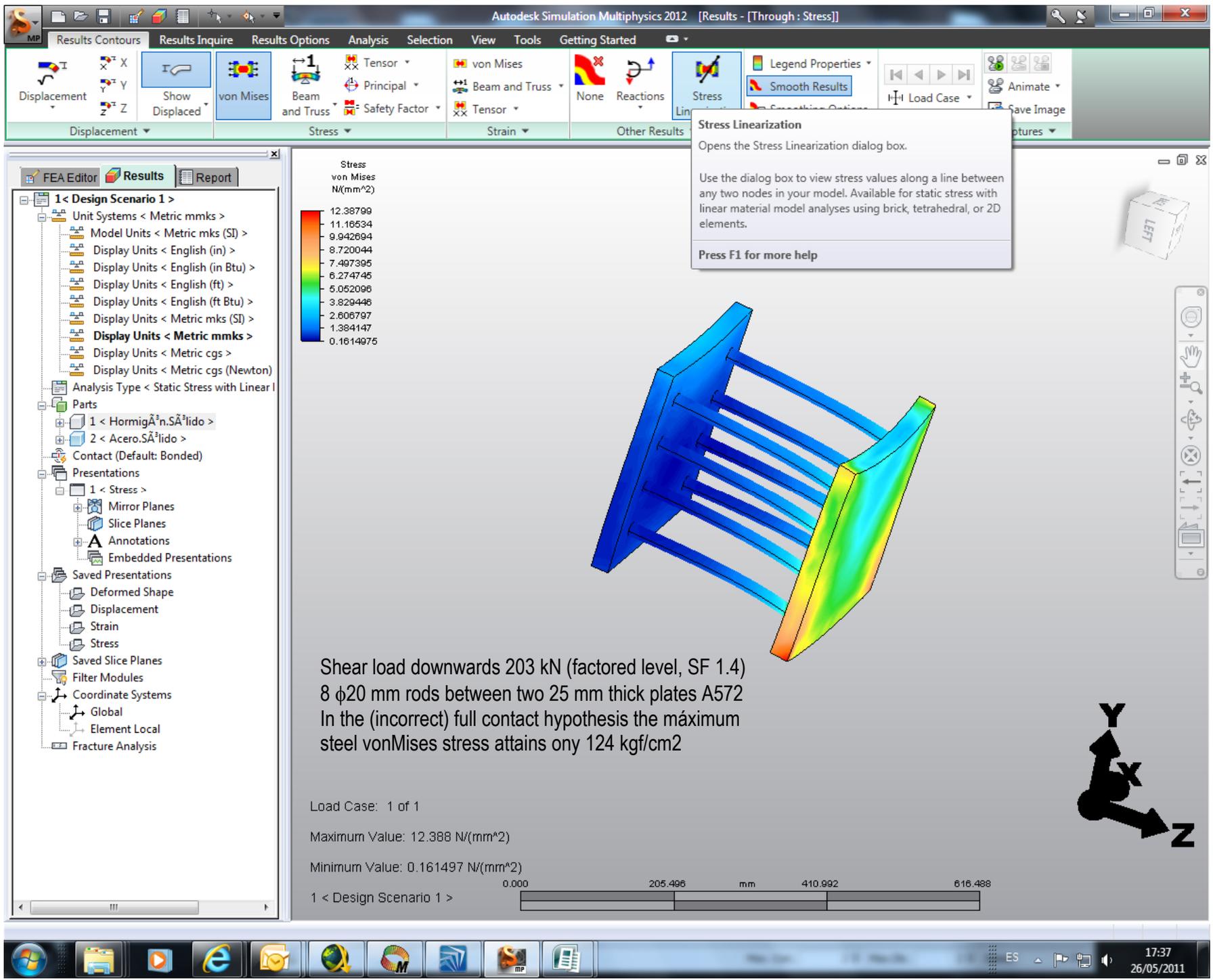Steel inset in 300 mm thick concrete.
Plates 300x300x25 mm
8 φ20 mm rods
We fix in the model all sides except
front, back and up sides

