

Energy Generation by Using Speed Breaker

Mr. Jadhav Rajendra B.

Lecturer, Department of Mechatronics Engineering
Amrutvahini Polytechnic, Sangamner, India

Abstract: *Today we see many vehicles on road creating pollution and using its mechanical energy only for transportation purpose, but if we use that kinetic energy of vehicles to convert into some useful electrical energy then we can use that energy for street lights and can save at least some amount of electrical energy. In this article various methods of generating power using the speed breaker are listed and studied carefully. Many authors conducted many experiments on each type of power generation method, and the results are noted down here. The methods listed here are rack and pinion method, roller speed breaker, crankshaft and piston mechanism, hydraulic speed breaker. Our project is to enlighten the streets utilizing the jerking pressure which is wasted during the vehicles passes over speed breaker in roadside. We can tap the energy generated by moving vehicles and produce power by using the speed breaker as power generating unit. The kinetic energy of the moving vehicles can be converted into mechanical energy through rack and pinion mechanism and this mechanical energy will be converted to electrical energy using generator which will be used for lighting the street lights. Therefore, by using this mechanism we can save lot of energy which can fulfill our future demands.*

Keywords: Power Generation, Renewable Energy, Speed Breakers, Infrastructure, Rack & Pinion

I. INTRODUCTION

The energy crisis is one of the major problems in our country. The pollution caused by generating power is enormously high. Even though we have many kinds of renewable energy sources we are affording the normal conventional methods in generating power. In addition to this pollution, we are having many vehicles on road creating more pollution. So, we are hurting our environment in many methods. So, this project can help the environment to escape from the pollution, not totally but a little bit. Since we see many vehicles on road, we can use the energy from those vehicles to generate electrical energy. All the vehicles use their kinetic energy in order to move from one place to another. In this process, it is wasting more energy. We can use that kinetic energy and convert it into electrical energy. We can provide the speed bumps on roads with specialized mechanisms under them. So, whenever a vehicle moves over the speed bump, the speed bump takes the kinetic energy of the vehicle and converts it into mechanical energy and which further converted into electrical energy. The process of generating electrical energy by this method is of different kinds.

Now a day's power has become the major need for human life. Energy is an important input in all the sectors of any countries economy. The availability of regular conventional fossil fuels will be the main sources for power generation, but there is a fear that they will get exhausted eventually by the next few decades. Therefore, we have to investigate other types of renewable sources. The day-to-day increasing population and decreasing conventional sources for power generation, provide a need to think on non-conventional energy resources [1] [2]. Another major problem, which is becoming the exiting topic for today, is the pollution. Power stations and automobiles are the major pollution producing places. So non-conventional power source is needed to reduce this problem. We proposed a non-conventional power generating system based on speed breaker mechanism which generates electricity without using any commercial fossil fuels, which is not producing any polluting products [3].

In this paper, our aim is to conserve the kinetic energy which converts into electricity that gone wasted, while vehicles move. This research paper investigates the feasibility and efficacy of generating electricity from speed breakers, utilizing the kinetic energy dissipated by vehicular motion. With the escalating global demand for sustainable energy sources, the potential of speed breakers as a renewable energy solution gains significance. The study explores various methodologies and technologies employed worldwide to capture and convert kinetic energy into electrical power. Key aspects such as energy conversion efficiency, environmental impact, and economic viability are analysed to assess the

practicality of speed breaker power generation systems. The paper also examines case studies and real-world implementations, highlighting their successes, challenges, and future prospects. Through this comprehensive examination, the research aims to contribute to the advancement of renewable energy infrastructure, emphasizing the role of speed breakers in fostering sustainable development.

