ANALYSIS REPORT OF 1550 KN FIXED BEARING

TITLE : - ANALYSIS REPORT FOR 1550 KN FIXED BEARING REPORT

Report no : - LLX-PPB-03-2021-FXB-01

Summary: -

Analysis was done to find the stress levels incurred in the bearing at various parts, it was found that the stress levels in the pot and piston where 398.76 Mpa and 361.91 Mpa respectively which is slightly above the yield strength of the cast steel but below the ultimate tensile strength of the material. And for the rest of the parts were found in the acceptable range.

Model: -

Bill of material: -

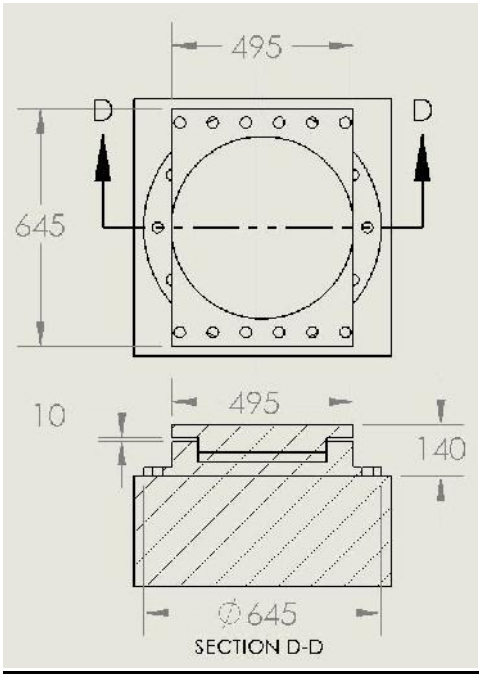
Sl. No.	Description	Size (mm)	Material	Qty (Nos)
1	POT	645 x 645 x 95	CAST STEEL	1
2	PISTON / TOP PLATE	645 x 495 x 74	CAST STEEL	1
3	ELASTOMERIC PAD	350 x 350 x 28	NEOPRENE	1
4	BRASS RINGS	350 x 350 x 2	BRASS	2

Model details: -

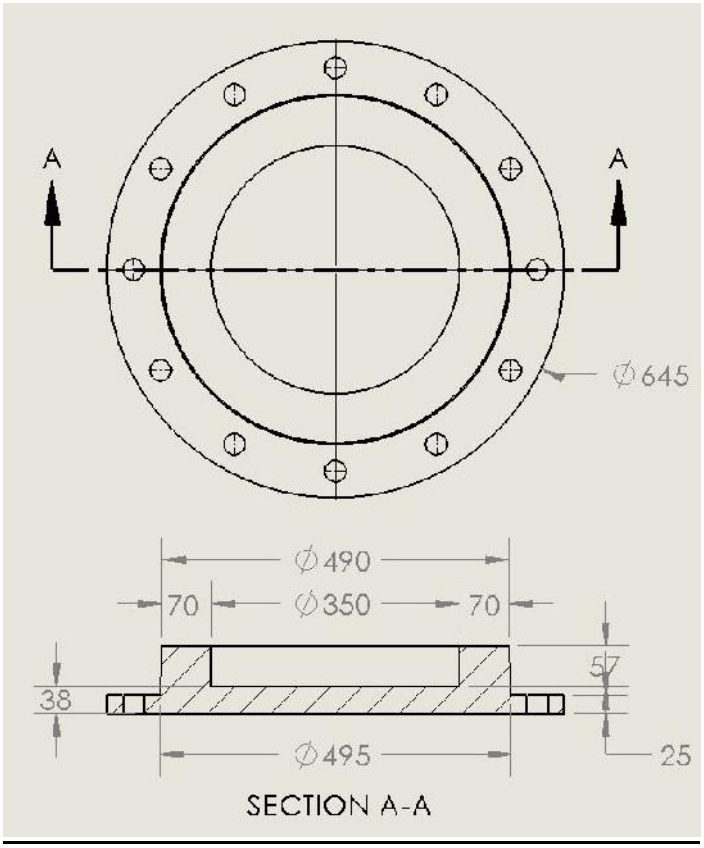
- Total number of nodes: - 31356
- Total number of elements: - 14790
- Type of analysis: - Static analysis

