

**Stress as a Function of the Block Orientation**

Ang Lee  
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In the pivoter review committee summery (Nova-doc-5775-v1, March 30, 2011), the following questions have been raised as :

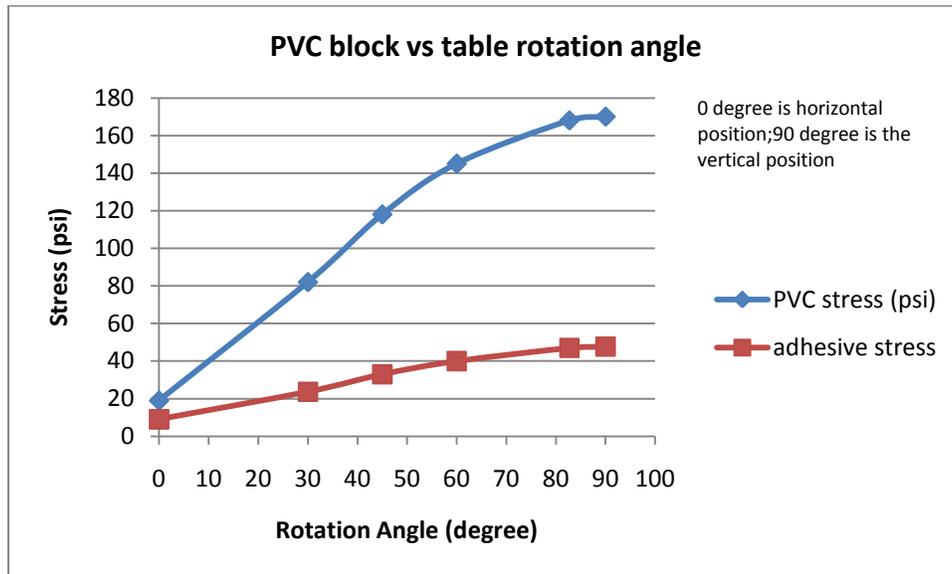
*&1.2 There was no reference to any stress analysis of a block in all orientations of the pivoter when going from the assembly phase (flat) to the installation phase (vertical, and in particular tilted back on the table during the movement to the installation location). Are there configurations during the rotation that cause high stress to the block as the load transfers from the table to the pallet?*

*&4.2 There is a concern for potential to damage the corner of the blocks when they arerotated to the vertical position for installation.*

The Nova PVC structure is designed for a fully loaded case, which contains:

- a) PVC weight\_ both vertical and horizontal.
- b) 19 psi hydrostatic pressure in the vertical extrusion.
- c) The oil weight in the horizontal.

For an unfilled case, the above structure only contains a load condition of (a)\_ PVC weight, which will be less severe than a fully loaded case. To response committee concern quantitatively, we have rotated a dry structure at 0 (horizontal), 30, 45, 60 and 90 degree (vertical). Both PVC and adhesive stress are extracted and plotted against the rotation angle as shown in Fig 1.

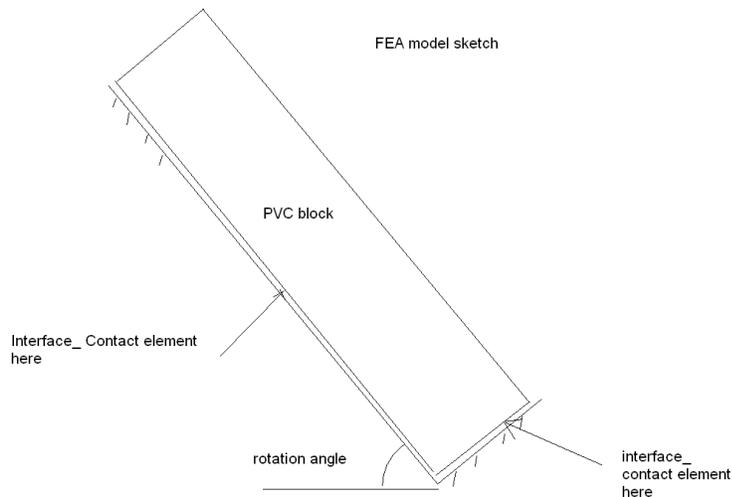


**Fig 1 Stress as function of rotation Angle**

- 1) The result indicates that both maximum, PVC and adhesive, occurs at the vertical position (90 degree). The PVC stress is less than 180 psi and ~50 psi for the adhesive shear, respectively. It is considered to be minimum as expected.
- 2) Plot in Fig 1 contains an additional data point at angle= $\sim 82.7$  degree where the block corner being lined up with the gravity center. There is no evidence, strictly from the calculation, showing any additional stress. However, a further attention is warranted for the FHEP table/block test since only the field test result can truly answer this question.
- 3) Lastly, we've purposely fixed left side of model as "fixed condition" and let the bottom of the extrusion\_ right corner dropping about  $\sim 0.22$ " to simulate folk deflection effect. The result indicates a max pvc stress of  $\sim 230$  psi .The maximum shear stress of adhesive is about  $\sim 51$  psi. It is an extreme case. In the reality, the actual folk deflection is only  $\sim 1/8$ ". Therefore, we expect that effect is minimum.

