

SOLAR ROADWAY

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ABSTRACT

The Solar Roadway is a series of well designed and engineered solar panels that are driven upon. The idea is to replace all currently using asphalt roads, parking slots, and driveways with solar road panels that collect energy to be used by houses, hospitals, schools, industries, etc. The energy generated by solar panel will replace the current need for fossil fuels like petrol, diesel which are used for driving vehicles which in turn reduces the Greenhouse effect nearly about half the current use. The researchers started thinking throughout the idea of converting asphalt and urban surfaces with solar panels. The Solar Roadways can preserve the area from power disaster and climate trade. Everyday people are finding out the answers to our deteriorating highway infrastructure, our crumbling energy grid, and the weather catastrophe. By implementing Solar Roadways Technology, it will create the clean energy with no damage to environment. The replacement of Asphalt Road with Solar Road will cost little extra but its maintenance is very much less than that of Asphalt roads. Solar roadway is an intelligent highways infrastructure which will eliminate our need for fossil fuels. If all the Asphalt road is replaced by Solar roadway in United States of America, it will create three times energy utilized by United States today. So it's time to upgrade our infrastructure with the 21st century technology i.e. "SOLAR ROADWAYS".

KEYWORD: *Electric Vehicles, Fossil Fuel, Intelligent Roads, Smart Grid, Solar Panels, Solar Roadways.*

1. INTRODUCTION:

Hearing about the concern of global warming and knowing our dependency on fossil fuels the solar roadways imagined to develop road with solar panels. This innovation is begun in early 2009 and later the company was established by as Solar Roadways in U.S. The Solar Roadway is a series of structurally-engineered solar panels. The idea of Solar Roadways is to replace all current petroleum based asphalt roads, parking lots, with Solar Road Panels that will collect energy which will be used by our homes and businesses. The ultimate goal is to store excess energy which will be generated by Solar panels in or along-side the Solar Roadways. This renewable energy replaces the current need for fossil fuels used for the generation of electricity. This reduces the green houses gasses to half.

Solar Roadways system at present, cost about three times what it costs to install an asphalt road, but Solar Roadways is more durable, and can be more easily replaced in modular, and are able to pay for itself by generating more electricity than our we consume. At just about 15% efficiency, far below what is expected or minimum

efficiency with the wrong alignment of Solar panels, a 100% efficient Solar Roadways enabled driving infrastructure would produce three times total electricity demand.

Asphalt road is convenient to lay-down, compared to other methods. It has carried our automotive infrastructure into the 21st century. But there are many hidden costs and maintenance cost that are making it increasingly difficult and expensive to continue favoring asphalt as predominant road for the entire nation. That's why asphalt road is not ideal for road construction.

1.1 Research Scope and Hypothesis:

The scope of this study changed into outline the design of a sun avenue panel that might be capable of face up to the structural and environmental hundreds positioned on it underneath use in a surrounding.

1.2 Research Objectives

The main objective of this research was to determine how a solar panel may be built. Primary standards considered have been structural and environmental overall performance of the panels and related materials. The specific objectives of this research blanketed:

1. Will power of the layout requirements and material selection required for the foremost solar road panel to be used.
2. Layout a prototype solar street panel for use for laboratory checking out and as a platform for future related studies.

1.3 Solar Roadways working:

In order for solar roadways to achieve success, the 3 components need to be working in unison. the street floor layer desires to be clear enough to let the sunlight bypass thru to the electronics layer, the electronics layer wishes to accumulate electricity and preserve the road functioning well, and the baseplate layer desires to determine wherein the strength is meant to move. Due to the fact that the road lines on solar roadways are in reality LEDs, the baseplate layer wishes to make certain the roadway has sufficient electricity wished before sending the rest of the electricity out toward the grid.

