



**A
PROJECT REPORT
ON
“ELECTRICITY GENERATION FROM SPEED BREAKERS AND
WINDMILL”**

*Submitted in the Partial Fulfilment of the Requirement For The Award Of
Degree Of*

**DIPLOMA
IN
MECHANICAL ENGINEERING**

**BOARD OF TECHNICAL EDUCATION
UTTAR PRADESH LUCKNOW**



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**2022-2023
GHAZIABAD**

ACKNOWLEDGEMENT

Completing a task is never a one man's effort. It is the result of invaluable contribution of a number of individuals and our project too is the outcome of sincere team work.

We extend our sincere thanks to our project guide (), who inspite of being busy round the clock, helped, motivated and guided us. He has contributed to a great measure in surmounting all the hurdles faced during the completion of the project.

We also acknowledge the inspiration and encouragement provided by our Head of Department, (), who has directly or indirectly helped in our endeavour. We take this opportunity to express our sincere gratitude to our honourable Director, () and all other lecturers, the staff of Department of Mechanical and the staff of college library.

We would like to extend special thanks to, of MECHANICAL Department, SGIT Ghaziabad .

And finally, our deepest gratitude to our parents and well wishers for their unfailing emotional support during the project. Lastly, we owe greatly to the almighty God who is always there as the guiding force behind all creations of the world and without whose wish, not a leaf can flutter.

Submitted with regards,

BHARAT BISHT
ANSH SINHA
AABID AHMAD
ROBIN RAWAT



Forwarding Letter

Forwarded herewith is the Project Report entitled

“ELECTRICITY GENERATION FROM SPEED BREAKERS AND WINDMILL”

Submitted by BHARAT BISHT, ANSH SINHA

*, AABID AHMAD and ROBIN RAWAT, students of this
institution. The Project Report is in the partial fulfilment of the
requirements towards the award of the Degree of Diploma
in Mechanical Engineering, (B.T.E.U.P, Lucknow).*

*It has been carried out under the guidance and supervision of
(), Department of Mechanical Engineering, SGIT, Ghaziabad.*

Forwarded By

SGIT, Ghaziabad



CERTIFICATE

This is to certify that the work entitled

**“ELECTRICITY GENERATION FROM SPEED BREAKERS AND
WINDMILL”**

*was carried out by BHARAT BISHT, ANSH SINHA ,
AABID AHMAD and ROBIN RAWAT ,students of DIPLOMA(Final Year),
Department of Mechanical Engineering, under my supervision and guidance.
We are absolutely satisfied with dissertation on the project, which was
presented in the Department of Mechanical Engineering, SGIT,
Ghaziabad, during the academic year 2022-23*

*This work is in partial fulfilment of the requirement towards the award of the
Diploma in Mechanical Engineering, (BOARD OF TECHNICAL EDUCATION
UTTAR PRADESH LUCKNOW).*

ABSTRACT

The experimental set up has been fabricated to utilize energy lost at speed breaker by vehicle .We have calculated energy lost by vehicle at speed 10 km\hr, 12km\hr, 15km\hr and we utilize the energy lost, with the efficiency of 0.4%, 0.45% ,0.48% respectively.

It has been concluded that speed of roller is directly proportional to Electrical energy produced wind energy is directly proportional to square of velocity of wind.

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INTRODUCTION

Amelioration of standard of Living and industrialization leap up the pressure on the conventional sources of power. Depletion of conventional sources becomes a problem in present world. And ever rising cost of conventional fuel may be major impediment in economic and social growth of third world nations.

All of us (developing and developed nations) are searching for new and newer sources of energy and its efficient use. Moving towards modernization, luxuries become necessities which lead the people towards the need of personal vehicle thus contributing to the substantially increased traffic density. This increased traffic density can be utilized for generation of Electricity by using an innovative Technique.

In this project work an attempt has been made to fabricate a ramp, by which we can utilize the energy in power generation. This may further be used in battery charging.

The efficiency of our machine is some where 0.4 to 0.5 percent. It is seems a very small number but if we think in terms of number of vehicles and time it will be a huge amount of energy saved. This type of ramp is best suited for the places where the speed breaker is a necessity. The places like Toll bridges and vehicle parking stands are best for its utilization.

