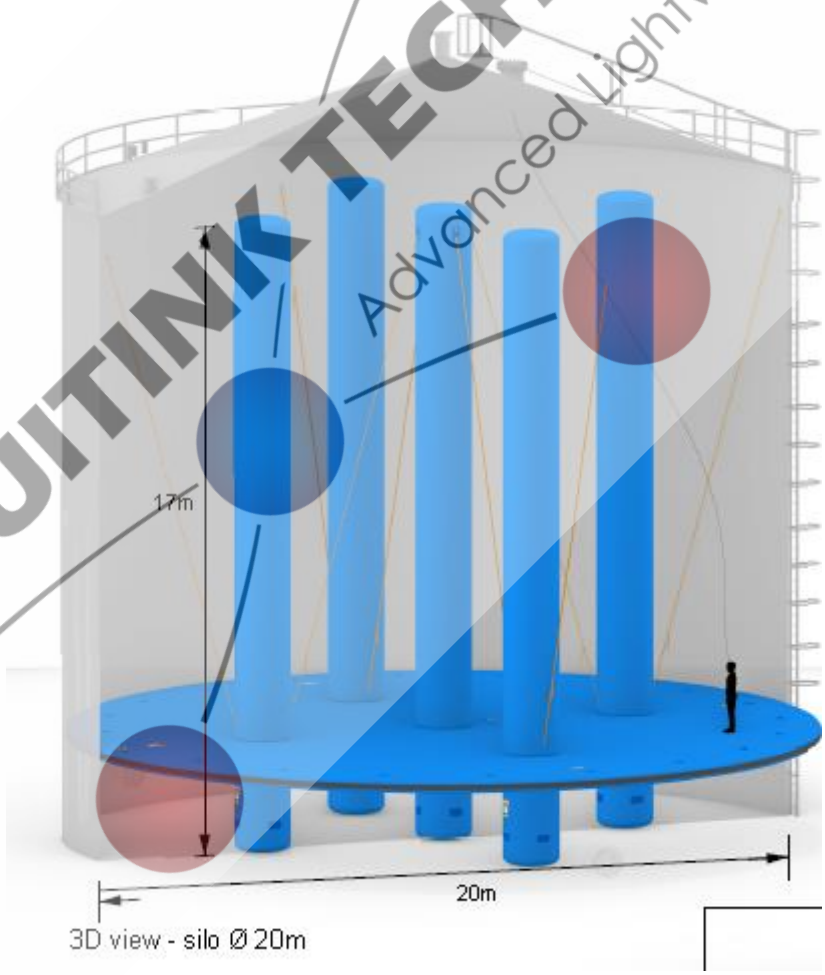
BUITINK TECHNOLOGY
Advanced Lightweight Structures

## Inflatable working platform ∅ 20 m

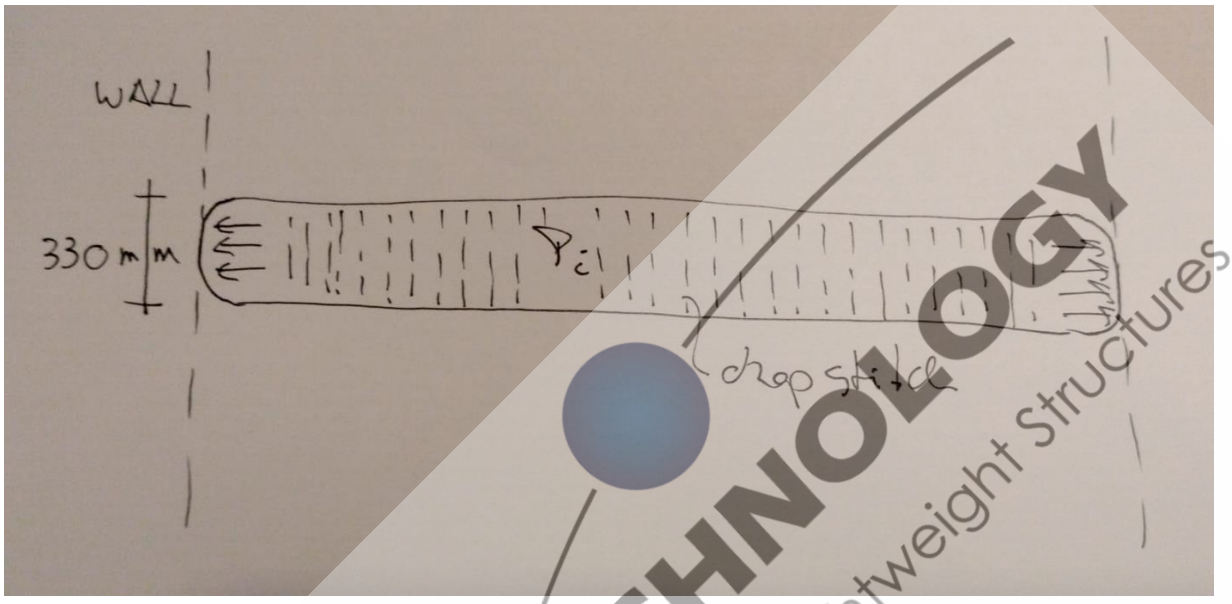
Buitink Technology developed an inflatable working platform that can be installed inside a tank.

