KIITPOLYTECHNIC

LECTURE NOTES

ON

ESTIMATION & COST EVALUATION-2

Compiled by

Mrs. Ananyashree Moharana

(Lecturer in Department of Civil Engineering, KIIT Polytechnic BBSR)

CONTENTS

CHAPTER-1

<u>Culvert and Bridge</u> :–

According to I.R.C. specification, a culvert is one which has a liner waterway upto 6m and structures having a linear waterway above 6m but below 30m are Minor Bridges and structures havings a linear waterway of 30m or more are Major Bridges.

As a general rule, a minimum of 6m of linear waterway should be provided per 15.km of the road for efficient drainage.

Some Common terms –

(a) Abutment :- It is a masonry or oriented concerned will that constitutes the end support of bridges or similar structures by which it joins the bank of waterway.
(b) Wing wall :- Wing wall is a retaining wall which sustains the embankments of the approaches where they join the bridge.
(c) Return wall :- A return wall is retaining wall built parallel to the centre line of a road to retain the embankment.
(d) Curtain walls :- Cross walls are built across the stream on the up-stream or down-stream in order to protect the structure from erosion due to strong current of water induced by the restriction of free passage of water through the water way.

Process of calculations of earth work for (1) Abutment, (2) Wing and (3) Curtain walls (when provided) :-

(1) Abutments 2nos. = 2 x Area ABCD x depth of excavation.
(2) Wing walls 4nos. = 4 x Area BEFG x depth of excavation.
(3) Curtain walls 2nos. = 2 x Area MNPQ x depth of excavation.

Curtain walls at the two ends of Abutment walls are not always provided.

Process of calculations to estimate quantities of earthwork, concrete work and masonry work for (1) Abutments, (2) Wing walls and (3) Return walls of a splayed Culvert or Bridge :-

(1) **Abutments** :- For each or concrete work :-

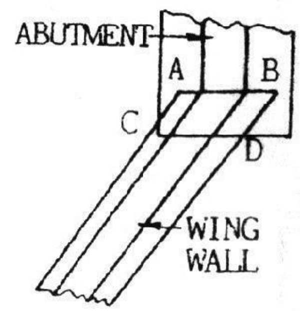


FIG. 10-28

When the inside the face of Abutment is continued to wing wall the extra bottom length due to batter may be considered as if included in the wing wall i.e. the two walls join on a vertical plane.

(a) Length = Road width + 2 parapet thickness.

When the width of Abutment at the ends is not equal to the inclined width of the wing wall joining with abutment-1s as shown in fig 10-28.

Length = ½ (Top length + Bottom length).

Bottom length – Top length + 2 x offset due to inner batter face of Abutment.

(1) Wing walls :- The thickness and height of the wall is maximum at the junction with its abutment and both the dimensions are gradually reduced to the section as that at return wall with which it joins.

For earth or correct work

Following Fig. 10-29 consider the end of excavations is up to the line R.S. We have to find out the quantity for the are ADSR.

(a) Length = Y + offsets from the outer edge of return wall

(b) Breadth = ½ + (AD+RS);

AD is the inclined trench width of wing wall parallel to the centre line of the road and generally the trench width of the abutment. If not equal, the offset (as shown in Fig. 10-28) is mentioned.

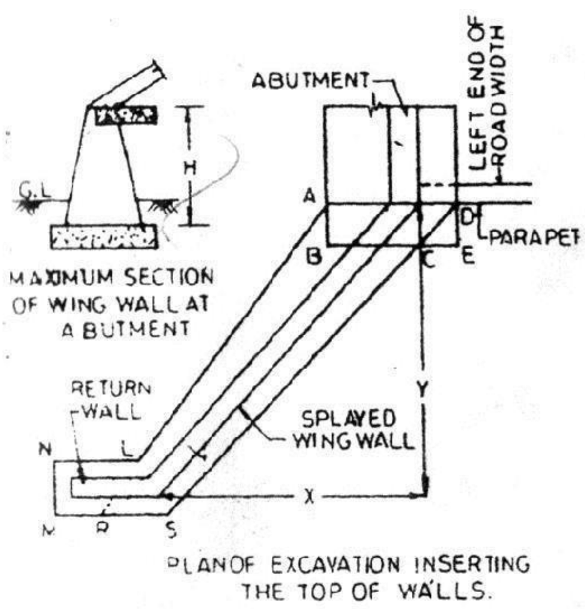


FIG. 10-29

RS = Inclined foundation trench width of Return wall parallel to the centre line of the road.

= Foundation width of Return wall x $\sqrt{\sum sq.of\ prop.of\ splay.}$

Usually, the proportion of splay X : Y = 1:1 (for 45^0)

$$\sqrt{sq.of\ of\ splay} = \sqrt{1^2 + \sqrt{1^2}} = \sqrt{2}$$

Thus when the ratio X : Y = 1:1/2 then the multiplying factor $= \sqrt{1^2 + 1.5^2} = 1.80$

Depth = usually the same depth of excavation as that of abutment is provided.

Deduction for end offset of Abutment :-

During excavation for Abutment the portion ABCD (see fig. 10-29) has already been excavated. Therefore, the volume of work for this portion should be deducted from the volume of work for the wing wall : Now AD = Foundation width

BC = AD-CE; CE-DE x X/Y

. .Deduction for Abutment offset = ½ + [trench width + (trench width – offset x X/Y)]

x depth.

For concrete work the depth of concrete instead of depth earthwork shall be considered.

For masonry work below G.L.

(a) Length = Y + offset of masonry in foundation of return wall
(b) Breadth = same process as that of earthwork
(c) Depth = thickness of the footing.

The construction of wingwall may be with its battered inner and outer faces starting from the top of the foundation concrete up to top. In such cases the whole mass shell be calculated in one operation considering this as Frusta of Pyramid, erected vertically on AD as base.

Volume = $\frac{h}{3}(A_1A_2 + \sqrt{A_1A_2})$ where A_1 and A_2 are areas of ends, i.e. vertical sectional area. At Abutment and at the end ; h is the measurement of Y.

Deduction for end offsets of Abutment :- Following the same procedures as in the case of earthwork deduction for Abutment offset for the corresponding footing of wing wall = ½ x [width of Abut. Footing + (width of Abut footing – projection x X/Y] x depth. The projection is form top face of the Abutment up to the edge of the corresponding footing.

For masonrywork above G.L.

Wing walls above G.L. may have the following shapes :- (i) Inside face vertical or battered but at the outer face with offsets; (ii) Both the faces are battered.

(i) Inside face vertical with offsets at the outer face :- Before starting the estimate, let us clarify how offsets are provided at the outside face of the wing wall. Let the top plan of wall is ABCD with three offsets, D_1 D, E_1 E and F_1 F of lengths L_1, L_2 and L_3 respectively as shown in Fig . 10-30.