FABRICATION DETAILS

FABRICATION DETAILS

An iron roller is fixed on a wooden ramp on which vehicle passes. As vehicle passes over it, it starts moving. A linkage is provided which transfer the motion to a stepper motor for electricity generation.

All parts are described in detail on their respective places.

2. MAIN PARTS THEIR SPECIFICATIONS

2.1 WOODEN RAMP.

2.2 METAL ROLLER.

2.3 CHAIN AND SPROCKET MECHANISM

2.4 FREEWHEEL MECHANISM.

2.5 BELT. AND PULLEY

2.6 DYNAMO

2.7 WIND MILL

2.8 LIGHT EMITTING DIODE

2.9 BATTERY

2.1 WOODEN RAMP

The whole apparatus is mounted on wooden board and the specifications of the wooden Boards are



Figure 1 - Wooden Ramp

Wooden board : 910mm * 1250mm

Platform: 500mm * 600mm

Thickness of board: 20 mm

Platform inclined at 25 degree from ground from both sides.

2.2 METAL ROLLER

Roller is made of iron pipe with metal strips welded on it to give better surface contact between vehicle tire and roller.



Figure 2: Metal Roller

SPECIFICATIONS

Outside diameter of metal roller	165 mm
Inside diameter of metal roller	155 mm
Length of roller:	520 mm
Diameter of shaft:	34mm
Thickness of metal strip:	6mm
No. of metal strip:	10

2.3 CHAIN AND SPROCKET MECHANISM

Chains are made up of number of rigid links which are hinged together by pin joints in order to provide the necessary flexibility for warping round driving and driven wheels. These wheels have projecting teeth of special profile and fit into the corresponding recesses in the links of chain as shown in figure. The toothed wheels are known as sprocket wheels or simply sprocket.

The chains are mostly used for transmit motion and power from one shaft to another, when the centre distance between their shafts is short such as in bicycle, motorcycle, agriculture machinery, etc

In the case of bicycle chains by varying the size (and therefore, the tooth count) of the sprockets on each side of the **chain**, we can modify the overall gear ratio of the chain drive. By providing different-sized driving sprockets and different-sized driven sprockets.



Figure.3: Chain and Sprocket

2.4 FREEWHEEL

In **mechanical** or **automotive engineering**, a **freewheel** is a device in a **transmission** that disengages the **driveshaft** from the driven shaft when the driven shaft rotates Faster than the driveshaft. This condition exists in a **bicycle** going downhill when the rider holds his feet still, no longer pushing the **pedals**. Without a freewheel, with a fixed connection between the rear wheel and the pedals, the rear wheel Would drive the pedals round. The simplest freewheel device consists of two **saw-toothed, spring-loaded** discs pressing against each other with the toothed sides together, somewhat like a **Ratchet**. Rotating in one direction, the saw teeth of the drive disc lock with the teeth of the driven disc, making it rotate at the same speed. If the drive disc slows down or stops rotating, the teeth of the driven disc slip over the drive Disc teeth and continue rotating.

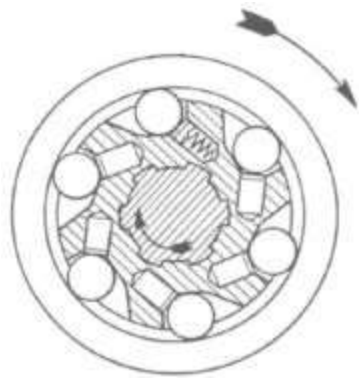


Figure 4: Freewheel



Figure 5: Freewheel Unit

2.5 PULLEY AND BELT

A pulley is a **wheel** with a groove along its edge, the pulleys are used to transmit power from one shaft to another by means of flat belts or ropes. Since the velocity ratio is inverse ratio of diameter of driving and driven pulleys.

The belts are used to transmit power from one shaft to another by means of pulley which rotate at the same speed or different speed.