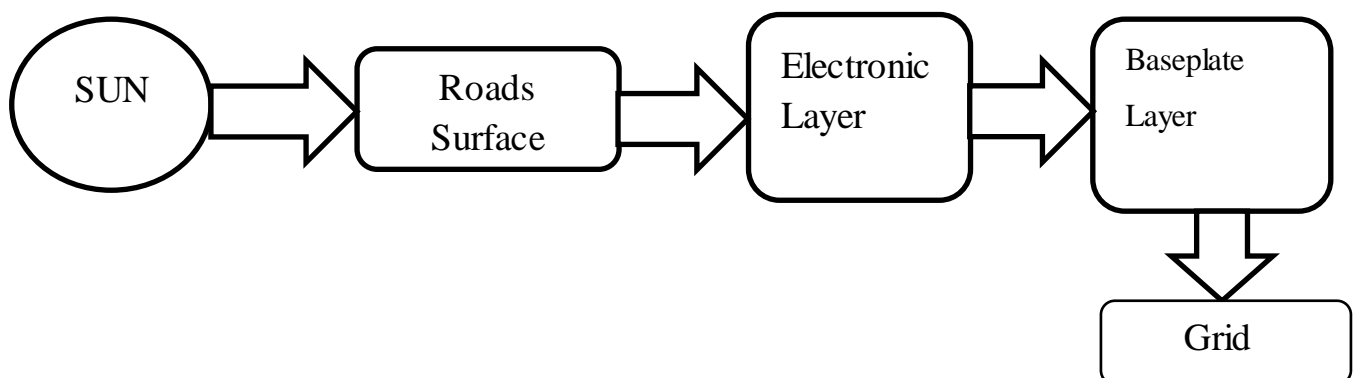


Figure 3: Path of energy in Solar Roadway

2. Solar Road Panel Design and Construction



3.1 Solar panel layer:

The solar panels are divided into three simple layers

- (a) Embedded LEDs Layer
- (b) Floor/Glass Layer
- (c) Electronics Layer
- (d) Base Plate Layer

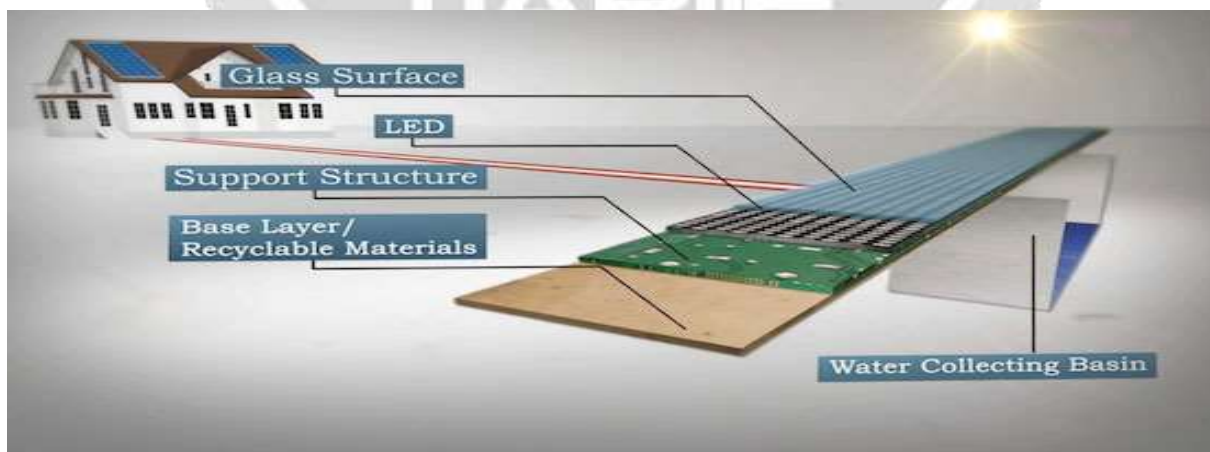


Figure 2 Structure of solar roadways

3.1.1 Embedded LEDs Layer.

A layer of embedded LEDs will be used to create visitors warnings or crosswalks, and extra strength will be used to price electric powered cars or routed into the energy grid. The electrical additives will be embedded among layers of extraordinarily durable, textured glass.

3.1.2 Road surface layer/glass layer

Translucent and high-strength glass, it is rough enough to provide sufficient traction, yet still passes sunlight through to the solar collector cells embedded within, along with LEDs and a heating element. This layer needs to be capable of handling today's heaviest loads under the worst of conditions and to be weatherproof, to protect the electronics layer beneath it. Solar Road Panels are made of tempered glass.

