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# Use of Solar Panel on the Road to Use the Available Space and Produce Solar Energy

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**ABSTRACT :**
A Solar Roadway is an electric road that can recharge electric vehicles (EVs) anywhere and with clean energy from the sun. The Solar Roadways consists of structurally engineered solar panels that we drive on. Each Solar Road Panel (roughly 1m by 1m) interlinks with neighbouring panels to form the Solar Roadways system. As a size and generating capacity of a solar system are a function of number of solar modules installed, application of a solar technology is readily scalable and versatile. A Solar Roadway is an electric road that can recharge electric vehicles (EVs) anywhere and with clean energy from the sun. The Solar Roadways consists of structurally engineered solar panels that we drive on. Each Solar Road Panel (roughly 1m by 1m) interlinks with neighbouring panels to form the Solar Roadways system. As a size and generating capacity of a solar system are a function of number of solar modules installed, application of a solar technology is readily scalable and versatile.

**Keywords:** Solar Roadway, Electric vehicles (EVs), Structurally engineered solar panels, Scalable and versatile solar technology

## I. INTRODUCTION:

The idea behind solar road panels is quite simple in theory; through the issues associated with urban heat islands it is known that pavements are often exposed to a vast amount of solar radiation throughout the day. If it were possible to extract a portion of this energy, we could begin to simultaneously solve civil and electrical infrastructure issues through the implementation of new sustainable technologies. Two methods have been developed to accomplish energy generation from roads before; using asphalt pavement as a solar thermal collector and installing piezoelectric generators to collect vibration energy from the traffic load on the pavement. Recent studies have also begun to use thermoelectric systems to extract heat energy from roads and directly convert it to electricity This project is taking a different approach to the concept as, through photovoltaic, the solar radiation is directly converted into electricity on the surface of the panel without a heat or vibration conversion. The Solar Roadway can distribute its electrical power to all businesses and homes connected to the system via their parking lots and driveways (made up of Solar Road Panels). In addition to electrical power, data signals (cable TV, highspeed internet, telephone, etc.) also travel through the Solar Roadways, which acts as a conduit for these signals (cables). This feature eliminates the power lines, utility poles, and relay stations we see all over the countryside. It also eliminates power interruption caused by fallen or broken electrical lines or poles. Solar roadways enabled driving infrastructure would produce three times total electricity demand about three times what it costs to install an asphalt road, but would be more durable more.

The roadways can also communicate with drivers, alerting drivers with visual messages to the presence of pedestrians in a crosswalk. They can make the emerging electric vehicle economy far more affordable, and easier to manage. They can help us eliminate hundreds of millions of rupees per year, or more, in externalized costs of burning fossil fuels. And, we can lead the world in powerful clean energy technology exports, capable of rolling back massive pollution and greenhouse gas emissions. In 2009, „solar roadways" in U S received a contract from the Federal Highway Administration to build the first ever Solar Road Panel prototype.

During the course of its construction, the technocrats learned many lessons and discovered new and better ways to approach this project. Using this technology, no more power shortages, no more

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roaming power outages, no more need to burn coal (50% of greenhouse gases), Less need for fossil fuels and less dependency upon foreign oil and Much less pollution. How about this for a long-term advantage: an electric road allows all-electric vehicles to recharge anywhere: rest stops, parking lots, etc. They would then have the same range as a gasoline-powered vehicle. Internal combustion engines would become obsolete. Our dependency on oil would come to an abrupt end.

**PROBLEM DEFINATION:**

Normal traditional asphalt road has less life span. In asphalt road there is many defects because of temperature and water effects like cracks, potholes, etc. Solar road is made up of tempered glass having high mechanical properties. There is no chance of potholes in solar road. There is delay in maintenance of asphalt road from authorities. If there are any defects in solar road the maintenance is done in very short time by authorities to protect large defects.