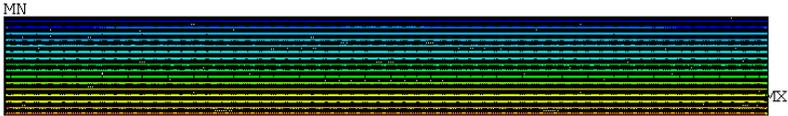
## Appendix A

### FEA model



**Fig A-1 FEA model**

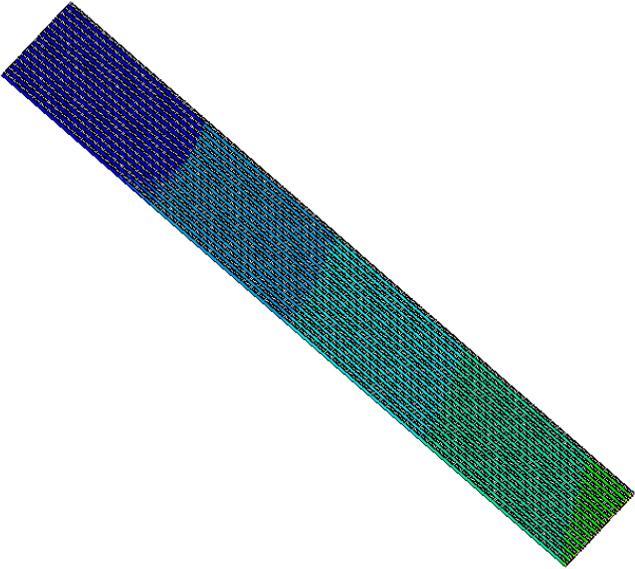
**ANSYS** APR 19 2011  
 14:38:22  
 NODAL SOLUTION  
 STEP=1  
 SUB =8  
 TIME=1  
 SEQV (AVG)  
 PowerGraphics  
 EFACET=1  
 AVRES=Mat  
 DMX =.086005  
 SMN =.034946  
 SMX =19.015  
 .034946  
 2.144  
 4.253  
 6.361  
 8.47  
 10.579  
 12.688  
 14.797  
 16.906  
 19.015



0 degreee psi

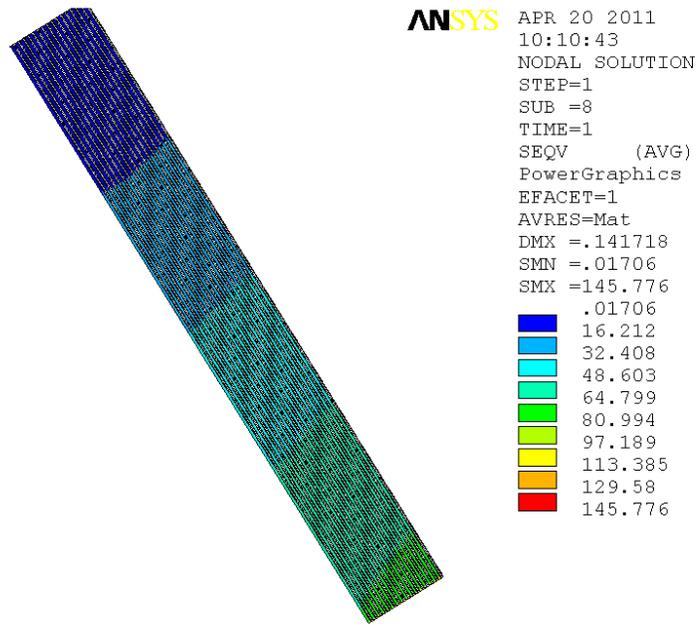
**Fig A-2 0 degree \_ flat**

**ANSYS** APR 20 2011  
 09:37:33  
 NODAL SOLUTION  
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 SUB =8  
 TIME=1  
 SEQV (AVG)  
 PowerGraphics  
 EFACET=1  
 AVRES=Mat  
 DMX =.113877  
 SMN =.020793  
 SMX =118.234  
 .020793  
 13.156  
 26.29  
 39.425  
 52.56  
 65.695  
 78.83  
 91.964  
 105.099  
 118.234

