



# REVIEW ON SMART ROADWAYS – FOR A SUSTAINABLE FUTURE USING SOLAR ENERGY

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## ABSTRACT:

*Smart Roadways, also known as Smart Highways, consist of series of structurally -designed solar panels which are based on Photovoltaic effect. The panels incorporate LED's, Microprocessor chips along with circuitry boards. These solar panels generate renewable energy which serve various domestic and commercial purposes. It also minimizes fossil fuel consumption as it can be used as a source of fuel for Automobiles. This in turn halves the greenhouse gases content in the atmosphere. Thus, the implementation of Smart Roadways Technology will create a pure energy boom as it smart, intelligent and self-healing. Thereby, the future of roadways lies in the implementation of this brand-new technology.*

**Keywords: Smart Road, Photovoltaic effect, Renewable energy, Fossil fuel, Greenhouse gases.**

## 1, INTRODUCTION

Smart roadway or Solar roadway is a surface of a road which produces electricity utilising Photovoltaic cells installed on solar panels that includes LED's and Microprocessor chips. The cost of Solar roadways might be three times that of an asphalt road, but it has greater durability and can be easily replaced. With a minimum 15 % efficiency, Solar Roadways would generate around three times the present electricity demand. Other benefits include Employment opportunities, Zero Maintenance cost, Zero Loss.

In the United States of America, the Department Of Transportation (DOT) granted \$100,000 to Solar Roadways for a Small Business Innovation Research (SBIR) in 2011. Solar Roadways is a company founded by Scott and Julie Brusaw in 2006. A crowd funding drive was started by this company at Indigo to procure funds for production in the year 2015.

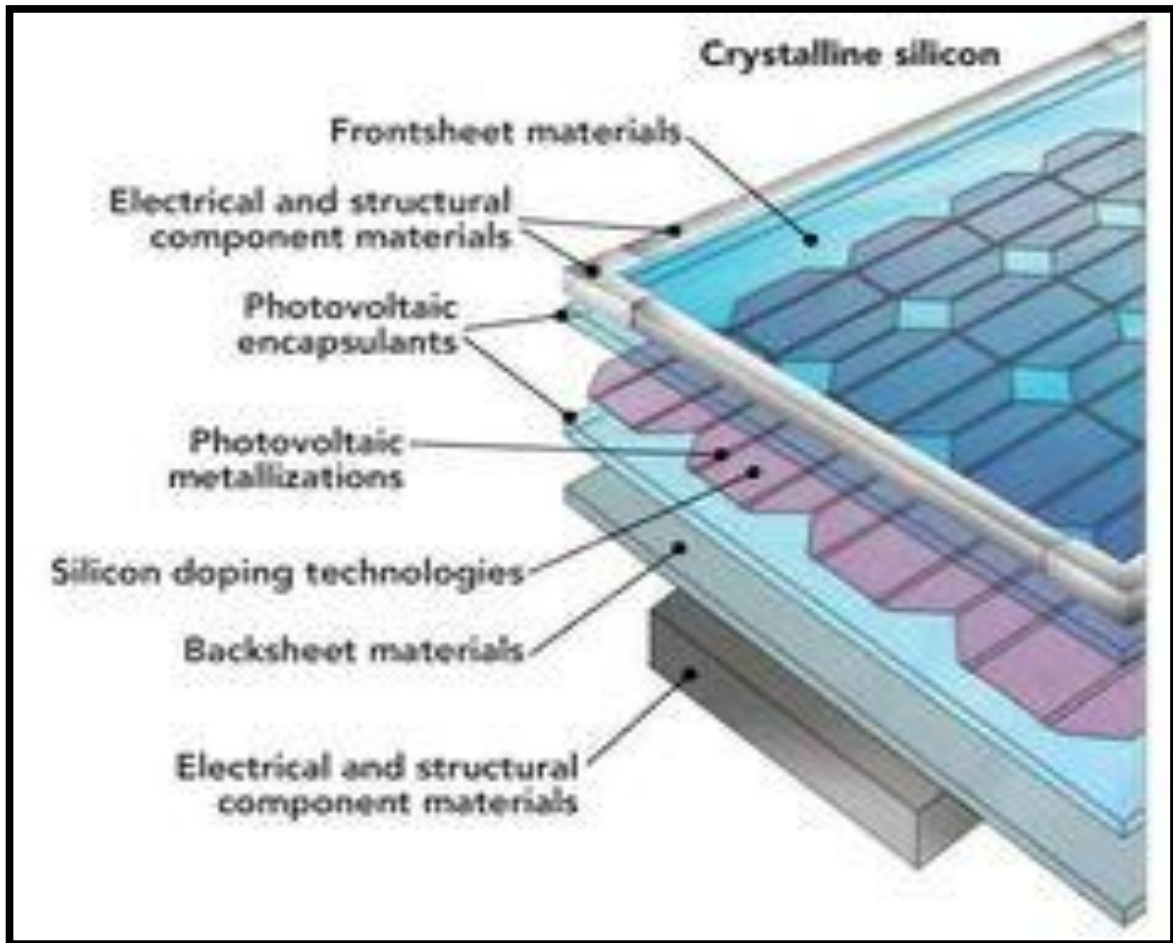
Solar Roadways is an efficient investment on Infrastructure development. The most significant element of Solar energy technology is that its power generation capacity simulates the base load viability of Renewable energy sources. The path to sustainable development can be firmly laid by upgrading to this new technology. SmartRoadway is the solution for energy crisis and rising fuel prices.

