Elevations for earthwork are usually computed to the nearest one-tenth (0.1) foot. Where grades or control elevations are not shown on the drawings, sufficient information for rough grading may be established by scaled measurements taken from the drawings.

It is standard practice to set grades for the various elements of structures to the nearest one-hundredth (0.01) of a foot.

All construction stakes should be set and marked to show finish elevation. Additional information may be added to stakes and notes for subgrades or other specific construction datums as needed.

Engineering Notes -- Construction Stakeout

Figure 3-9 illustrates a format for stakeout notes for dams or other embankments. The elevations and structure dimensions illustrated are from plan data in Figures 3-1 through 3-4 and field notebook Figure 3-6.

The example shows the original cross section and embankment staking. The foundation was stripped and a second cross section was taken concurrently with setting the cutoff trench cut stakes. This is an optional procedure and in some cases one cross section will be sufficient. The (T) denotes the edge (toe) of fill or cut.

The computer program, STAKE, may be used to develop tables of horizontal distances from the toe of dam to the centerline for all expected fills. This can improve efficiency and accuracy of survey crews.

Figure 3-10 illustrates a format that may be used for recording the layout notes for the construction of principal spillways for flood control dams, and can also be readily adapted for use in laying out other types of closed conduits or culverts.

Figure 3-11 illustrates format that may be used for recording notes for the cross sections and the layout of the emergency spillway or other earth work. The work may consist of excavation, or sections which combine excavation and embankment.

The layout (including curve data) and the elevations for this example were taken from Figure 3-8. Simple curves are frequently required in the layout of embankments, excavations or elements of structures.

Stationing for the project should be continued along the centerline of the curve at the time of stakeout, and these stations should be used as control points for cross sections and the staking of the structure limits. Transverse measurements are made normal to the tangent to the curve at the point under consideration. This measurement line parallels an imaginary line that passes through the centerline station and the reference or radius point for the curve.

Plotting and Computations

Figure 3-12 shows the plotted cross section of dam centerline station 15 + 10. Fill height and distance from the centerline are the parameters used for plotting. Calculations should normally be made directly from field notes. It may be necessary in cases of complex geometry to plot cross sections to visualize the element. However, copying numbers and plotting cross sections should be kept to the minimum. There are computer programs available for computing quantities, some directly from rod readings. They may be used were appropriate. Figure 3-13 shows a convenient way of tabulating field notes for calulations where it is not convenient to compute directly from the fieldbook.

Setting and Marking Stakes

Figure 3-14 shows an example for staking embankments. This is the same cross section as recorded on Figure 3-9. Figure 3-15 shows an example for staking an open channel spillway. This is the same cross section as recorded for emergency spillway station 9 + 12 on Figure 3-11. The berm was added to the sketch to show the procedure (not in notes.) Stake location and markings must convey the necessary information. The examples show proven methods but may be varied to accomplish this objective.

