

APPENDIX 1 A

Data to be collected for design of
C.D. Works on canals.

GOVERNMENT OF BOMBAY
PUBLIC WORKS DEPARTMENT

Circular No. MIP.2259/27908-J
Sachivalaya, Bombay No.1, 19th October 1959.
Chief Engineer, Public Works Department (Irrigation
Project's) Technical Circular.

1.0) The following data should be furnished for the design of a C.D.Work on a canal where the cost of such a structure is likely to exceed Rs. 2.0 lakhs.

2.0) A Plans :-

1. Index map.
2. Contour Plan.
3. Site Plan.
4. Cross Section.
5. Longitudinal section of stream.
6. Trial pit or bore results.
7. Catchment area plan.
8. General Report.

1. Report giving details of :-
 - a) Nature of catchment.
 - b) Existing structures on the stream.
 - c) Flood data
 - d) Recuperation tests.
 - e) Availability of construction materials.
 - f) Hydraulic data.
 - g) General notes about suitable sites investigated.
 - h) Miscellaneous information.

2) Proforma " A " duly filled in.

2.1) Index map :- An index map should be submitted to a suitable scale (Generally topo sheet , topo sheet scale 1" = 1 mile showing the proposed location of the crossing, the alternative sites investigated, the existing line of the communication viz . roads , railways, the general topography of the country , and the important towns etc., in vicinity.

2.2) A contour plan of the site of work.

2.2.1. This should be with 5 feet contour showing topographical or other features that might influence the location and design of the crossing and approaches. The extent of the contouring should be as indicated in paragraph .

2.2.2. below. All sites for the crossing which are worth considering shall be shown on the plan. The scales of the plan and the extent of contouring along each side of the stream should be as shown in the table below :-

Catchment Area	Scale not less than	Extent	
		U/s and D/s	sides
1. Sq. mile.	1" = 100'	300'	10' above H.F.L.
1. to 5 Sq. miles.	1" = 100'	1000'	or 5' above C.B.L. whichever is higher.
More than 5 sq. miles.	1" = 300'	1 mile or 8 times the nalla width whichever is more.	

2.2.3. This plan shall clearly show edges of high bank, H.F.L. line, low water line, rock outcrops, nature of river bed formation e.g. murum, and silt, etc, the direction of the river flow, north line, and the canal alignment for 1/2 a mile on either side of crossing for C.A. 5 square miles or less and for 1 mile for larger catchments. Proposals, if any for training the streams channel should be indicated.

2.3) A site plan :- The site plan for the site selected should be submitted after the site fixed. This should be drawn to a suitable scale (generally 1" = 200') showing precise location and details of the site selected and should extend both upstream and downstream of the centre line of the proposed crossing, for a distance on each side equal to at least the length of the structure or one furlong whichever is greater. All information essential for a complete and proper appreciation of the work should be included on the plan. Normally, the following information shall be shown.

(a) The name of the stream, and the channel, its reduced distance, and the identification number allotted to the C.D. Works.

(b) Approximate outline of the banks, and river channel (at high water and low water) with contours of the river channel at intervals not greater than 5 feet extending beyond

the banks. The line of deepest points along the dry weather channel shall be clearly marked.

(c) The direction of flow of water should be shown.

(d) The alignment of canal for at some distance beyond the limits of C.D. Works shall be given.

(e) Angle and direction of crossing (if a skew crossing is proposed)

(f) Proposals, if any, for training the stream channel should be indicated.

(g) The position of benchmarks used in the surveys shall be clearly marked and its level and description given.

(h) The alignment and identification numbers of the cross sections and longitudinal sections, within the limits of site plan and exact location of their extrem points should be given.

(i) Location of trial pits or bore with identification numbers.

(j) Location of all buildings, wells, outcrop or rocks and other possible obstructions to the canal alignment.

(k) The north direction.

