

#### 4. UNDER TUNNELS (TYPE II AQUEDUCTS) / PIPE UTs

| S.No.                            | ITEM / COMPONENT  | REFERENCE          |        |                                  |        |                          |        |   |
|----------------------------------|---|--------------------|--------|----------------------------------|--------|--------------------------|--------|---|
| I                                | <p><b><u>GENERAL:</u></b></p> <p>1.The proposals , be scrutinised and verified by the Unit Officers before communicating to CDO for vetting.</p> <p>2.Catchment Area (C.A.) of drains/rivers and the assessed MFD/OMFL be scrutinised,verified and confirmed by the Unit Officers.</p>  |                    |        |                                  |        |                          |        |   |
| II                               | <p><b><u>SITE SURVEY:</u></b></p> <p>1 Site Survey to be furnished as per check slip for CM &amp; CD works with the following details.</p> <p>a I ) Report accompanying the Site survey<br/>ii ) HPs of canal &amp; drain / river.</p> <p>b Site plan with flow direction of canal &amp; drain with net levels at 10m intervals &amp; contours</p> <p>c LS of drain / river :</p> <p>i) Covering 500 metres on U/S &amp; D/S.</p> <p>ii) The LS with levels @ 10m to 20m interval with Cross sections of drain on U/S, D/S @ centre line, 10 m, 25m, 50m,100m, &amp; @ 100m interval beyond for a length of 500m.</p> <p>iii) The Cross section levels shall be @ 3m to 5m interval in the gorge portion and 10m intervals in the flanks extended upto MFL touching the ground.</p> <p>d The catchment area shall be marked on the Topo Sheet for all the CAs more than 2.5 Sq. Km.If the C.A. is less than 2.5 Sq.km.,the C.A. is to be traversed on ground and to be furnished.</p> <p>e <b><u>M.F.D.CALCULATIONS:</u></b></p> <p>The MFD may be computed as per the following formula.</p> <p>1.IN UPLAND AREAS:</p> <p>Dicken's Formula, <math>Q = CM^{3/4}</math><br/>where Q = Discharge in Cusecs.<br/>M = Catchment area in sq.miles<br/>C = Coefficient depending on Catchment area.</p> <table><tr><td>CA upto 1 Sq.mile.</td><td>C=1400</td></tr><tr><td>CA from 1 Sq.mile to 30 Sq.miles</td><td>C=1200</td></tr><tr><td>CA more than 30 Sq.miles</td><td>C=1060</td></tr></table> <p>(2) IN DELTAIC AREAS :</p> <p>Ryve's Formula <math>Q = CM^{2/3}</math><br/>C = 1000 for Q more than 500 cusecs<br/>C = 750 for Q less than 500 cusecs</p> <p>iii) For deltaic catchment areas of Krishna &amp; Godavari, the formula shall be Ryve's formula adopting 'c' value as per Mitra Committee Report for Upland &amp; Deltaic Catchments.</p> <p>f Observed MFD may be computed from the observed MFL and shown on the LS &amp; CSs.</p> | CA upto 1 Sq.mile. | C=1400 | CA from 1 Sq.mile to 30 Sq.miles | C=1200 | CA more than 30 Sq.miles | C=1060 | <p>Check Slip enclosed.</p> <p>IS ; 7784 (Part I) : 1993</p> <p>CE/CDO<br/>Lr No:CDO/EEC1/1084/83-3<br/>Dt.28/3/83.</p> <p>Mitra Committee Report</p> |
| CA upto 1 Sq.mile.               | C=1400  |                    |        |                                  |        |                          |        |   |
| CA from 1 Sq.mile to 30 Sq.miles | C=1200  |                    |        |                                  |        |                          |        |   |
| CA more than 30 Sq.miles         | C=1060  |                    |        |                                  |        |                          |        |   |