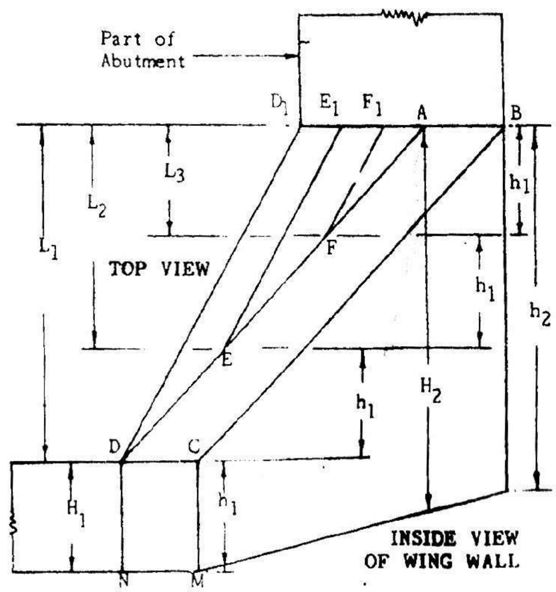


FIG. 10-30

The height of the wingwall is h_1 at the end and h_2 at Abutment. The top of ABCD of the wing wall is sloped downward uniformly from AB to DC.

To have a clear picture regarding the shape of the outside offsets suppose we are to reach the inclined level AF of the from the left side ground level.

For this purpose three numbers steps ADD_1, AEE_1 and AFF_1 are constructed with uniform rise h_1, when $h_2 = 4h_1$

The second step AEE_1 is constructed over the first step ADD_1 and similarly the third step AFF_1 over AEE_1. Now by crossing the three steps from the left wehave reached to the height of F = $3h_1$. The difference of level between the points F and A is also h_1.

But, actually these triangular steps are known as offsets of the wing wall. The projections are shown on plan and height on elevation drawn by the side of section of the Abutment. The purpose of these offset is to strengthen the core part ABCD of the wing wall.

Masonrywork above G.L. excluding offsets but including inside batter :-

Considering the mass as Frusta of Pyramid, $V = \frac{h}{3}(A_1 + A_2 + \sqrt{A_1 A_2})$.The notations are same as given before. When there be no battered at the inside face, the volume for the rectangular mass within the same inclined width through its length shall be calculated for different height at the ends by ordinary method, i.e., average depth x inclined breadth x straight length.

Vol. of 1st offset $= \frac{h}{2}\ L_1 X\ AD_1\ X\ h_1$,

Vol. of 2nd offset = $\frac{h}{2}\ L_2 X\ AE_1\ X\ h_1$and

Vol. of 3rd offset $= \frac{h}{2}\ L_3 X\ AF_1\ X\ h_1$.

Deduction of Abutment offset :-

When the width of Abutment at the ends is not equal to the inclined width of the wing wall as the well as the inside face of the Abutment is battered then the length of the Abutment includes the offsets at the end. In this case deduction for the offset projection is made from the volume of wing wall.

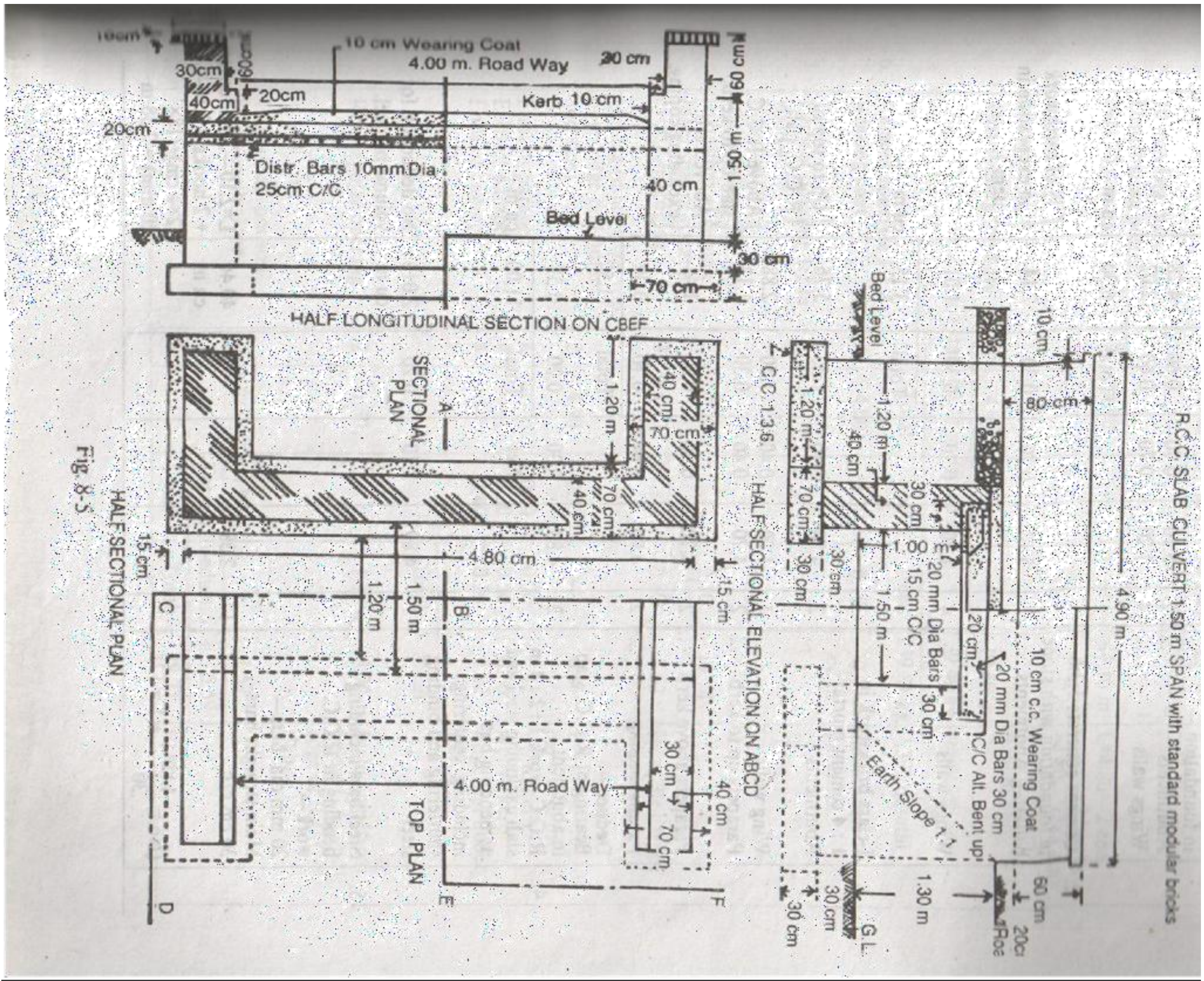
Return wall :-

Length = Average length for the RMNL = ½ (RM+NL)

RM =MS

NL = RM + MN x–. MN is the trench width.

Estimation of materials in Culverts and bridges



Details of Measurements and Calculation of Quantities.

