

FHEP Table Subjected to several Different Lifting and Pulling/pushing Case

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FHEP Table will be moving around in ANL during loading /unloading . Several cases have been studied to understand some of the local stress due to the different lifting and pulling/pushing position. It is requested by Pat Lukens and David Pushka. The result has been summarized as following:

- 1) MD-ENG-290, by Mike Zuckerbrot , describes the Hillman roller and front/back leg design for FHEP. It conforms to the AISC code.
- 2) The analysis here includes that both front and back legs in the model to understand the local stress during pulling / pushing. The 10% of G load is used as pulling force applied at location 1 or 2 or 3 or 4 to check the local stress.

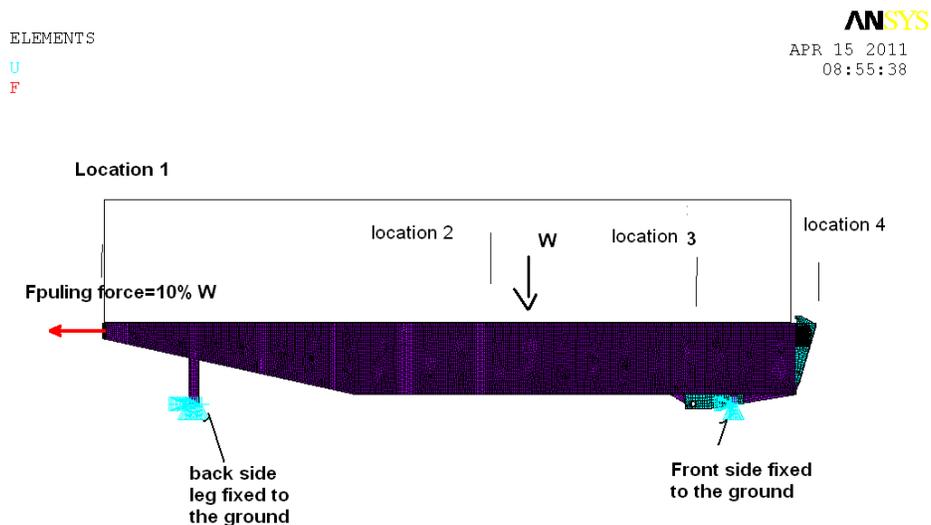


Fig 1 FEA Model

3) Table 1 is the summary of the result. It shows that the structure should be adequate for the given loading case

Case	description	stress
1	Pulling at location 1 with 10% force/ <u>Table + block sitting on both legs</u>	~10.4 ksi
2	Pulling at location 2 with 10% force/ <u>Table + block sitting on both legs</u>	~12 ksi
3	Pulling at location 3 with 10% force/ <u>Table+ block sitting on both legs</u>	~12 ksi
4	Pulling at location 4 with 10% force/ <u>Table + block sitting on both legs</u>	~10.4 ksi
5	Lifting on location1 / only <u>front leg sitting on the roller</u>	~11 ksi /except back lug area with a local bearing stress up ~24.6 ksi (see note)
6	Same as case 5 with 10% of W applied at location 1	~11 ksi/except back lug area with a local bearing stress up ~26 ksi
7	Same as case 5 with 10% of W applied at location 4	~11.7 ksi/except back lug area with a local bearing stress up ~25 ksi

Note :

- a) Overall stress is very low (~11 ksi) regardless the puling/pushing position as long as the table +block sitting on both legs.
- b) For the case of lifting on back lug with its front leg sitting on the roller (case 5,6,and 7), the stress is also very low with an exception of bearing stress at the back lug. The bearing stress (local) at the lug area is about ~25 ksi in compressive. The average bearing stress can be estimated as :

$$F(\text{each})=80000/4=20000 \text{ lbf}$$

Bearing area of 2" plate with 2" hole will be 2"x2".

The average compressive stress will $20000/4=5000 \text{ psi}$ very low $\ll 0.9*36=32.4 \text{ ksi}$ (allowable for bearing stress).

