A3D MAX: Rigid panels divert axial forces?

The rigid plane option for panel objects in A3D MAX is an extremely powerful way to model the in-plane stiffness of most concrete floor and roof slabs. However, sometimes the results can be be surprising at first sight and it is advisable to be aware of what is going on in the model - and the real structure.

The frame nodes forming the corners of each rigid panel are locked together so that the panel acts as a rigid body. This means that the members joining the nodes and supporting the edges of the panel sustain none of the in-plane forces applied to the nodes. The in-plane forces are effectively diverted into the panel. Where the members are beams this is of no concern and will probably go unnoticed because the out-of-plane shear, bending and deflection are not affected. However if the panel support member is the top chord of a lattice girder, the results will show no axial force in the members forming the chord. The vertical deflection of the lattice girder is greatly dependent on the axial deformation of the top and bottom chords so it is not surpring that the midspan deflection is roughly halved when the top chord nodes are locked into a rigid slab.

If there is an effective shear connection between the chord and the slab this may be realistic modelling. If not, then it may be necessary to re-assess and perhaps model the slab in-plane stiffness with equivalent bracing members and treat the panels as non-rigid - ie for gravity loading only. Another simpler option is to create a non-rigid copy of the model for the purpose of designing the lattice girder conservatively. The following illustrations show a rendered image of a simple lattice girder building with concrete slab deck with partial views of the lattice girder axial force diagrams with and without rigid panel action.