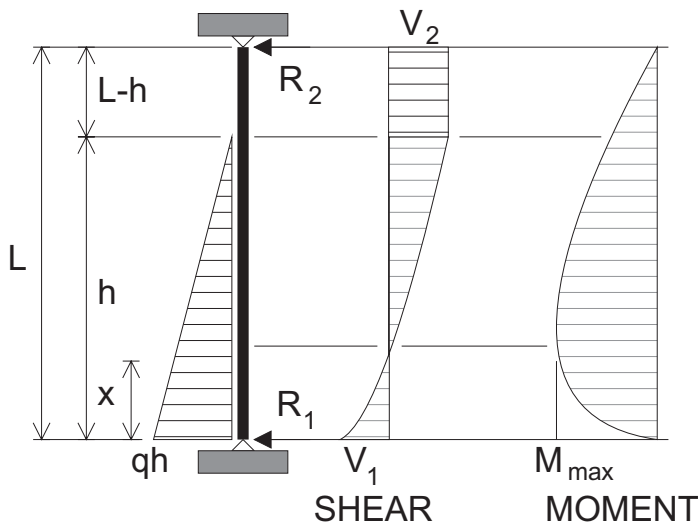# Appendix A
Shear and Moment Diagrams and Beam Equations

q = equivalent fluid density of soil (pcf)

qh = soil presure (psf) at $x = 0$

$$V_2 = -R_2 = \frac{-qh^3}{6L}$$

$$V_1 = R_1 = \frac{1}{2}qh^2 \ (1 - \frac{h}{3L})$$

$$V_x = V_1 - \frac{1}{2}xq\,(2h - x) \text{ (where } x < h)$$

$$V_x = V_2 \text{ (where } x \geq h)$$

$$M_x = V_1 x - \frac{1}{2}qhx^2 + \frac{1}{6}qx^3 \ \text{ (where } x < h)$$

$$M_x = -V_2\,(L - x) \text{ (where } x \geq h)$$

$$x_{@\,M_{max}} = h - \sqrt{h^2 - \frac{2V_1}{q}}$$

$$\Delta_{max} \ (\text{at } x \cong L\!\big/\!2) \cong \frac{qL^3}{EI}\left[\frac{hL}{128} - \frac{L^2}{960} - \frac{h^2}{48} + \frac{h^3}{144L}\right]$$

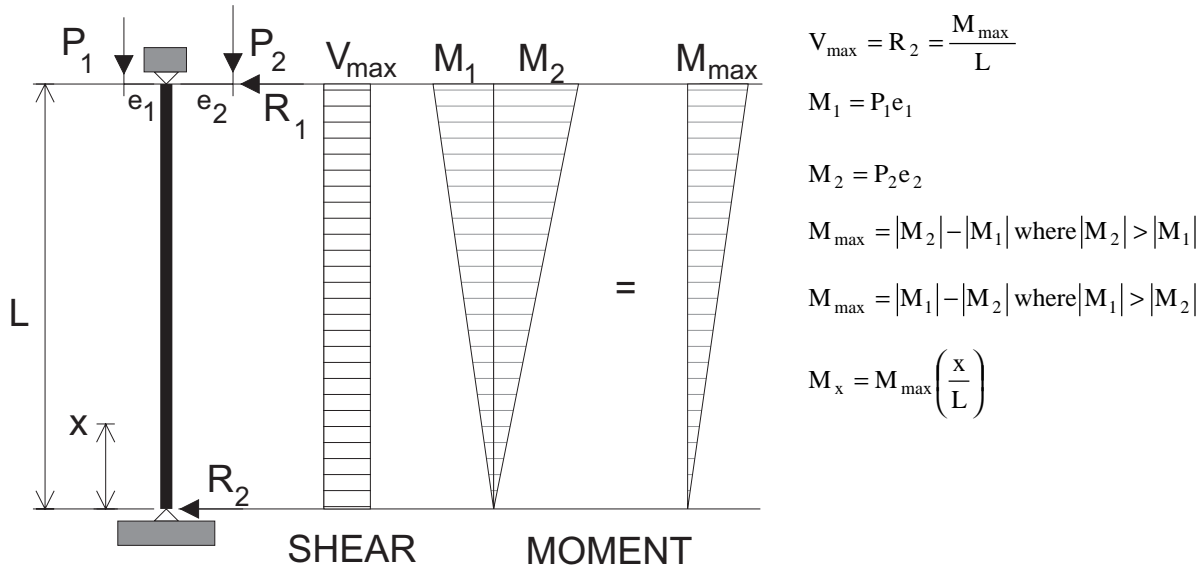**Figure A.1 - Simple Beam (Foundation Wall) - Partial Triangular Load**