## 2, WORKING PRINCIPLE

Solar Roadway is a pavement that is structurally designed with solar panels upon which vehicles are driven. Its main function is production of electricity using Sun's energy. The approximately 12' by 12' solar panels are interconnected with neighbouring panels forming the Solar Road system. Solar panels can light up some LED's using their own heat which illuminates the road surface. This can be used to convey road safety messages such as "Go



Slow”, ” Drive with Caution” etc. In colder climates, these panels self-heat. The excess electricity generated is distributed to nearby residential and commercial places.



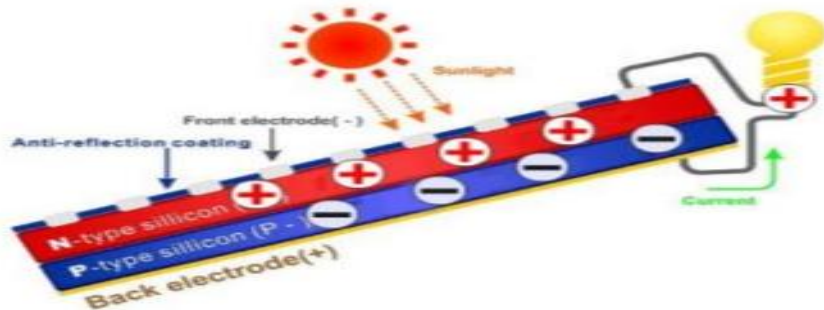
**Figure 1. Layers of Smart Roadway**

The components of Solar roads consist of

- Surface Course
- Circuit Layer
- Base Course

**2.1 SURFACE COURSE:**

It is the first layer on which the solar radiations strike and then are transferred to the Photovoltaic cells. As it is the surface on which there is going to be traffic flow, it must be of greater strength and adequate roughness index must be provided to prevent skidding of vehicles. The material used must be translucent and Water resistant to achieve greater serviceability even in extreme climatic conditions.



**Figure 2. Function of Surface Course**

**2.2 CIRCUIT LAYER:**

It is the second significant layer that is installed with microprocessor board and support circuitry for receiving the radiations from Sun and keeping in check the heating of the element. These components are placed twelve feet apart.

**2.3 BASE COURSE:**

This is the third layer which collects the Solar energy from the second layer and distributes it to the consumers (Automobiles, Residential, Businesses). As it the bottom most layer it is also made weatherproof.

**3, INFERENCES AND DISCUSSION**

**3.1 BENEFITS:**

**3.1.1 DURABILITY AND SERVICEABILITY-** The most highlighting feature of Solar roadway is its lifespan and ease of replacement. When compared to Asphalt roads they provide longer serviceability and they don't require any frequent maintenance.

**3.1.2 SUSTAINABILITY-** Smart highways make use of Solar Energy which is renewable and Pollution free. This minimizes Global Warming.

**3.1.3 LIFE SAVER-** These intelligent highways are self-illuminated with road safety messages which help to prevent road accidents and also help in lighting the roads at night.

**3.1.4 IMPROVED INFRASTRUCTURE-** Solar roadways do not require construction of new roads. They can be installed on existing roads.



