MODIFIED CAM CLAY MODEL

- Suppose clay changes from:
  - State 1: e_0, $p = p_0$, $q = q_0 = 0$ to
  - State 2: e, p, q

$$\rightarrow 1 + e_0 = N - \lambda \ln (p_0 / p_a)$$

$$\rightarrow 1 + e = N - \lambda \ln (P / p_a) + (\Gamma - N) \frac{\ln\left\{1 + \left(\frac{q}{Mp}\right)^2\right\}}{\ln 2}$$

- Volumetric strain from this change of state:

$$\varepsilon_v = -\frac{(1+e) - (1+e_0)}{1+e_0} = \frac{1}{v_0}\left[\frac{N-\Gamma}{\ln 2} \ln\left\{1 + \left(\frac{\eta}{M}\right)^2\right\} + \lambda \ln \frac{P}{p_0}\right]$$

Elastic volumetric strain

$$\varepsilon_v^e = \frac{K}{1+e_0} \ln \frac{P}{p_0}$$

Plastic volumetric strain

$$\varepsilon_v^p = \varepsilon_v - \varepsilon_v^e = \frac{1}{v_0}\left[\frac{N-\Gamma}{\ln 2} \ln\left\{1 + \left(\frac{\eta}{M}\right)^2\right\} + (\lambda - K) \ln \frac{P}{p_0}\right]$$

Increase stress: $\varepsilon_v^p \uparrow$
- others: $\dot{\varepsilon}_v^p = 0$

$\Rightarrow$ Suitable for the meaning of yield surface

Yield function:

$$f = \frac{1}{v_0} \frac{N-\Gamma}{\ln 2} \ln\left\{1 + \left(\frac{\eta}{M}\right)^2\right\} + \frac{\lambda - K}{v_0} \ln \frac{P}{p_0} - \varepsilon_v^p.$$