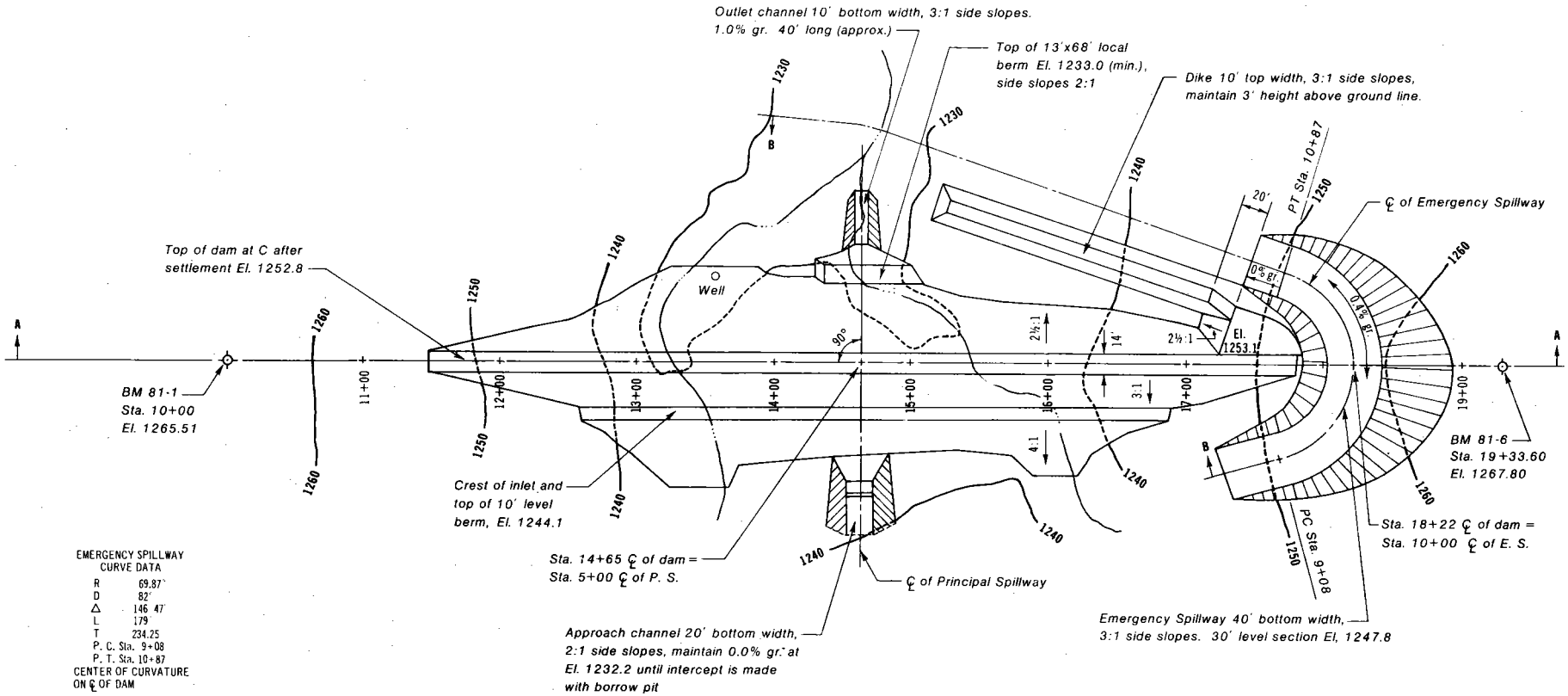
Figure 3-16 shows stake marking for various purposes applicable to construction.

Figures 3-17, 3-18 and 3-19 show methods of staking various other structures.

