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Fabrication of Automatic Speed Bump with Day Night Control

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Abstract : Here we are fabricating the model pneumatic speed breaker with day night control. Nowadays traffic has increased as the use of vehicle hasincreasing day to day. We require speed breaker to slow down the vehicles which are traveling at high speed. In certain areas at daytime traffic may be heavier than nighttime. So, we require speed brake only during the daytime and not at night. For this purpose, this project gives a solution. This equipment consists of pneumatic cylinder, Speed breaker setup, solenoid valve, LDR, proximity Sensor and Control unit.

Fig : Automatic Speed Bump

1. INTRODUCTION

According to the NATPAK report of road accidents 2009 , India ranks 2nd in the number of persons killed in road accidents and among the Indian states Kerala ranks 2nd .According to their findings, carelessness of the drivers, improper and nonscientific construction of roads and speed breakers, over speeding and ineffective traffic management contributes about72% of the total number of accidents.

Our project automatic speed breaker is a new concept in this field and its innovative too. The device mainly consists of a speed breaker which is operated with the help of electric power. This system is mainly employed in the areas where the need of speed breaker is restricted to certain specific timings in areas like school and collage roads, theatre roads etc. and during the other hours the inconvenience of the speed breaker can be removed by folding down the speed breaker below the road surface. Hence they seem to be more effective in against over speeding and helps in traffic management.

2. LITERATURE REVIEW

There is evidence to support the claim that speed breakers can cause accidents and injury when a vehicle approaches a speed-breaker at a speed greater than some threshold velocity, the risk accident or injury is substantial. Speed- breakers are inconspicuous in low visibility conditions, like at night, or when there is fog, rain or snow. This problem is particularly acute in developing countries where speed-breakers don': always accompany warning signs. We propose an early warning system that uses a Smartphone based application to alert the driver in advance when the vehicle is approaching a speed breaker. In addition, the application constantly monitors the Smartphone accelerometer to detect previously unknown speed-breakers. The proposed detection algorithm easy

implement because it does not require accelerometer reorientation this is one of the main contributions of our work since previous approaches have used expensive computations to reorient the accelerometer. The algorithm was evaluated using 678 Km of drive data, which involved 22 different drivers, 5 different types of vehicles (bus, auto rickshaw, cycle rickshaw, motorcycle, and car), and 4 smart phones. The results are very promising and can be further improved by aggregating detection reports from multiple smart phones.

3. DESIGN CALCULATION

DESIGN OF PISTON ROD:

Load due to air Pressure. P		
Diameter of the Piston (d)	=	40 mm
Pressure acting (p)	=	6 kgf/cm²
Material used for rod	=	C-45
factor of safety		
Force acting on the rod (P)	=	PressurexArea
	=	p x (Πd² / 4)
	=	6x{(Πx4²)/4}
P	=	73.36 Kgf
	=	σy / FOS
Design Stress (σy)		
	=	36 / 2
		=18Kgf/mm²
	=	P / (Π d² / 4)
∴ d	=	√ 4 p /Π[σy]
		=√4x75.36/{Πx18}
	=	√ 5.33
		= 2.3 mm

∴ Minimum diameter of rod requiredfor the load = 2.3 mm

DESIGN OF CYLINDER THICKNESS:

Material used	=	Cast iron
Assuming internal	=	40 mm

diameter of the cylinder		
Ultimate tensile stress	=	250 N/mm²
	=	2500gf/mm²
Working Stress	= Ultimate tensile stress / factor of safety	
Assuming factor of safety	=	4
Working stress	=	2500 / 4
(ft)	=	625 Kgf/cm²

According to 'LAMES EQUATION'

Minimum thickness of cylinder (t)	ri {√(ft +p)/(ft-p)-1}

Where,

ri	=	inner radius of cylinder in cm.
ft	=	Working stress (Kgf/cm²)
p	=	Working pressure in Kgf/cm²

∴ Substituting values we get,

t =	2.0{√(625+6)/(625–6)-1}
t	0.019 cm=0.19mm
We assume thickness of cylinder	=2.5 mm
Inner diameter of barrel	=40 mm
Outer diameter of barrel	=40 + 2t
	=40 +(2x2.5)=45mm

DESIGN OF PISTON ROD

DAIMETER OF PISTON ROD:

Force of piston Rod (P)	= Pressurexarea =p x Π/4(d²) =p x Π/4 (d²)
	=6 x (Π /4) x (4)²

	=73.36Kgf
Also, force on piston rod (P)	=(Π/4) (dp)² x ft
P	=(Π/4) x (dp)² x 625
73.36	=(Π/4)x(dp)² x 625

∴ dp^2	$=73.36 \times (4/\Pi) \times (1/625)$ =0.15
dp	= 0.38 cm = 3.8 mm
By standardizing dp	= 15 mm

LENGTH OF THE PISTON ROD:

