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Green Up Pavement Rehabilitation Decision Tool

Project 1855
December 2019

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Climate change is a bitter reality. Pavements, like many other man-made structures, unfortunately contribute to climate change through the urban heat island effect; by polluting rivers and oceans with contaminated stormwater; and bringing unwanted traffic noise and pollution to residential areas. The quest for ways to "green up" pavement structures and materials by design is on.

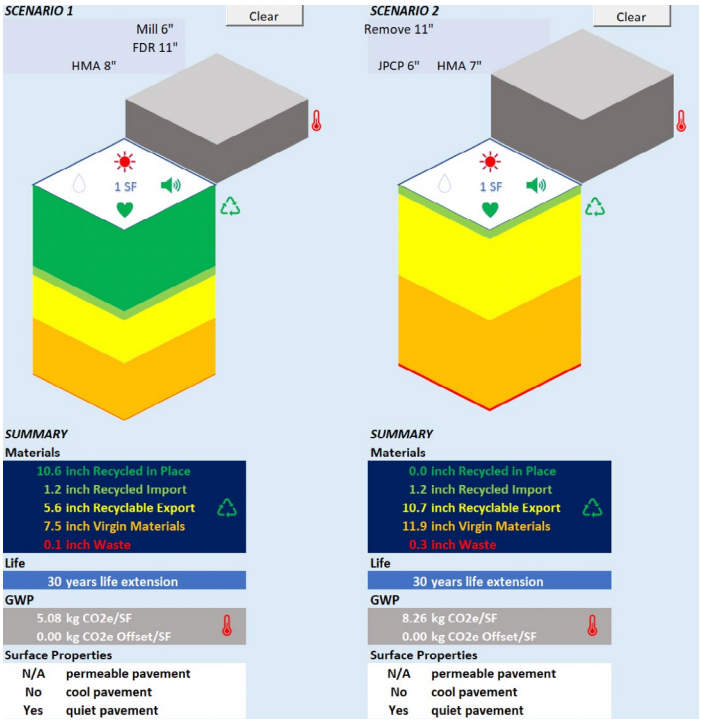
A team of researchers from the Pavement Recycling and Reclaiming Center (PRRCenter.org) at Cal Poly Pomona is proposing a novel approach to evaluate and include sustainable aspects of pavements and materials in the design decision-making process. The new methodology – Green Up Pavement Rehabilitation Decision Tool – allows designers involved in projects large or small to "green up" their recommendations and build more sustainable pavement structures.

Green Up aims to offer a simple and relatively quick approach to visualize and compare design alternatives by focusing on key aspects related to sustainabil-ity: materials, surface properties, and carbon footprint.

Study Methods

Designers can easily get lost in the complexity of evaluating the sustainability of a solution or system. Terminology, life-cycle scenarios, and environmental impact metrics can all be confusing and discourage designers from undertaking an analysis. Green Up aims to offer a simple and relatively quick approach to visualize and compare design alternatives by focusing on key aspects related to sustainability: materials, surface properties, and carbon footprint.

Central to the Green Up methodology is a graphic that illustrates the sustainability of different aspects of a solution through colors and shapes:



The graphic represents the 3D view of a cross section of the pavement being rehabilitated in the form of a white surface sitting on top of colored layers of materials. The depth of the cross-section corresponds to total thickness of pavement that will be added, removed, or reused in place. Different colors are used to illustrate amounts of materials in the following categories:

- Recycled in place: green
- Recycled import: light green
- Recycled export: yellow
- Virgin materials: orange
- Waste: red

Users will be encouraged to increase the amount of "green" and reduce the "red" areas in the Green Up graphics.

The white surface represents an area of one square foot, which is used in Green Up as the reference area to calculate and compare amounts of materials as well as the corresponding carbon footprint – per square foot of project.

The graphic also uses four symbols on the white surface to indicate whether the following sustainable pavement strategies are being used:

- Permeable pavements, such pervious concrete or porous asphalt: the water drop symbol.
- Cool pavements, or pavements with higher solar reflectance: the sun symbol.
- Quiet pavements, or pavement surfaces that are less noisy than regular pavement surfaces.
- Long-life pavements, or pavements that last longer than the generally accepted 20-year life for flexible pavements and 40-year life for rigid pavements.

The color of the symbols indicates whether a strategy was used (green), not used (red), or it is not applicable for the project in question (clear).

The last component of the Green Up graphic is the carbon footprint cloud shown as a gray block to the right of the pavement surface. The thickness of the cloud corresponds to the 100-year global warming potential of the proposed pavement rehabilitation solution, in kilograms of carbon dioxide equivalent per square foot of project. Strategies with a larger carbon footprint will exhibit a thicker carbon cloud.

By itself, the graphic shows the pavement cross-section as seen through a sustainability lens. The real value of the graphic, however, is when several design alternatives are being considered and the corresponding graphics can be observed and compared side-by-side.

Findings

The project team developed precise algorithms for calculating the elements of the Green Up graphic. In consultation with representatives of the portland cement concrete and asphalt concrete industries in California, the team meticulously revised and refined the design of the graphic. The research team also produced an Excel macro that can be used to create and compare graphics for up to three different pavement rehabilitation strategies.

POLICY/PRACTICE RECOMMENDATIONS

The next step for Green Up is to translate and implement the methodology developed in this project into an online application that users will be able to access and use in a web browser. The online application will also add an educational dimension to the tool by offering fact sheets about sustainable pavement strategies as well as links to additional resources for those interested in learning more.

About the Authors

The project team was led by Dr. Dragos Andrei, Director of the Pavement Recycling and Reclaiming Center at Cal Poly Pomona.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/project/1855

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