Figure 6 Pulley

SPECIFICATIONS

Diameter of Driving Pulley = 330 mm

Diameter of Driven Pulley = 65 mm

Length of Belt = 1425 mm

2.6 DYNAMO

It is an electrical generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry and the foundation upon which many other later electric power conversion devices were based ,including the electric motor,the alternating current alternator,and the rotary converter.Today,the simpler alternator dominates large power scale power generation,for efficiency,reliability and cost reasons.



Figure 7: Dynamo

SPECIFICATIONS

NUMBER OF DYNAMOS - 2
VOLTAGE – 12V

2.7 WIND MILL

A wind mill is a machine that converts the energy of wind into rotational energy by means of vanes called blades or vanes. The reason for the name “WIND MILL” is that the devices originally were developed for milling grains for food production; the name stuck when in the course of history windmill machinery was adapted to supply power for many industrial and agricultural need other than milling. The majority of modern wind mills take the form of wind turbines used to pump water, either for land drainage or to extract groundwater.



Figure 8 : windmill

2.8 LIGHT EMITTING DIODE

A light emitting diode (LED) is a two lead semi conductor light source that resembles a back pn junction diode; expect that an LED also emits light. When an LED's anode lead has a voltage that is more positive than its cathode lead by at least the LED's forward voltage drop, current flows. Electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called ELECTROLUMINESCENCE and the colour of light (corresponding to the energy of the photons) is determined by the energy band gap of the semiconductor.

