



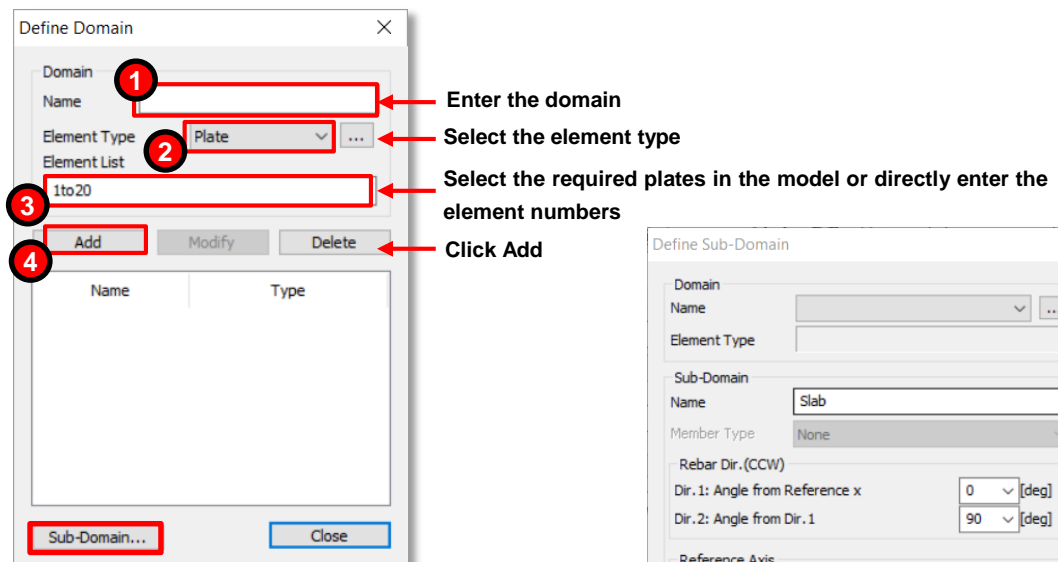
## What are Wood Armer moments? How to view in midas Civil?



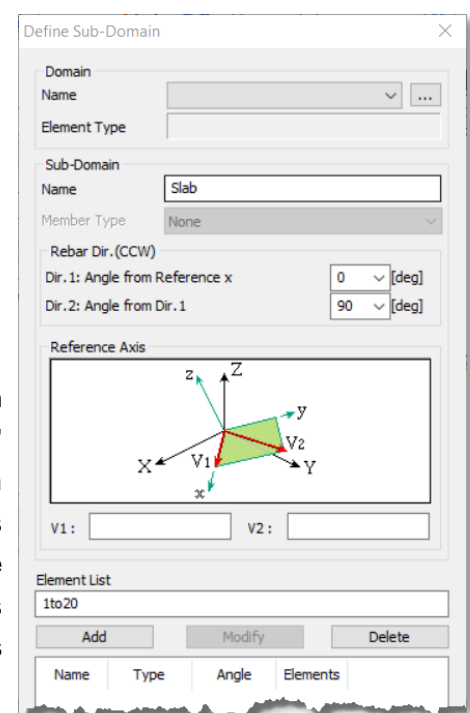
Wood Armer method allows moment triads from plates ( $M_x$ ,  $M_y$ ,  $M_{xy}$ ) to be transformed into simple bending moments in two directions (Wood Armer moments) for reinforcement design of plate elements.

This is important because the twisting moment  $M_{xy}$  can be significant. At any point in the slab, the normal moments in a direction, resulting due to design moments  $M_x$ ,  $M_y$ , and  $M_{xy}$ , must not exceed the ultimate normal resisting moment in that direction. The ultimate normal resisting moment is typically provided by ultimate resisting moments  $M_{ux}$  and  $M_{u\alpha}$  related to the reinforcement in the  $x$ - and  $\alpha$ - directions.  $M_x$ ,  $M_y$  and  $M_{xy}$  are bending and twisting moments, usually obtained from a finite element analysis program.  $\alpha$  is angle of transverse steel, measured clockwise, from the  $M_x$  axis.

