Annex A

Adopting the notations introduced above, let us first calculate $X^T Y$.

$$X^T W(u_1, v_1) Y = \begin{bmatrix} X_1^T & X_2^T \end{bmatrix} . \begin{bmatrix} 1 & 0 & 0 & \\ 0 & \ddots & 0 & 0 \\ 0 & 0 & 1 & \\ & 0 & & 0 \end{bmatrix} . \begin{bmatrix} Y_1 \\ Y_2 \end{bmatrix}$$
$$= \begin{bmatrix} X_1^T & X_2^T \end{bmatrix} . \begin{bmatrix} Y_1 \\ 0 \end{bmatrix}$$
$$= X_1^T Y_1$$

Calculating now $X^T W(u_1, v_1) X$ we find:

$$X^T W(u_1, v_1) X$$
$$= \begin{bmatrix} X_1^T & X_2^T \end{bmatrix} . \begin{bmatrix} 1 & 0 & 0 & \\ 0 & \ddots & 0 & 0 \\ 0 & 0 & 1 & \\ & 0 & & 0 \end{bmatrix} . \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$$
$$= \begin{bmatrix} X_1^T & X_2^T \end{bmatrix} . \begin{bmatrix} X_1 \\ 0 \end{bmatrix}$$
$$= X_1^T X_1$$

Using these two results we have proven that

$$(X^T W(u_1, v_1) X)^{-1} (X^T W(u_1, v_1) Y)$$
$$= (X_1^T X_1)^{-1} X_1 Y$$