Engineering Notes - Checking Completed Work

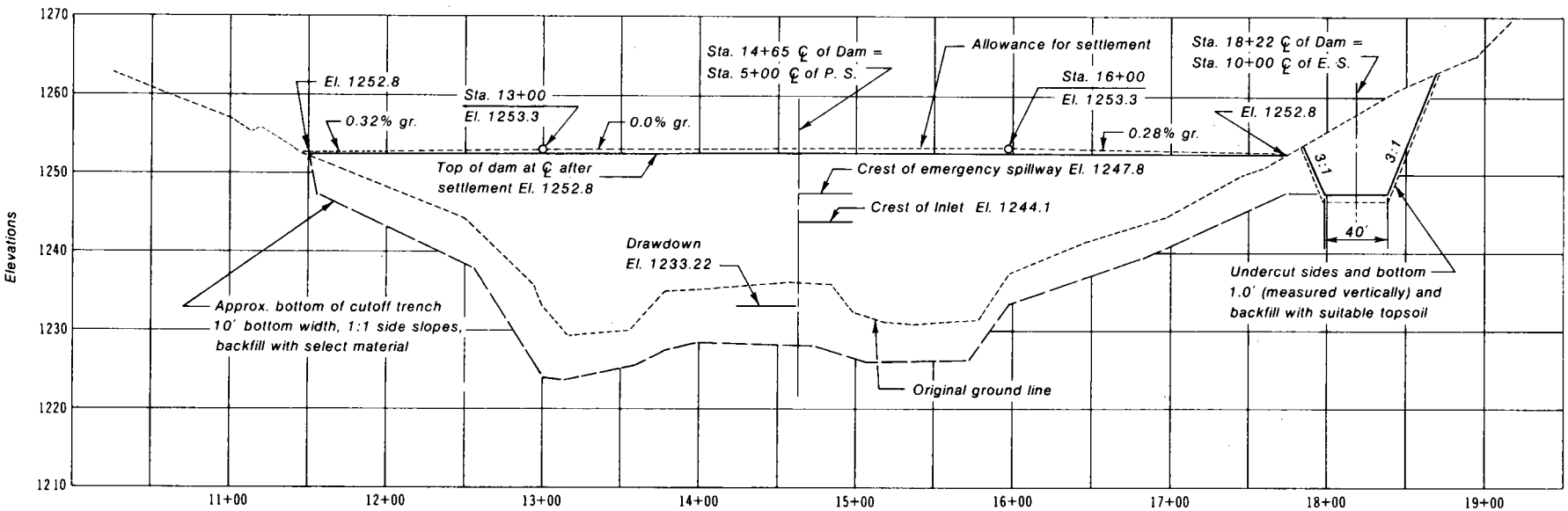
Figure 3-20 shows an example of recording a check of completed construction and although an embankment is shown, the principles are applicable for all construction work.

Some technicians develop a checkout schedule similar to the stakeout schedule based on constructed fill height to the dam centerline. Use of such schedules may be appropriate for large complex dams. The notes shown, along with good visual judgement should be sufficient for the ordinary dam. A plot of the planned embankment section overlain with the constructed cross section can also be made to visually compare the two.



