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# Design and Fabrication of Portable Motor Driven Concrete Mixing Machine: A Review

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***Abstract:*** ***The aim of our paper is design and fabrication of portable concrete mixture machine. Mixer widely used to make a concrete mixture which used to building construction and other industrial application such as concrete block, pipe, sheets, etc. As for all materials, the performance of concrete is determined by its microstructure. To determine the mixing method best suited for a specific application, factors to be considered include: location of the construction site. the concrete mixture machines which are currently available in the market is heavy and having big capacity of concrete mixing. Continuously and easy handling, we have fabricated this concrete mixture machine. The construction and building industries are expanding on a daily basis as a result of increase in human population and continually demand for shelter. Concrete which comprises mainly of sand, cement and gravel is an important component required for construction of houses and roads. However, most operation of mixing concrete in Nigeria is done manually as a result of lack of insufficient machinery and high importation cost. In this research, I carried out the design of a low-cost concrete mixing machine. The materials used in this research work are as follow; sand, gravel, water, mild steel, hopper, electric motor, shaft, bearing, V-belt, angle bar, mild steel plate, bolts and nuts, etc. In other to achieve a good design, feasibility studies, and preliminary tests were carried out. The materials selected for this design were justified.***
***Keywords: portable mixer, design model, mixing volume, power, torque, belt tension***

## I. INTRODUCTION

Concrete is a structural material widely used in the construction industry. It consists essentially of cement, fine aggregate (sand) and coarse aggregate (natural gravels or chippings). These constituent materials proportioned are properly mixed together with water to form the concrete. The cement serves as the binder to the aggregates while the aggregates serve as the filler materials that give strength to concrete. Concrete has the unique distinction of being the only construction material manufactured on the site, whereas other materials are merely shaped to use at the work site [1].

A concrete mixer machine is a device that homogeneously combines cement, aggregate such as sand or gravel, and water to form concrete [2]. A typical concrete machine mixer uses a revolving drum to mix the components. The compressive strength of concrete depends on the aggregate grading, aggregate/cement ratio as well as the water/cement ratio. The freshly mixed concrete should be workable to be properly placed and the hardened concrete needs to be durable and attain a specific compressive strength [3].

The aim of concrete mixer machine design is to achieve concrete that meets a specified strength. Concrete can be produced by employing either mechanical or manual mixing methods. In Nigeria like every other developing country, hand mixing which involves turning over the mixture of the concrete materials from one end of the mixing tray or platform to the other is a popular method of producing concrete. However, the end product obtained from manual mixing method possesses weak compressive strength. The compressive strength of concrete depends so much on the consistency achieved through mixing [4].

Based on the above-mentioned requirements, this review paper discussed design and fabrication of portable concreate mixer machine, we were planning for design and fabrication of a concrete mixer. This project brought advantages over manual mixing and expensive mechanized concrete mixer.

## II. WORKING PRINCIPLE OF CONCRETE MIXING MACHINE

A portable concrete mixer is a device that homogeneously combine concrete, aggregate such as sand or gravel, and water to form concrete a powered device that mixer concrete with water and aggregate, such as sand or pea gravel, to make concrete. A concrete mixer is comprised primary of motor, a rotating drum, and the materials used to make concrete spin around, mixing together evenly and remaining soft for application and forming. The stopper is fabricated to the main frame for operator or labour, here to this machine the inclination arrangement to concrete drum is provided so that raw material will get come outside.

## III. DESIGN OF CONCRETE MIXING MACHINE

Components Used: Components are chosen to maximize the product's output. The following are the components that are employed as follows.

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*A. Drum*

A concrete mixer is a device that homogeneously combines cement, conglomeration such as sand or gravel, and water to form concrete. A typical concrete mixer uses a revolving drum to mix the components. Cement, sand and other aggregates are loaded in a hydraulically operated hopper and then poured in the mixing drum for final mixing and then can be unloaded by tilting the drum.

*B. Motor Specification*

motor is used to rotate drum. The specification of motor are as follows:

Electric motor=0.5 HP

RPM of motor =1500

Shaft diameter= 20mm

Pulley diameter = 8.89mm

*C. Shaft*

Shaft of concrete mixer is mounted concentrically at the centre of the Drum. Electric Motor, Metal Bucket/ the mixing trough, Shaft Pulley, Motor Pulley, set of blades mounted on the shaft, Bearings, Shaft, Supporting flat belt.

*D. Pulley*

A pulley is wheel on axle or shaft that is design to support moment and change of direction of belt. A pulley is a simple machine that is used to lift heavy objects.

Specification:
Parameter= Pulley
Quantity=3
Material type=MS
Dimension=3inch,5inch,9inch

*E. Chain*

A series of linked metal rings use for fastening sequencing of atoms of the same type. A chain type of ring connected to fitted into one another and use for various purpose.

Specification:
Parameter =Chain
Quantity = 1
Material type =Cast iron
Dimension= 1916mm

*F. Blade*

The blade is flat cutting edge of knife saw, or other tool the flat wide section of an implement or device such a propeller a long, narrow leaf of grass or another similar plant.