II. LITERATURE SURVEY

- [1] Sharma, P.C., "Non-conventional power plants", Public Printing Service, New Delhi, 2003.
- [2] Sharma.P.C , Principle of renewable energy systems (Public printing service, New Delhi, 2003). The vehicle load acted upon the speed breaker system is transmitted to rack and pinion arrangements. Then, reciprocating motion of the speed-breaker is converted into rotary motion using the rack and pinion arrangement where the axis of the pinion is coupled with the sprocket arrangement. The sprocket arrangement is made of two sprockets. One of the sprocket is larger in dimension than the other sprocket. Both the sprockets are connected with chain which transmits the power from the larger sprocket to the smaller sprocket. As the power is transmitted from the larger sprocket to the smaller sprocket, the speed that is available at the larger sprocket is relatively multiplied at the rotation of the smaller sprocket. This speed is sufficient to rotate the rotor of a generator and is fed into the rotor of a generator. The rotor which rotates within a static magnetic stator cuts the magnetic flux surrounding it, thus producing the electric motive force (emf).
- [3] Mukherjee, D. Chakrabarti, S., "Non-conventional power plants", 2005. Due to this force is applied on the piston/spring mechanism in the water tank. And then water is coming outside of the tank. 11 Now one valve & DP transmitter is there which measured the pressure & Valve is maintaining of flow of water. This water is passing on rotor blade which rotates & one chain belt is there so Generator is also rotates with rotor.
- [4] Watts,G., "Effects of speed distribution on the Harmonoise model predictions", Inter-noise Conference, Prague, 2004. The power is generated using Air compression mechanism. In this method when vehicle pass from the speed breaker the piston of the pump is goes down and air is compressed. The following figure shows air compression mechanism. This compressed air has some velocity so we can use it to rotate turbine. The tank is provided for the more compression and storage of air it is not necessary if a force by the pump is very high. The exhaust air goes to turbine which is connected with the alternator or any type of electric generator so we can generate electricity. This method is needed less maintenance and also low cost, here absence of any other rotational parts reduces losses. The reason for select this method is, it is applicable for constructing speed breakers which can generate electricity. The cost of construction is less and efficiency is high.
- [5] Dr. Anders Brandt & MSc. John Granlund Swedish Road Administration. "Bus Drivers Exposure to Mechanical Shocks Due To Speed Bumps". Society for Experimental Mechanics, IMAC 25th. When the vehicle load acted upon the speed breaker system is transmitted to rack and pinion arrangements. Because of the weight of vehicle the top portion of the speed breaker moves downwards. The 12 hydraulic press convert the force into 4 times from small piston to large piston. 3 rakes attached to large piston. Every rack connected with 2 one way pinions. Pinions are getting rotation from the movement of rack backward and forward. Every pinion connects to a fly wheel which absorbs the energy when demand is less and releases the same when it is required. Fly wheel connected to a large gear and large gear connected to a small gear which attached to a generator. Generator convert rotational energy into electrical energy . When the vehicle passes the speed breaker, the expansion of springs takes the speed breaker at previous state which done the system reverse. The charging circuit charges a battery. The Inverter circuit converts this DC voltage into AC voltage and a step up transformer stepped up the AC voltage. A dark sensing circuit is used to sense the night so that the street light is on.

III. METHODOLOGY

Electricity is a basic part of nature and it is one of our most widely used forms of energy. A large amount of energy is wasted at the speed breakers through the dissipation of heat and also through friction, every time a vehicle passes over it. In this research, a roller is fitted in between a speed breaker, and some kind of a grip is provided on the speed breaker so that when a vehicle passes over the speed breaker it gets displaced in a vertically downward direction distance 7 cm. The rack which is connected to the speed breaker also moves down simultaneously with the same distance of 7 cm. The rack is in mesh with the pinion which is coupled with the shaft of gear which has 72 teeth that meshes with the pinion

with 32 teeth which is coupled with the generator motor. This whole mechanism converts linear displacement into rotary motion. Hence shaft of the generator rotates which generates a current proportional to the number of revolutions of the pinion. This produced current is stored in the battery for future use. Later the rack gets displaced to the original position due to the spring mechanism