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	**Earthwork in excavation** in foundation						
	Abutments	2	5.10	0.70	0.60	4.28	
	Wing walls	4	1.20	0.70	0.60	2.02	
					Total	**6.30**	**m^3**
2	Cement concrete 1:3:6 In foundation with stone ballast- Abutments	2	5.10	0.70	0.30	2.14	(1/2) of earthwork in excavation in item 1
	Wing walls	4	1.20	0.70	0.30	1.01	
					Total	**3.15**	**m^3**
3	I-class brickwork in 1:4 cement mortar-						
	Abutments	2	4.8	0.4	1.5	5.76	(Up to top of RCC slab)
	Wing walls	4	1.2	0.4	1.5	2.88	
	Parapets up to kerb	2	4.7	0.4	0.3	1.13	(Above RCC slab up to Kerb)
	Parapets above kerb	2	4.7	0.3	0.5	1.41	(Above kerb excluding coping.)
	Parapets coping	2	4.9	0.4	0.1	0.39	
					Total	**11.57**	
	Deduct						
	Bearing of R.C.C. slab in abutment	2	4.8	0.3	0.2	0.57	
					Total	**11.00**	**M^3**
4	**R.C.C. work 1:2:4 in** Slab excluding steel and its bending centering shuttering and binding steel	1	4.8	2.1	0.2	2.016	m^3 no deduction for volume of steel.
5	**Steel bar including bending in RCC work-**						
	20 mm dia. Bars-						
	Main straight bars 30 cm c/c {No= (4.8/0.30) +1=17}	17	2.38	--	--	40.46 m	L=2.10-2side covers + 2hooks= 2.10-(2x4cm)+(18x20mm) =2.38m
	Main bent up bars 30 cm c/c {No. = (4.80/0.30)=16}	16	2.54	--	--	40.64 m	Adding one depth, 16 cm for two bent ups L=2.38+0.16=2.54m
	10mm Dia. Bars-						
	Distributing bottom bars 25 cm c/c	9	4.90	--	--	44.10 m	L=4.80-2end covers+ 3hooks = 4.80-(2x4cm)+(18x10mm) =4.90m
	Distributing top bars	4	4.90	--	--	19.60 m	
	Total 63.70m @ 0.62kg=					**39.49 kg**	

6	Cement concrete 1:2:4 wearing coat	1	4.00	2.30	0.10	0.92 cu.m	In between parapets
7	**Cement pointing 1:2 in**						

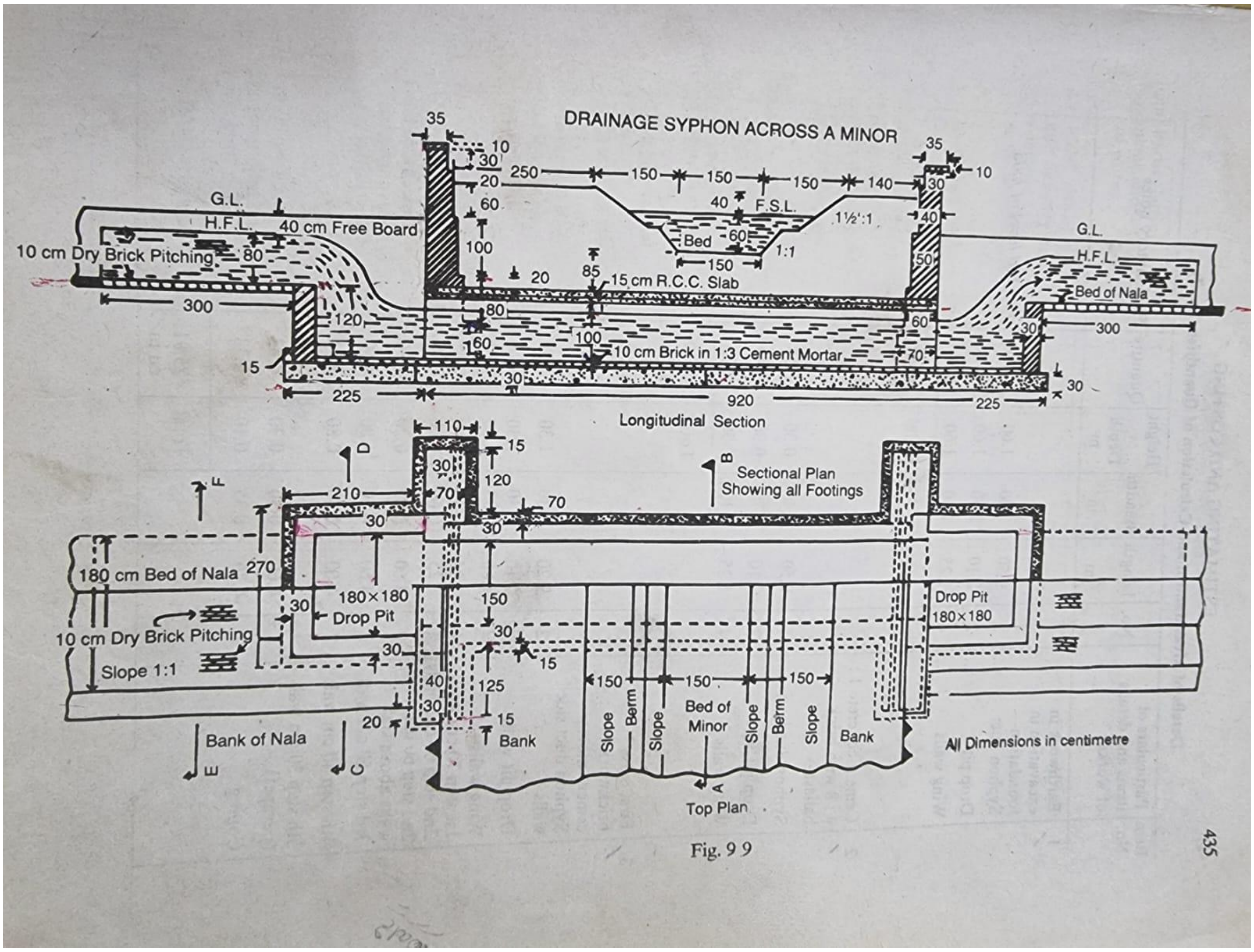
	walls- Face wall from 10 cm below G.L. up to bottom of copping inner side	2	4.70	--	2.10	19.74	
	of parapet excluding copping	2	4.70	--	0.80	7.52	Ht.=(20+10+50)=0.80
	Coping(inner edge, top, outer edge and outer end side)	2	4.90	.70	--	6.86	B=(10+40+10+10)cm=.70m
	Ends of parapet	4	--	.40	.20	.32	Up to kerb.
	Ends of parapet	4	--	.30	.50	.60	Above kerb
	End of coping	4	--	.40	.20	.32	Edge and under side
					Total	35.36	
	Deduct- Rectangular opening	2	1.50		1.30	3.90	Including 10cm below G.L. and edge of RCC slab
	Triangular portion below earth slope	2	X1-3	X1.3		1.69	
				Total of	**Deduction**	**N5.59**	
				Net	**Total**	**29.77**	**Sq m**

