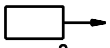
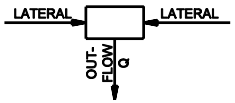


$$H_m = \frac{V^2}{2g}$$

TERMINAL JUNCTION LOSSES
(at beginning of run)

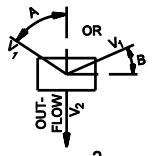
Where g = gravitational constant, 32.2 ft/s^2



$$H_{j1} = \frac{V^2}{2g} \quad \text{(outflow)}$$

JUNCTION LOSSES

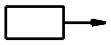
Use only where flows are identical to above; otherwise, use H_{j2} Equation.



$$H_b = \frac{KV_1^2}{2g}$$

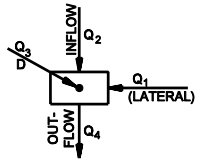
BEND LOSSES
(Change in direction of flow)

Where K	Degree of Turn (A) in Junction
0.19	15
0.35	30
0.47	45
0.56	60
0.64	75
0.70	90



$$H_e = 0.5\frac{V^2}{2g}$$

ENTRANCE LOSSES
(for structure at end of run)
Assumiong square - edge



$$H_{j2} = \frac{Q_4V_4^2 - Q_1V_1^2 - Q_2V_2^2 + KQ_1V_1^2}{2gQ_4}$$

JUNCTION LOSSES
(After FHWA)

Total losses to include H_{j2} plus losses for changes in direction of less than 90° (H_b).

Where: K = Bend loss factor
Q_3 = Vertical dropped-in flow from an inlet
V_3 = Assumed to be zero

FRICTION LOSS (H_f)

$$H_f = (S_f)(L)$$

Where: H_f = Friction head, ft
S_f = Friction slope, ft/ft
L = Length of conduit, ft

$$S_f = \left[\frac{Qn}{1.486\,AR^{2/3}}\right]^2$$

Where: Q = Discharge of conduit, ft^3/s
n = Manning's coefficient of roughness (use 0.013 for R.C. Pipes)
A = Area of conduit, ft^2
R = Hydraulic radius of conduit (D/4 for round pipe), ft

TOTAL ENERGY LOSSES AT EACH JUNCTION

$$H_t = H_{tm} + H_e + (H_{j1} \text{ or } H_{j2}) + H_b + H_f$$

SUMMARY OF ENERGY LOSSES

Figure 36-13E