

Sustainability Analysis of Unpaved Road Construction with Recycled Materials in Council Bluffs, IA

Problem Statement

Approximately 68,400 miles of unpaved roadways exist in the 114,000 mile road network in the State of Iowa, costing roughly \$270 million annually to operate and maintain. There are similar extensive networks of unpaved roads in the other EPA Region 7 states. Maintaining good-quality unpaved roadways is very important to the rural economy, as these roads enable easier and faster transportation between urban and rural regions for people, goods and services. These roadways also enable transportation of agricultural products from farms to urban centers and are thus essential for enabling access to local food and agricultural products. Unpaved roads also provide access to essential services for many underserved and lower-income populations. However, their high maintenance costs requires significant levels of government funds, which could be allocated to other highly needed services for communities. Current practices for construction and maintenance of unpaved roads are also highly energy intensive and thus have a significant impact on the environment.

The costs of maintenance of unpaved gravel road surfaces and shoulders is partially due to the frequent extensive damage caused by degradation of materials under heavy traffic loading and winter/spring freeze-thaw cycles. Current maintenance practices typically involve covering the entire damaged roadway surface with virgin aggregate, which must first be blasted from a quarry and transported to the site for use. This common practice is not the most sustainable nor economical solution. With limited state and local budgets to maintain these essential roadways in the face of climate change and increasing environmental pressures, new innovative solutions are needed to maintain high-quality unpaved roadways at lower costs and with reduced environmental impacts.

In an existing Iowa DOT-funded project (IHRB 14-04), the PIs, in coordination with county engineers and other stakeholders in Council Bluffs, IA, are assessing methods for recycling degraded and aged aggregates of existing unpaved roads. These methods have been found to maintain the necessary surface quality needed, using less virgin aggregate thus saving time and cost, while recycling approximately 50-60% of the virgin materials. These recycling methods are applicable to Council Bluffs, IA as well as all other regions in EPA Region 7 with unpaved roadways. However, while the scope of the Iowa DOT-funded project covers the evaluation of strength and durability of unpaved roads, it does not include comprehensive assessment of the life cycle costs or positive environmental impacts of using recycling unpaved roadway materials compared to conventional construction and maintenance methods.

In the proposed project, the research team will conduct a sustainability assessment of the new unpaved road construction and maintenance methods using the BE²ST-in-Highways assessment method. This assessment includes both Life Cycle Cost Analysis (LCCA) to assess the cost savings, and Life Cycle Analysis (LCA) to assess environmental impacts and several other factors, to provide stakeholders with a holistic picture, a decision-making tool, and qualification of the environmental and economic impacts of implementing such recycling methods. This assessment method will be applied to the test sections of project IHRB 14-04 in Council Bluffs, IA but the proposed methodology will be applicable to any location. The results of this work will be summarized and presented to both interested stakeholders in the city of Council Bluffs, IA in a workshop, and to a larger community via a pre-conference workshop during the Iowa County Engineers Conference.

Through the sustainability assessment analysis of using recycled unpaved road materials, and dissemination of these findings through workshops, the proposed research supports the US EPA Sustainable Materials Management (SMM) program's vision of advancing the sustainable use of materials throughout their lifecycle to minimize waste and environmental impacts in the built environment (Strategic Priority 1). The results of this research will provide a quantification of the benefits of the use of recycled unpaved road

materials, with the ultimate impact of decreasing disposal rates of deteriorated aged unpaved road materials and encouraging their recycling (Objective 1). By quantifying the reduction in environmental impacts and through dissemination to local and wider audiences, stakeholders can be motivated to implement these methods to ultimately reduce environmental impacts (Objective 2). The outcomes of the research will benefit local and state economies (Objective 3) by enabling counties to allocate less funding to construction and maintenance of unpaved roads. Finally, through the proposed workshop/training session, the research team will provide local stakeholders with information to support the use of recycled unpaved road materials that will equip them with the necessary tools and knowledge to utilize these methods in their respective locations (Objective 4).