Abstract of Estimated cost of Bridge

S.No	Description of item	Quantity	Unit	Rate	Per	Amount Rs. P.
1	Earthwork in excavation in foundation	6.30	Cu m	350.00	Cu m	22.05
2	Cement concrete 1:3:6 in foundation with stone ballast	3.15	Cu m	400.00	Cu m	1260.00
3	I-class brickwork in 1:4 cement mortar	11.00	Cu m	365.00	Cu m	4015.00
4	R.C.C. work 1:2:4 in slab excluding steel and its bending but including centering, shuttering and binding steel	2.016	Cu m	775.00	Cu m	1562.40
5	Steel bar including bending in R.C.C work	2.398	Quintal	515.00	Quintal	1234.97
6	Cement concrete 1:2:4 in wearing coat	0.92	Cu m	450.00	Cu m	414.00
7	Cement pointing 1:2 in wall	29.77	Sq m	5.60	Sq m	166.71
					Total	**8675.13**
Add 5%(3% for contingencies and 2% for work-charged Establishment)						433.75
				Grand Total		**9108.88**

CHAPTER-2

DRAINGE SAYPSON



DETAILS OF QUANTITY CALCULATION

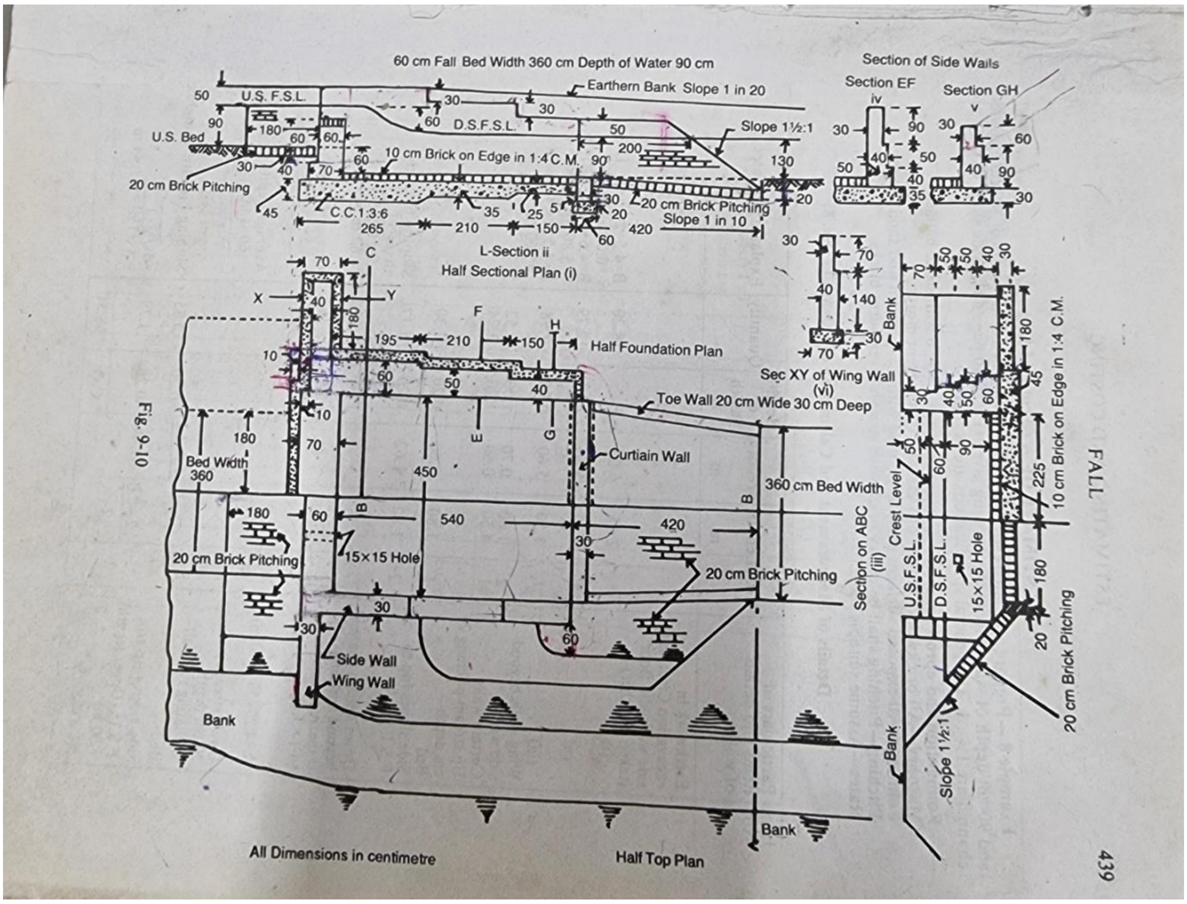
Item no	Particulars of item	no	Length(m)	Breadth(m)	Height(m)	quantity	remark
1	E/W excavation for foundation						
	Siphon duct	1	9.5	2.4	1.6	36.48	
	Drop pit	2	2.1	2.7	1.6	18.14	
	Wing wall	4	1.25	1.1	1.6	8.80	
					Total=	63.42cum	
2	Cement concrete						
	Siphon duct	1	9.5	2.4	0.3	6.84	
	Drop pit	2	2.1	2.7	0.3	3.4	
	Wing wall	4	1.25	1.1	0.3	1.65	
					Total=	11.89cum	

3	1st class b/w Siphon duct side wall	2	9.2	0.3	1.3	7.18	
	Drop pit wall Wing walls	2x2 2	2.1 1.8	0.3 0.3	1.3 1.3	3.28 1.40	
	1st step70cm	4	1.25	0.7	0.7	2.45	
	2nd step60cm	4	1.25	0.6	0.6	1.8	
	2nd step 60cm above slab	2	4.6	0.6	0.2	1.1	
	3rd step 50cm wall	2	4.6	0.5	1.00	4.6	
	4th step 40cm wall	2	4.6	0.4	0.8	2.94	
	5th step 30 cm wall(parapet)	2	4.6	0.3	0.3	0.83	
	coping	2	4.7	0.35	0.1	0.33=25.91cum	
4	Rcc slab including reinforcement	1	9.2	2.1	0.15	2.9cum	
5	Brick pitching						

	Floor of duct	1	9.2	1.5	-	13.80	
	Floor of drop pit	2	1.8	1.8	-	6.48	
					Total=	20.28sqm	
6	Cement pointing Siphon duct inner face	2	9.2		1		
	Drop pit 3 vertical faces	2x3	1.8		1.2		
	Drop pit 3 top faces	2	5.7		0.3		
	Parapet wall inner face top and outer face up to GL	2	4.6		2.3		
	Outer face of wing wall above slab	2	1.8		1.2		
	Triangular portion of outer face of wing wall	2x2	(1/2x0.8x0.8)	=		1.28	
					Total=	61.54cum	
7	Brick pitching						
	Bed of nala	2	3	1.8		10.8	
	Side slope	2x2	3	1.13	Total=	13.56 24.36sqm	

