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ANALYSIS OF DESIGNING AND FAILURE OF CONCRETE MIXER MACHINE BLADES

Diva Sinde[*1], Pallavi Jain[*2]

[*1]PG-Student, Department Of Mechanical Engineering, Bapurao Deshmukh College Of Engineering, Sewagram,Wardha, Maharashtra, India.

[*2]Professor , Department Of Mechanical Engineering, Bapurao Deshmukh College Of Engineering, Sewagram,Wardha, Maharashtra, India.

ABSTRACT

In today era the construction is on its unmatchable prores and continue. This analysis is to optimize the design of blades of concrete mixer machine. Mixer blades directly affect the mixing performance. Good mixing performance obtain by designing the mixing arm and mixing blade Mixing blades force the Concrete material along the circumference for mixing, and also along the shaft for transport during the mixing process While mixing concrete material, machine blades does not mix mixture uniformly and pull all material on one side cause high stresses induced in blade & blade get breaks. Also low quality concrete mixture reduce the efficiency of concrete mixer machine. Present design of blades is not strong enough to bear stresses & not satisfactory for making mixture. So this study is made for Design And Failure Analysis Of Blades of concrete mixer to make it effective. Study done on existing concrete machine blades & with the help of existing blades, modified blades design.by making this study blades work more effectively, uniformly mixes all material & increases efficiency of machine. To evaluate the analysis of model are done on ansys.

Keywords: Horizontal shaft concrete mixer machine, T shape blade of concrete mixer.

1. INTRODUCTION

In concrete mixer machine rotating blades mix concrete material uniformly. It has been observed that the blades of mixer not mix concrete mixture uniformly also blade ger break . While working of machine, concrete mixture between blades remains unmixed. Existing blade design push all concrete material unevenly causes high stresses on one blade & blade get break. So in this project research is done to identify the causes of blade failure & modified design of existing blade which is capable to withstand heavy stresses.

2. METHODOLOGY

Problem identified in concrete mixer machine related to Failure of blade at Wainganga Spun Pipe Industry, Sewagram. For pipe making its important that the concrete mixer should be effectively working. In Wainganga Spun Pipe Industry. But it has been observed that the blades of mixer not mix concrete mixture uniformly. Also present design of blade is not effective & stronger.It is observed that the blade of mixer machine break due to overloading of input mixture only at one side and various forces acts on it. This results into low quality of concrete mixture. So in this project I am researches to identify the different causes of blade failure & design such blade which is effective & strong.

Design data related to dimensions and process of concrete mixer machine gathered from Wainganga Spun Pipe Industry, Sewagram. Study The Present Design Of Blades & Machine. Takes information about concrete mixture machine machine working, background information about machine, electric motor specification, amount of concrete material fed into concrete mixer machine from production in charge. Take dimensions of various part of concrete mixer machine like blade assembly, gear & pinion teeth measurement , mixing tank measurement, shaft measurement, with the help of measuring tape . Then Draft 2D diagram of concrete mixture machine. Blade assembly is total combination of blade, arm, blade mounting plate (upper plate, bottom plate with stiffener) & fixing bolts:

- There are 4 blade assemblies (T section) mounted on square shaft as shown in pictures. Blade is made up of Mild Steel material(A36 Grade)
- Blade assembly fixed at 85 degree with respect to axis of shaft.
- The peripheral speed of the paddles is approximately 167 RPM.
- Cross-sectional area of blade assembly=75530 mm^2 or 0.075530 m^2

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Figure 1 :- Blade Assembly in concrete mixer machine

3. MODELING AND ANALYSIS

Design Calculations Of Concrete Mixer Blade Assembly

Design of blade of mixer to modify the existing blade assembly by performing design calculations. Then after finding reasons behind the breaking of blade from various research papers and books I collected data about shear stress analysis and shear capacity strength of blade for calculations. I followed many research papers, books and design data book for material properties of blade to solve calculations.

Calculation of forces on blade assembly-

The loads exerted on the blade include:

- Centrifugal force f_c
- Pressure f_n
- Frictional f_f
- Gravity g
- Mass of concrete on 1 blade F_{CM}

Combining all force we get total force.

Calculation Of Stress On Blade Assembly-

Axial tensile load on blade (σ_t)=total load/ cross sectional area

Also shear force calculated.

Calculation of maximum shear stress & equivalent shear stress by von mises stress-

According to distortion energy theory)on existing blade by calculating maximum shear stress & Von mises stress, we know that all forces acts on blade is above the allowable stresses of blade.

CAD Modeling Of Design

Develop CAD model of modified machine by using CAD software. The designing of existing blade on the AutoCAD cad model and designing of Modified blade done.