- c) Weld stress around back lug location:

Based on the #3929.000-ME-466385, the weld stress can be estimated as

$$L=2 (\text{sides})*(12.75''+8+12.75'')=67'' \text{ total. For } \frac{1}{4}'' \text{ fillet weld, } A=0.707*0.25''*L=11.86 \text{ in}^2$$

Possible lifting and pulling force for each lug will be

$$F(\text{per lug})=(F_{\text{lifting}}^2+F_{\text{pulling}}^2)=(20000^2+(0.1*80000/2)^2)^{0.5}=20.4 \text{ Kips}$$

$$\text{Weld stress}=20.4/11.86=1.72 \text{ ksi} \ll 0.3*70 \text{ ksi}=21 \text{ ksi (ok)}$$

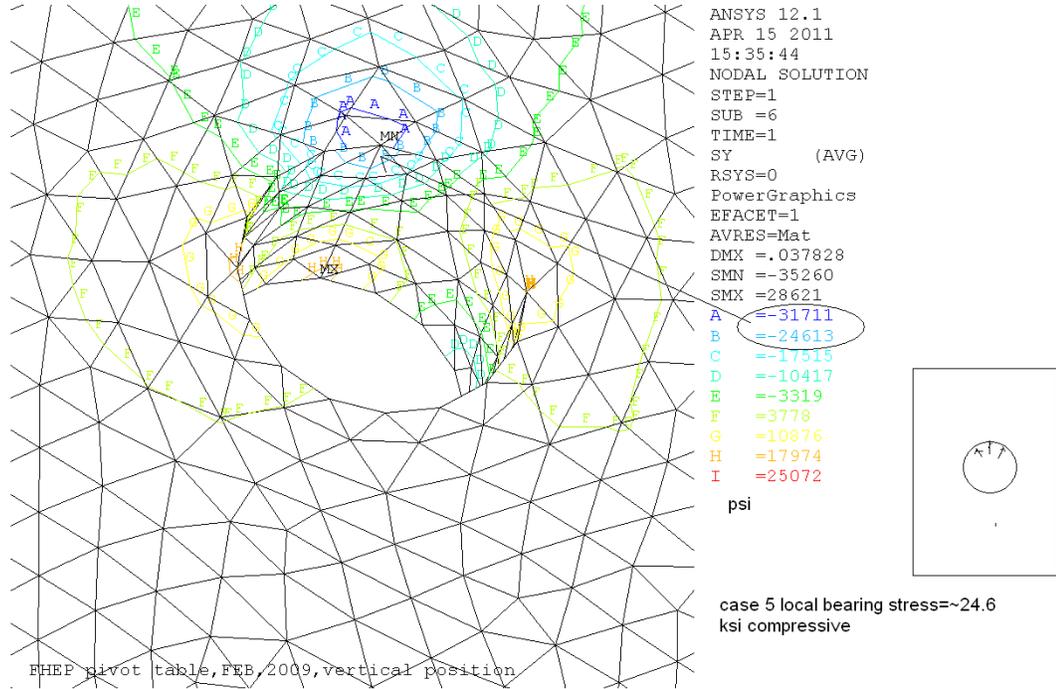


Fig 2a The local bearing stress for the back lug

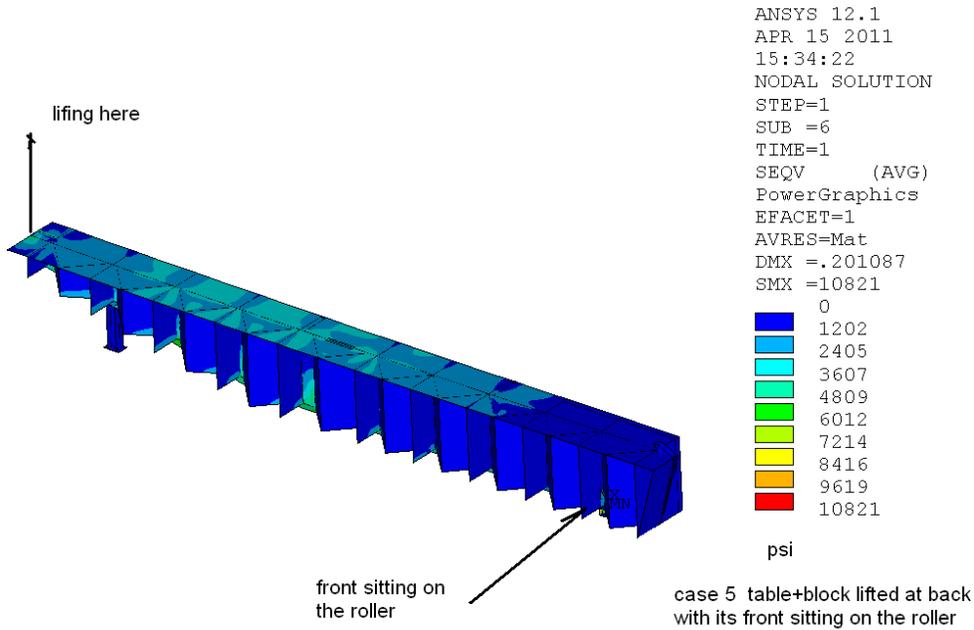


Fig2b Table stress (excluding the lug) just for lifting on back

Appendix A

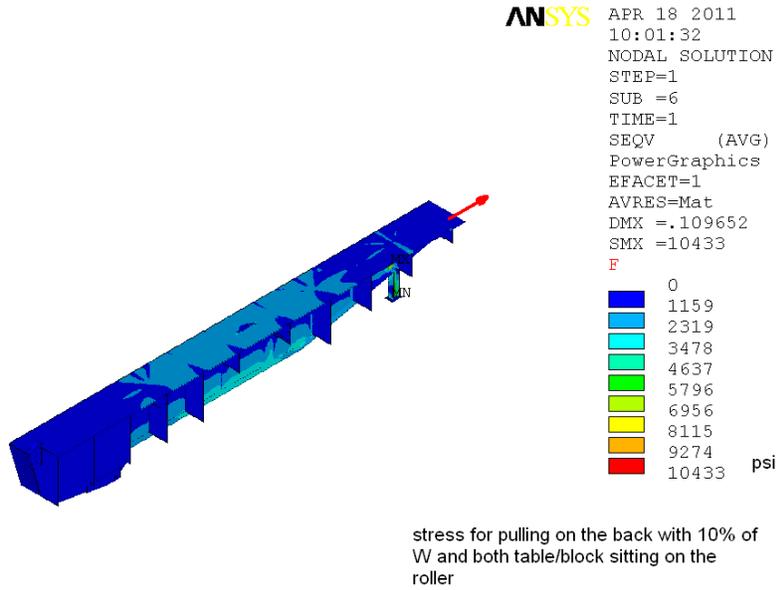


Fig A_1 Stress plot for the case of pulling on the back lug and table/block both legs sitting on the roller

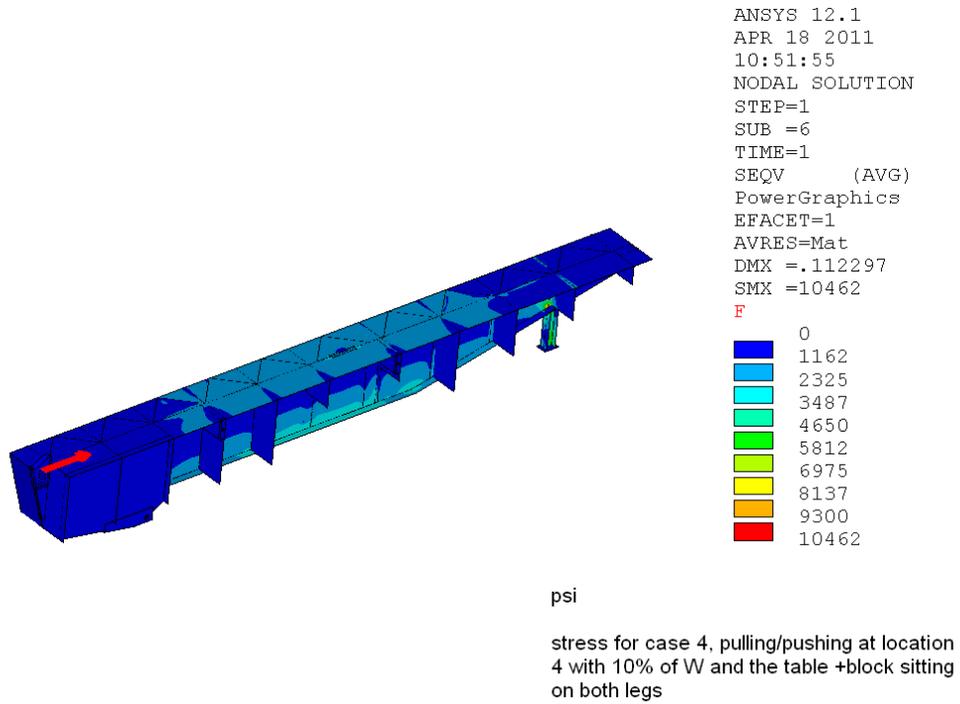
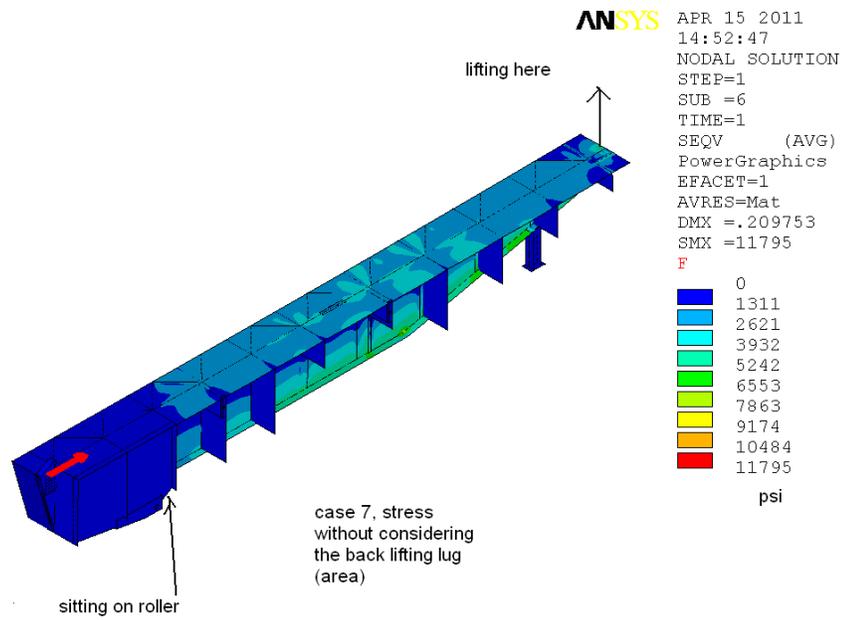