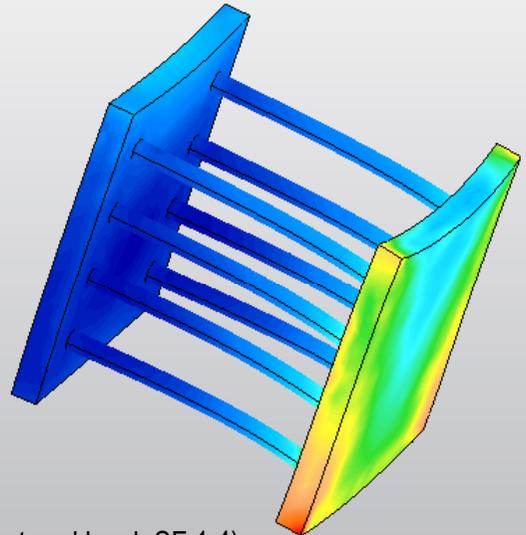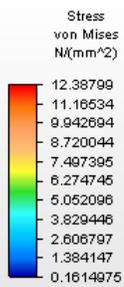Shear load downwards 203 kN (factored level, SF 1.4)
8 φ20 mm rods between two 25 mm thick plates A572
In the (incorrect) full contact hypothesis the máximum
steel vonMises stress attains ony 124 kgf/cm2
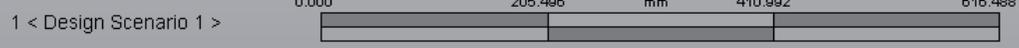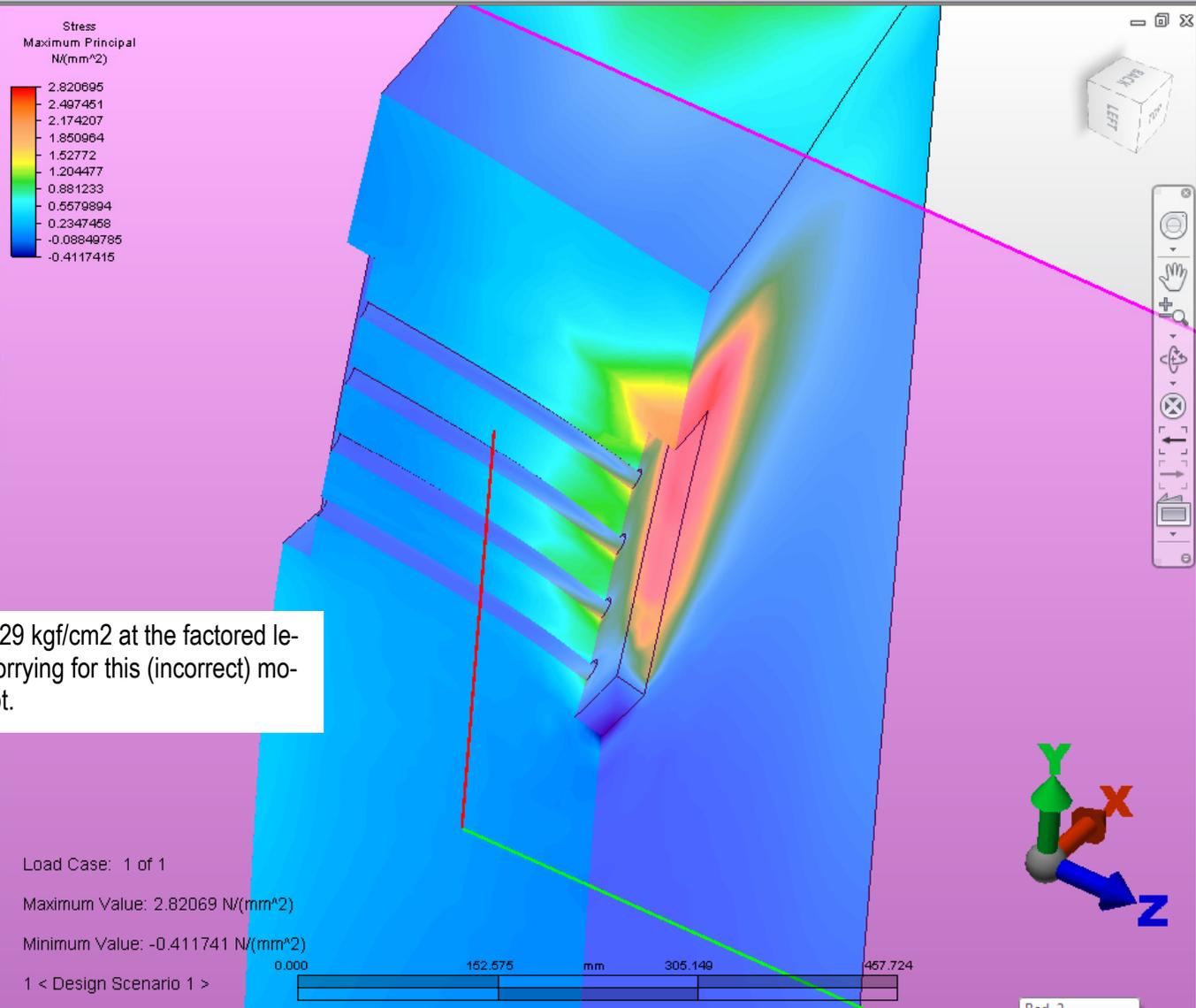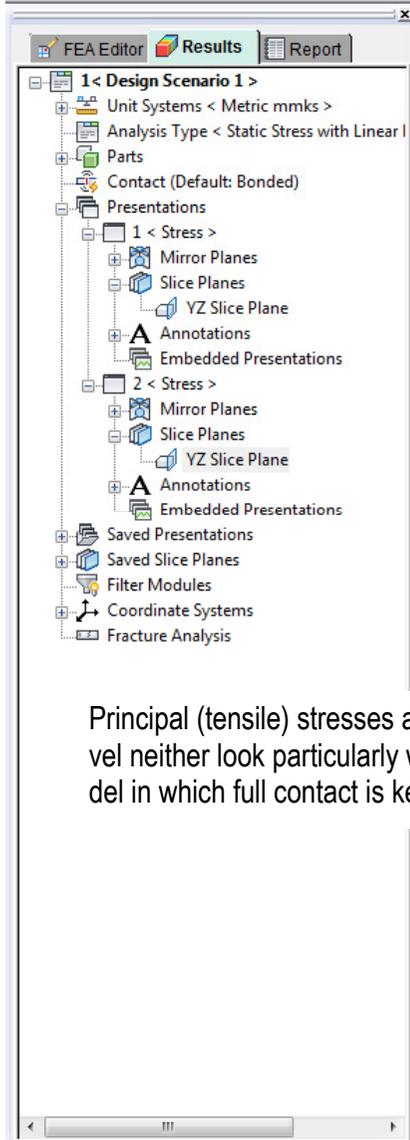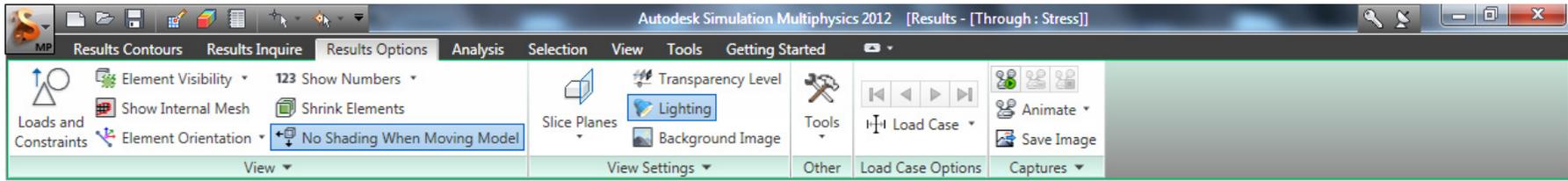
Principal (tensile) stresses at 29 kgf/cm2 at the factored level neither look particularly worrying for this (incorrect) model in which full contact is kept.