Proof of concept has been made by a platform with a diameter of 3m. To extend this principle to a larger tank of e.g. 20m, Buitink worked out the following concept:




A dropstich fabric floor is made that is additionally supported. In this visualization it is supported by 5 inflatable columns.

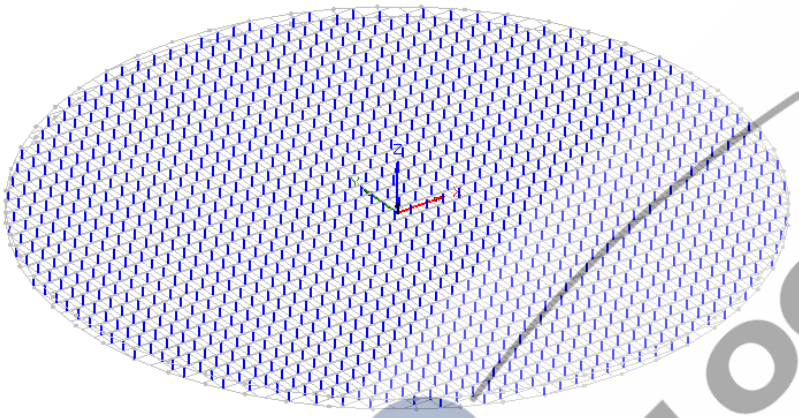
The load bearing principle of the platform exists due to the inner pressure that pushes the cirmcumfernce to the silo wall.




| | | |
|---|---|---|
| Diameter | 20.00 | m |
| Circumference | 62.83 | m |
| Height Dropstitch | 0.33 | m |
| Pressure area | 20.73 | m2 |
| | | |
| Inner pressure in dropstitch | 500.00 | mBar |
| | 50.00 | kN/m2 |
| pressure on wall | 1036.73 | kN |
| friction | 0.60 | |
| safety on friction | 1.50 | |
| max vertical force | 414.69 | kN |
| | 41469.02 | kg |
| Force along boundary | | |
| Radius ( = half height) | 0.17 | m |
| force per m/ cercumference | 8.25 | kN/m' |
| | due to shape, the upper and lower foil are not tensioned | |
| due to deformation, foil tension is activated | | |
| ==> foil stress shall be lower than force/m' | | |

An inner pressure of 500mBar is chosen. The maximum inflation pressure is 2000mBar so there is a safety margin of 2000/500 = 4 on the allowable inner pressure.

With this pressure, a maximum tension force in he upper or lower layer can be reached of 8.25 kN/m'. To investigate whether the span of 20m is possible, a double layered floor panel is modelled with dropstiches to simulate the behavior.