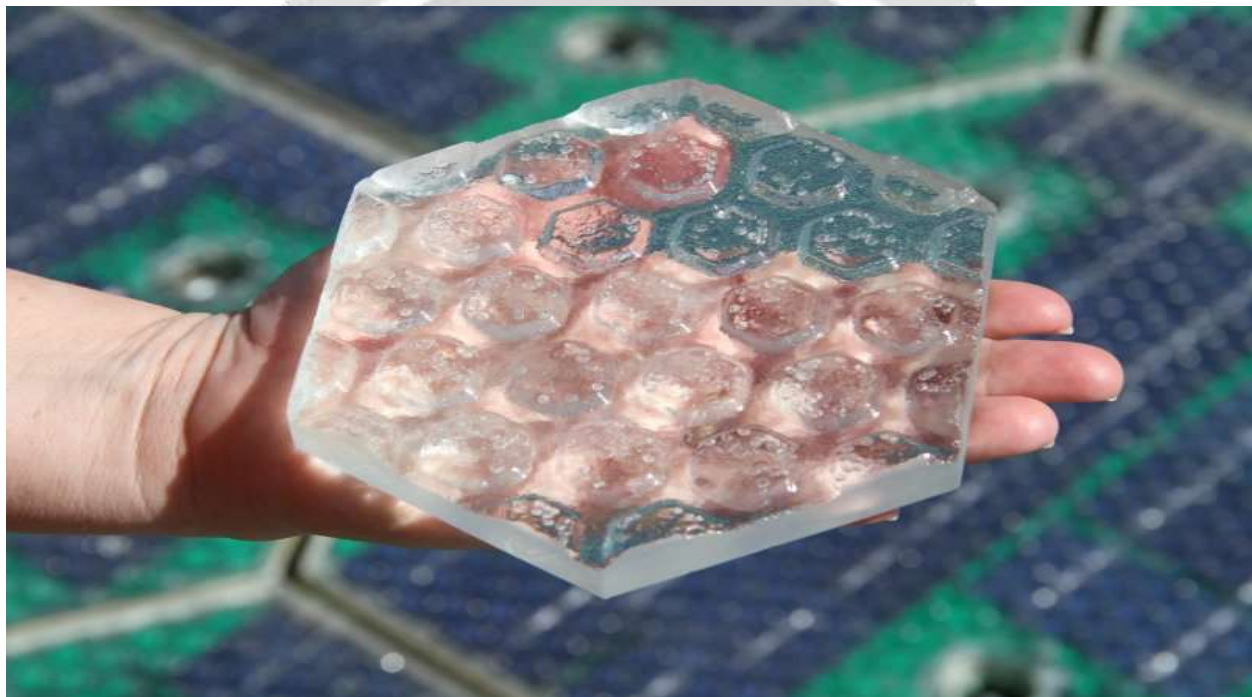


Figure 3 Structure of glass

HARDNESS	METERIAL
0.7	Graphite
1.3	Asphalt
3.5	Brass
5-5.5	Knife Blade
5.5-6	Plate glass
6.5-7	Steel file

Table 1 Strength of glass

3.1.3 Electronics layer:

It contains photovoltaic cells which absorb solar energy. It also contains a microprocessor board with support circuitry 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, communications, monitoring, etc. With a communications device every 12 feet, a solar roadway can be an intelligent highway system.

3.1.4 Base plate layer:

Even as the electronics layer collects electricity from the sun, it is the bottom plate layer that distributes that energy as well as information signals (phone, TV, net, and so forth.) down the road to all homes and groups related to the sun roadway. It wishes to be weatherproof to protect the electronics layer above it. Transmission lines may want to simply be run along already hooked up roadways.

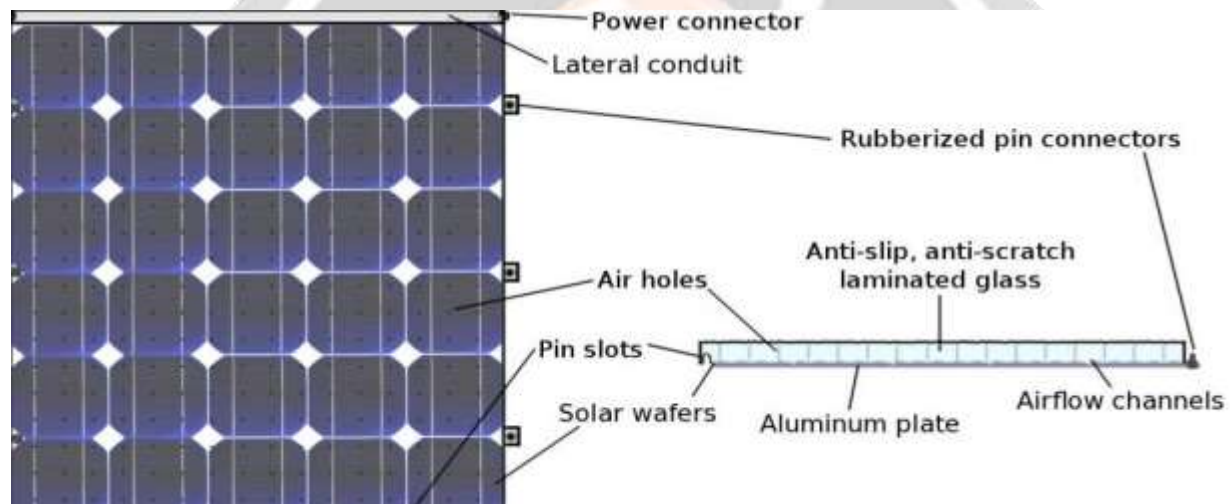
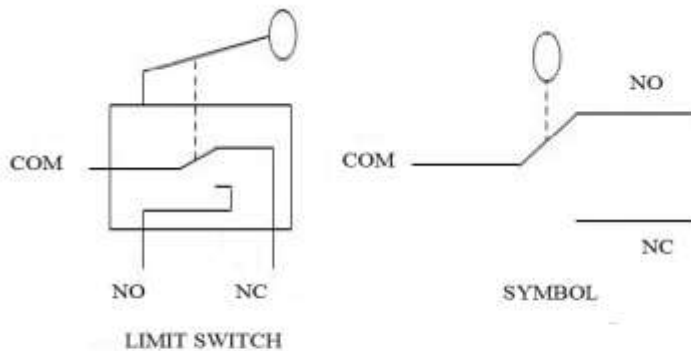