## II. LITERATURE SURVEY:

- Xudong Zha (2022) [5] He invented Preparation and performance study of solar pavement panel based on transparent Resin-Concrete In order to realize the transformation and utilization of renewable energy, a new solar pavement module, which can harvest solar energy using often uncovered pavement/road surfaces, is proposed and investigated in this paper.
- Domenico Vizzari (2021) [2] He invented Solar pavements: A critical review Resilient, smart and sustainable: these are the keywords for the next generation of road infrastructures. As a renewable and environment-friendly energy harvesting pavement, the concept of a solar pavement has become one of the most researched new highway transportation infrastructures with a goal to transform the road system from the energy consumer to the energy provider alleviate pollution from the source of energy.
- Biao Liu (2021) [6] She invented Research and Exploration of Phase Change Materials on Solar Pavement and Asphalt Pavement The consumption of non-renewable resources has made the earth's resource crisis increasingly prominent. Renewable energy solar energy is more and more popular.
- Mohiuddin Munna (2020), [11] Concrete and asphalt are the primary materials used to construct roadway. Solar Roadway® proposed a solar pavement technology example, Solar Road panel (SRP) as an alternative materials and energy source. Solar Roadway® performed a load, traction and impact test to use SRP in non-critical use application like parking lots. For critical use like public roads engineering tests are performed example, freeze, moisture absorption, heavy vehicle, and shear stress on "SR3" prototype. Overall results show "SR3" prototype is strong, flexible and functional for "Real World" test conditions.
- F. Kehagia, (2019) [7] He invented Renewable Energy has evolved into an integral part the future Their unique feature being perpetual and consumed close the loads and thus within urban new ways of their integration. Solar Collector Pavements mesh creating operational and efficient sources of energy for different applications.
- Kiran Pal kour (2019), [2] as impact studies are the major focus of this research existing studies that have been undertaken to impact associated with solar highway and PV development. We can use solar road for electric vehicle charging street light and near community limitation of solar road is high maintenance cost. It could not be constructed in the poorest developing nation because of high initial cost. In long term its gives lots of benefits. It is total green renewable energy.
- Psomopoulos etal. (2019),[4] The paper presents the two types of solar pavements thermal and electrical collector, example of innovative structure leading to sustainable road infrastructure. Studies have confirmed the viability of solar pavement or solar road. In thermal pavement the array of water pipe embedded in surface layer of asphalt road, allowing continues collection of heat on hot days, thus generating on site renewable energy. In electrical collector system solar cells or panels are placed in road surface. To protect solar cells high strength transparent rough layer is provided, thus electricity generated by photovoltaic system.
- Harpreet Kaur Channi (2019), [5]the present paper shows the information about solar road and mentioned the three layers of solar road is road surface layer, electronic layer, base plate layer and their work or function. • The main purpose of this type of road to replace asphalt road which generate electricity and contains lots of benefits. There are three main Layers. Road surface layer it is high strength transparent and waterproof layer electronic layer contains mini microprocessor boar for

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controlling heat, solar cells and LEDs. This layer can sense how much weight is on the panels and control the heating element to melt snow. Base plate layer is for protection of electronic layer form ground temperature and moisture.