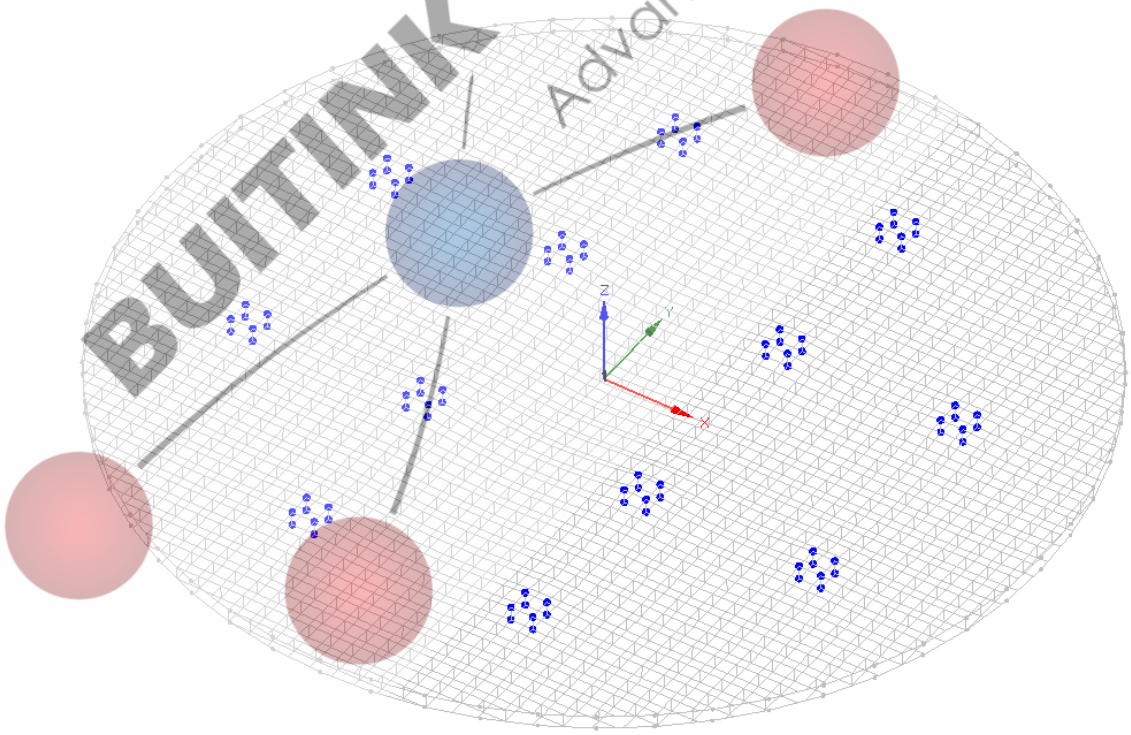


(in blue the dropstiches are shown).

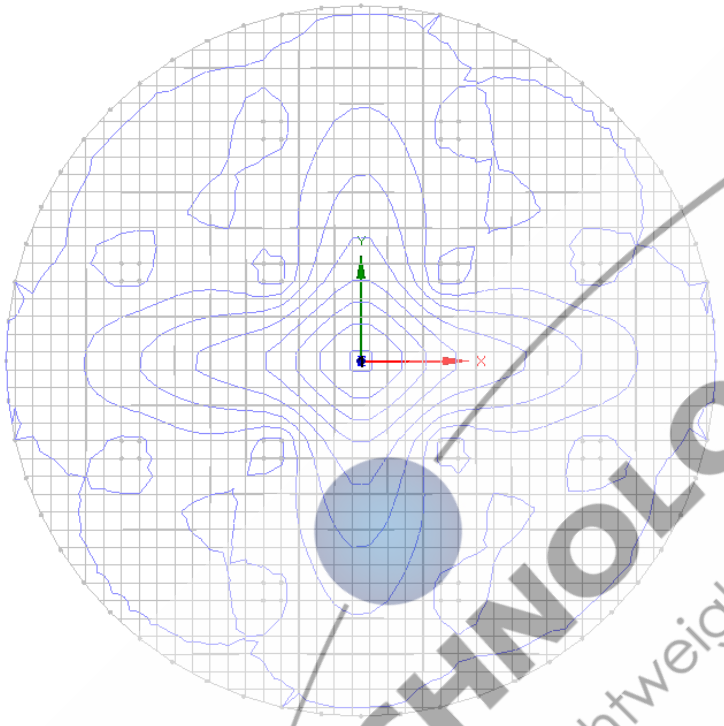
As the fabric itself is quite heavy (appr. 2 kg/m2), the platform is checked first under self weight and an inner pressure of 300 mBar.