**Figure 3. Smart Illuminated Roadway**



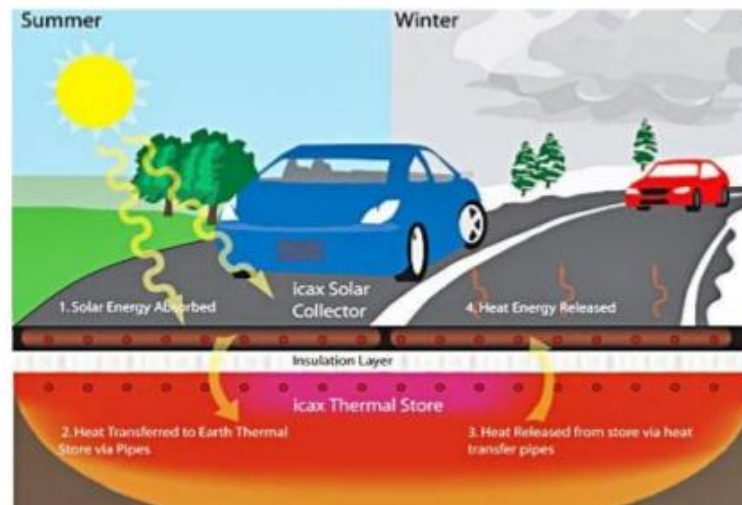
**Figure 4. Adaptable Roadway**

**3.1.5 LIFE CYCLE COST-** Though overall lifecycle cost of these roadways is very much lower when compared to asphalt roads.

#### **4, LIMITATIONS:**

**4.1.1 INITIAL COST-** Smart Highways incur a huge investment in the early stages unlike Asphalt roads due to the components involved in its construction.

**4.1.2 EFFECT OF SEASONS-** The efficiency of Solar Roadways varies with Seasons. In Summer, they work with greater efficiency than in Winter. The efficiency can't be maintained at a constant rate during every season.



**Figure 5. Seasonal effect on Efficiency of Smart Roadway**

**4.1.3 RE-PLANNING OF AREA-** Though solar roadways can be constructed on existing roads, the Buildings, Parking areas, Public parks, Sanitary lines etc. must be planned to collect the electricity from the panels in the best way possible.

## 5, CONCLUSION

The rapidly deteriorating oil resources necessitate the need for other renewable forms of energy which can be fulfilled by Solar roadways. Implementation of these roads in developing countries would prove to be a boon for the economy as well as infrastructure. These roadways will create an intelligent and secure highway system. The prototypes produced by Solar Roadways company has proved the significance of solar power. In spite of the installation cost being high, they are the best system for Sustainable development.

## REFERENCES:

- [1] "Solar Roadways - About".
- [2] Scott, Cameron (22 May 2014), "Following the Solar Brick Road". SingularityHUB. Singularity University.
- [3] Scott Brusaw, "Solar Roadways: A Real Solution," 2012. [Online]. Available: <http://solarroadways.com/main.html>. [Accessed 15 January 2012].
- [4] G. Valk, "Solar Road: Amsterdam, 26 January 2011," 26 January 2011. [Online]. Available: [http://www.tno.nl/downloads/Presentation%20SolaRoad%20definitief\\_uk.pdf](http://www.tno.nl/downloads/Presentation%20SolaRoad%20definitief_uk.pdf). [Accessed 15 January 2012].
- [5] A. North more and S. Tighe, "Developing Innovative Roads Using Solar Technologies," in CSCE 9th International Transportation Specialty Conference, Edmonton, 2012.
- [6] Remon Industrial Limited, "Mono 125S0R2 Solar Cell," [Online]. Available: <http://www.rmsolarpanel.com/html/49/2010-12-13/content-34.html>. [Accessed 2012 March 14].
- [7] "Alternative Uses of Highway Right-of-Way". Federal Highway Administration.



- [8] R. Roark and W. Young, Formulas for Stress and Strain, New York: McGraw-Hill, 1975.
- [9] Solar Roadways; Indiegogo; Crowd funding ended June 20, 2014.
- [10] "The Centuries-Old Technology Behind Solar Roadways, Indiegogo's Most Popular Campaign Ever". Forbes. 3 June 2014.
- [11] Maben, Scott (31 May 2014). "Star Trek: George Takei tweet boosts Solar Roadways". Christian Science Monitor. Associated Press. Retrieved 1 June 2014.
- [12] "On the not so sunny side of the street". The Economist. 5 June 2014.
- [13] "We Could Build a Solar Powered Roadway. But Will We?". Popular Mechanics. June 11, 2014. Retrieved February 24, 2015.
- [14] Carolyn Mathas (February 23, 2009). "2009 EE Times ACE Awards finalists announced". EE Times. Retrieved June 23, 2014.
- [15] "Solar Roadways named as finalist in most promising renewable energy award". Renewable Energy Magazine. 16 March 2010. Retrieved June 23, 2014.