Minimum Principal (compressive) stresses at 54 kgf/cm2 at the factored level neither look particularly worrying for this (incorrect) model in which full contact is kept.
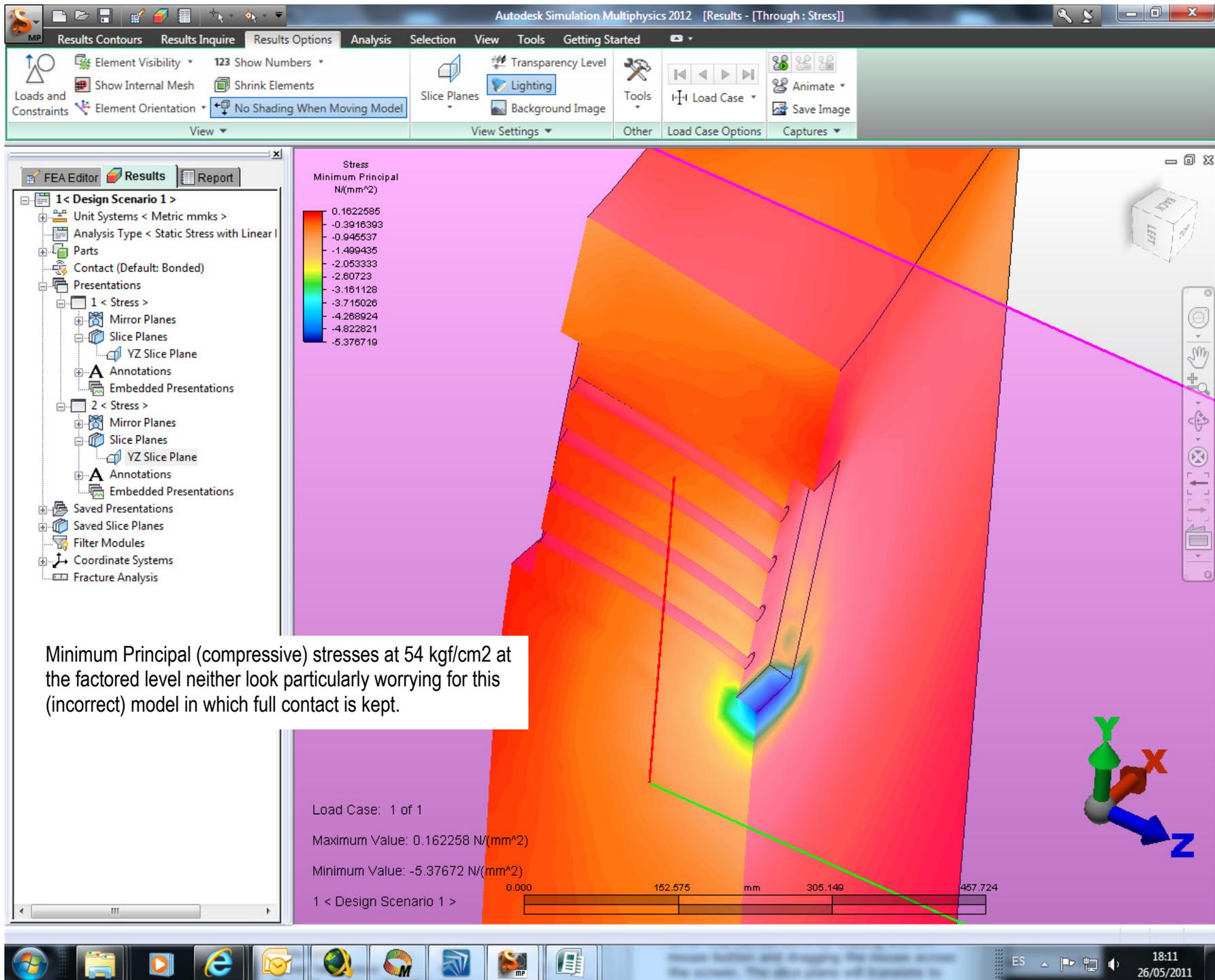
Speculative Considerations on this Incorrect Model