Since the most loaded area will be at the perimeter of the platform, 8 columns are equally distributed along the perimeter at the distance of 3m from the edge. Internally another 4 columns are positioned to carry the inner part of the platform.

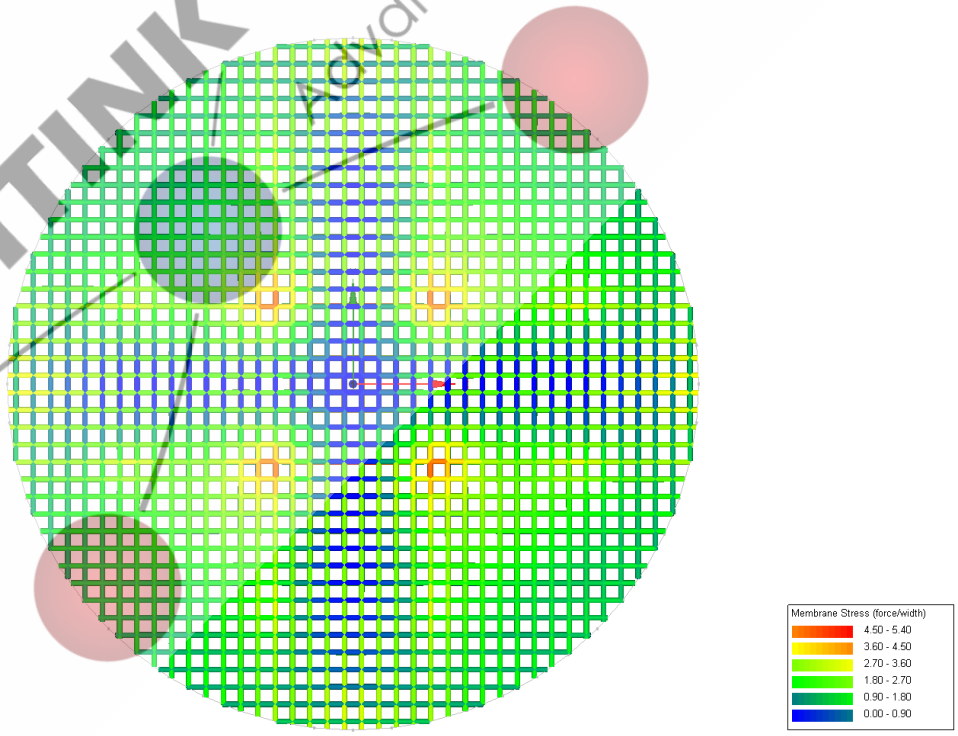
**LC01 Inner pressure and self weight**



It can be seen that the platform deforms under the selfweight,



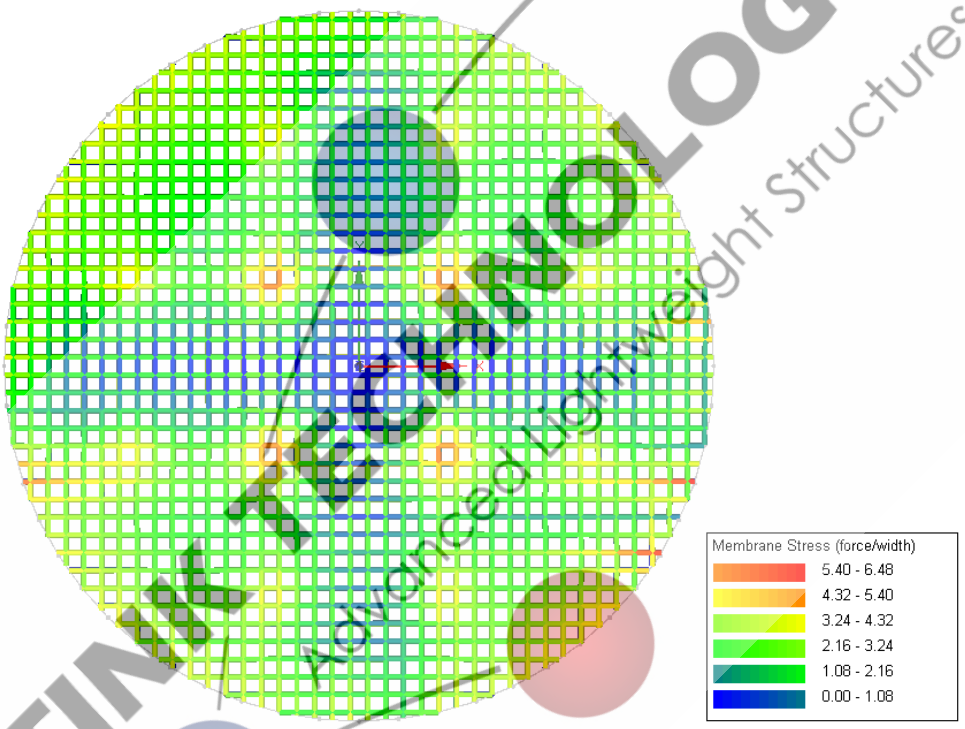
Deformation lines shown in 5cm difference. At the perimeter there is approximately 5 cm deflection, therewith creating