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| g          | Bore hole data / TPs upto Hard strata or for min. depth of 2m for shallow foundations & upto 1/3rd embedment depth below maximum scour depth, along the Centre Line @ suitable intervals depending upon the importance of the structure with minimum 5 Nos. of TPs covering both the Drain & Canal @ centre, U/S & D/S sides. Also the Safe Bearing Capacity of foundation strata be furnished. | Table I & II of APERL for test results of foundation soils enclosed.,<br>IRC 78:2000. |
| <b>III</b> | <b><u>DESIGN :</u></b>  |   |
| <b>a</b>   | Note on Principles of Design, the assumptions made & the general features of the structure.   |   |
| <b>b</b>   | <b>HYDRAULIC DESIGN :</b>   |   |
|            | 1. MFL computations adopting Step by Step method.   | Design of Small Dams by USBR.   |
|            | 2. (a) Design of ventway for the Drain / river in UT / Pipe UT limiting allowable velocity. Pipe conduit with minimum of 900mm dia and barrel of 1.2m minimum height may be provided.   | IS:7784 (Part 2 / section1):1995,<br>IS : 7784 (part I) - 1993                        |
|            | (b) For small discharge of Drain, Pipes can be proposed limiting the velocity.  | IS 458 -1988, IS :783 - 1985  |
|            | 3. Design of Tail channel & Approach channel keeping in view the Lacey's Formula for Wetted perimeter & velocity limits depending on stratification.  | IS : 7784 (part - I) - 1993   |
|            | 4. Lift Wall on D/S side of the structure may be avoided.   |   |
|            | 5. Transition lengths on U/S & D/S of drain.  | IS ; 7784 (part 2/sec1) : 1995  |
|            | 6. TEL calculations for the Drain considering eddy loss coefficients as per IS code along with flow diagram with dimensions and levels.   | IS : 7784 (part - I) - 1993   |
|            | 7. Scour depth calculations of drain.<br>$R=1.34 (q^2 / f)^{1/3}$ with relevant factor of safety.   | IS : 7784 (part - I) - 1993   |
|            | 8. Uplift calculations for the floor of the barrel and U/S & D/S side aprons  | IS : 7784 (part - 2 / sec 2) - 2000   |
|            | 9. Exit gradient calculations<br>$G_E = (H/d) \times [1/(\pi \sqrt{\lambda})]$ ; Where $\lambda = [1 + \sqrt{(1+\alpha^2)}]/2$ ; $\alpha = b/d$ ;   | IS : 7784 (part - I) - 1993,<br>CBI Publication 12                                    |
|            | 10. Proposal Sketch.  |   |
| <b>c</b>   | <b>STRUCTURAL DESIGN :</b>  |   |
|            | <b>i) SUPER STRUCTURE</b>   |   |
|            | a. Design of Slab under canal trough & under earth bank / RCC Box for critical load combinations.   | IS : 3370 - 1965 part I & part II,<br>IS : 7784 (Part 2 / sec I) : 1995               |
|            | b. Design of Head wall on U/S & D/S by adopting TVA procedure/ Coulomb's Theory / Rankine's Theory with a top width of 500mm.   | TVA Hand Book   |
|            | <b>ii) SUB STRUCTURE</b>  |   |
|            | I a) CONVENTIONAL TYPE :-   |   |
|            | 1. Design of Pier under canal trough & earth bank   | TVA Hand Book,<br>IS - 7784 (part 2 / sec- I): 1995.                                  |
|            | 2. Design of Abutment under canal trough and earth bank.  | TVA Hand Book,<br>IS - 7784 (part 2 / sec- I): 1995.                                  |
|            | 3. Abutment and Pier foundations shall be Isolated Footing / RCC raft as the case may be.   | IRC - 78- 2000 ; SP - 16 ;<br>SP 34   |
|            | 4. Design of Holding down bolts where ever applicable.  |   |
|            | I b) RCC BOX :-   |   |
|            | RCC box under canal trough, earth bank and Head wall.   | IS : 7784 (Part 2 / sec I) : 1995   |

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|           | <p>I c) PIPE UTs :-</p> <p>Pipe details</p> <p>II Design of Wing walls &amp; Return walls both on U/S &amp; D/S of drain - The walls adopting TVA procedure / Coulomb's Theory / Rankine's Theory with a top width of 500mm.</p> <p>III Tabulation of stress table :- A consolidated stress table has to be furnished indicating the stress on concrete &amp; stress on soil for the Head wall, Abutment, Piers, Wings &amp; Returns.</p> <p>IV Unless otherwise mentioned, the minimum grade of PCC shall be M10 Grade and the minimum grade of RCC shall be M20 grade.</p> | <p>IS 458 : 1988 , IS 783 - 1985</p> <p>TVA Hand book</p> <p>IS - 456 : 2000</p>   |
| <b>d</b>  | <p><b>MISCELLANEOUS ITEMS :-</b></p> <p>a) Water stops</p> <p>b) Weep holes in the Retaining walls</p> <p>c) Bearings</p> <p>d) Expansion , Contraction &amp; Construction Joints</p> <p>e) Bell Mouth on U/S side</p> <p>f) Cut &amp; Ease waters</p>   | <p>IS : 7784 (part I) :1993</p> <p>IS : 7784 (part I) :1993</p> <p>IS : 7784 (part I) :1993</p> <p>IS : 3370 (part I) - 1965,<br/>IS : 7784 (part 2/Section 3) :1996</p> |
| <b>IV</b> | <p><b><u>DRAWINGS</u></b></p> <p>a) General Layout on net level plan duly showing contours.</p> <p>b) General Plan, Sectional Elevation &amp; End View - Plan indicating Half plan @Top &amp; Half plan @ bottom &amp; Sectional elevation along the LS of the drain &amp; End view along the cross section of the drain.</p> <p>c) Wall Sections, RCC Details &amp; Details of miscellaneous items.</p> <p>The Drawings shall contain assumptions made, TPs, Specifications, HPs of canal, Hydrology of the drain, Bar bending schedule, Stress table etc.</p>              | <p>Scale : 1:50, 1:100 (or) 1:200</p> <p>Scale : 1:50 (or) 1:100 for sections</p> <p>Scale : 1:25 (or) 1:20/1:10 for Rcc details.</p>                                    |