Approach stroke	=160 mm
Length of threads	=2x20=40mm
Extra length due to front cover	= 12 mm
Extra length of accommodate head	= 20 mm
Total length of the piston rod	=160 + 40 +12 +20
	=232 mm
By standardizing, length of the piston rod	=230 mm

SPECIFICATION

DOUBLE ACTING PNEUMATIC CYLINDER:

Stroke length	: Cylinder stoker length 160 mm = 0.16 m
Quantity	: 1
Seals	: Nitride (Buna-N) Elastomer
End cones	: Cast iron
Piston	: EN – 8
Media	: Air
Temperature	: 0-80 º C
Pressure Range	: 8 N/m²

SINGLE ACTING PNEUMATIC CYLINDER:

Stroke length	: Cylinder stoker length 80 mm = 0.08 m
Quantity	: 2
Seals	: Nitride (Buna-N) Elastomer
End cones	: Cast iron
Piston	: EN – 8
Media	: Air
Temperature	: 0-80 º C

Pressure Range	: 8 N/m²

SOLENOID VALVE

Max pressure range	: 0-10 x 10^5 N/m²

FLOW CONTROL VALVE

Port size	: 0.635 x 10^{-2} m
Pressure	: 0-8 x 10^5 N/m²
Media	: Air
Quantity	: 1

CONNECTORS

Max working pressure	: 10 x10^5 N/m²
Temperature	: 0-100 °C
Fluid media	: Air
Material	: Brass

HOSES

Max pressure	: 10 x10^5 N/m²
Outer diameter	: 6 mm =6x 10^{-3}m
Inner diameter	: 3.5 mm = 3.5 x 10^{-3}m

4.14 FORCE CALCULATION OF PNEUMATIC CYLINDER

Force to be exerted is 40N

Force	= pressure x area
Pressure in the cylinder	= 0.4 x105 N/m²
Area of the piston, (πd2)/4	= Force/pressure
	= 40/ 40000
	= 0.001m2
Bore diameter	= 0.0356m = 35.6 mm

FOR FORWARD STROKE

For 40mm bore diameter	
Corresponding rod diameter	= 16mm
Area of the piston	= (πd2)/4
	= (πx402)/4 = 1256.8mm²
Force (modified) to be exerted	= pressure x area

= 0.4 x105 x1256.8
= 50N

FOR RETURN STROKE

On the return stroke, when the pressure is applied to the reverse direction, the force on the piston due to the pressure is

= P x (A-a)

Where,

P = Pressure in the cylinder (N/m2)

A = Area of the piston (m2)

a = Cross sectional area of the piston rod (m2)

Therefore,

Area of the piston (A-a) = {(π x d2)/4}-{(π x d12)/4}

= {(π□ 402)/4}-{π (□162)/4}

= 1256.6-201

= 1055 mm²

FORCE TO BE CONVERTED

Onthe reverse direction = pressure x area

= 0.4 x 105 x 1055

= 42.2 N

For working pressure of 0.4 x 105 N/m^2

Extending force = 50.3 N

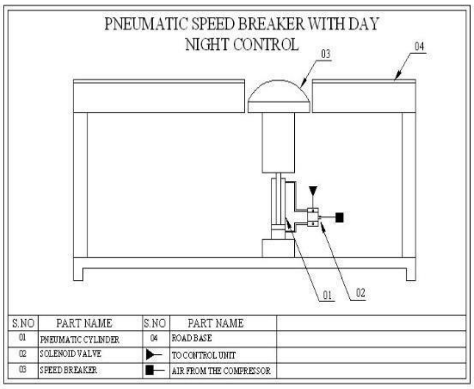
Retracting force = 42.2 N

4. WORKING PRINCIPLE

The speed breaker works normally during the day time on to the roads this speed breaker setup consists of the pneumatic cylinder which has a piston for the linear motion of the speed breaker. This piston is connected to the speed breaker and when the piston moves in the downward direction, the speed breaker moves down so that the road is made free for the speeding.

This project has a sensor and the control unit which operates on the light rays, during the day time the sunrays falls on the LDR sensor unit, the sensor sends the signal to the control unit and the control unit actuates the pneumatic cylinder and then the cylinder piston moves forward direction and makes the speed breaker on the road. During theight time, the LDR sensor does not get any light signal from the sun and it deactivates the control unit which makes the piston of the pneumatic cylinder to retract making the speed breaker to get down and thus making the road speed breaker free on the night time.

5. LAYOUT OF THEMODEL



6. CONCLUSION

A strong multidiscipline team with a good engineering base is necessary for the Development and refinement of advanced computer programming, editing techniques, diagnostic Software, algorithms for the dynamic exchange of informationaldifferent levels of hierarchy.

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling, and machining while doing this project work.

We are proud that we have completed the work with the limited time successfully. The **"FABRICATION OF AUTOMATIC SPEED BUMPWITH DAY NIGHT CONTROL"** is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality.

We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work. Thus, we have developed a **"AUTOMATIC SPEED BUMP WITH DAY NIGHT CONTROL"**. Byusing more techniques, they can be modified and developed according to the applications.

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