# Design and Analysis of Concrete Mixture Cylinder

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## ABSTRACT

*Concrete mixture is a device that homogenously combines cement, aggregate such as Sand or gravel and water to form concrete. In this project the strength analysis and structural analysis of concrete mixture cylinder is investigated by finite element analysis (FEA). The software's used are PRO-E 4.0, HYPERMESH-10 and ANSYS-11. The result of analysis revealed that remarkable deformations and stresses occurred along the y direction and z direction. To analyze the concrete mixer cylinder under the concrete loads. The stresses in concrete mixer and simulations are below yield strength by reducing the thickness of the cylinder from 10mm to 6mm.*

## 1. Introduction

Concrete mixer also commonly called as an cement mixture is a device that homogenously combines cement aggregate such as gravel or sand with water to form concrete



## 2. Description

In this work static analysis of the concrete mixture cylinder is carried out. In the static analysis, the parameters such as the thickness of the cylinder. In static analysis the concrete load is converted in to pressure load and applied on the concrete mixture cylinder.

In this design, we need to design the concrete mixture cylinder in such way that it should withstand for concrete loading. By varying the thickness of the same cylinder and the von misses stresses and factor of safety are studied for this design.

**Material properties of Mild steel**

Young's modulus = 20 MPa
Poisson's Ratio = 0.3

Ultimate tensile strength=600MPa

## 3. Modeling and Meshing

The chosen problem is considered as 3-D solid model. With the dimensional parameters the structure is modeled in Pro-E wildfire3.0 modeling software as shown in Fig.1. The model is meshed for further analysis using a meshing package hyper mesh 10 with Shell63.
The model consists of 4926 elements with 4994nodes.Fig.2.shows FE model of the concrete mixture cylinder under loading and subjected to constrain. Fig 3.shows the Shell 63element considered for meshing. The shell63 is defined by four nodes and each node is having six degrees of freedom (UX, UY and UZ) at each node translations in the nodal x, y and z directions, and rotations about the nodal x,yand z directions. The element has Plasticity, Creep, Swelling, Elasticity, Stress stiffening, Large deflection, Large strain, Adaptive descent, Initial stress import capabilities.

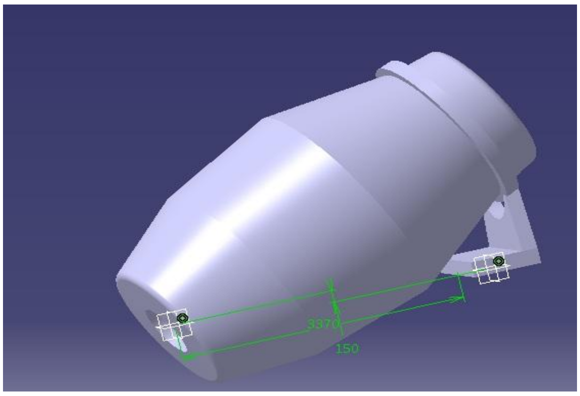

**Fig 1. Solid model of Concrete mixture cylinder**

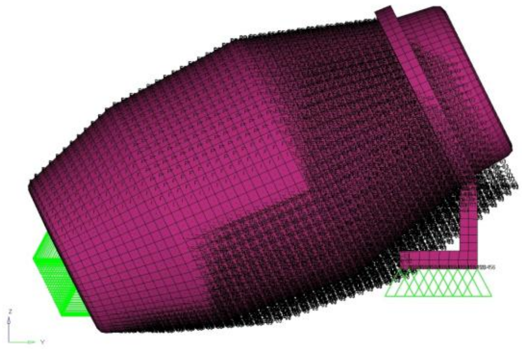

**Fig 2. Finite Element model with boundary conditions on concrete mixture cylinder**

**Table 1. Mesh is created in hyper mesh with following quality parameters**

| | |
|---|---|
| Aspect Ratio | 11 |
| Tet collapse | 0.11 |
| Length | 5 |
| Min. angle of trias | 20 |
| Max. angle of trias | 125 |