- 4 Department of civil engineering AMRIT 2023-24 • Bonghyun Kim (2018) [3] He invented this study is a development of road system applying solar panels to road pavement block. Concrete pavement block to mount solar panel is designed to verify effective of power generation. Pavement blocks with solar panels is photovoltaic block that enables to produce renewable energy.
- Dezfooli etal.(2017) [1] The present work is conducted to evaluate the feasibility of using solar pavements as a sustainable energy producer to supply electrical energy. For this purpose, we prepared two prototypes entitled as “solar panel” (solar cell embedded in rubber and Plexiglas) and “solar pavement” (solar cell embedded between two porous rubber layers) which both are capable of harvesting and converting the solar energy into photovoltaic cells.
- Sadeghi etal. (2017) [4] He invented Solar pavement: A new Emerging technology. The present work is conducted to evaluate the feasibility of using solar pavements as a sustainable energy producer to supply electrical energy "solar pavement" which both are capable of harvesting and converting the solar energy into photovoltaic cells. In this work, components of the new solar pavements.
- Prajakta Patil (2017) [9], we have lots of kilometres asphalt road across the country in summer season it absorbs a Lots of Heat worming the road up to 140° F. If we can harvest that heat, we can use it for daily use, save on fossil fuels and reduce global warming. There is three Method to harvest energy. One is solar cell lined highway that generates electricity with photovoltaic system. Second is water pipe system in asphalt layer that generating thermal energy and third one is generating of electricity thermoelectric effect.
- Azin Sadeghi Dezfooli (2017) [10], The present paper is conducted to evaluate the possibility of using solar pavement as a sustainable energy producer for This Two prototypes take one is solar panel (solar cell embedded in rubber and Plexiglas) and solar pavement (solar embedded between two porous rubber layer). Which both are capable to harvesting electricity? The British pendulum tester (BPT) and universal test machine (UTM) were used for measuring surface frictional property and determining the strength or properties of prototypes. Solar pavement is better than solar panel in the following test skid resistance under wet and dry condition. Drainage test loading resistance tracking test and power conversion.
- Nawaj sharif (2017), [3] A solar panel can be placed on the road with sufficient reinforcement of glass and such materials have ability to resist the breakage of panel and transmit the sunlight. The solar panels earlier invented to lie on the road and generate electricity having lots of problems. This panel is durable but not suitable for its installation time on the special concrete pavement. If some changes are made on the panels and the road then it will be possible to lay the panels on the traditional road. Three methods is used for using solar panels are Lock system, Rubber and Gaskets and Construction manual for side wall and panel barrier.

## III. MATERIALS AND METHODS:

In this project, prototype solar panels were manufactured by Solar Roadways®, Inc. using a proprietary process [27]. For pavement applications the solar pavement was expected to meet the following requirements, as described by Solar Roadway, Inc. in Sandpoint, ID [27]:

1. Capable of generating its own power from solar PV, solar thermal or vehicle vibration.
2. Facilitate the transferring, storing and distributing the generated power efficiently.
3. Be constructed of recycled or other sustainable materials.
4. Be modular in design so that damaged or worn section can be replaced quickly and easily.
5. Withstand repetitive heavy traffic loading and be structurally durable.
6. Meet or exceed safety standards of existing pavement systems. 25
7. Mitigate water runoff through either permeability or designed retention and filtration.

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Fig: 2.3 Solar illuminated roads

8. Be cost effective, i.e., the benefits of power generation and water runoff mitigation over the operational life outweigh its initial cost. In the first prototype, "SR1" Solar Roadways®, Inc constructed a 3.66 m × 3.66 m (13.38 m2) panel array shown in Figure 1 below. To make a solar panel that could withstand the abuse of fully-loaded tractor trailers, a protective case had to be created to protect the sensitive solar cells and electronics inside. Additionally, the surface of this case had to be transparent to allow the sunlight to reach the solar cells inside. SRI decided to use glass for the surface according to the recommendation of Penn State's Materials Research Institute and the University of Dayton's Research Institute (Brusaw, 2016). Unlike plastic, the optical properties of glass are stable against solarization (long-term darkening) and other UV induced mechanisms of material degradation. Float glass was recommended due to its widespread commercial availability and relatively low cost. Float glass comes in different forms, one of which is soda Lyme glass that contains iron particles.

The amount of iron content affects the transmittance (ability to pass sunlight) of the glass, so a low-iron glass was selected. The SR1 also contained LED and microprocessor circuitry. The SR1 was designed around a 32 × 32 array of LED cells. Each cell contains three white and three yellow LEDs to simulate road line paint configurations.

**PROPOSED METHODOLOGY:**

In the present project, all of the specified information like principal of solar how is constructed material used for solar road construction. A study was planned to research feasibility of solar road in India. The solar road is designed manually with the help of IRC 58 code of rigid pavement design. The pavement design for wheel load of 5100kg and soil coefficient is assumed. The pavement was subjected to the load combinations consisting of wheel load, friction load, warping load at edge and corner portion of road. The steel mainframes were analyzed by considering the building under fully enclosed conditions. The research work discusses the comparison between normal traditional road and solar road features and benefits of solar roadways. A typical solar road is shown below

3.2 Principal of solar road

The Solar Roadways consists of structurally engineered solar panels that we drive on.

