Research Summary

Feasibility of 3D printing applications for highway infrastructure construction and maintenance

Research Need

In recent years there has been a significantly increased interest in additive manufacturing (also frequently referred to as 3D Printing), a design platform largely unexplored within infrastructure projects. This project built on a previous and explore further the feasibility of 3D printing applications for highway construction and maintenance in the Commonwealth of Massachusetts.

Goals/Objectives

The research effort focused on the following objectives:

1. Explore the feasibility of additive repair technologies for real corroded steel beams ends. Different additive manufacturing solutions and repair technologies were examined in the lab and for potential on-site application.

2. Perform research on the key factors related to the different repair technologies and equipment investigated that can impact the success of an attempted repair (Example: velocity of material being deposited). Use the research to develop a list of suggested options for equipment and facilities that seem well suited for handling 3D printing applications and the associated qualifications testing of 3D printing repaired steel bridge beams.

Methodology

The work shows the steps for obtaining results using different additive manufacturing technologies.

Several additive manufacturing technologies were studied and applied and their mechanical properties were carefully tested.

To determine the mechanical properties, both tensile- and compression tests have been performed in the lab. The results are used to then carefully examine the potential of the additive manufacturing technologies.

Key Findings

Additive manufacturing technologies are showing great potential for future use to repair steel corroded bridge beams. A key finding is the swift and precise deposition possibilities that cold-spray can offer in practice. Furthermore, great results are obtained in compression and further research need to be performed to improve the tensile properties.

Use of Findings

The team encourages MassDOT to distribute the knowledge described in the report among the employees to widen the options for future possibilities of structural repair.

With that, a broad awareness can be created within MassDOT that will allow use of future AM technologies for structural repair.

A new rehabilitation and repair protocol should be developed as a next step and then on-site applications should be explored to showcase the new additive repair solution. The corroded beam end problem is extensive in the state and this solution has the potential to be a paradigm change.

Project Information

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