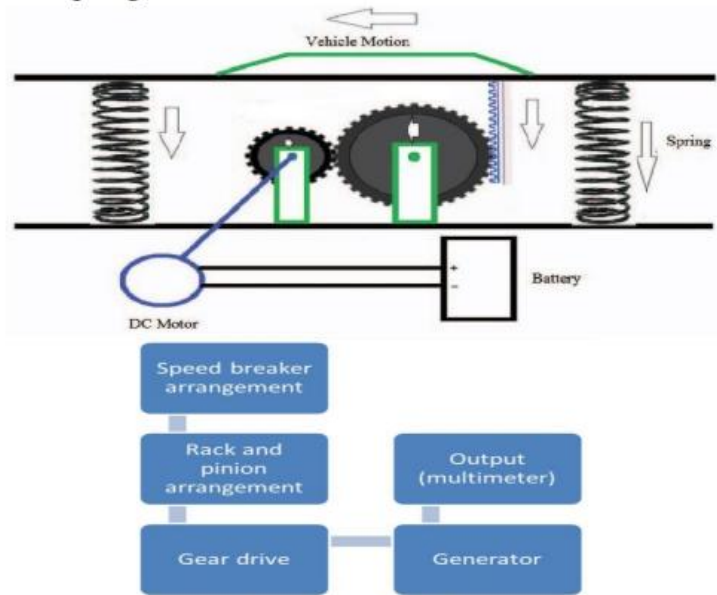


Fig. 2.Mechanism Diagram

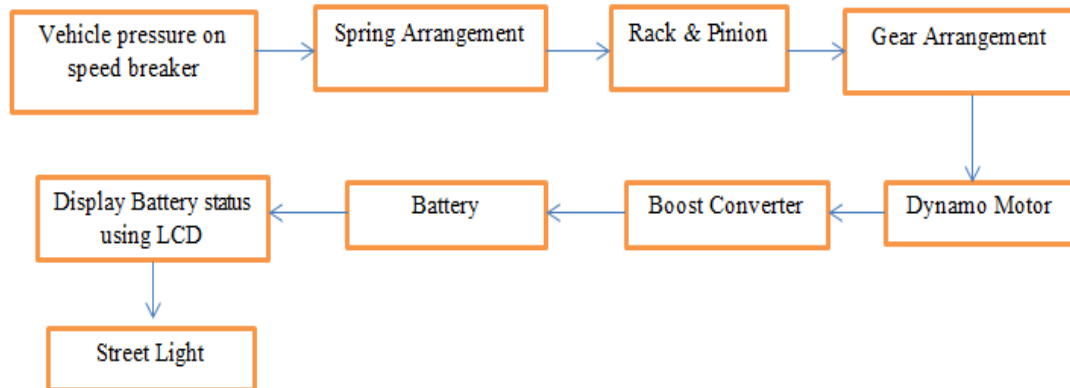


Fig. 2.Block Diagram

3.1 Design Calculation

1) Spring design for 200 kg weight:-
 Weight of vehicle = 200Kg * 9.81 = 1962.00 N
 There fore P=1.962 KN=2KN
 Permissible shear stress is taken as 0.5 of sut
 $\tau = 0.5 * sut(\text{ultimate tensile strength}) \tau = 0.5 * 1050 = 525$
 N/mm²
 The spring stiffness k,
 $K = (4c - 1/4c - 4) + (0.615/c) \dots \dots \text{std formula}$
 $K = (4 * 8 - 1/4 * 8 - 4) + (0.615/8)$
 K=1.184
 Calculation of wire diameter d,
 $\tau = k * (8pc / \pi d^2) 525 = 1.184(8 * 2000 * 8 / \pi * d^2)$
 D=4mm
 Free length of spring =150mm

Model Calculations

Theoretical Calculation (Approximate) Let us consider,
 The mass of a vehicle moving over the speed breaker = 200Kg (Approx.)
 Height of speed brake =10 cm
 Work done=Force x Distance where, Force =
 Weight of the Body
 = 200 Kg x 9.81m/s² = 1962 N
 Distance travelled by the body = Height of the speed brake =10 cm
 Output power=
 (1962 x 0.1)/60 = 3.27 Watts (For One pushing force)
 Power developed for 1 vehicle passing over the speed breaker arrangement for one minute
 = 3.27 watts

3.2 Design of square pipe frame

The Yield Strength the yield strength or yield point of a material is defined in engineering and materials science as the stress at which a material begins to deform plastically (bends and not returns). Prior to the yield point the material will deform elastically and will return to its original shape when the applied stress is removed. It should be provided as a specification by the supplier of the material. The value depends on the quality of the material. In this instance the value of the yield strength was rated at 280Mpa (mega Pascal) that of a construction quality steel. Moment of Inertia Also known as the second moment area, the area moment of inertia, moment of inertia of plane area, or second area moment, is a property of a cross section that can be used to predict the resistance of beams to bending and deflection, around an axis that lies in the cross-sectional plane. It should be provided as a specification by the supplier of the material (see below). Standard Table of Dimension and Properties

3.3 Design of Welded Joint:

Checking the strength of the welded joints for safety
 The transverse fillet weld welds the side plate and the edge stiffness plates, The maximum load which the plate can carry for transverse fillet weld is
 $P = 0.707 * S * L * x * ft$
 Where, S = factor of safety, L = contact length = 25mm The load of shear along with the friction is 50 kg = 500N Hence, $500 = 0.707 * 3 * 35 * x * ft$
 Hence let us find the safe value of 'ft'

$$ft = \frac{500}{0.707 * 3 * 35}$$

$$ft = 6.73536 \text{ N/mm}^2$$

 Since the calculated value of the tensile load is very smaller than The permissible value as $ft = 56 \text{ N/mm}^2$. Hence welded joint is safe.