Estimation of vertical fall

DETAILS OF QUANTITY CALCULATION



Sl no	Particulars of item	no	Length(m)	Breath(m)	Height(m)	quantity	remark
1	E/W excavation Crest wall,side wall and floor(taken together) (1)	1	2.65	6.00	1.15	18.29	

	(2)	1	2.1	5.8	1.05	12.79	
	(3)	1	1.5	5.6	0.95	7.98	
	Wing wall beyond side wall	2	1.8	0.7	1	2.52	
	Curtain walls	1	4.5	0.6	1.2	3.24	
	Upstream pitching 20cm depth						
	bed	1	1.8	3.6	0.2	1.3	
	Side slopes up to FSL	2	1.8	1.62	0.2	1.17	
	Down stream channel beyond curtain wall trapezium section	$(4.05x0.8+1.5x0.8^2)$	X3.9	=		16.38	
	Down stream pitching 20cm depth excluding toe wall Bed	1	$3.9x\frac{4.1+3.2}{2}$	X0.2	=	2.85	
	Side slope up to FSL	2	$\frac{4.2+2}{2}$	X1.44	X0.2	=1.79	
					Total	=68.31cum	
	Curved portion	2	$\Pi x0.6^2$		X0.2	0.45	
	toe wall	2	3.9	0.2	0.3	0.47	
	Deduct for setback of wing wall	2	0.6	0.10	1.15	0.14	
2	Cement concrete in foundation				Total=	69.09cum	
	Crest wall,side wall and floor(taken together)						

	(1)	1	2.65	6.00	0.45	7.16	
	(2)	1	2.1	5.8	0.35	4.26	
	(3)	1	1.5	5.6	0.25	2.1	
	Wing wall beyond side wall	2	1.8	0.7	0.3	0.76	
	Curtain wall	1	4.5	0.6	0.2	0.54	
					Total=	14.82cum	
	Deduct for setback of wing wall	2	0.6	0.1	1.15	0.14	
3	1st class b/w 1st step 2nd step	 1 1	 4.5 4.5	 0.7 0.6	Total= 0.4 1.00	14.68cum 1.26 2.7	
	Side wall 1)1st step	2	2.35	0.6	0.4	1.13	
	2nd step	2	2.35	0.5	0.5	1.18	
	3rd step	2	2.35	0.4	0.5	0.94	
	4th step	2	2.35	0.3	0.7	0.99	
	2) 1st step	2	2.1	0.5	0.4	0.84	
	2nd step	2	2.1	0.4	0.5	0.84	
	3rd step	2	2.1	0.3	0.9	1.13	
	3) 1st step	2	1.5	0.4	0.9	1.08	
	2nd step	2	1.5	0.3	0.6	0.54	
	Wing wall beyond side wall	2	1.8	0.4	0.4	0.58	
		2	1.9	0.4	0.5	0.76	
		2	2.00	0.4	0.5	0.80	
		2	2.1	0.3	0.7	0.88	
	Curtain wall	1	4.5	0.3	0.4	0.54	
	Toe wall	2	3.9	0.2	0.3 Total=	0.47 16.66cum	
4	Brick on edge floor	1	5.4	4.5	-	24.30sqm	

CHAPTER-3

DETAIL ESTIMATION OF ROAD

CROSS SECTION OF ROAD

Cross-section of earthwork of road in banking or in cutting is usually in the form of trapezium, nd the quantity of earthwork may be calculated by the following methods :—

Quantity or volume = Sectional area × Length.

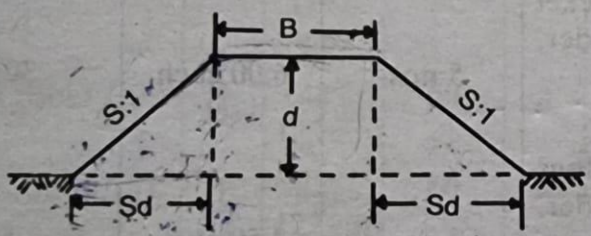


Fig. 7-1
Banking

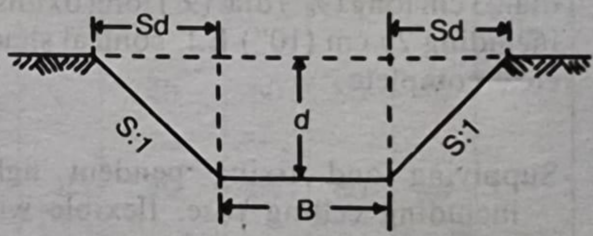


Fig. 7-2
Cutting

Sectional area = Area of central rectangular portion + Area of two-side triangular portions.

$$= Bd + 2(\tfrac{1}{2}\, sd \times d) = Bd + sd^2$$

S : 1 is the ratio of side slopes as horizontal : vertical. For 1 vertical, horizontal is s, for d tical, horizontal is sd.

Quantity= $(Bd+sd^2) \times L$.

METHODS OF E/W FOR ROAD

1.mid sectional formula method
2.mean-sectional formula method

3.prismoidal formula method

Problem:

Reduced level pf ground along the center line of a proposed road from chainage 10 to chainage 20 is given.the formation level at the 10th chainage is 107 and the road is in downward gradient of 1 in 150 up to the chainage 14 and then the gradient changes to 1 in 100 down ward.formation width is 10m and side slopes of banking are 2:1.length of chain is 30m.draw the longitudinal section and prepare the e