2.4) Cross - Sections :-

2.4.1) Location :- Cross -Section should be taken at the site of the crossing and at suitable intervals upstream and downstream as given below extending upto limits indicated. In paragraph 2.2.2 above.

i) At every 100 feet up to 300 feet upstream and downstream for catchment area less than 1 sq. mile.

ii) At every 200 feet up to 1000 feet upstream and downstream for catchment area of 1 to 5 sq. miles.

iii) At 220 feet intervals up to 2 furlongs upstream and downstream at intervals of one furlong thereafter up to one mile or a distance of 8 times of the width of the nalla whichever is less for catchment areas more than 5 square miles.

2.4.2) Scales :- In those cross - sections, the vertical scale may be exaggerated if necessary (scale not less than 1" = 100' horizontally and exaggerated vertical scale not less than 1" = 10').

2.4.3) Other data :- The cross sections should clearly show the following information:-

a) The name of stream and the serial number of the crossing.

b) The name of channel with R.D. at centre of crossing.

c) The bed line up to the top of bank and the ground line to a sufficient distance minimum up to 5' to 10' above H.F.L. with levels at intervals sufficiently close to give a clear outline of markedly even features of the bed and ground. The section should indicate right and left banks and names of villages on each side.

d) The nature of the surface of the soil in the bed, banks and approaches (in case of cross section at site of works) with trial pits or bore hole sections showing the levels and nature of various strata. Soil below the foundations at the crossing should be classified

properly as per chart attached (vide statement B) and its characteristics especially in regard to permeability should be described.

- e) Low water level at all the cross sections.
- f) Ordinary flood level likely to occur every year.
- g) Highest recorded flood level with the year of observation (The source of information should be clearly mentioned.)
- h) The highest recorded depth of scour, at any of the existing bridges, etc., in the vicinity.

It is desirable to observe the fair weather water level on the same day, preferably simultaneously, for all cross section.

2.5 Longitudinal section of the stream :- The longitudinal section along the approximate centre line of the deep water channel extending up to the limits referred to in paragraph 2.2.2. above should show the highest flood level, surface (if observed) the ordinary yearly flood level, the low water and the bed level at suitable intervals.

Trial pits may be taken at intervals of 50' to 100' along this cross section or closer if necessary to include representative samples of strata in foundation. Trial pits should go up to hard rock or below the scour level if possible. Sometimes open pits up to this depth may not be possible on account of highly permeable strata met with causing heavy percolation. In that case bore will have to be resorted to. No bores should, however, be taken till the alignment and location of C.D. work etc. has been examined and tentatively approved by the concerned Superintending Engineer (Irrigation Projects). Position of ground water in the pits should be shown.

Bore should be taken at least 5 feet into hard rock.

2.6 Catchment area plan :- A plan of the catchment area to a scale of " 1" = 1' mile with a detailed note giving particulars about size and shape of the area, the intensity and frequency of rainfall, the nature of the terrain (whether forest, under cultivation or urban etc.) the nature of the soil (whether porous or rocky). And details of any artificial storage in the catchment area.

2.7 General Instructions for preparing data plans :-

Reference to field book numbers, pages and the name of officer who has conducted the survey shall invariably be given in all the above plan.

2.7.2 For cross-section and longitudinal sections it is usual to take levels at certain regular intervals. While doing so, it should be seen that levels of abrupt changes in profile, are not missed irrespective of the interval adopted.

2.7.3 The soil strata met with in pits or bores or at surface should be described as per chart at statement "B" where difficulties in foundation are expected on account of soft strata. In other cases information as given as in column 1-6 and 10-12 of the statement is adequate.

3.0 General Reports :- The General Report should contain a brief description of the nature of catchment, existing crossings on the stream, hydraulic data of canal and the stream report of recuperation tests, availability of construction materials and a review of the various alternative sites and alignments considered with comparative merits of the various alternatives. The extent of canal excavation done on both sides also should be specifically mentioned. Other points requiring special mention should also be included in the report.

3.1 Nature of catchment should be briefly described particularly giving the size, shape topography extent of afforestation cultivation or urban areas, nature of soil, details of natural or artificial storages etc.

3.2) Details of existing bridges, aqueducts etc. on the stream - Details of existing rail or road bridges on the stream in the vicinity with the sketch showing the bed level, highest recorded flood level, ventways provided and the depth of scour etc. should be furnished.