a comfortable working area. Toward the center of the platform, the deflection increases up to 40 cm. as this is only to cross the platform, it considered an acceptable deflection.



Membrane stresses are higher around the support points, this is acceptable. Along the perimeter the stresses are around 3 kN/m', which is failly below the maximum allowable stress level of 8.25 kN/m', resulting in a safety margin of 8.25 / 3 = 2.75

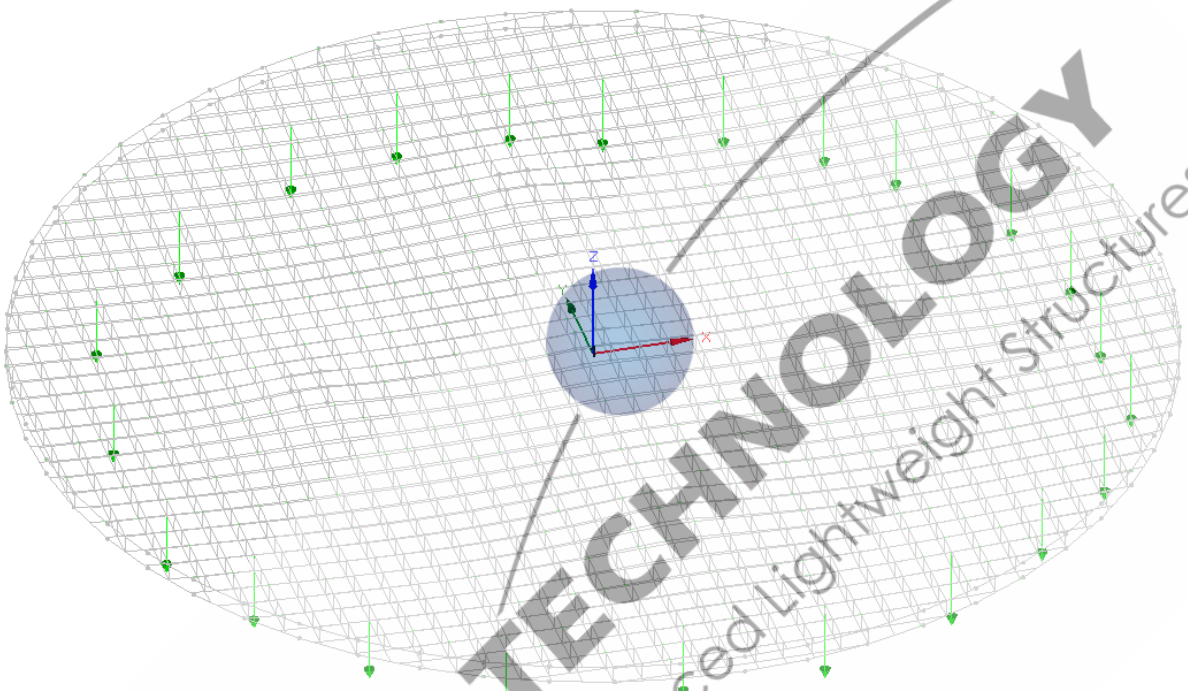
**LC02 Innner pressure, self weight and equal distributed load of 10 kg/m2**