## IV. DESIGN AND CALCULATION OF CONCRETE MIXING MACHINE

*A. Determination of Mixing Force of the Concrete*

The mixing force of the concrete was calculated as follow:

$W = MT \times g$ (1)

where,

MT = Total Mass = Mass of concrete + Mass of mixing drum

g = Acceleration due to gravity = 10m/sec2

But, Maximum mass of concrete the mixing drum can take = 40kg (Measured)

Mass of drum = 5kg (Measured)

Therefore,

Total Mass MT =$40kg + 5kg = 45kg$

Therefore,

Weight required by the grating machine $W = MT \times g = F$ [8]

*B. Determination of Volume of Mixing*

The volume of the mixing chamber is calculated as follows:

$VmC = \pi r\ 2h$ (2)

where,

Vmc= Volume of mixing chamber

r = Radius of cylinder

h = Height of cylinder

*C. Design for Speed Ratio*

The velocity ratio for belt drive is the ratio between the velocity of the driver and the follower (driven). It may be expressed mathematically as:

$N2\ /N1 = D1\ /D2$ (3)

where;

D1 = diameter of the driver

D2 = diameter of the driven

N1 = speed of the driver

N2 = speed of the follower =?

Therefore;

*D. Determination of Torque*

The torque is obtained from the equation as follow:

$T = Fl$ (4)

where;

T = Torque

F = Force

L = Length of the paddle

*E. Determination of Power*

The power requires mixed the concrete is the power that turns the shaft and is calculated as follow:

$P = FV$ (5)

But;

$V = \pi DN\ 60$ (6)

Equation becomes:

$P = F\ \pi DN\ 60$ (7)

where;

P = Power to turn the shaft

V = Speed

F= Force

D= Diameter

N= Speed in revolution per minute

*F. Design of Shaft*

Td = 60PKL/2πN

TD= Design torque

KL= Load factor=1.75 for line shaft[8]

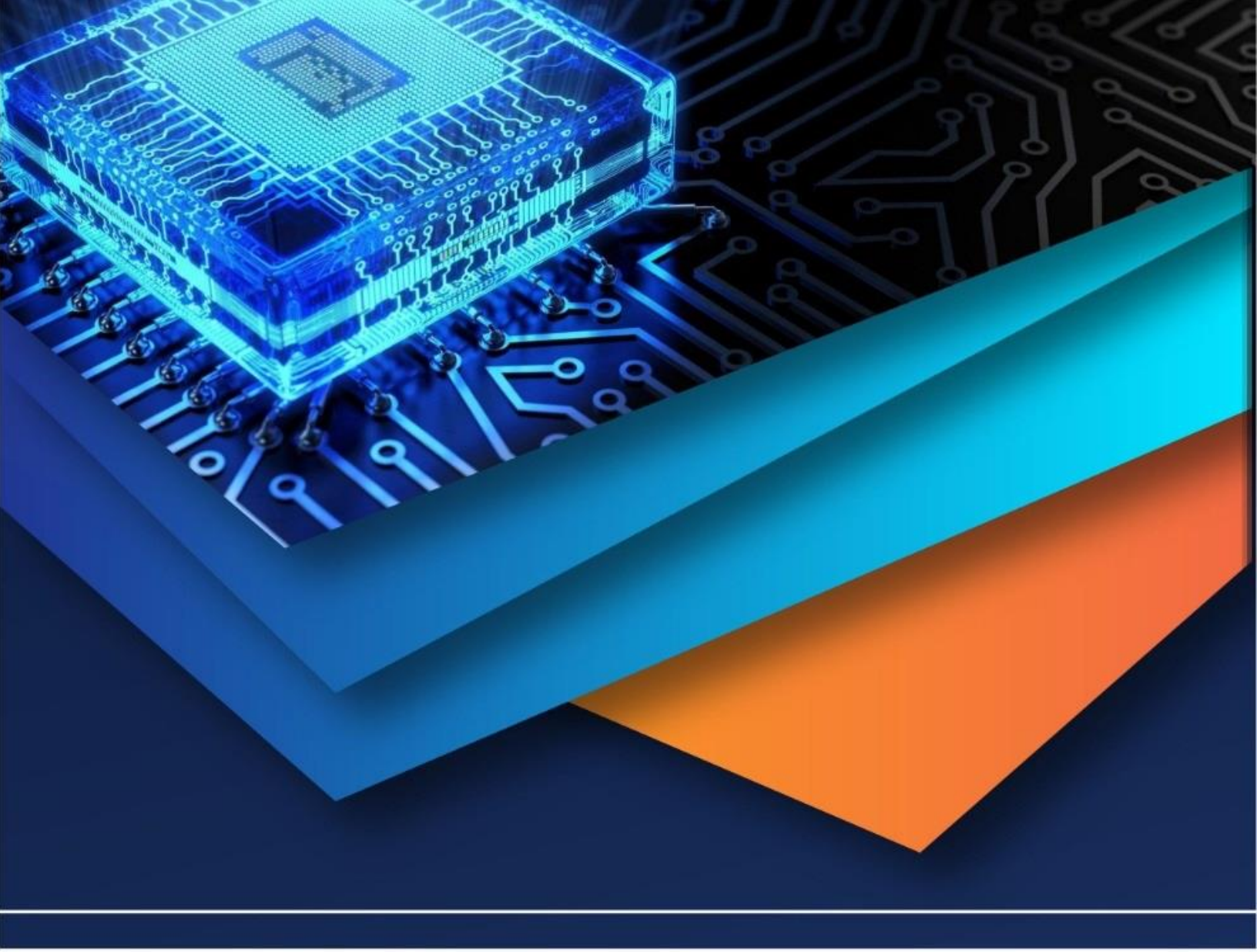
## V. RESULTS AND DISCUSSION

*A.* Mixing is a complicated process that is affected by the type of mixer, the mixing cycle as defined by the duration, the loading method, and the energy of mixing.

*B.* For most machine shafts, however, analysis should be relatively straightforward. That's because the failure typically provides strong clues to the type and magnitude of forces on the shaft and the direction they acted in, The failed parts will tell exactly what happened.

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