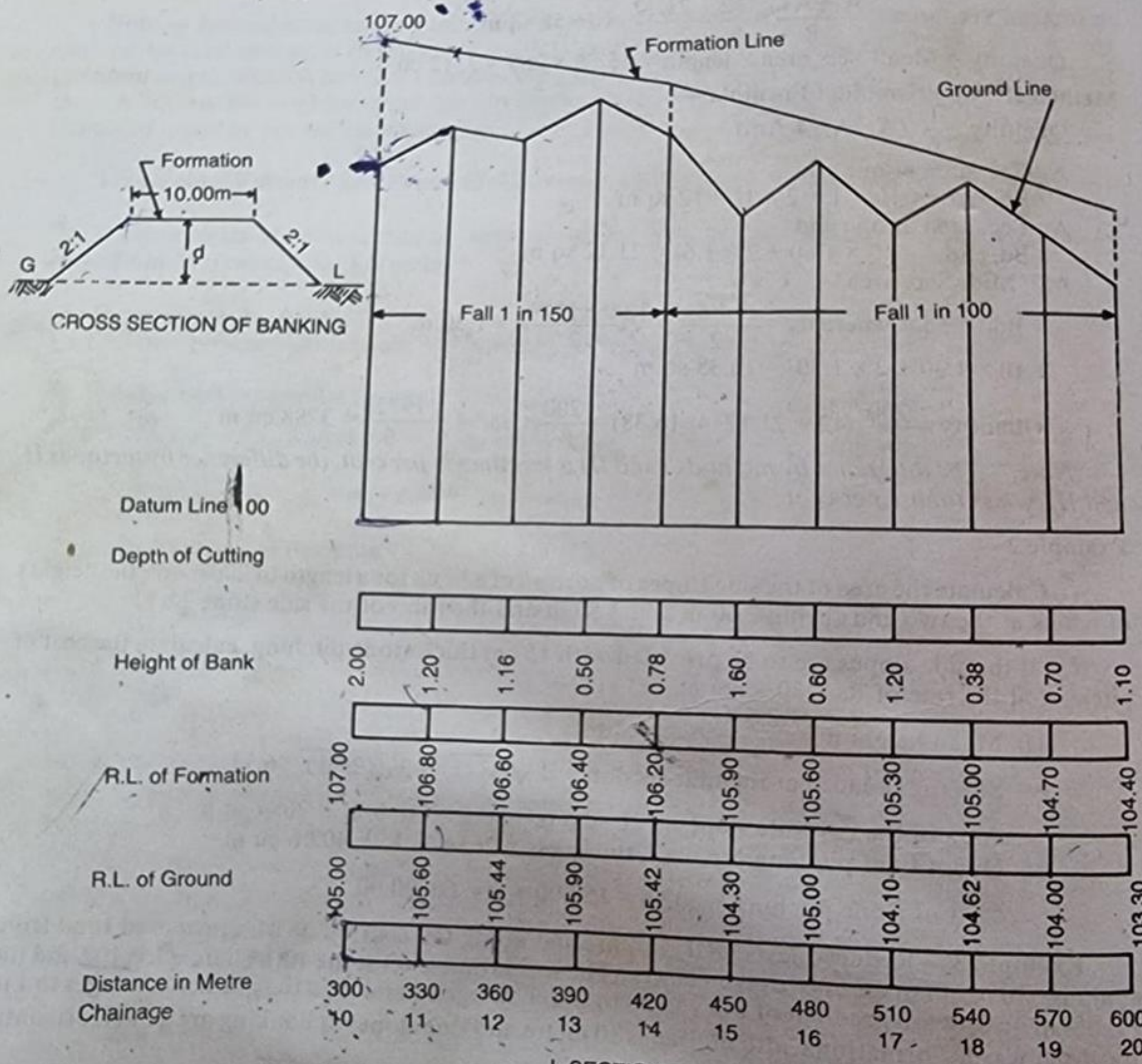
(*i*) Find also the area of the side slopes and the cost of turfing the side slopes at the rate of Rs. 60.00% sq. m.

Chainage	10	11	12	13	14	15	16	17	18	19	20
R.L. of ground	105.00	105.60	105.44	105.90	105.42	104.30	105.00	104.10	104.62	104.00	103.3

R.L. of Formation 107.00.

Gradient — Down gradient 1 in 150 ⟶ ⟵ Down gradient 1 in 100

L=Section and Typical cross-section of the road are as given in Fig. 7-8.



L-SECTION

B=10 m, s=2

Stations or Chain-age m	Length m	Height or Depth Diff. of G.L. and F.L. m	Mean height or depth d_m m	Central area Bd m^2	Side area sd^2 m^2	Total sec. area $Bd+sd^2$ m^2	Length in betw. stations L m^2	Quantity $(Bd+sd^2)+L$ Banking m^3	Cutting m^3
10	300	2.00	—	—	—	—	—	—	—
11	330	1.20	1.60	16.00	5.12	21.12	30	633.6	—
12	360	1.16	1.18	11.80	2.78	14.58	30	437.4	—
13	390	0.50	0.83	8.30	1.38	9.68	30	290.4	
14	420	0.78	0.64	6.40	0.82	7.22	30	216.6	
15	450	1.60	1.19	11.90	2.83	14.73	30	441.9	—
16	480	0.60	1.10	11.00	2.42	13.42	30	402.6	—
17	510	1.20	0.90	9.00	1.62	10.62	30	318.6	—
18	540	0.38	0.79	7.90	1.25	9.15	30	274.5	—
19	570	0.70	0.54	5.40	0.58	5.98	30	179.4	—
20	600	1.10	0.90	9.00	1.62	10.62	30	318.6	—

Total 3513.6 cu m

ABSTRACT OF ESTIMATED COST (Ex. 3)

Item No.	Particulars of items	Quantity	Unit	Rate Rs. P.	Per	Cost Rs. P.
1	Earthwork in banking ...	3513.6	cu m	275.00	% cu m	9662.40
					Total ...	9662.40
	Add 5% (3% for Contingencies and 2% for Workcharged Establishment) ...					483.12

CHAPTER-4

9-3 Estimate for sinking one 40mm dia. Tube-well. Fig. 9-1 shows the elevation of a tube-well 40 mm dia. fitted with an ordinary hand pump after removal of earth etc. Prepare an estimated cost with schedule of items to construct a tube-well for a total depth of 90 m. Assume any reasonable rate of your locality. Length of strainer is 3.6 m and surface drain is 2 m.

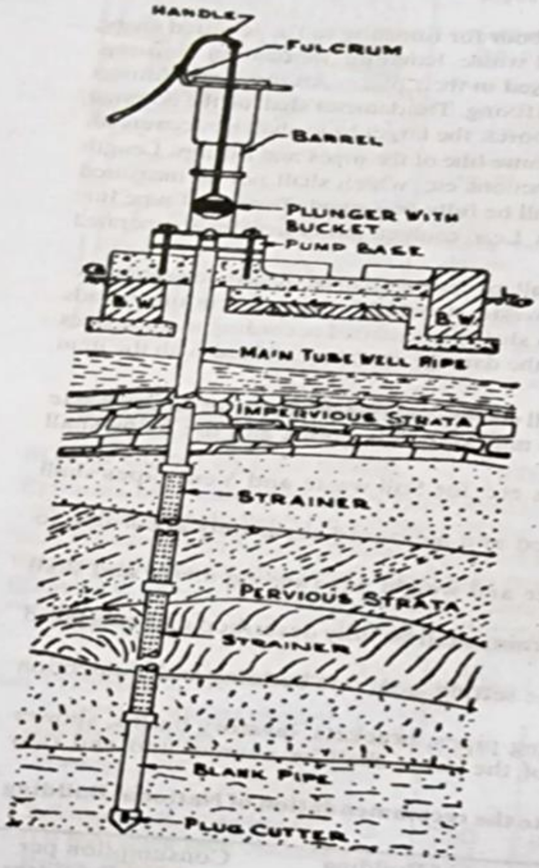


FIG. 9-1
For water level up to 7.3 m from G.L.

