Pop-Up Metro

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# Transforming Legacy Rails into Modern Transit Solutions: NSF Grant Awarded for AI-Based Track Monitoring Research

## Near real-time track monitoring will revitalize legacy railroads to enhance transit accessibility and sustainability.

**By:** Iris Chang and Henry Posner III

The U.S. has thousands of miles of rail infrastructure, but much of it is abandoned or underutilized due to current levels of passenger and freight operations. Many of these “legacy rails” run through communities that could benefit from revitalization through passenger transit, addressing critical multimodal transportation needs.

Carnegie Mellon University researchers in the College of Engineering, with a $75,000 planning grant from the National Science Foundation’s Civic Innovation Challenge (CIVIC), are collaborating with civic, community, and industry partners on a low-cost broken rail and damage detection system to make better use of these underutilized rail lines.

The project, “Revitalizing Existing Community Infrastructure for Affordable and Efficient Passenger Rail Mobility Solutions,” intends to test an acceleration and vision-based AI technology that monitors rail integrity in near real time. The system will detect and alert operators to current track conditions, as well as potential safety and reliability issues. With improved track monitoring, communities would be able to confidently introduce rail transit on their legacy lines. Benefits go beyond providing transit alternatives; the potential impact includes economic growth, reduced emissions, and a shift towards more livable, affordable, and accessible urban environments.

“This project introduces a dynamic and scalable solution aligned with a concept we refer to as a ‘feasibility study on wheels,’ which is a data-driven strategy supporting rapid, cost-effective monitoring and enhancements to track safety and reliability that can shape to changing community needs”, said Katherine Flanigan, Assistant Professor in Civil & Environmental

Engineering (CEE) and Principle Investigator (PI) of this project. Mario Bergés, Associate Professor in CEE and Co-PI, adds that “we are especially excited to work closely with the community and all the different stakeholders participating in the project as it forces us to consider important practical dimensions of our proposed track monitoring solution.”

Compared to car and bus transportation, rail transit is generally regarded as the best choice for improving accessibility due to its capacity to support large ridership numbers with greater reliability, scalability, and sustainability. However, rail transit projects frequently encounter high costs, regulatory barriers, and lengthy deployment timelines that prevent them from ever starting.

In an industry pilot occurring alongside Flanigan’s, Pop-Up Metro - a fresh transit infrastructure alternative and key partner whose trains the track monitoring system will run on - aims to prove that these barriers to rail transit can be overcome.

“Pop-Up Metro’s potential shines in its ability to enable rail transit quickly, economically, and sustainably,” says Henry Posner III, Chairman of Pop-Up Metro and Adjunct Instructor in the Department of History. The company runs refurbished London Underground trains on existing low-density freight lines for rapid, low-cost deployments. “By combining innovation with practical solutions, we are demonstrating that rail transit can be accessible to more communities than ever before.”

The project will launch in Philadelphia along the Delaware River Waterfront in 2025. With the data generated from the track monitoring system, it could pave the way towards revitalizing thousands of legacy rail lines, solving accessibility challenges nationwide.

The Civic Innovation Challenge is a research and action competition designed to build a more cohesive research-to-innovation pipeline and foster a collaborative spirit between communities and researchers. Whereas many community-university partnerships take years to provide tangible benefits to communities, CIVIC funds projects that rapidly pilot state-of-the-art technologies and ideas and have the potential for lasting impact in the partnering community, as well as the potential to be scaled and implemented in other communities.