Part details: -

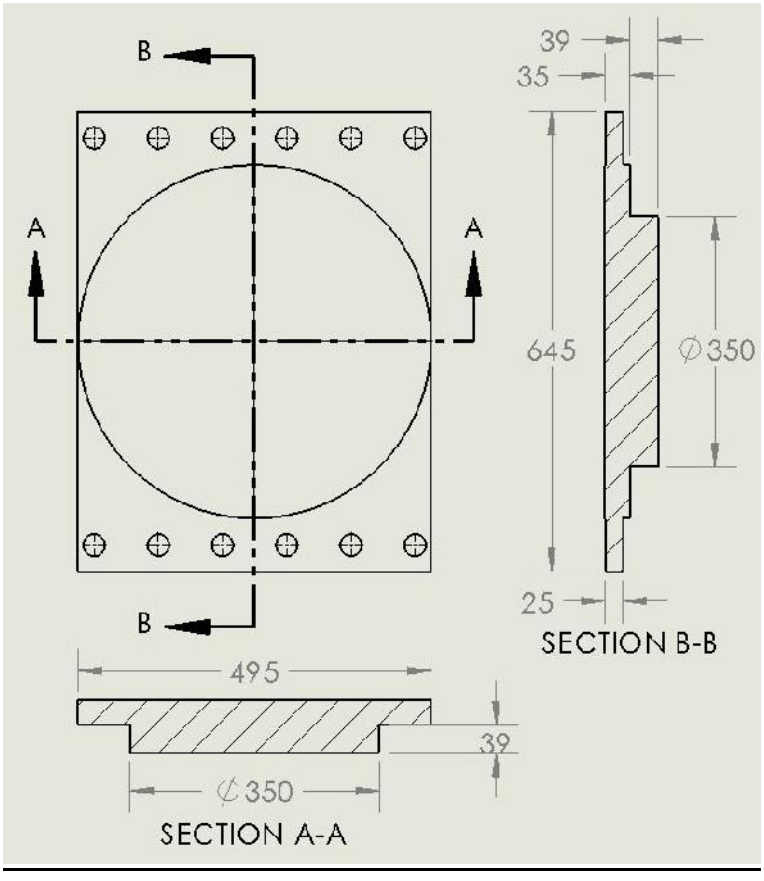
i. Assembly



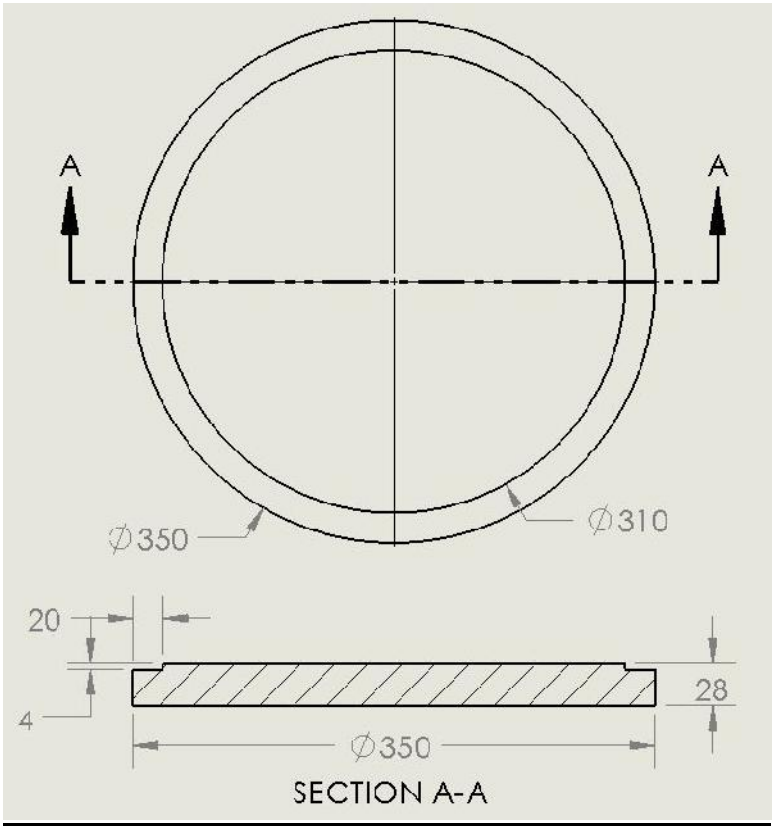
ii. Pot



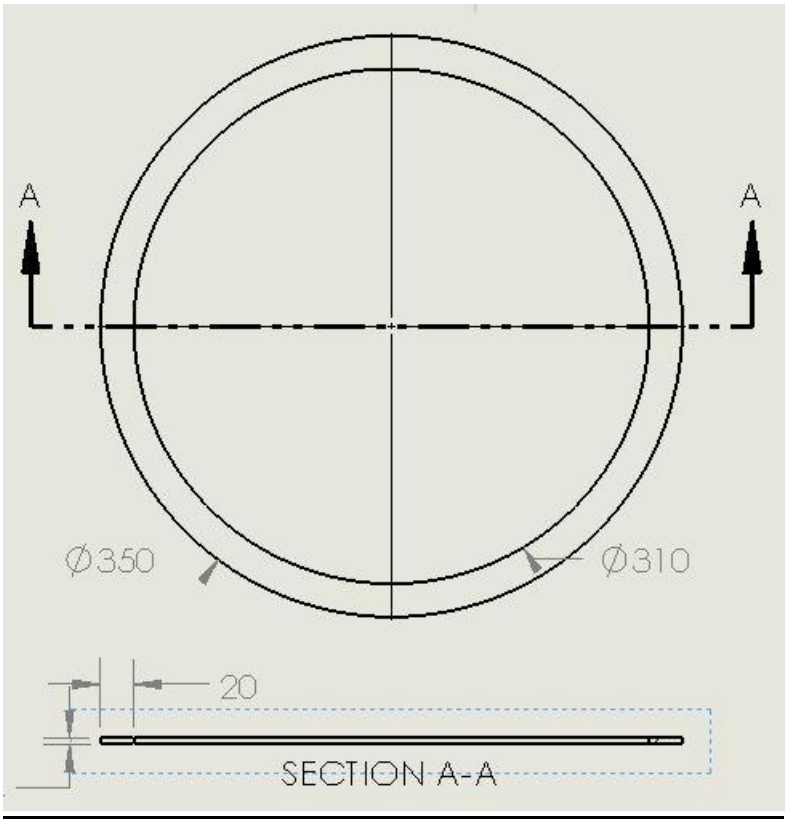
iii. Top plate



iv. Elastomeric pad



v. Brass rings



Assumptions: -

- Brass rings are considered as one whole entity.
- There is no clearance between pot inner diameter and piston outer diameter.
- Load application is considered as surface effect on the effective diameter on the top surface.

Material data: -

1. **Cast steel: -**
   - Density: - 7854 kg/m^3
   - Tensile yield strength: - 340 Mpa
   - Ultimate tensile strength: - 570 Mpa
   - Young's modulus: - 21,000 Mpa
   - Poisson's ratio: - 0.3
   - Bulk modulus: - 16,667 Mpa
   - Shear modulus: - 7,692.3 Mpa
2. **Neoprene: -**
   - Density: - 140 kg/m^3
   - Young's modulus: - 1.4 * 10^{-3} Mpa
   - Poisson's ratio: - 0.45
   - Bulk modulus: - 4.667 * 10^{-3} Mpa
   - Shear modulus: - 4.8276 * 10^{-4} Mpa
3. **Brass: -**
   - Density: - 8267 kg/m3
   - Tensile yield strength: - 367.4 Mpa
   - Ultimate tensile strength: - 502 Mpa
   - Young's modulus: - 99,950 Mpa
   - Poisson's ratio: - 0.345
   - Bulk modulus: - 107,470 Mpa
   - Shear modulus: - 37,156 Mpa
4. **PTFE: -**
   - Young's modulus: - 540 Mpa
   - Poisson's ratio: - 0.46
   - Bulk modulus: - 2,250 Mpa
   - Shear modulus: - 184.93 Mpa
5. **Concrete: -**
   - Density: - 2300 kg/m3
   - Tensile ultimate strength: - 5 Mpa
   - Compressive ultimate strength: - 41 Mpa

- Young's modulus: - 30,000 Mpa
- Poisson's ratio: - 0.18
- Bulk modulus: - 15,625 Mpa
- Shear modulus: - 12,712 Mpa