Under a distributed load of 10 kg/m2, the stress in lower fabric increases. Along the perimeter this will be around 3.5 kN/m'. This gives a safety margin of 8.25/3.5 = 2.4

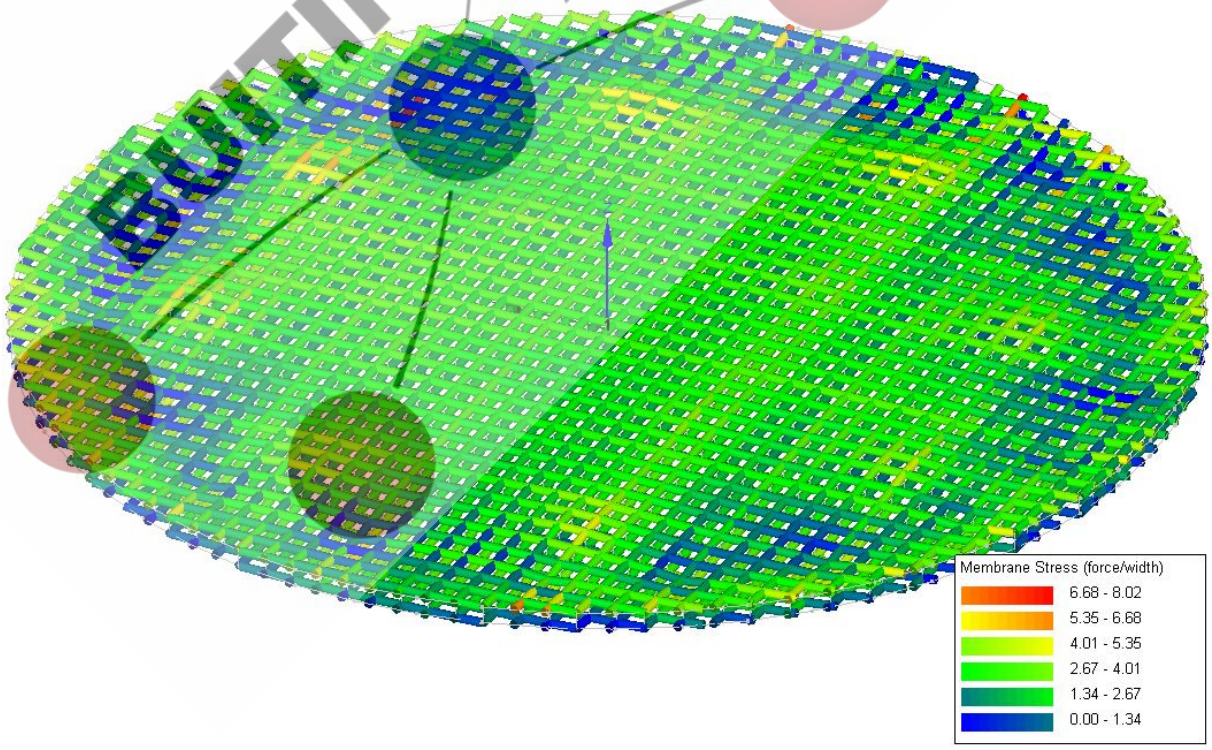


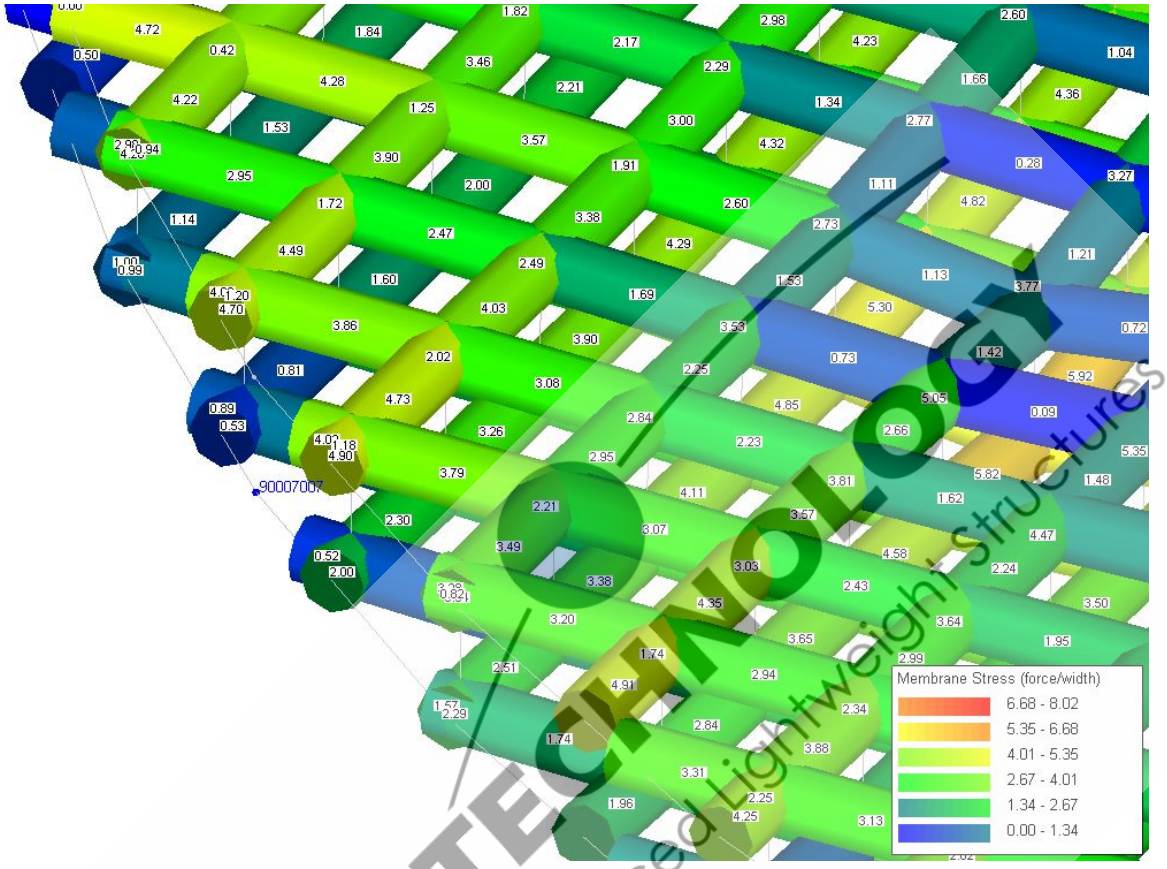
**LC03 EG+ V + point loads**

To model people walking on the platform, pointloads are introduced with a magnituede of 1.5 kN. This corresponds to a person with equipment of 150 kg. There are 23 people modelled with a total load of 3450 kg.




This causes of course deformation and larger stresses along the perimeter, but not that much.






Along the perimeter the stresses go up to max 5 kN/m', resulting in a safety margin of 8.25 / 5 = 1.65

**Conclusion:**

By supporting the fabric platform at regular distances of approximately 5m, using an inner pressure of 500 mbar, results in a work platform that can be used by persons with a maximum load of 150 kg including equipment.

The inner pressure of 500 mbar generates enough compression force to the silo wall to garantuee the position of the platform in the tank.

It is advised to locate the working area within a distance of 3m from the perimeter as the platform will be the most straight in this area.

Part of the safety concept will be the life lines that are used by the persons.