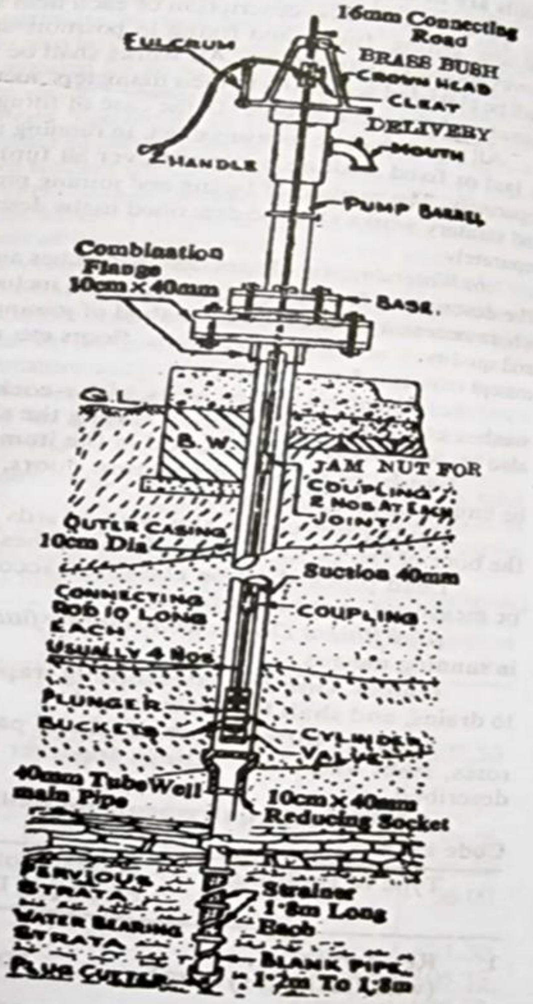


FIG. 9-2
For water level beyond 7.3 m from G.L.

Item no	Description of item	Quantity	Rate	Unit	Amount
1	a) Materials 40mm dia Galvanised iron (G.I) pipe ITC(medium)	86.4m	238.00	Rm	20563.2
2	40mm dia strainers	2 nos	432.00	Each	864.00
3	Hand pump no 6	1 no	570.00	Each	570
4	40mm dia C.I plug cutter	1 no	36.00	Each	36.00
5	40mm dia steel plug cutter	1 no	78.00	Each	78.00
6	Labour for boring tube well of 40mm dia by water jet system through any of soil strata including hir and changel for boring pipes,scaffolding.	90rm	200.00	Each	18000.00
7	Construction of 1.2m x 1.2m masonry platform of cement concrete(1:2:4) base.	1 no	1800.0	Each	1800
8	Brick masonry surface drain 15cm wide 10cm depth on 8cm cement (1:3) surface finished.	2m	250.00	Rm	450

Total Rs.42361.20

Add 5% for contingency = Rs 2118.06

2 ½ for W.C = Rs. 1059.03

Grand total=Rs.4553829

CHAPTER-5

Administrative approval

"Administrative approval" is the communication of formal acceptance of the proposals by the competent authority of the Administrative Ministry/Department requiring the work.

Accord of administrative approval

(a) The concurrence of the competent authority of the Administrative Ministry/Department requisitioning the work should be obtained to the Preliminary Estimate for the work. However, no such concurrence is required for normal repairs and maintenance works.

(b) The Preliminary Estimate should be framed or countersigned by the authority as specified , and sent in triplicate to the Administrative Ministry/Department

requisitioning the work. The requisitioning authority shall be requested to return one copy of the estimate, duly countersigned in token of acceptance, while communicating the administrative approval.

(c) One copy of the administrative approval shall be endorsed to the concerned Accounts Officer.

Powers for accord of administrative approval

(a) Various Ministries/Authorities who get their works executed through the CPWD, have been delegated specific powers to accord administrative approval to the works.

(b) The amount of administrative approval accorded, in all cases, shall include departmental charges, wherever it is leviable.

(c) In case of estimates for residential accommodation, it has to be seen by the authority concerned before the issue of administrative approval that the scale of accommodation provided for therein does not exceed the one approved by the Ministry of Finance.

(d) If the estimated cost of a work exceeds the powers of any officer, the administrative approval of the Government of India in the Administrative Ministry must be obtained.

(e) The Director General, Special Director General and Additional Directors General have been delegated powers as in Appendix-I to accord administrative approval for construction of houses for CPWD project staff in major projects, as well as for CPWD maintenance staff.

Technical sanction

A "technical sanction" amounts to a guarantee that the proposals are technically sound, and that the estimates are accurately prepared and are based on adequate data.

2.5.1 Accord of technical sanction

(a) After receipt of administrative approval and expenditure sanction, detailed estimates are required to be prepared for technical sanction. The technical sanction should be accorded by the competent authority before a work is taken in hand. In case of revised estimates, it is not necessary to wait for the revised administrative approval or the revised expenditure sanction to accord revised technical sanction.

(b) A copy of the technical sanction for the building work should also be endorsed to the concerned Senior Architect, Superintending Engineer (Elect)/Executive Engineer(elect) as well as the Director/Deputy Director of Horticulture for initiating action at the appropriate time on electrical, air conditioning, horticulture and other works. Similarly, copies of Technical Sanction of Estimate for Horticulture works shall also be forwarded to Senior Architect and CE(C)/SE(C)/EE(C) as the case may be. The municipal/Local Bodies and Electrical Supply Companies should also be approached by the Executive Engineer, Civil and Electrical, well in time for providing External Services including power supply.

(c) Before an estimate is technically sanctioned, the following shall be desirable:

(i) Detailed architectural drawings and specifications.

(ii) Preliminary structural drawings for foundations

(iii) Preliminary structural drawings of superstructure at least upto slab at level 2

(iv) Preliminary drawings for internal and external services.

MEASUREMENT BOOKS (MBS)

7.1 General

(1) Expenditure on the construction or maintenance of a work may be divided broadly into two classes, viz. (i) Cash (ii) Stock Charges. In addition to the main charges, there are other charges affecting the cost of work. For example, there may be charges incurred in other Divisions,

Departments or Government, materials received from them or services rendered by them, or there may be cash receipts such as are taken in reduction of expenditure in accordance with the rules. To account for all these charges affecting the cost of work, separate accounts are maintained in Sub-Division/Divisional Offices for recording

(i) the cost of individual works, and

(ii) the transactions of individual Contractors/Suppliers. These are known as works accounts. The accounts of manufacture operations and non-government works are maintained in the same manner as for Government works. (Para 10.1.1 of CPWA code may be referred to).

(2) Cash charges of works consist of payments to (i) labourers and members of the work-charged establishment of their wages, and (ii) contractors and others for work done or other services rendered. The cost of materials procured specially for work is charged to the accounts of works by transfer credit to the "Material Purchase Settlement Suspense Account". The payments to suppliers are governed by the same rules as payments to contractors for work done (Para 10.2.1 of CPWA code may be referred to).