Each Solar Road Panel (roughly 1m by 1m) interlinks with neighboring panels to form the Solar Roadways system. As a size and generating capacity of a solar system are a function of number of solar modules installed, application of a solar technology is readily scalable and versatile.

The solar panels are divided into three basic layers:-

1. Road Surface Layer.
2. Electronics Layer.
3. Base Plate Layer.

3.2.1 Road surface layer

Translucent and high Strength, it is rough enough to provide sufficient traction, yet still passes sunlight through to the solar collector cells Embedded within, along with LEDs and heating element. This layer needs to be capable of handling todays heaviest Loads under the worst of conditions and to be weather Proof, to protect the electronic layer be neat it.

3.2.2 Electronic layer

It contains photovoltaic Cells which absorb solar energy. It also contains a microprocessor board with support circuit for sensing loads on the surface and controlling a heating element with a view to reducing or eliminating snow and ice removal as well As school and business closings due to inclement weather. The microprocessor controls lighting communication and monitoring etc.

3.2.3 Base plate layer

It needs to be weather proof to protect the electronic layer above it. Distributes power and Signals to and from the panel.

**OUTCOMES:**

After looking at the capabilities of solar road panels it is clear that they are truly a viable and dynamic solution to the problem of finding renewable energy sources. The solar road panels

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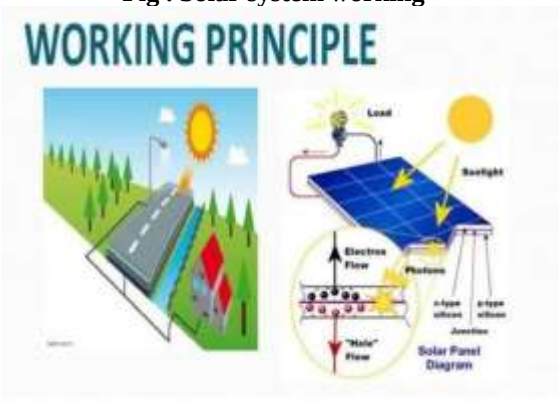
can withstand weight of 5100 kg wheel load with factor of safety more than 5. The longevity of the solar road panels should not be an issue unless there is a natural disaster. The ability to replace a single, damaged solar road panel adds a dynamic quality that could prove to be a cornerstone of the whole idea. Being able to install a new solar road panel with higher efficiency solar cells when an old panel is damaged allows for the solar road to constantly be upgraded

**Fig . Solar system working**




## IV. CONCLUSION AND FUTURE WORK

Conclusion: This project concluded that the implementation of solar road is not feasible at this moment in time although there are clear educational and financial benefits. Solar road having initial cost is approximately three to five time of normal asphalt road. While the idea of a roadway generating enough energy to power the surrounding buildings and potentially allow for entire institutions and cities to go off grid is really cool, it is still not cost feasible without an efficient method of production. At this moment, the only way to implement this project would be to receive large amounts of grant money from the government. This route is feasible, but it would take a lot of time, planning, politics, and collaboration among professors and senior staff members. Even with large amounts of grant money the project would still cost an astronomical amount compared to the financial benefits gained by its implementation. As the solar road panel makes its way into production and the efficiency of the solar cells increases projects like this one will become more feasible. We fully expect for the solar road panel to become a common technology across the nation in the next 10 to 15 years. Overall, this exciting idea has presented the world with a promising solution to the global problem of finding renewable energy sources.Solar Panel use will provide many enviornmental benefits such as minimizing green house emission, less fuel consumption & prevent pollution.

Future work:

Cost Reduction: Find ways to make solar roads more cost-effective through technology and construction innovations.

Efficiency Boost: Improve the energy conversion efficiency of solar cells in road panels.

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