Design of erodible and non-erodible, alluvial channels- Kennedy’s and Lacey’s theories.

According to Kennedy the critical velocity ratio Vc in a channel may be defined as the mean velocity of flow which will just keep the channel free from silting or scouring.

His investigations pertain to Upper bari Doab canal in UP.

$$V_c = 0.55.m.d^{0.64}$$

m = Critical velocity ratio

= 1.1 to 1.2 for coarse sand

= 0.8 to 0.9 for fine sand

KENNEDY'S METHOD OF CHANNEL DESIGN PROCEDURE

Q = A x V

$$V_c = C_v.m.d^{0.64}$$

$$V =$$

$$C = \frac{\left[\frac{1}{n} + \left(23 + \frac{0.00155}{S}\right)\right]}{\left[1 + \left(23 + \frac{0.00155}{S}\right)\frac{n}{\sqrt{R}}\right]}$$

$$V = C\sqrt{RS}$$

- **Assume a depth of flow = d, m**
- **Compute the critical velocity from kennady's formula**
- **Compute are of c/s of flow = Q/Vc**
- **Assuming a side slope of channel, say 0.5:1 compute the bed width**
- **Compute the wetted perimeter for the assumed depth abd computed bed width**
- **Calculate C from Kutter's formula and then the velocity of flow by Chezy's equation**
- **If the Velocity computed now is same as found by kennady's method the design depth is correct**
- **Otherwise repeat the above steps by assuming different depth of flow**

CWPC PRACTICE FOR "n"

Type of soil	Canal discharge (cumecs)	Value of n
1. Soil other than rock	Up to 0.014 0.14 to 1.4 1.4 to 14 Above 14	0.03 0.025 0.0225 0.020
2. Rocky cuts	1. When rock portion at least 15 cm above the excavated bed level is left out in working out cross sectional area.	0.035 to 0.05
	2. When no portion above bed level is left out	0.05 to 0.080

Channel of condition	**Value of n**
1. Very good	0.0225
2. Good	0.025
3. Indifferent	0.0275
4. Poor	0.03

LACEY'S REGIME THEORY

The regime theory postulates that a channel with erodible boundaries tends to adjust the dimensions viz., width, depth and slope in order to attain a state of equilibrium called REGIME STATE.

Two regimes – initial and final

Initial regime occurs immediately after constructing and putting the channel under use by adjustment of bed form.

Final regime occurs after long time adjustment of

Two regimes – initial and final

Initial regime occurs immediately after constructing and putting the channel under use by adjustment of bed form by silting or scouring.

Final regime occurs after long time adjustment of bed width and banks.

When the channel reaches a regime condition the channel conveys water smoothly without deposition or scouring.

Lacey's theory

Silt factor = $$f = 1.76\sqrt{m}$$

Where,

m = mean particle size, mm

$$V = \left[\frac{QF^2}{140} \right]^{1/6}$$

$$A = \frac{Q}{V}$$

$$P = 4.75\sqrt{Q}$$

$$R = \frac{5}{2}\left[\frac{V^2}{f}\right]$$

$$S = \left[\frac{f^{5/3}}{3340.Q^{1/6}}\right]$$

The difference between Kennedy’s and Lacey’s theory is that Kennedy considered the depth of flow (d) as significant variable and Lacey considered the Hydraulic radius (R) as the significant variable

Design procedure

- Q and m are initially known
- Calculate the silt factor “f”
- Compute V from Lazey’s equation
- Compute A from continuity equation
- Compute P & S from Lazey’s equations