TOPOGRAPHIC MAP OF DAM SITE AND SPILLWAY AREA

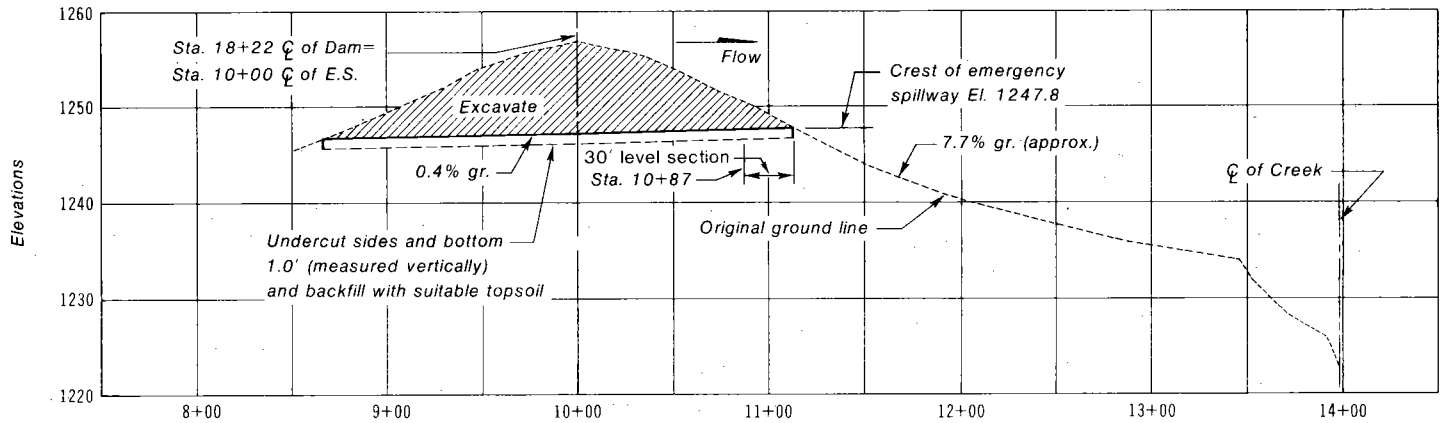
Figure 3-1



SECTION A-A

PROFILE ALONG ℄ OF DAM

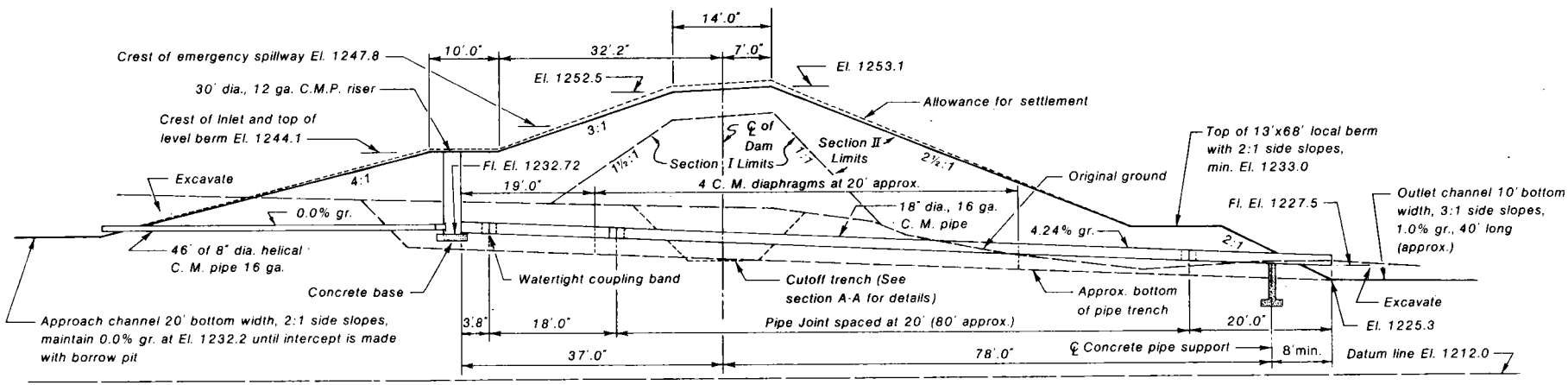
Figure 3-2



SECTION B-B

PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

Figure 3-3



CROSS SECTION OF DAM ALONG ℄ OF PRINCIPAL SPILLWAY

(Sta. 14+65)

Figure 3-4

Figure 3-5 Sheet 1 of 2

McVicker
Beason

7/1/70

BM Level Circuit

Sta.	B.S.	H.I.	F.S. or Grade Rod	Elev. or Planned Elev.	
BM 81-1	1.75	1267.26		1265.51	Top of ½" rebar set in concrete @ Sta. 10+00 ℄ of dam guarded by R&W steel post.
TP	0.22	1255.33	12.15	1255.11	
TP	1.15	1243.70	12.78	1242.55	
TP	9.17	1240.51	12.36	1231.34	Top of south steel handle on well cap.
TP	11.61	1250.75	1.37	1239.14	
TP	12.60	1262.69	0.66	1250.09	
TP	8.51	1269.54	1.66	1261.03	
BM 81-6	1.29	1269.09	1.74	1267.80	Top of ½" rebar @ R&W steel post on ℄ of dam Sta. 19+33.60.
TP	0.35	1257.34	12.10	1256.99	
TP	1.54	1246.88	12.00	1245.34	
TP	9.77	1247.73	8.92	1237.96	Top of steel post.
TP	11.11	1258.26	0.58	1247.15	

BM Level Circuit

7/1/70

Sta.	B.S.	H.I.	F.S. or Grade Rod	Elev. or Planned Elev.	
		1258.26			
BM 81-2	10.14	1266.77	1.63	1256.63	
BM 81-1			1.25	1265.52	0.01 error

Top gate post downstream from north end of dam.