Loading conditions: -

Vertical load: - 1550 KN

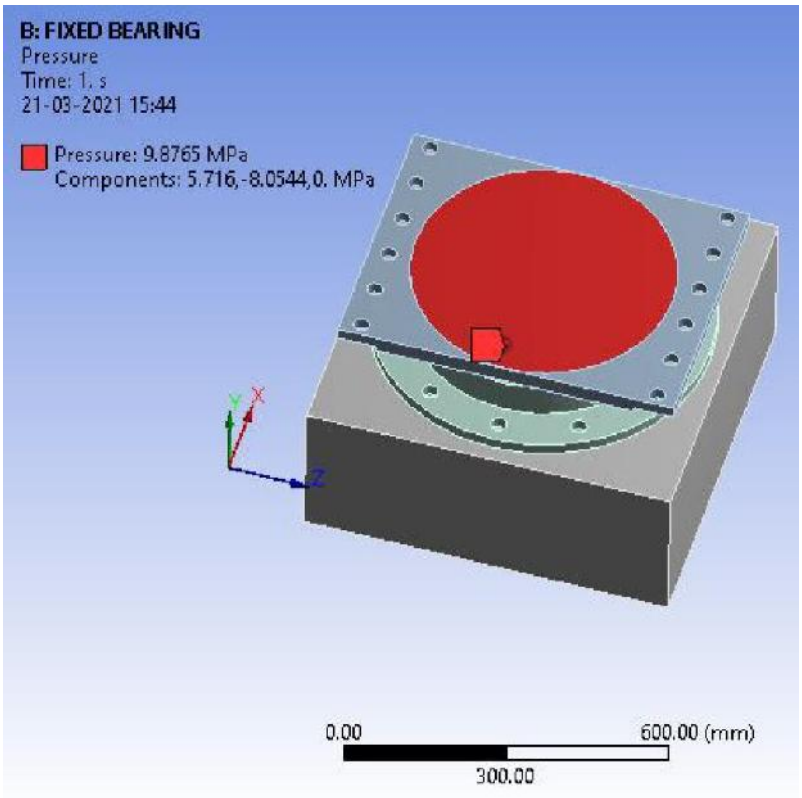
Pressure due to vertical load on bearing: -