Fig A_2 Stress plot for the case of pulling front leg and table/block both legs sitting on the roller



FHEP pivot table,FEB,2009,vertical position

Fig A-3 Stress for case 7 with 10% of W applied at front and table +block sitting on the front leg with the back lug lifted by crane.

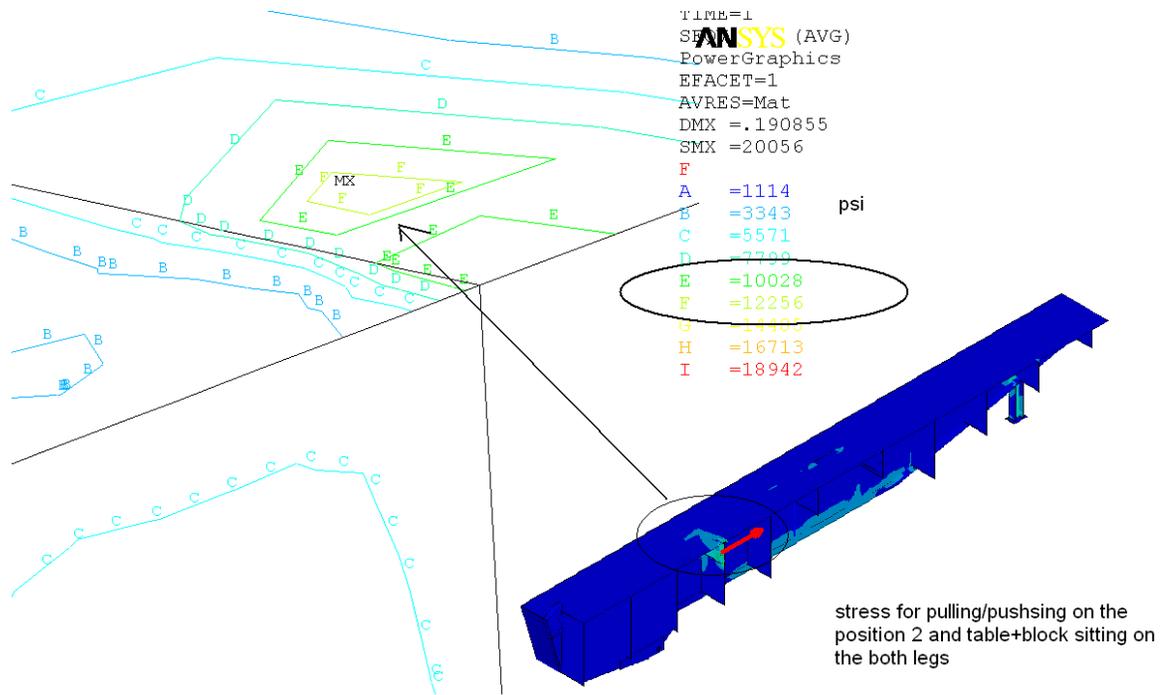


Fig A-4 Stress for the pulling/pushing on the position 2 and table_block sitting on both legs