**Table 2. Static Analysis of Concrete mixture cylinder when the thickness of the cylinder is 10mm**

| Name | Results as per Analysis | Allowable stresses /deflection | Reference figure |
|---|---|---|---|
| Displacement in X-direction, mm | 0.131 | 2.0 | 4 |
| Displacement in Y-direction, mm | 0.677 | 2.0 | 5 |
| Displacement in Z-direction, mm | 0.253 | 2.0 | 6 |
| Stress in X-direction, MPa | 34.18 | 400 | 7 |
| Stress in Y-direction, MPa | 15.09 | 400 | 8 |
| Stress in Z-direction, MPa | 45.18 | 400 | 9 |
| vonMisses stress, MPa | 49.38 | 400 | 10 |
| Factor of safety(F.O.S) | 12.16 | | |



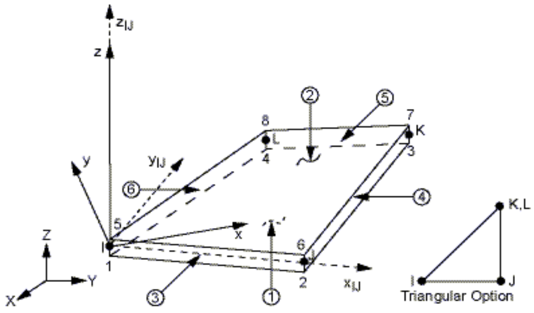


**Fig 3. Shell 63 element**

## 4. Concrete Mixture Cylinder Static Analysis

Static analysis was carried out to know the displacements and stresses of the concrete mixture cylinder by applying the concrete loading.

## 5. Discussion

### 5.1 Static Analysis:

Static Analysis of Concrete mixture cylinder made with mild steel is performed. Displacements in X, Y and Z directions are shown in Fig.4, Fig.5 and Fig.6 respectively.Fig.7 shows stress in X direction. Stress in Y direction is shown in Fig 8. Fig.9 shows stress in Z direction. The vonmises stress of the concrete mixture cylinder with thickness as 10mmshown in Fig.10.