IV. ADVANTAGES AND APPLICATION

A. Advantages

- 1) Renewable Energy Source: The power generation system using speed breakers is a renewable energy source that does not emit any harmful pollutants or greenhouse gases, making it an eco-friendly solution.
- 2) Cost-Effective: The installation and maintenance cost of the power generation system using speed breakers is relatively low compared to other renewable energy sources like solar or wind power.
- 3) Energy Savings: The generated electricity can be used to power street lights or other electrical appliances, reducing the overall energy consumption and cost.
- 4) Reduces Traffic Speed: The installation of speed breakers can help reduce traffic speed, which can lead to a safer driving environment and fewer accidents.
- 5) Easy to Install: The power generation system using speed breakers can be installed quickly and easily without the need for any specialized skills or equipment.

B. Application:

- 1) Urban Areas: The power generation system using speed breakers can be installed in urban areas where there is a high traffic flow, such as roads and highways, to generate electricity.
- 2) Rural Areas: The power generation system can also be installed in rural areas where there may not be access to traditional power sources.
- 3) Public Spaces: The system can be installed in public spaces such as parks, shopping centres, and universities to generate electricity and reduce energy consumption.
- 4) Military Installations: The system can be used to provide power to military installations, especially in remote locations where traditional power sources may not be available.
- 5) Airports: The power generation system using speed breakers can be installed in airports to provide electricity for lighting and other applications.

V. CONCLUSION AND SCOPE FOR FUTURE WORK

In conclusion, the project on power generation by speed breakers is a promising solution for generating renewable energy in urban and rural areas. The system is cost-effective, easy to install, and has various applications in public spaces, military installations, and airports. The project involves the design and fabrication of a speed breaker that can generate electricity by harnessing the kinetic energy of moving vehicles. The generated electricity can be used to power streetlights, traffic signals, and other electrical appliances, reducing energy consumption and cost.

- 1) Increasing Efficiency: There is a need to increase the efficiency of the power generation system to generate more electricity from speed breakers. Researchers can explore the use of different materials and designs that can improve the conversion of kinetic energy into electrical energy.
 - 2) Integration with Smart Grid: The power generation system can be integrated with the smart grid to optimize the energy flow and distribution. This will ensure that the generated electricity is stored and distributed efficiently.
 - 3) Expansion of Applications: The power generation system using speed breakers can be applied in various fields, including transportation, construction, and mining. Researchers can explore these areas to identify new applications and develop solutions that are tailored to meet the specific needs of each field.
 - 4) Scalability: The power generation system can be scaled up to meet the energy demands of a larger population. Researchers can explore the use of multiple speed breakers and other renewable energy sources to generate enough electricity to power entire cities.
 - 5) Commercialization: The power generation system can be commercialized to generate revenue and create job opportunities. Researchers can explore the market potential and develop business models that can help bring the technology to the market.
- In conclusion, the project on power generation by speed breakers is a promising solution for generating renewable energy. The future work outlined above can help improve the efficiency, expand the applications, and scale up the power generation system to meet the energy demands of a growing population.

REFERENCES

- [1] Prof.Niranjan M, Madhukar N, Ashwini A, Muddsar J, Saish M (Department of Electronics and Communication, Jain College of Engineering Belagavi, India)
- [2] D. L. Wu, Wing W. Y. NG, D. S. Yeung, and H. L. Ding, "A brief survey on current RFID applications," in Proc. International Conference on Machine Learning and Cybernetics, Baoding, July 12-15, 2009, pp. 2330-2334.
- [3] Umar Farooq, Mahmood ul Hasan, Muhammad Amar, Athar Hanif and Muhammad Usman Asad.the design of RFID based security and access control system for use in hostels inside the Punjab University premises.
- [4] G. Ostojic, S. Stankovski, and M. Lazarevic, "Implementation of RFID technology in parking lot access control system," in Proc. Annual RFID Eurasia Conference, 2007, pp. 1-5. [5] M. A. Mazidi, J. C. Mazidi, and R. D. Mckinaly, The 8051 Microcontroller and Embedded Systems, Pearson Education, 2006