of labour

TABLE 10. Cost of labour

Labour	No.	Rate	Per	Amount
Head Mason	1.5	1000	Day	1500
Head Mason	3	800	Day	2400
Male Mazdoor	13	400	Day	5200
Female Mazdoor	10	400	Day	4000
Blacksmith	15	800	Day	12000
Bhisti	2	400	Day	800
Contingencies,T&P	LS	500	LS	500
		Total		26400

D)Centering and shuttering

TABLE 11. Centering and shuttering

Particulars	Quantity	Rate	Per	Amount
Carpenter	10	800	Day	8000
Mazdoor	10	600	Day	6000
Nails	LS	500	LS	500
		Total		14500

E)Total

TABLE 12. Grand total

Total cost of material, labour and centering & shuttering	=	131091	Rs.
Add 1.5 for water charges	=	1966.37	Rs.
10% for contractor's profit	=	13109.1	Rs.
Grand total	=	146167	Rs.
Rate per m³	=	14616.7	Rs.
Quantity of Canal Fall at Ch.3750/4060	=	213.968	m³
Cost of Canal Fall at Ch.3750/4060		3127498	Rs.
Quantity of Canal Fall at Ch.4150	=	99.4924	m³
Cost of Canal Fall at Ch.4150		1454250	Rs.
Quantity of Super Passage at Ch.4105	=	275.409	m³
Cost of Super Passage at Ch.4105		4025565	Rs.
Total quantity of canal structures	=	588.869	m³
Total cost of canal structures	=	8607312	Rs.

9.2 Final estimate

In this project prepared final estimation of canal Construction by using MS-Excel.Measurement sheet shown in Table 13 and Abstract sheet shown in Table 14.

TABLE 13. Measurement Sheet

Item No.	Description of Item of Work	No.	Length (L)	Breadth (B)	Depth (D)	Quantity	Remark
			m	m	m	Cu.m	
1	Site Cleaning	1	2160	10	-	21600	
2	Excavation						
	i)Cutting	1	-	-	-	10705.7	Ref. Table 6.12
	ii)Filling	1	-	-	-	9011.18	Ref. Table 6.12
3	Canal Lining	1	2160	0.48	-	1036.8	Area=0.48m²
4	Canal Structures						
	i)Canal Fall at Ch.3750/4060	1	-	-	-	213.968	Ref. Table 6.17
	ii)Canal Fall at Ch.4150	1	-	-	-	99.4924	Ref. Table 6.18
	iii)Super Passage at Ch.4105	1	-	-	-	275.409	Ref. Table 6.19

TABLE 14. Abstract Sheet

Item No.	Description of Item of Work	Unit	Quantity	Rate	Amount
			Cu.m	Rs.	Rs.
1	Site Cleaning	m²	21600	80	1728000
2	Excavation				0
	i)Cutting	m³	10705.6884	500	5352844.2
	ii)Filling	m³	9011.1754	2500	22527938.5
3	Canal Lining	m³	1036.8	5000	5184000
4	Canal Structures				
	i)Canal Fall at Ch.3750/4060	m³	213.9676	14616.69	3127498.079
	ii)Canal Fall at Ch.4150	m³	99.49241	14617.69	1454349.207
	iii)Super Passage at Ch.4105	m³	275.4088	14618.69	4026115.87
				Total	43400745.86
				Add 5% for contingency	2170037.293
				Add 2.5% for workcharged	1085018.646
				Grand Total	46655801.8

10. CONCLUSION

By using MS-excel the time required to obtain the results is more compared to SW-DTM software. SW-DTM software is more accurate as compared to manual work for preparing L-section & X-section and is less time consumption for preparing all data. The basic aim of this project is to get accurate result and time consuming method of canal Earthwork and hydraulic structures at Ratnagiri (lanja).Then submit the report of canal estimation to irrigation Department, Lanja. (Government of Maharashtra)

11. ACKNOWLEDGEMENT

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