Checked: [illegible]
7/24/70

Note: If the error exceeds 0.01 but is within allowable error for the precision of the survey, the elevations should be adjusted.

Figure 3-5 Sheet 2 of 2

Figure 3-6 Sheet 1 of 2

EMBANKMENT

Stake Out Schedule

Sta.	B.S.	H.I.	F.S. or Grade Rod	Elev. or Planned Elev.	Settlement	Constructed Elev.	Constructed Core Trench Elev.	
	BERM							
	Elev.	Settle-ment	Const. Elev.					
11+51				1252.8	0.0	1252.8		End of dam
11+56					0.0	1252.8	1247.3	
12+56					0.3	1253.1	1240.0	Begin berm
13+00	1244.1	0.3	1244.4		0.5	1253.3	1224.0	
13+15		0.3	1244.4		0.5	1253.3	1224.0	
13+60		0.3	1244.4		0.5	1253.3	1226.0	Ground Core break
13+80		0.2	1244.3		0.5	1253.3	1227.5	Ground break
14+00		0.2	1244.3		0.5	1253.3	1229.0	
14+75		0.2	1244.3		0.5	1253.3	1228.6	
15+10		0.2	1244.3		0.5	1253.3	1226.5	
15+75	1244.1	0.2	1244.3	1252.8	0.5	1253.3	1226.5	

EMBANKMENT

Stake Out Schedule

Sta.	B.S.	H.I.	F.S. or Grade Rod	Elev. or Planned Elev.	Settlement	Constructed Elev.	Constructed Core Trench Elev.
	BERM						
	Elev.	Settlement	Const. Elev.				
16+00	1244.1	0.2	1244.3	1252.8	0.5	1253.3	1233.5
16+90				1252.8	0.2	1253.0	1240.0 End berm
17+78				1252.8	0.0	1252.8	1247.8

Figure 3-6 Sheet 2 of 2

Figure 3-7 Sheet 1 of 1

PRINCIPAL SPILLWAY

Stake Out Schedule

Sta.	B.S.	H.I.	F.S. or Grade Rod	Elev. or Planned Elev. Trench Bottom	LT. DIST. INCL. 50 SLOPE 1:1 Pipe Invert Grades	RT. DIST. INCL. 50 16 SLOPE 1:1 Backfill Grades
4+50				1237.0		
4+56				1231.0		(backfill) 1232.72 Riser Base
4+64				1230.2	1232.72	1232.97 Inlet
4+86				1229.2	1231.75	1232.0
5+00					Dam ℄ Sta. 14+65 @ 90°	
5+06				1228.5	1230.90	1231.15
5+26				1227.8	1230.05	1230.30
5+46				1227.0	1229.20	1229.45
5+66				1226.2	1228.35	1228.60
5+86				1225.3	1227.50	

EMERGENCY SPILLWAY

Stake Out Schedule

Sta.	B.S. Defl.	H.I. Central	F.S. or Grade Rod	Elev. or Planned Elev. Design	Subgrade	LT. DIST. INCL. 20	RT. DIST. INCL. 20
						SLOPE 3:1	SLOPE 3:1
						Curve Data	
8+61				1246.8	1245.8	RP. 17+52.1	
						R = 69.87'	
						D = 82°	
9+08PC	0°00'	0°00'		1247.0	1246.0	Δ = 146°47'	
						L = 179'	
						T = 234.25	
9+12	1°38'	3°17'		1247.1	1246.1	PC Sta. 9+08	
						PT Sta. 10+87	
9+37	11°53'	23°47'		1247.2	1246.2	Sta. 10+00 ES = 18+22 ℄ of Dam	
9+62	22°08'	44°17'		1247.3	1246.3		
9+87	32°23'	64°47'		1247.4	1246.4		
10+00		75°26'				Dam ℄	
10+12	42°38'	85°17'		1247.5	1246.5		

Figure 3-8 Sheet 1 of 2