= 1550 * 1000 / (π * 495^2 / 4) = **8.0544 Mpa**

Horizontal load: - 1100 KN

Pressure due to horizontal load on bearing: -

= 1100 * 1000 / (π * 495^2 / 4) = **5.7160 Mpa**

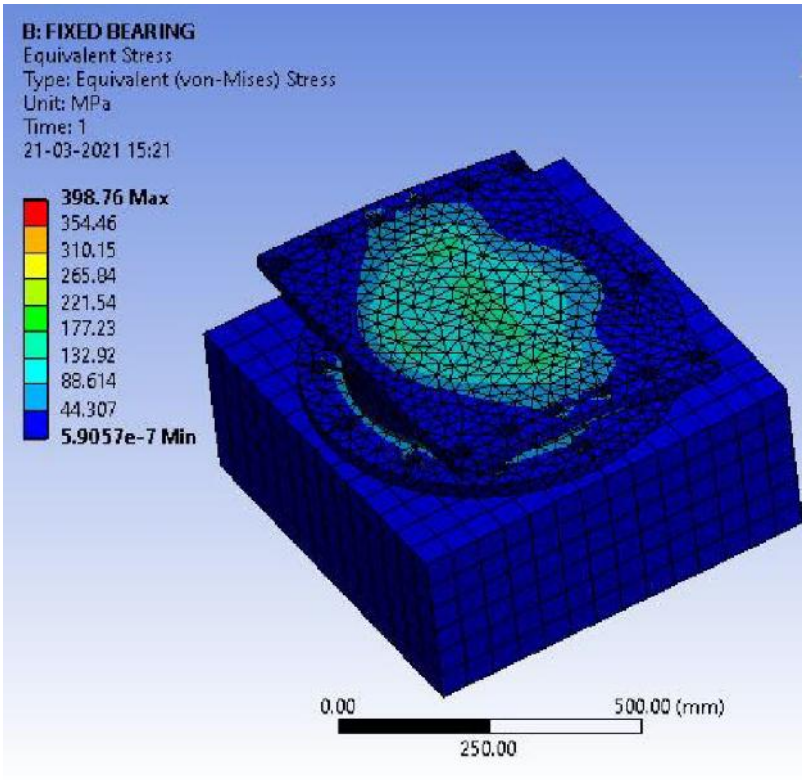


Constraints: -

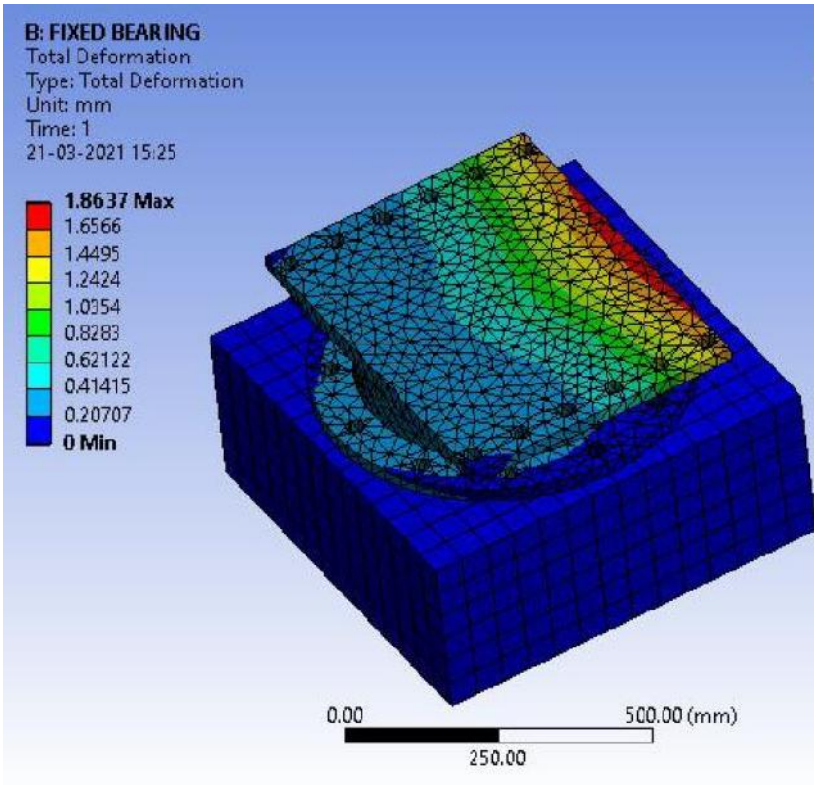
- Bottom of the concrete is considered as fixed support and there are no external supports in the model elsewhere.