For those plates where, Wood Armer moments are to be found the reinforcement direction needs to be defined. Create plate elements either with **Node/Element > Create Element > Plate** or by using the Mesh option. Next is to define Domain. Invoke the 'Define Domain' dialogue box from **Node/Element** Tab. To assign the plates to a particular domain, follow the steps below:

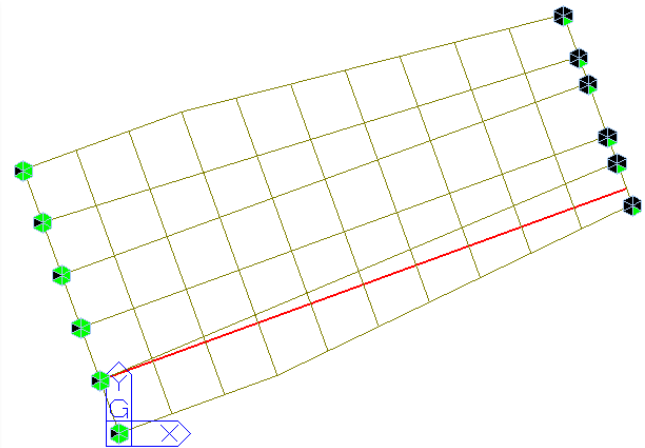
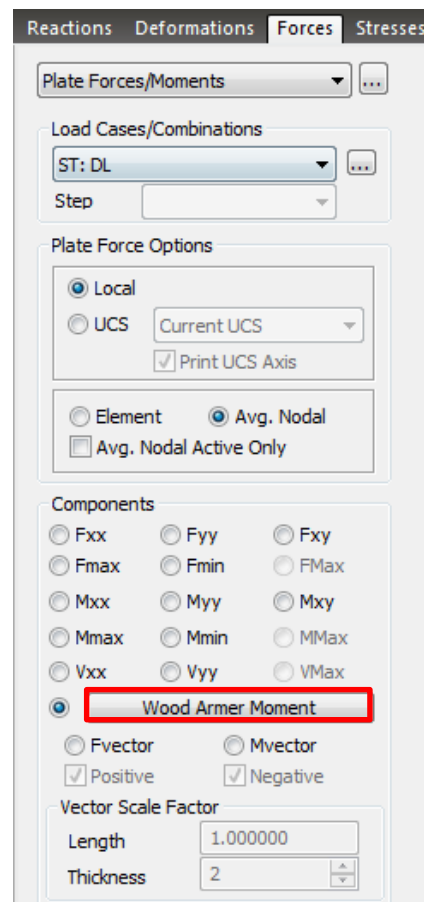


Now, to add sub domain, one could either click on the Sub-Domain button form 'Define Domain' dialogue box or click on 'Define sub domain' from **Node/Element** ribbon menu. The sub-domain is where details like the angle of reinforcement to the global axis, angle between the reinforcements spanning in either direction and reference axis definition are specified.



Also if different parts of the same domain have different details, then these could be provided using the subdomain.

On applying the necessary loads and boundary conditions, the Wood Armer moments could be checked graphically as well as in form of table. For an irregular hypothetical slab as shown below, the Wood Armer moment result in the direction of reinforcement (i.e., the design moment) will be more than those in local X and Y directions of the plate.



Along the red line shown in the image above, the  $M_{xx}$  value obtained for its dead load was 62kNm, while the Wood Armer moment, considering the  $M_{xx}$ ,  $M_{yy}$  and  $M_{xy}$ , which would all be acting along the direction of reinforcement, i.e., at 20° angle to the global X direction is 74.2kNm. This is the moment for which the slab needs to be designed.

The Wood Armer moments could be obtained at top and bottom of plates along both the reinforcement directions. This option could be accessed by clicking on the 'Wood Armer Moment' button as highlighted in the image above.

The results could be viewed in tabular format from **Results > Results Tables > Plate > Force (Unit Length)...** Once the table interface opens, click on Plate Force (UL:W-A Moment) as in image below and select the required load cases as well as output positions.

	45.231	6.893	-12.894	0.000	45.231	6.893	-12.894	58.126
	35.016	5.036	-9.621	0.000	35.016	5.036	-9.621	44.636
	48.961	5.947	-14.278	0.000	48.961	5.947	-14.278	63.239
	44.329	3.912	-12.936	0.000	44.329	3.912	-12.936	57.266
	53.307	4.889	-15.639	0.000	53.307	4.889	-15.639	68.046
	Plate Force(UL:Local)	Plate Force(UL:UCS)	Plate Force (UL:W-A Moment)					