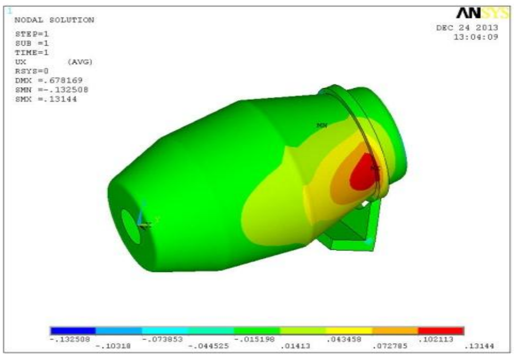


**Fig 4. Displacement in X- direction**

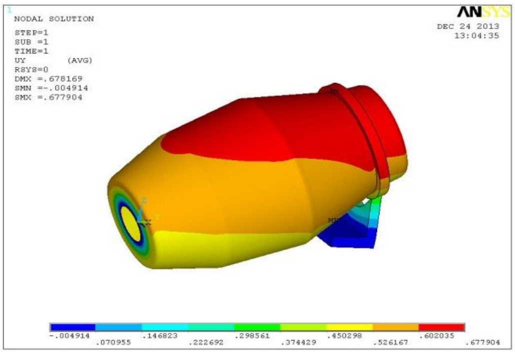


**Fig 5. Displacement in Y- direction**

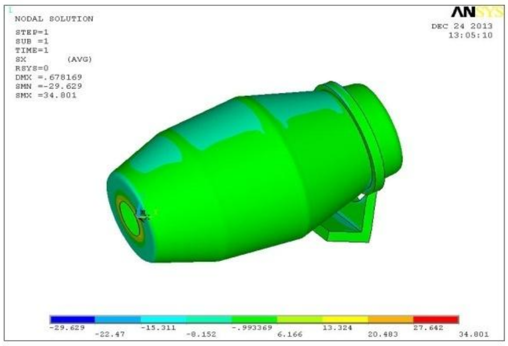


**Fig 7. Stress in X direction**

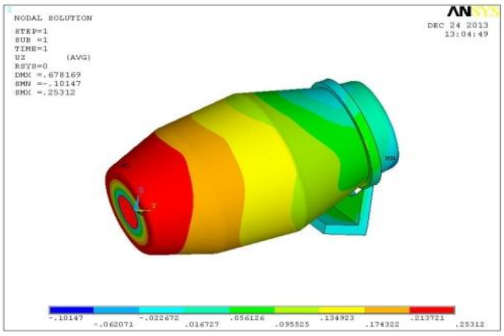


**Fig 6. Displacement in Z- direction**

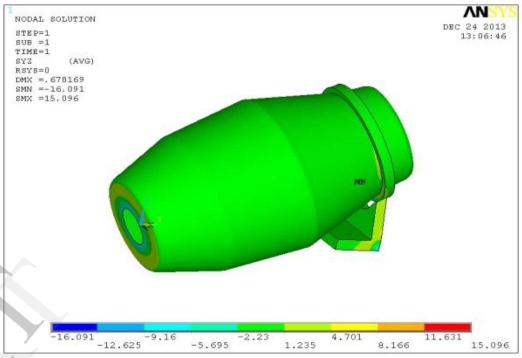


**Fig 8. Stress in Y direction**



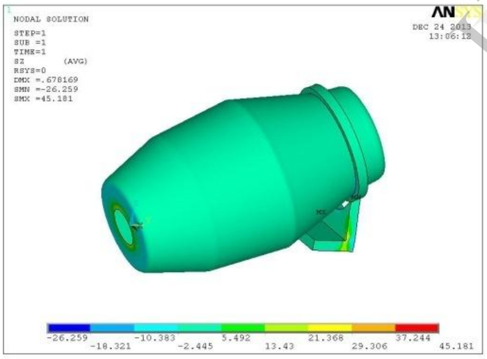


**Fig 9. Stress in Z direction**

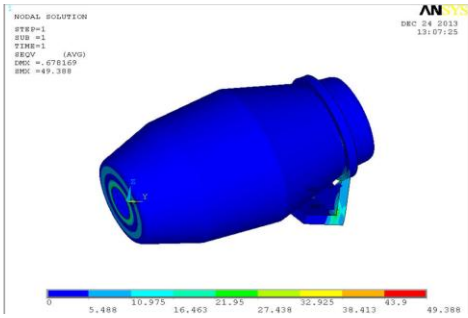


**Fig 10. Vonmises Stress**

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### 5.2. Static analysis of concrete mixture cylinder The thickness of the cylinder reduced from 10mm To 6mm

Static analysis of concrete mixture cylinder made up with mild steel when the thickness of the cylinder is 6mm performed. Displacements in X, Y and Z directions are shown in Fig.11, Fig.12 and Fig.13 respectively.Fig.14 shows stress in X direction. Stress in Y direction is shown in Fig. 15. Fig. 16 shows stress in Z direction. The Vonmises stress of the exhaust manifold shown in Fig. 17

**Table 3: Static analysis of concrete mixture cylinder when the thickness of the cylinder is 6mm**

| Name | Results as per Analysis | Allowable stresses /deflection | Reference figure |
|---|---|---|---|
| Displacement in X-direction, mm | 0.161 | 2.0 | 11 |
| Displacement in Y-direction, mm | 0.794 | 2.0 | 12 |
| Displacement in Z-direction, mm | 0.299 | 2.0 | 13 |
| Stress in X-direction, MPa | 36.29 | 400 | 14 |
| Stress in Y-direction, MPa | 25.29 | 400 | 15 |
| Stress in Z-direction, MPa | 47.53 | 400 | 16 |
| Vonmises stress, MPa | 51.99 | 400 | 17 |
| Factor of safety(F.O.S) | 11.54 | | |

