GM assumptions: $E[e]=0$, $V[e]=\sigma^2$ and $Cov(e_1,e_2)=0$

Let $\hat{\beta}=Cy$ where $C=(X^TX)^{-1}X^T+D$

$$E[\hat{\beta}]=E[Cy]=E[((X^TX)^{-1}X^T+D)(\beta X+e)]$$

$$E[\hat{\beta}]=((X^TX)^{-1}X^T+D)X\beta+((X^TX)^{-1}X^T+D)\cancelto{0}{E[e]}$$

$$E[\hat{\beta}]=((X^TX)^{-1}X^T+D)X\beta$$

$$E[\hat{\beta}]=\underbrace{(X^TX)^{-1}X^TX}_{I}\beta+DX\beta$$

$$\boxed{E[\hat{\beta}]=(I+DX)\beta}$$

$\hat{\beta}$ is only an unbiased estimate of β if $DX=0$