$$V_{max} = R_2 = \frac{M_{max}}{L}$$

$$M_1 = P_1 e_1$$

$$M_2 = P_2 e_2$$

$$M_{max} = |M_2| - |M_1| \text{ where } |M_2| > |M_1|$$

$$M_{max} = |M_1| - |M_2| \text{ where } |M_1| > |M_2|$$

$$M_x = M_{max} \left(\frac{x}{L}\right)$$

Figure A.2 - Simple Beam (Wall or Column) - Eccentric Point Loads

$$R = V_{max} = \frac{wL}{2}$$

$$V_x = w\left(\frac{L}{2} - x\right)$$

$$M_{max} = \frac{wL^2}{8} \quad (\text{at } x = \frac{L}{2})$$

$$M_x = \frac{wx}{2}(L - x)$$

$$\Delta_{max} = \frac{5wL^4}{384EI} \quad (\text{at } x = \frac{L}{2})$$

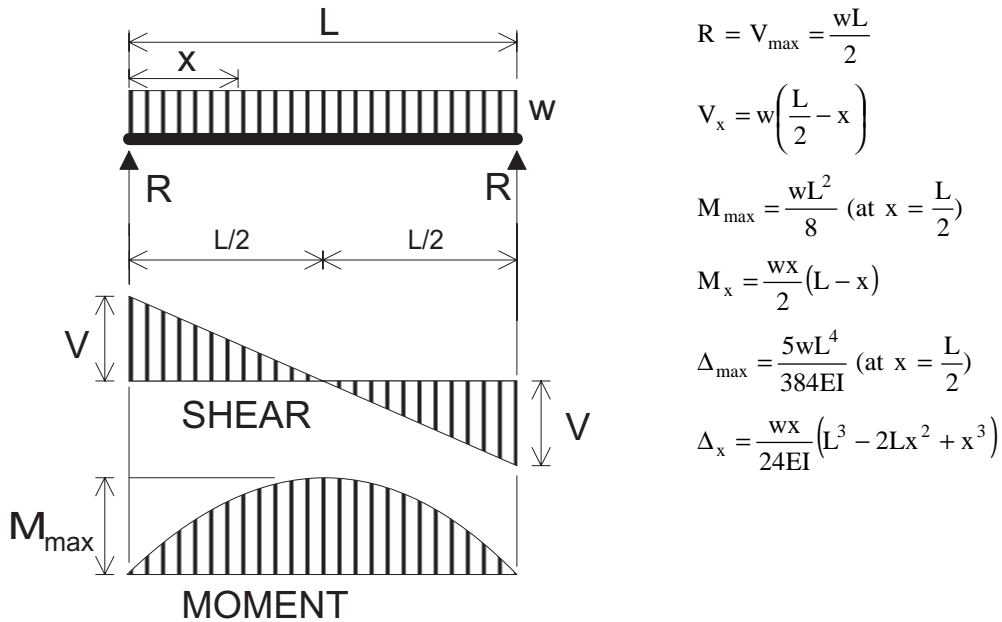$$\Delta_x = \frac{wx}{24EI}\left(L^3 - 2Lx^2 + x^3\right)$$

Figure A.3 - Simple Beam - Uniformly Distributed Load