Results: -

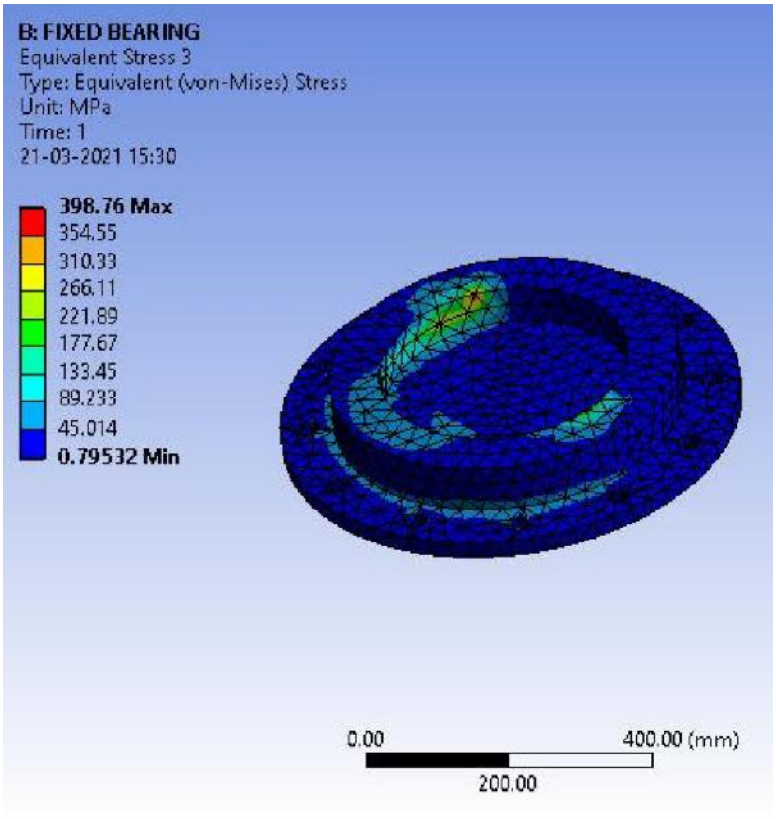
Equivalent stress on the bearing: -



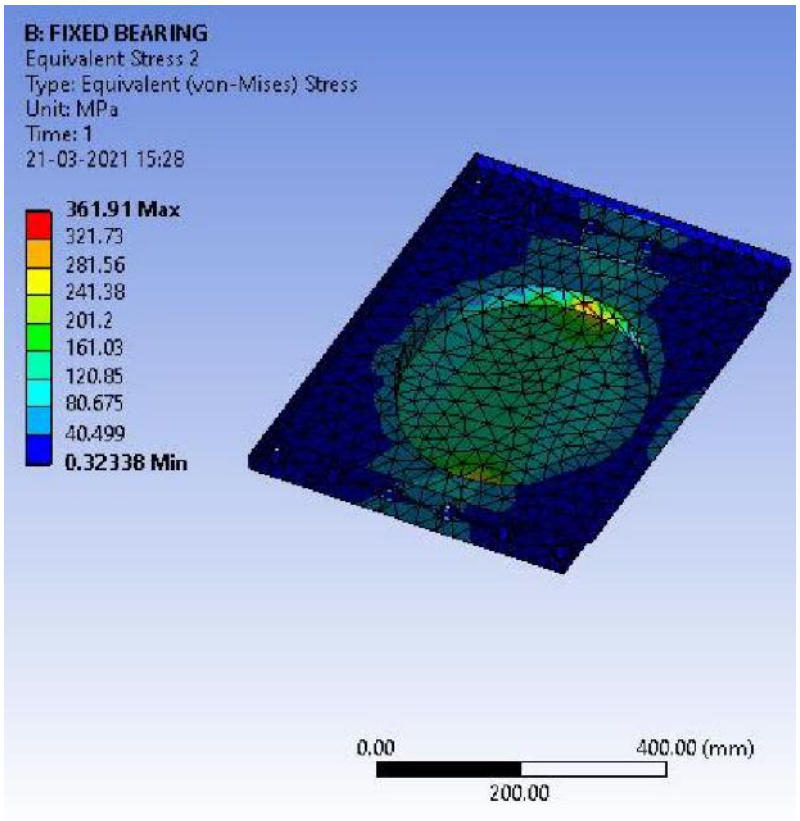
Total deformation on the bearing: -



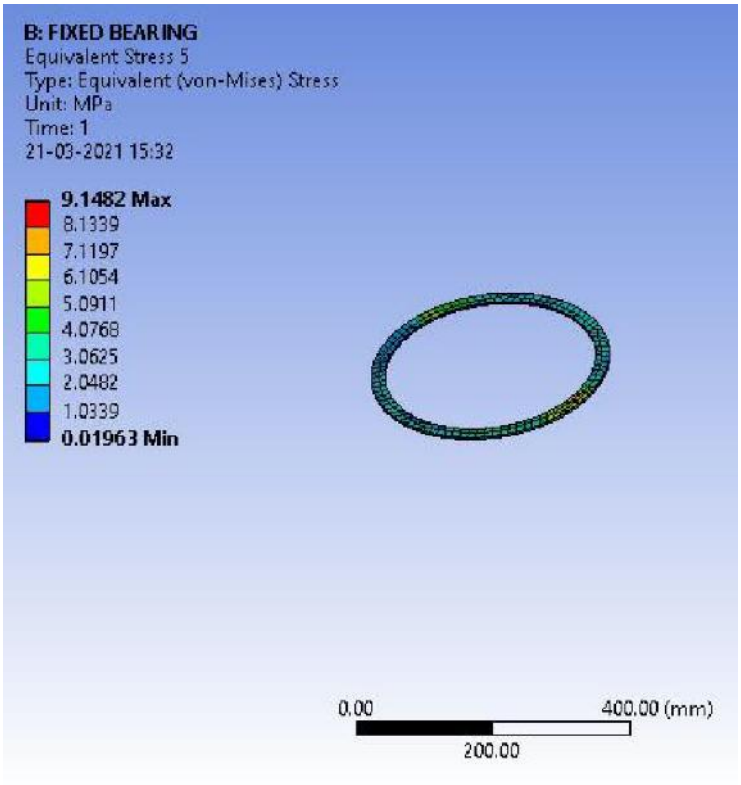
Equivalent stress on the pot: -



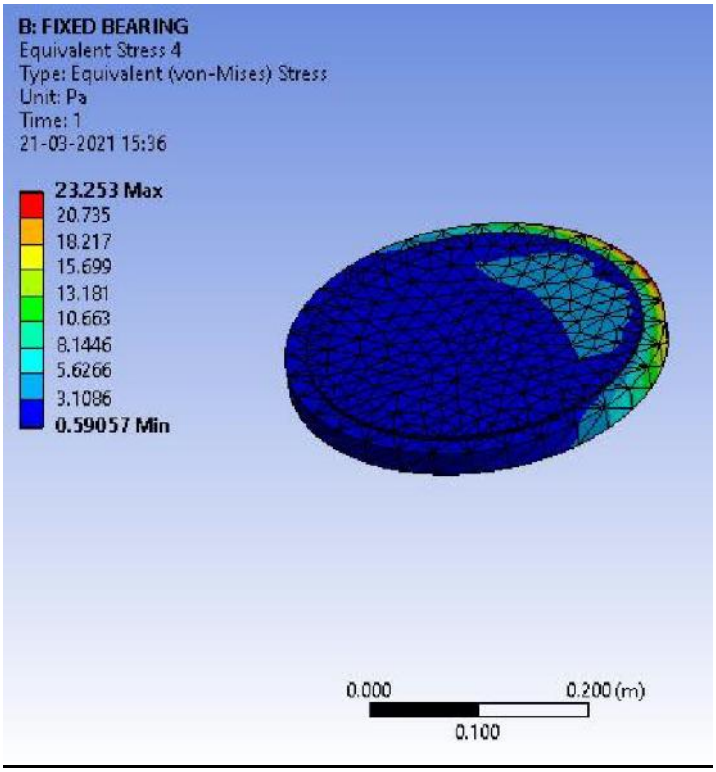
Equivalent stress on the top plate: -



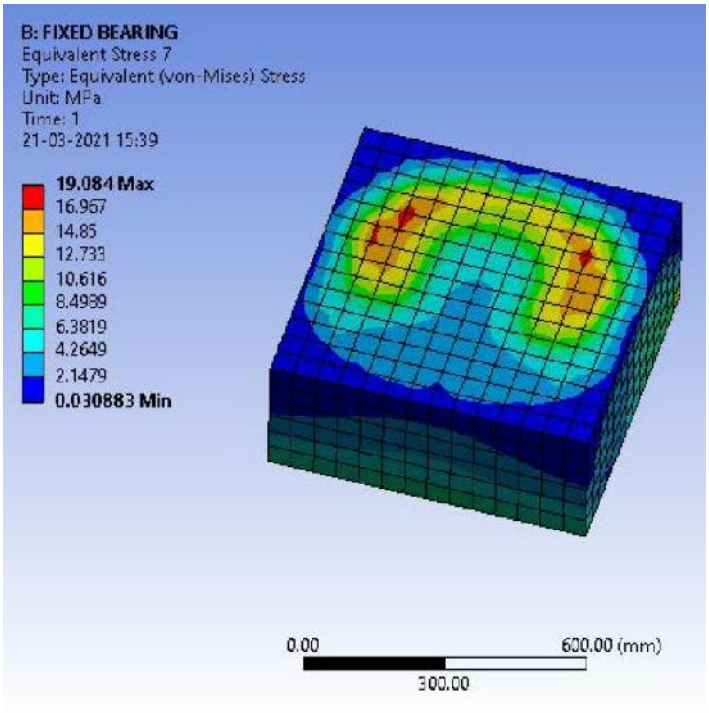
Equivalent stress on the brass rings: -



Equivalent stress on the elastomeric pad: -



Equivalent stress on the concrete: -



Conclusion: -

From the above analysis it is found that stress levels on the pot and piston is above yield strength of the material used (cast steel) where the yield strength is 340 Mpa. In case the design can be accepted in the case of ultimate tensile strength since the bearing is subjected to ultimate limit state then the bearing can be accepted.

Since the stress levels on concrete is 19.084 Mpa any grade above M25 would be preferable.

And for the rest of the parts in the bearing the stress induced in these parts is below the yield stress of these materials hence no need to change the grade of these materials

References: -

i. IRC 83 – PART III – 2018

********** THE END **********