3.3) Maximum flood data :- Observed maximum flood gauges and or discharges at other crossings or hydraulic structures like weirs, bridges etc. on the stream in the vicinity should be furnished. The H.F.L. at the site as well as the surface slope at H.F.L. (Observed for high or moderate floods) should be clearly indicated on the plan after careful and through observations and enquiries. In each case full details regarding source of information and definite opinion of the field officer as to its reliability should be recorded. Name of officer who collects this information shall be invariably given. In the absence of surface slope observations during high flood, low water levels for distances as mentioned in paragraph 3.2 above, should be observed after taking levels immediately upstream and downstream of all falls and /or rapids if any, in the reach.

3.4) Recuperation test :- Whether the foundation depth is deeper than 10 feet below the water table and where the strata are pervious, it can be expected that dewatering will be an important operation during construction, costing more than Rs. 50,000. In such cases only a recuperation test should be carried out in a pit 6' x 6' or any suitable size. Water level may be depressed to a safe working level or to foundation level. Rate pumping involved at the lowest water level shall be recorded. The time required for the water to rise 3 feet from bottom of pit after stoppage pumping should be observed three times. The recuperation rate should be determined from the mean of the three observations. The recuperation test report should specify the depression head size of pit including struts met with and the recuperation rate in Cft. per minute.

3.5) Construction materials :- A statement showing the availability of various construction materials such as bricks, sand, rubble, aggregate, gravel (nature or crushed) cement, lime etc. leads involved in miles and rates at source and source and at site shall be made whether khandkis can be dressed from available rubble in the vicinity.

3.6) Hydraulic data :- Hydraulic data as detailed in the proforma 'A' attached should be furnished.

3.7) Information about the excavation of Canal :-
Information as to the extent of the work of canal excavation if already done, on both sides of the structure should be supplied. The Unexcavated length should be clearly shown on the plan, and stated in the general report.

Sd/-
For Chief Engineer, Public Works
Department (Irrigation Projects).

Accompaniment to Government Circular, Public Works Department,
No. MID.2259/27903-J, dated 19th October 1959.

PROFORMA - A
DATA

Form No. CS-I
CDO

(For Designs of C.D. Works across canal)

Project
Design of
at R.D.
of channel
ex.

(A) CANAL DATA

- (i) Hydraulic details.
F.S. Discharge.
Full supply level.
Bed level/ Bed Width
Velocity.
Canal bed slope
Bank level.
Side slopes.
Allowable head loss.
Whether canal is lined and if so the lining material
- (ii) Section of the canal.
- (iii) Extent of Excavation already done.
 - (a) R.D. on upstream up to which the work is done/is in progress.
 - (b) R.D. on downstream beyond which the work is done/is in progress.

(B) STREAM DATA.

- 1) Catchment area. *Acres
Sq.miles.
- 2) H.F.L. R.L.
 - (i) Source of information whether flood marks, or records (if so, give particulars) or local enquiry.
 - (ii) By whom collected and when.
Name :
Date :
 - (iii) Opinion of the field officer as to reliability of flood marks.

- 3) Maximum observed flood discharge -
If gauged, give particulars.
- 4) Waterway at nearby bridges -
Foot bridge
or Road Bridge
or Rail Bridge
No. of spans of feet | for each
Bed level. | existing
H.F.L. if observed or as per enquiry. | bridge

5) Topography :-
(Describe briefly the general topographical features)

6) Results of recuperation test (refer paragraph 3.4)
(Required to be submitted when cost of dewatering is
expected to be more than Rs. 50,000)

Size of pit.

Depression head (H)
(i.e. normal water (h) level - Depressed water level before the test.)

Rise of water during observation period Keep (h) constant.

Observation period (t)

Mean of at least 3 readings.

Recuperation rate (y) Cft. per minute.

7) Construction materials :-

Lead (Miles)	Rate at quarry factory etc.	Rate at site.	Remarks
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Bricks
Rubble.
Broken metal 1½" gauge.
Broken metal ¾" gauge.
River gravel.
Sand
Cement.
Steel
Lime.