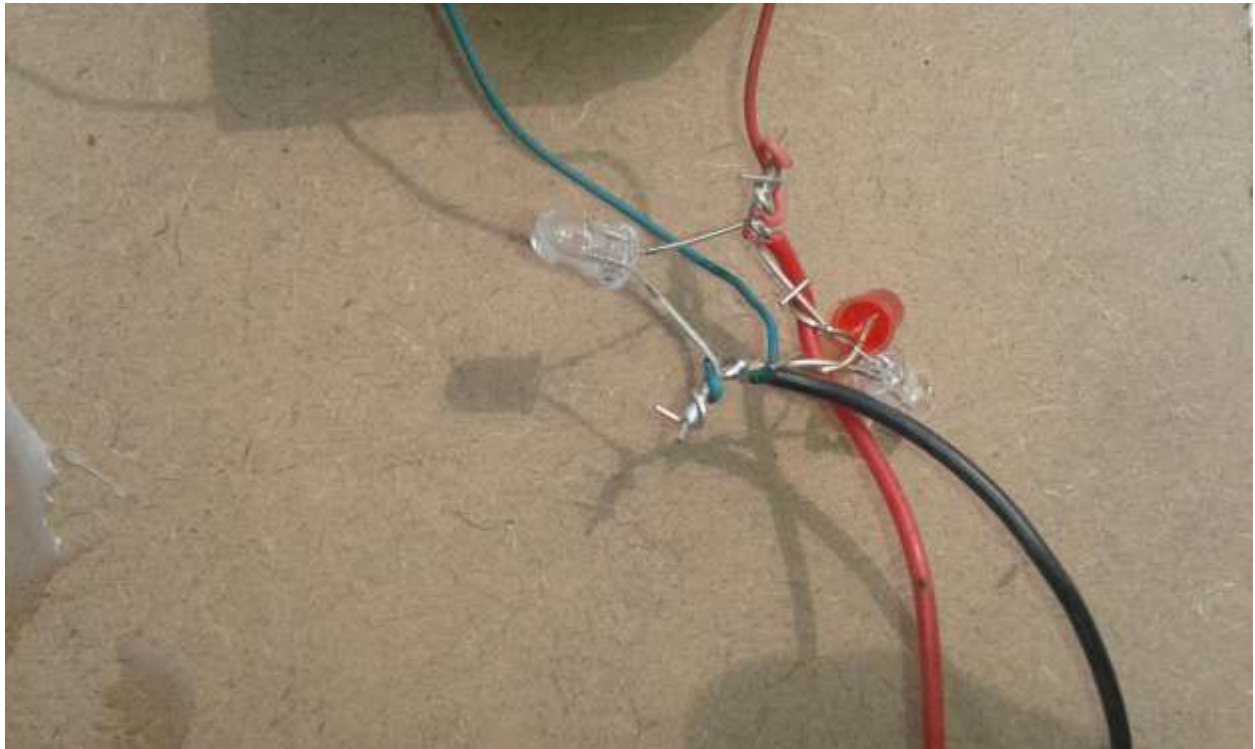


Figure 9: LED

SPECIFICATIONS

Number of LED used - 3

2.9 BATTERY



Figure 10 : Battery

SPECIFICATION

Number of battery used: 1

Voltage: 500v

WORKING PRINCIPLE

LAW OF INERTIA

- According to *Newton's law of inertia*, force is designated as the product of mass and acceleration, where acceleration is measured relative to an inertial reference.

$$\text{Newton's law} \quad F = M \cdot A.$$

LAW OF DYNAMIC FRICTION

- The stage when the body acted upon by an external force is just on the point of moving, is called *limiting equilibrium* of the body. The force of friction which is offered by the rough surface at the stage of limiting equilibrium, is called *limiting friction*. When a body starts moving, the force of friction offered by the surface is called the *dynamic friction*.
- When a body is at the point of limiting equilibrium the force of friction is maximum. The angle which the resultant of the maximum force of friction and normal reaction make with the normal reaction is called the *angle of friction*. It is denoted by *tan lambda*.

$$\text{Tan lambda} = \text{Maximum force of friction} / \text{Normal reaction}.$$

- The ratio of the limiting friction and normal reaction is called *coefficient of friction*.

BELT AND CHAIN

- Belt and chain are used for the power transmission from one shaft to another shaft.
- According to *law of belting*, the centre line of the belt as it approaches the pulley must lie in a plane perpendicular to the axis of that pulley, or must lay in the plane of the pulley, otherwise the belt will run off the pulley.

$$\text{Power transmitted by the belt} = (T_1 - T_2) * V / 75.$$

- If **T** be the number of teeth on chain, **p** the pitch, **d** the pitch circle diameter, then

$$D = p \operatorname{cosec} (180/T).$$

- Gears are mainly used for transmission of power and motion; gears are used when positive drives are necessary and when the centre distance is relatively short.

FARADAY LAW OF ELECTRICITY

- Electric current flows from positive to negative polarity but electrons flow reverse direction. Current flows when electrons find a path to move along. Electricity is measured in ampere.
- Coulomb is the basic quantity of electricity. One coulomb equals 6.25 billion electrons.

WORKING

- As the vehicle passes over the ramp, there's a surface contact between vehicle tires and roller, which will tend to rotate the roller, it is free to rotate as it is supported on bearings which are mounted on T-shape supports which are bolted to wooden base.

TESTING AND RESULTS

OBSERVATION TABLE

MECHANICAL APPARTUS

Serial No.	Velocity of vehicle (m/sec)	Angular speed of vehicle tire (rad./sec)	Angular speed of roller (rad./sec)	Rotational kinetic energy (Joules)
1	2.78	.00926	.0336	4541
2	3.32	.01108	.0401	6469
3	4.155	.0138	.0503	10057

Table 1

ELECTRICAL APPARATUS

Serial No.	Rotational kinetic energy of roller(J)	Voltage (volts)	Current (ampere)	Time (seconds)	Electrical energy(J)	Efficiency (percent)
1	4541	5	.8	4	16	.4
2	6469	5.5	1	4	22	.45
3	10057	6.4	1.2	4	31	.48

Table 2

CALCULATIONS:

Here,

w_1 = Angular Speed of Vehicle Tire (rad/sec)

w_2 = Angular Speed of Roller (rad/sec)

d_1 = Diameter of Tire (mm)

d_2 = Diameter of Roller (mm)

v = Velocity of Vehicle (m/sec)

I = Moment of Inertia of Roller (pipe)

D_o = Outside Diameter of Roller (mm)

D_i = Inside Diameter of Roller (mm)

V = Voltage (volts)

I = Current (Ampere)

T = Time (seconds)

R = Rotational Kinetic Energy of Roller (Joules)

E = Electrical Energy (Joules)

When Velocity of Vehicle is, $v=2.78\text{m/sec}$

$d_1=600\text{mm}$

$d_2=165\text{mm}$

And $v=r*w$.