- We see that the higher principal tensile stresses develop mainly on the attachment of the plate to side and upper face of front steel plate. Much of these tensile stresses will be relieved by lack of effective contact at the factored actual situation.

- Note that in this model the maximum compressive stresses in the concrete are kept approximately at 1/5 of what bearing of the whole force in the side would cause; this must be an effect of the contact in all other sides, both lateral and through what would be the friction behind the plate.

- A scheme of equilibrium where the brunt of the shear force is kept in bearing on its side opposed to the shear action placed in the front face would be by this model overly conservative. A mix of direct adhesion, bearing and strut and tie scheme is at work. The stresses that should be showing in the rods for a pure strut and tie scheme are not present in enough magnitude for the struts adequately counteract the shear in magnitude: this an effect of the direct shear transfer to the concrete through direct contact in this model. If we would think the direct adhesion is as effective, we likely wouldn't need some traditional shear friction scheme to justify the capacity of the device.

- Given the bearable stresses we are getting now, neglecting contact at 3 sides of the plate should have little impact on the solution working. The moderate stresses in the rods combined with the fact of that this through solution is deemed effective in properly anchoring the shear friction tie forces gives an optimistic lookout for the result of a more proper analysis. The moment of the shear force respect the centerline of the wall should be easily taken by some reasonable section of the plate, however.

- To model more properly this device in the same intent is just establish the proper relative constraints between faces in initial contact, something more or less difficult depending on the ability of the program to state independent constraints for specific contiguous faces.