Existing Design Of Blade-

There are 4 blade assemblies (T section) mounted on square shaft as shown in pictures.

Blade is made up of Mild Steel material(A36 Grade).

Weight of blade assembly= 10 kg

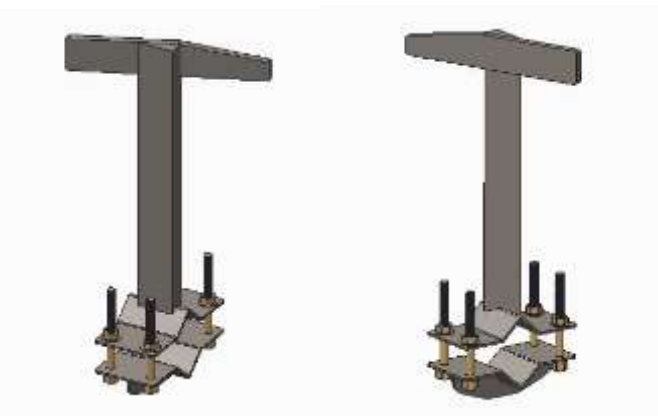

Figure:- Existing Design Of Blade

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Modified Design Of Blade-

Shape of blade arm changes from T section to Y section to make it more strong & as blade length increases it is capable to withstand total deformation, maximum shear stress & equivalent stress as shown in FEM result.

Cross-sectional area of y shape arm= 56850 mm^2

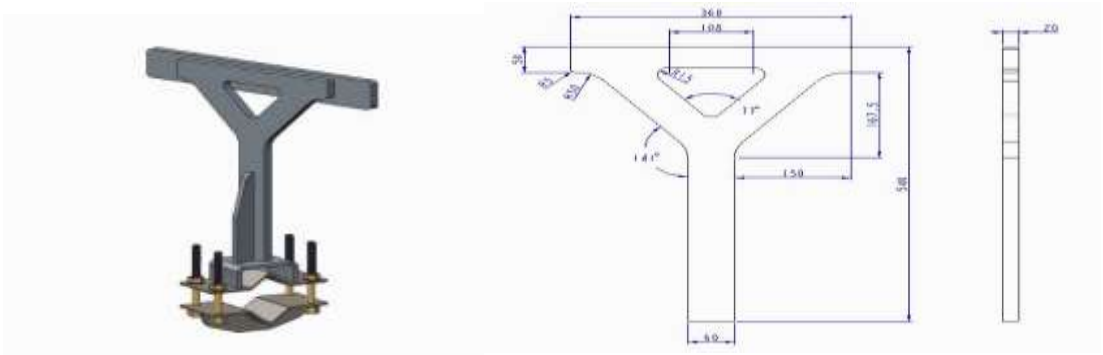

Figure:-Modified Design Of Blade With Dimension Of Arm (Y Shape Arm)

Finite Element Model Generation(Modified Design Of Blade)

To discretize a continuous body into Finite Elements, A finite element model of the machine generated by using CAD model in hyper mesh.

Geometry Of Blade

Figure:-Modified Design Of Blade CAD Model (Geometry)

Meshing

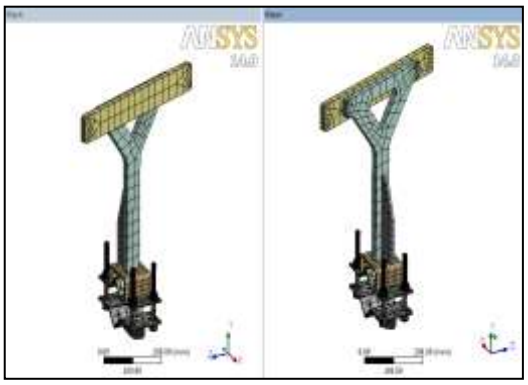

Figure:-Modified Design Of Blade CAD Model (meshing)

Meshing of blade assembly done. Mesh Type = Tetrahedral Mesh

Nodes=156118

Elements = 79115

Boundary Condition

a) Fixed Support
b) Force Applied(78780 N)

a) Fixed Support

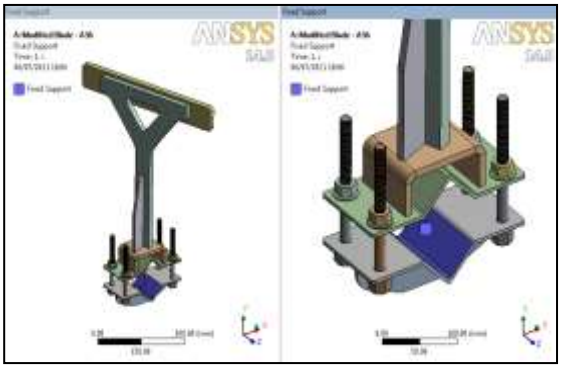

Figure :-Modified Design Of Blade CAD Model (fixed support)