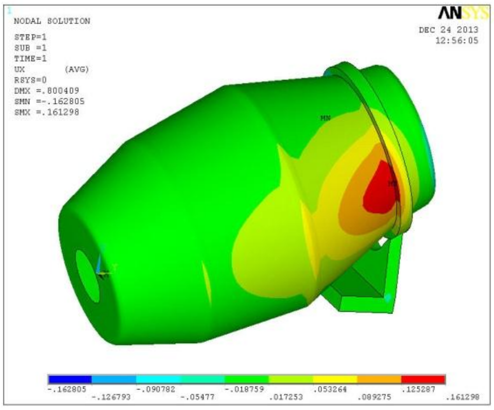


**Fig 11. Displacement in X- direction**

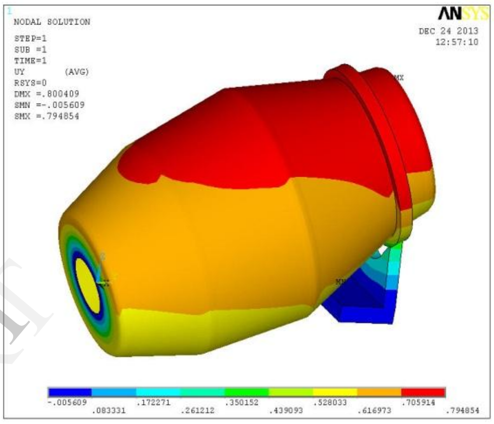


**Fig 12. Displacement in Y- direction**

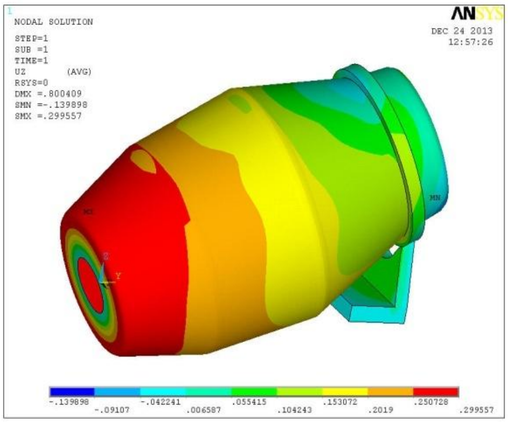


**Fig 13. Displacement in Z- direction**

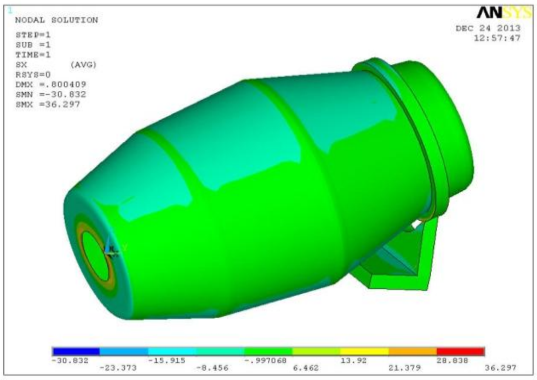


Fig 14. Stress in X direction

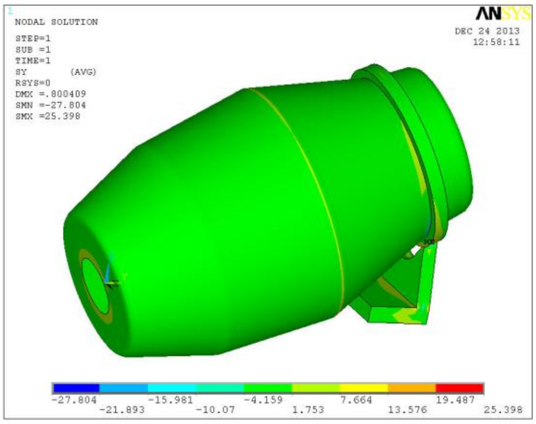


Fig 15. Stress in Y direction

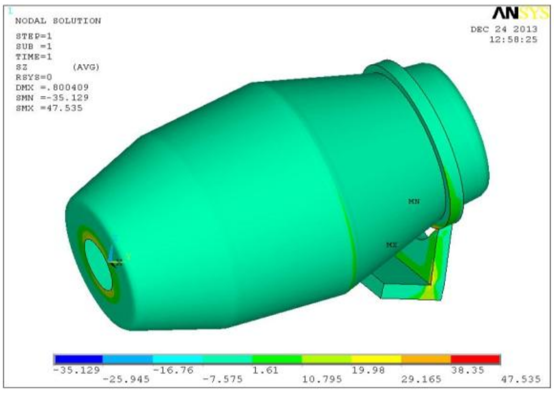


Fig 16. Stress in Z direction

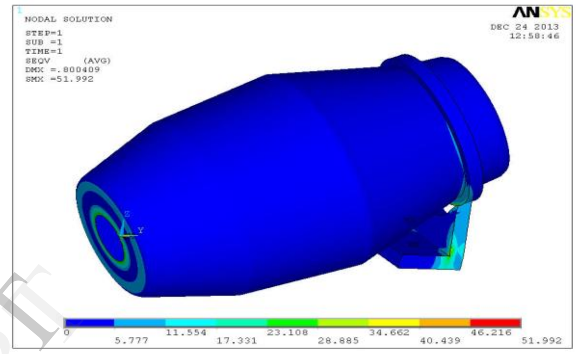


Fig 17. Vonmises Stress



## 6. Conclusion

The following conclusions are drawn from the present work.

1. The maximum displacement induced 0.677 mm along y axis in a cylinder of thickness 10mm

2. The maximum stress induced is 49.38MPa which is less than allowable limits of 400MPa. Hence the factor of safety is 12.16.

3. The maximum deflection induced 0.794 mm along y axis under the same loading condition in the same cylinder when the thickness is6mm.

4. The maximum stress induced is 51.99 MPa which is less than allowable limits of 600 MPa. Hence the factor of safety is 11.54

## 7. References

[1]. MIKLÁNEK Ľ. (2004). Analysis of Sensors Locations in Engine Exhaust Manifold, In: AED 2004, Glasgow, 2004, ISBN 80-86059-41-3

[2]. TAKÁTS M. (2003). INTEC – software for evaluation of in-cylinder pressure record (Josef Božek Research Center Code Library, CTU Prague)

