

Matrix  $X = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 1 & 0 & 1 & 1 \\ & & 1 & 1 \\ & & 1 & 1 \\ & & 1 & 1 \\ & & 1 & 1 \\ & & 1 & 1 \end{bmatrix}$  } design matrix  
incidence

Model :  $\underbrace{y}_{\text{Known}} = \underbrace{X}_{\text{Known}} \cdot \underbrace{b}_{\text{Unknown, estimated from data}} + \underbrace{e}_{\text{Unknown}}$

Estimates of  $b$  using least squares

~~Thus~~  
□ Find  $\hat{b}$  such that  $e^T e$  is minimal

□ Result :  $X^T X b^{(0)} = X^T y$  (NEq)

Reg :  $\hat{b} = \underbrace{(X^T X)^{-1}}_{\text{is only possible, if } X \text{ has full rank}} X^T y$