So, $w_1= 2.78 / (d_1/ 2)$

$= 2.78 / (.600 / 2)$

$= .00926 \text{ rad / sec}$

And, $(w_1/w_2) = (d_2/d_1)$

So, $w_2= (.0926*600) / 165$

$= .0336 \text{ radian / sec}$

$$\begin{aligned}\text{Moment of Inertia of Roller, } I &= (3.14 \cdot (d_o^4 - d_i^4)) / 64 \\ &= d_o = 165 \text{ mm} \\ &= d_i = 155 \text{ mm} \\ &= 8046250 \text{ mm}^4\end{aligned}$$

$$\begin{aligned}\text{Rotational Kinetic Energy of Roller} &= (I \cdot \omega^2) / 2 \\ &= (8046250 \cdot 0.0336^2) / 2 \\ &= 4541 \text{ J}\end{aligned}$$

$$\begin{aligned}\text{Electrical energy} &= V \cdot I \cdot t \\ &= 5 \cdot 8 \cdot 4 \\ &= 16 \text{ J}\end{aligned}$$

$$\begin{aligned}\text{Efficiency} &= \text{Electrical Energy} / \text{Rotational Kinetic Energy} \\ &= 16 / 4541 \\ &= 0.004 \\ &= 0.4 \text{ percent}\end{aligned}$$

When Velocity of Vehicle is, $v = 3.32 \text{ m/sec}$

$$\begin{aligned}d_1 &= 600 \text{ mm} \\ d_2 &= 165 \text{ mm}\end{aligned}$$

$$\text{And } v = r \cdot \omega$$

$$\begin{aligned}\text{So, } \omega_1 &= 3.32 / (d_1/2) \\ &= 3.32 / (600/2) \\ &= 0.01108 \text{ radian/sec}\end{aligned}$$

$$\text{And, } (\omega_1/\omega_2) = (d_2/d_1)$$

$$\begin{aligned}\text{So, } \omega_2 &= (0.01108 \cdot 600) / 165 \\ &= 0.0401 \text{ rad/sec}\end{aligned}$$

Moment of Inertia of Roller, $I = (3.14 * (d_o^4 - d_i^4)) / 64$

$$= d_o = 165 \text{ mm}$$

$$= d_i = 155 \text{ mm}$$

$$= 8046250 \text{ mm}^4$$

Rotational Kinetic Energy of Roller = $(I * \omega^2) / 2$

$$= (8046250 * .0401^2) / 2$$

$$= 6469 \text{ J}$$

Electrical Energy = $V * I * t$

$$= 5.5 * 1 * 4$$

$$= 22 \text{ J}$$

Efficiency = Electrical Energy / Rotational Kinetic Energy

$$= 22 / 6469$$

$$= .0045$$

$$= .45 \text{ percent}$$

When Velocity of Vehicle is, $v = 4.155 \text{ m/sec}$

$$d_1 = 600 \text{ mm}$$

$$d_2 = 165 \text{ mm}$$

And $v = r * \omega$.

