Bridging the Gap: A Transdisciplinary Approach to Geosynthetic Research and Engineering Education through Community-Industry Partnerships

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As national funding environments face increasing uncertainty, creative collaborations between academia, industry, and local stakeholders are vital for advancing Earth science and engineering. This presentation details a five-year study on geogrid-reinforced soil improvement for an unpaved road at Northern Arizona University (NAU) located in Flagstaff, Arizona, USA. This project serves as a case study for integrating geotechnical research with hands-on undergraduate education and community-led infrastructure resilience.

The unpaved road provides critical access for university maintenance operations and represents infrastructure commonly found in rural and less-developed regions worldwide. The site lies at elevations of 1,850–2,350 m and experiences harsh climatic conditions, including approximately 150–200 freeze–thaw cycles annually and 105–120 cm of average winter snowfall. These conditions accelerated deterioration of the soft clay subgrade, resulting in rutting, poor drainage, and restricted access during precipitation events.

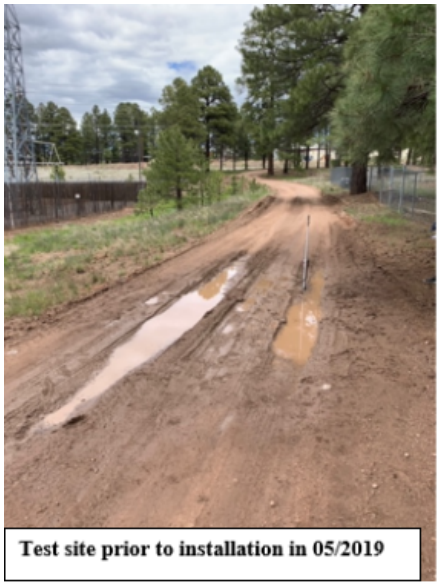
Facing a lack of institutional funding, a transdisciplinary collaboration was initiated. Industry partners (Tensar International and Applied Arizona Materials) donated advanced geogrid products and aggregates, while the NAU Facilities Department provided heavy machinery.

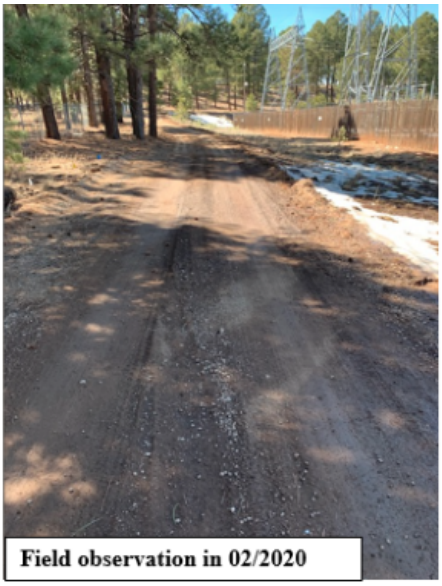
Central to this initiative was the educational component: a cohort of students led the geotechnical design and field experiments. The roadway was divided into seven experimental sections—varying aggregate base course (ABC) thickness from 15cm to 35cm—to optimize reinforcement design. Performance was monitored via Dynamic Cone Penetrometer (DCP) and Light Weight Deflectometer (LWD) testing, alongside five years of field observations.

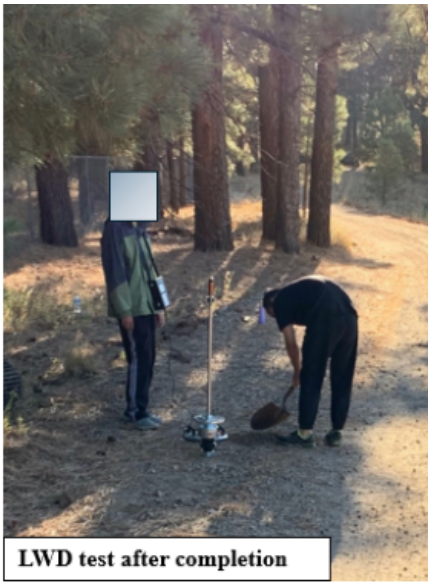
Results and Impact:
Technical Success: Geogrid-reinforced sections showed no rutting or potholes after five years, whereas non-reinforced control sections exhibited significant failure.
Optimization: LWD data identified that 20cm of ABC with one layer of geogrid provided the highest relative soil capacity and cost-efficiency.
Pedagogical Value: Students gained critical "field-to-lab" experience, bridging theoretical soil mechanics with practical application.
Sustainability and Resilience of infrastructure: Since its completion in May 2019, the geogrid-reinforced road has maintained good structural condition, enabling safe transportation for facilities technicians, reducing maintenance needs, and supporting long-term infrastructure sustainability.

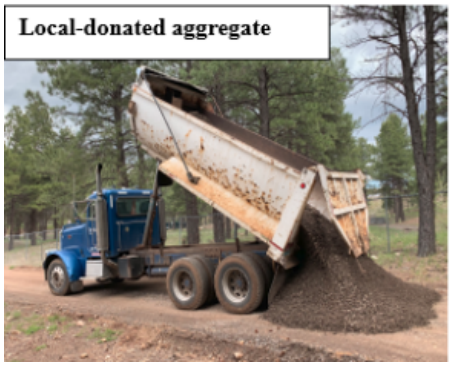
This project demonstrates how geoscientists or geotechnical engineers can lead transdisciplinary teams to solve local challenges, providing a replicable and scalable model for research-education initiatives that remain resilient despite limited state funding.

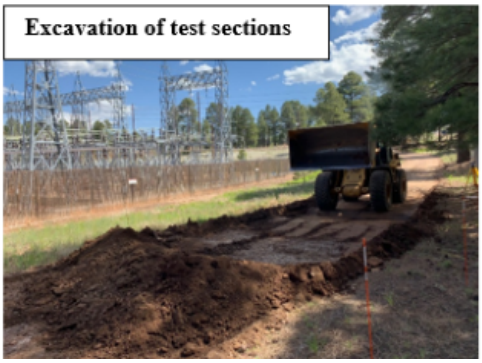
Keywords: Geogrid Reinforcement , Geological and Geotechnical Engineering Education , Community-Industry Partnership

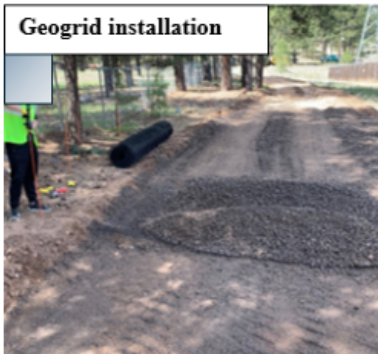

Test site prior to installation in 05/2019


Field observation in 02/2020


LWD test after completion


Local-donated aggregate


Excavation of test sections


Geogrid installation