(3) The payments to the work charged staff are made monthly in the same manner as it is made to the regular staff but on a different bill form CPWA 29, and are charged direct to the work on which the labour is actually employed.

(4) The payments to contractors and others for the work done or other services rendered are made on the basis of measurements recorded in the Measurement Book. Subsidiary instructions regarding maintenance of the measurement books including standard Measurement Books and review of measurement books are given in subsequent paras here under.

7.2 Writing of Measurement Book

(1) The measurement book is the basis of all accounts of quantities whether of works done by Contractors or by labourers employed departmentally, or materials received. It should be so written that the transactions are readily traceable.

(2) These books should be considered as very important accounts records and maintained very carefully and accurately as these may have to be produced as evidence in a court of law, if and when required.

7.3 Register of Measurement Books

(1) All the Measurement Books belonging to a Division, should be numbered serially. A register should be maintained in form CPWA 92 showing the serial number of each book, on receipt,

Sub-Division to which it is issued, the date of issue, date of its return to the Divisional Office and date of its record after the required review in the Divisional Office has been completed.

(2) A similar register should be maintained in the Sub-Divisional Office showing the names of persons, i.e. Assistant Engineer/ Junior Engineer, to whom the Measurement Books are issued.

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7.4 Transfer of Measurement Books

(1) The Measurement Books that are no longer required to be used in the Sub-Division or with the Junior Engineer should be with drawn promptly even though not completely written up and reissued.

(2) When an Assistant Engineer or Junior Engineer in charge of the work or stores is transferred he should hand over the Measurement Books issued to him to his successor and these should be shown as received back from him and re-issued to the relieving Officer. The transfer should also be recorded in the Measurement Book after the last entry in each book under dated signature of the relieving Officer and relieved Officer.

7.5 Recording of measurements

(1) Entries at commencement of measurements

Each set of measurements to be recorded should commence with entries stating:

(i) In the case of bills for works done:

(a) Full name of work as given in the agreement/estimate.

(b) Location of work.

(c) Name of contractor.

(d) Number and date of agreement.

(e) Date of written order to commence work.

(f) Date of actual completion of work.

(g) Date of recording measurements.

(h) Reference to previous measurements.

(ii) In the case of bills for supply of materials:

(a) Name of supplier.

(b) Number and date of supply order/agreement.

(c) Purpose of supply in one of the following forms as applicable to the case:

(i) Stock (for all supplies for stock purpose).

(ii) "Purchase" for direct issue to the work (full name of the work as given in the estimate shall be mentioned).

(iii) "Purchase" for (full name of work as given in estimate) for issue to contractor ...... on...... :

(d) Date of written order to commence the supply.

(e) Date of actual supply.

STANDARD MEASUREMENT BOOKS (SMB'S)

8.1 Purpose

The Standard Measurement Books are maintained to record the measurements of permanent standing in a building, and are required to be brought upto date from year to year on the basis of additions, etc. that are made to the building during a year. These are used for preparing the repairs estimates and contractors' bills for such repairs so as to avoid taking detailed measurements on each occasion.

8.2 Preparation and accounting of Standard Measurement Books

(1) The Standard Measurement Books shall be prepared after the completion of the work by the Construction Division that has executed the work. The preparation of these books will ordinarily be undertaken in accordance with the program for each Sub-Division or such other suitable unit as may be fixed by the Divisional Officer.

(2) All drawings, Standard Measurement Books etc. should be properly documented before handing over the building.

(3) All the Standard Measurement Books should be on Form CPWA 23-A, and should contain pages in singleton. They should be numbered in an alphabetical series so as to be readily distinguishable from those assigned to ordinary Measurement Books.

(4) These will be accounted for in the same manner as ordinary Measurement Books in a register in Form No CPWA 92 (Part II).

(5) A similar register will be maintained in each Sub-Division showing the books belonging to it, and reviewed as done in case of the ordinary Measurement Books.

8.3 Writing of Standard Measurement Books

(1) The Standard Measurement Books should be written legibly in ink, and certified as correct by the Executive Engineer. These should be maintained very carefully and accurately, as they may

have to be produced as evidence in a Court of Law.

(2) The Standard Measurement Books should either be written by the Assistant Engineer himself or a Junior Engineer under his orders. Each set of measurements taken by the Junior Engineer should, however, be fully checked by the Assistant Engineer, after which it should be examined by the Executive Engineer. He should declare in writing in the Book itself as finally approved by him for the purposes of preparing annual repair estimates and contractors' bills for the work done. Until this is done, the Book will not be assigned a number, and will not be entered in the Register of Standard Measurement Books.

(3) The Standard Measurement Books shall be brought upto date under the supervision of the Assistant Engineer with reference to the building or work concerned within one month of closing of the accounts of the estimate thereof. All such corrections shall be attested by the Assistant Engineer, and approved by the Executive Engineer.

Preparation of bill

(1) On completion of the abstract, the Measurement Book should be submitted to the Sub-Divisional Officer, who after carrying out his test check should enter the word "Check and bill" with his dated initials. The Sub-Divisional Clerk should then check the calculation of quantities in the abstract, and the bill in case of work carried out by contract, and should then place the Measurement Book and the bill before the Sub-Divisional Officer who, after comparing the two, should sign the bill and the Measurement Book at the end of the abstract.

(2) From the Measurement Book all quantities should be clearly traceable into the documents on which payments are made. When a bill is prepared for a work or supplies, every page containing the detailed measurements must be invariably scored out by a diagonal red ink line. When the payment is made, an endorsement must be made in red ink, on the abstract of measurements, giving a reference to the number and date of the voucher of payment.

Forms of Bill for payment and vouchers

The authorised forms of bills to be used for payment of contractors/ suppliers and their utility are described below:

(a) **First and Final Bill Form**

It should be used for making payments both to contractors for work and to suppliers, when a single payment is made for a job or contract on its completion. A single form may be used for making payments to several payees, if they relate to the same work/section of work, or to the same head of account in the case of suppliers and re-billed for at the same time.

(b) **Running Account Bill Form**

This form should be used for all running and final payments to contractors and suppliers (other than those relating to lump sum contracts for which Forms CPWA 27A and 27B are prescribed), including cases where advance payments are proposed to be made or are already outstanding in respect of the same work against the contractor. In case where secured advances are to be made or already outstanding in respect of the same work against the contractor, Account of Secured Advances Form CPWA 26A should be attached to the bill.

(c) **Hand Receipt Form**

(i) This is a simple form of voucher intended to be used for all miscellaneous payments and advances for which none of the special forms mentioned above is suitable.

(ii) This form is not to be used for refund of lapsed deposits for which Form TR 62 is to be used.

Cash Book

The Cash Book is to be maintained in Form CPWA I. On the receipt side, an additional column is to be opened with a heading "Local Bank". On the payment side, the column "Bank or Treasury" will be utilized as "Local Bank

References: Book. **Estimating and costing in civil engg.(B.N Dutta)**
Estimating,costing,specification & valuation in civil engineering(M.chakraborty)