b) Force

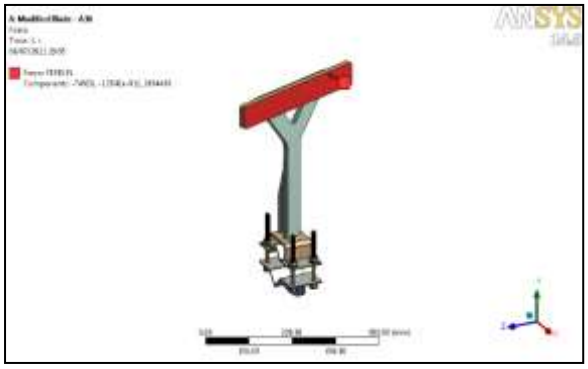

Figure :-Modified Design Of Blade CAD Model (force applied)

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Finite Element Analysis

A Linear Static analysis is performed, for finding displacement and stresses for different boundary conditions. In FEM analysis there are three inputs geometry, meshing and boundary conditions in boundary condition we give the data of loading, moment, after that it provide the results in the deformation, max shear stress , von- mises shear stress by comparing all values we can find out about the result .

- Material of blade is A36 Grade Steel

Material Properties

	Property	Value	Unit
1			
2	Density	7850	kg m^-3
3	Isotropic Elasticity		
4	Derive from	Young's Modul...	
5	Young's Modulus	2E+05	MPa
6	Poisson's Ratio	0.26	
7	Bulk Modulus	1.3889E+11	Pa
8	Shear Modulus	7.9365E+10	Pa
9	Tensile Yield Strength	250	MPa
10	Tensile Ultimate Strength	400	MPa

Figure: A36 Material properties table

Total Deformation

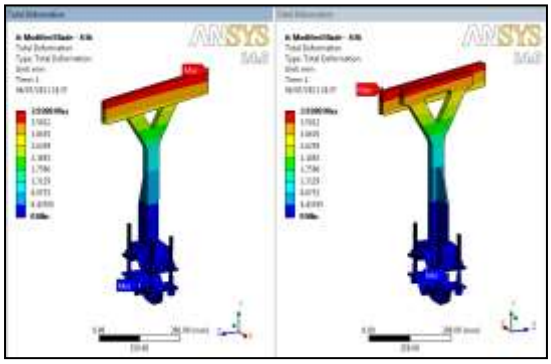

Figure: Total Deformation Developed On Modified Blade

Max Shear Stress

Figure: Maximum Shear stress developed on Modified blade

Von-Mises Stress

Figure: Equivalent stress developed on Modified blade.

After applying different boundary conditions analysis is carried out. Maximum shear stress observed is 116.05 Mpa which is lower than allowable stress. Thus blade design is safe.

Equivalent stress of blade is 228.7 MPa which is lower than allowable stress. Thus blade design is safe.

4. RESULT DISCUSSION

In a modified blade assembly thickness of blade increases from 15 mm to 20 mm to sustain deformation of blade. Also width of modified blade is increased to its now mixes more concrete uniformly .so there is no concrete remains between gap of two blades. Additional stiffener support gives to the modified blade arm. So now it not break as it capable to withstand heavy shear stresses. Based on design calculations graphical representation 3D CAD model of blade assembly and Modified model is generated in Creo 2.0 and to validate the design a finite element analysis is carried out in ANSYS. From the results it is observed that max shear stress in blade assembly is found to be under allowable stresses and observed that the design is safe for the given loading conditions.

Table.1: Result comparison Between Existing Design & Modified Design of Blade with same material & same force.

Existing Design = A36 Steel Material (F=78780 N)	Total deformation(mm)	23.49
	Max shear stress(Mpa)	365.14
	von-mises stress(Mpa)	687.62

Modified Design = A36 Steel Material (F=78780 N)	Total deformation(mm)	3.93
	Max shear stress(Mpa)	116.05
	von-mises stress(Mpa)	228.73

5. CONCLUSION

After the complete analysis the results of finite element analysis, we can see the stresses developed in the design are within the allowable stress which results in safe design. Modified blade of machine is safer & stronger to existing blade assembly and will become useful in effective concrete mixture making. The existing blade design which has high max shear stress value, high deformation value and high von misses stress value and low shear strength value the blade is found to fail. Through the study of the blade and using ansys software we found out the values and keeping with 6 cases we found out the best blade assembly design the shear failure will be overcome. The cases which are consider in this project with the calculations and stress analysis will help the other people to understand the design and analysis of blade assembly.

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