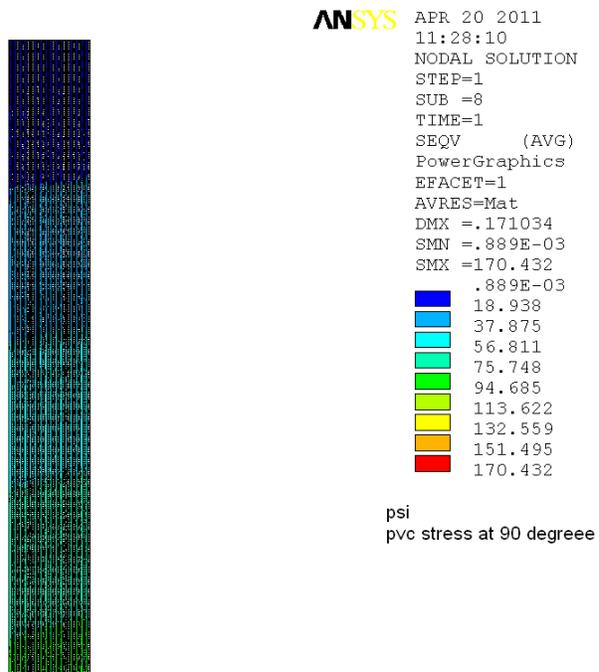


psi  
at 45 degree

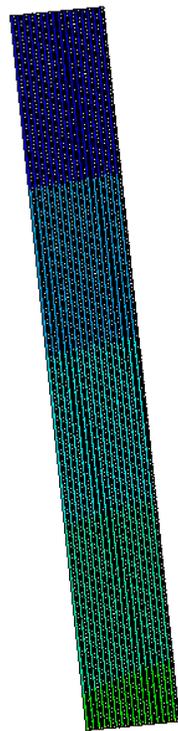
**Fig A-3 Stress at 45 degree**



**Fig A-4 Stress at 60 degree**



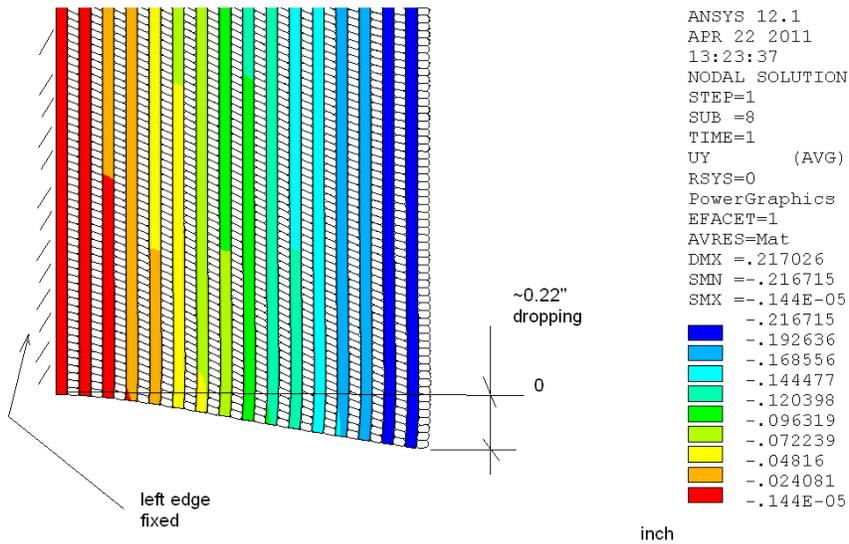
**Fig A-5 stress at 90 degree**



**ANSYS** APR 22 2011  
 11:00:33  
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 SUB =8  
 TIME=1  
 SEQV (AVG)  
 PowerGraphics  
 EFACET=1  
 AVRES=Mat  
 DMX =.165094  
 SMN =.006166  
 SMX =168.145  
 .006166  
 18.688  
 37.37  
 56.052  
 74.734  
 93.416  
 112.098  
 130.78  
 149.462  
 168.145

psi pvc at angle =82.7

**Fig A-6 Stress at angle=82.7 degree**



ANSYS 12.1  
 APR 22 2011  
 13:23:37  
 NODAL SOLUTION  
 STEP=1  
 SUB =8  
 TIME=1  
 UY (AVG)  
 RSYS=0  
 PowerGraphics  
 EFACET=1  
 AVRES=Mat  
 DMX =.217026  
 SMN =-.216715  
 SMX =-.144E-05  
 -.216715  
 -.192636  
 -.168556  
 -.144477  
 -.120398  
 -.096319  
 -.072239  
 -.04816  
 -.024081  
 -.144E-05

**Fig A-7 Model for the case of left edge fixed and right lower corner dropping about 0.22"**



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ANSYS 12.1
APR 22 2011
13:24:12
NODAL SOLUTION
STEP=1
SUB =8
TIME=1
SEQV      (AVG)
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.217026
SMN =.012078
SMX =230.829
.012078
25.658
51.305
76.951
102.597
128.244
153.89
179.536
205.182
230.829

```

psi

pvc stress for left edge fixed and right lower corner drop about ~0.22"

**Fig A-8 The Stress for the case of left edge fixed and right lower corner dropping about 0.22"**