[3]. AVL (1993). Engine indicating with piezoelectric transducers. Handbook AT0157E. AVL List GmbHLI Ke-an(Department of Mechanics and Electricity, Hunan Institute of Science and Technology,Yueyang,Hunan 414000,China);Finite Element Analysis on the Rear Axle Housing of Vehicle[J];Hunan Vocational College for Nationalities;2007-04

[4]. ZHANG Lei, GUO Yaobin (Construction and environment engineering college University of Science and technology Beijing, Beijing 100083);Structural Analysis for Drive Axle

Housing of Dump Truck[J];Modern Manufacturing Technology and Equipment;2007-03

[5]. Zheng Yanping1, Wang Yu2, Song Huailan2 (1.Nanjing Forestry University; 2.Yuejin Automobile Co., Limited); Study on CAE Design Method for Driving Axle Housing [J]; Automobile Technology; 2007-06

[6]. ZHU Mao Tao HAN Bing(School of Automobile and Traffic Engineering, Jiangsu University, Zhenjiang 212013,China);prediction of fatigue life distribution of drive axle housing of farm transport vehicle[J];Journal of Mechanical Strength;2008-01

[7]. Bench Test Based on FEA. J. Natl. Univ. Defense Technol., 31: 106-108. (In Chinese).

[8]. Gao J, Song J (2008). Fatigue Life Prediction of Vehicle's Driving Axle House Under Random Loading. J. Mech. Strength, 982-987.