$$\text{So, } \omega_1 = 4.155 / (d_1/2)$$

$$= 4.155 / (.600/2)$$

$$= .0138 \text{ radian/sec}$$

And, $(\omega_1 / \omega_2) = (d_2 / d_1)$

$$\text{So, } \omega_2 = (.0138 * 600) / 165$$

$$= .0503 \text{ radian/sec}$$

Moment of Inertia of Roller, $I = (3.14 \cdot (d_o^4 - d_i^4)) / 64$

$= d_o = 165 \text{ mm}$

$= d_i = 155 \text{ mm}$

$= 8046250 \text{ mm}^4$

Rotational Kinetic Energy of Roller $= (I \cdot \omega^2) / 2$

$= (8046250 \cdot 0.0503^2) / 2$

$= 10057 \text{ J}$

Electrical Energy $= V \cdot I \cdot t$

$= 6.8 \cdot 1.2 \cdot 4$

$= 34 \text{ J}$

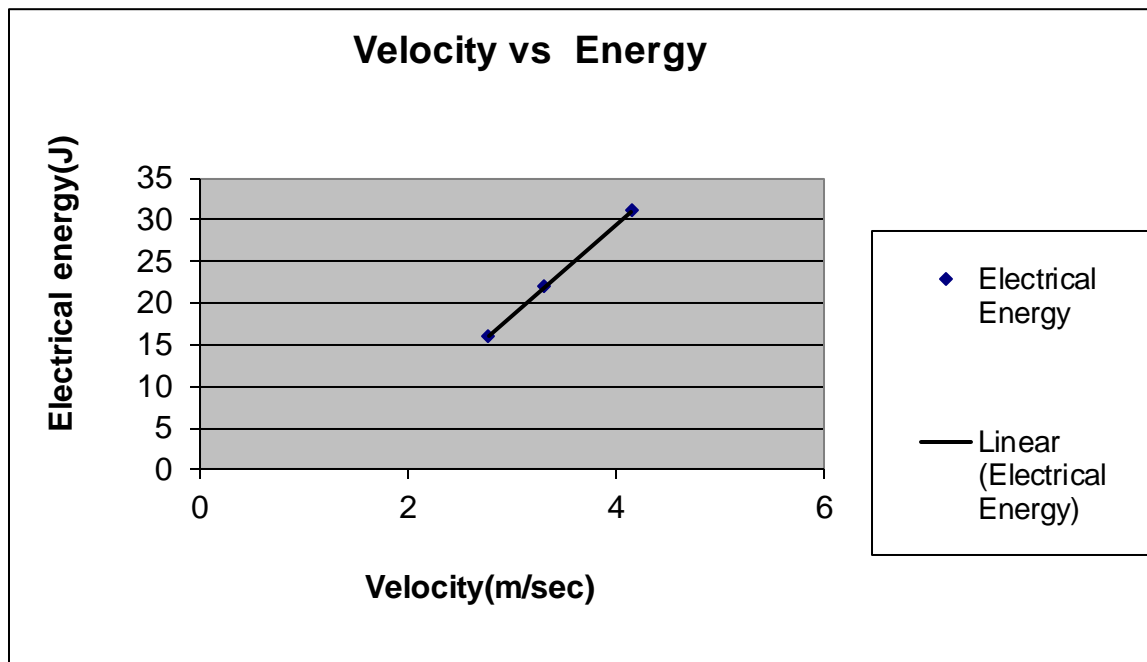
Efficiency $= \text{Electrical Energy} / \text{Rotational Kinetic Energy}$

$= 34 / 10057$

$= .0048$

$= .48 \text{ percent}$

GRAPH



CONCLUSION

We concluded that, electricity is generated by our project. By implementing we observed that on moving a vehicle over the roller speeds varying from 10-15 km/hr, And in this region 5-7 volts is being produced. Speed Vs energy plot shows that energy produced is directly proportional to speed but there will be a limit of Mechanical Instruments.

The efficiency of air set ups is about 0.4 to 0.5%, which seems a very small value but if we see it in terms of numbers of vehicles passed per unit time, there will be huge amount of energy saved.

AREA OF UTILITY & FUTURE SCOPE

Electric ramp can be utilized on Express Toll Stoppages for en-lightning the path lights and also for the ticketing at the pickets. It can be used in rural areas contributing towards high paced development of villages. As we know most of the villages having electricity problem. So it can play a major role in en-lightning the streets of villages as well fulfills the basic need of electricity in villages.

A part from that, energy generated from this should meet the environmental standards and cost-effective. And finally would like to sum up with the fact that scarcity of electricity in India is major obstruction towards the development of our country and hitting on the pockets of common man with increase in the consumption and the prices. So, conservation could be one way to do that however the other and better way would be to install these electricity generating ramps where ever possible thus helping our society with catastrophic problem of electricity, rather government should take an initiative and all the cooperative societies to help and ward off this problem and making it a success

****THE ELECTRICITY GENERATOR RAMPS**.**

If we use concert structure in fabrication of speed breaker on the roads, It will become more beneficial. The structure of concert works efficiently and reliably. We can also use more rollers instead of one; also leap up the size of the roller to generate more electricity.

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