Figure 4 Frame of solar road

3.2 Limit switch:

Limit is a switch operated by the motion of a machine part or presence of an object.

They are used for controlling machinery as part of a control system, as a security interlocks, or to count objects passing a point. A limit switch is an electromechanical device which consists an actuator which are mechanically linked to a set of contacts. When an object comes into contact with the actuator, the limit switch device operates the contacts to make or break an electrical connection. A limit switch is operated by roller-lever mechanism; this can be put on a gate on a canal lock, and indicates the position of a gate to a control system.



3.3 DC Motor

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.

3.4 Copper Strip

Copper, a raw material used to produce the whole range of Silmet's products, has proven to be the best material due to its excellent electrical and thermal conductivity, has a 100% recycling rate, not to mention its special mechanical and physical properties that distinguish the products manufactured using this raw material.

The coefficient of friction between two materials in relative sliding may depend on contact pressure, surface roughness of the relative harder contact surface, temperature, sliding velocity and the type of lubricant whether the level of contamination. It's the reason that the data found in the many reference tables available may show a large variation.

3.5 Calculation of annual solar energy output of photovoltaic cell

The global formula to estimate the electricity generated in output of a photovoltaic system is :

$$E = A * r * H * PR$$

E = Energy (kWh)

A = Total solar panel Area (m²)

r = solar panel yield (%)

H = Annual average solar radiation on tilted panels (shadings not included)

PR = Performance ratio, coefficient for losses (range between 0.5 and 0.9, default value = 0.75)

Conclusion:

Solar Roadways has taken the first step to creating the world's largest solar panel: The Company uses tempered glass and photovoltaic cells to create intelligent, energy-harvesting pavement, complete with built-in heating elements for melting ice and LEDs for signage. The technology is still in its infancy, but with funding from the Federal Highway Administration and an Indiegogo campaign, the company finished a prototype parking lot in Idaho last year. Solar Roadway has released the first pictures of their new Solar Roadways prototype parking lot. Initial installation is complete, with some additions still to come (i.e., covers for mounting holes, mastic between panels, software for LED patterns). The parking lot is fully functional with solar cells, LED's, heating elements, and the textured glass surface. The prototype results show the significance of solar power roads uniquely. However installation cost is very high this new technology is capable of replacing the costly fossil fuel system and can give us clean energy without any climate change.

References:

- [1] Scott Brusaw, "Solar Roadways: A Real Solution," 2012. [Online]. Available: <http://solarroadways.com/main.html>. [Accessed 15 January 2012].
- [2] G.Valk, "Solar Road: Amsterdam, 26 January 2011," 26 January 2011. [Online]. Available: http://www.tno.nl/downloads/Presentation%20SolaRoad%20definitief_uk.pdf. [Accessed 15 January 2012].
- [3] A. Northmore and S.Tighe, "Developing Innovative Roads Using Solar Technologies," in CSCE 9th International Transportation Specialty Conference, Edmonton, 2012.
- [4] 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].
- [5] R. Rollings, "Comparison of the British Class 60 Trackway and AM-2 Mat for Bomb Damage Repair Applications," DTIC Document, 1975.
- [6] T. Rushing and J. Tingle, "Full-scale evaluation of mat surfacing for roads over sand subgrades," *Journal of Terramechanics*, vol. 46, no. 2009, pp. 57-63, 2009.
- [7] Institution of Structural Engineers, *Structural use of glass in buildings*, London: SETO, 1999.
- [8] R. Roark and W. Young, *Formulas for Stress and Strain*, New York: McGraw-Hill, 1975.