

NATIONAL SCIENCE FOUNDATION
Proposal Abstract

Proposal:1937115

PI Name:El-Gohary , Nora

Proposal Title: Convergence Accelerator Phase I (RAISE): Civil Infrastructure Systems Open Knowledge Network (CIS-OKN)

Institution: University of Illinois at Urbana-Champaign

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The NSF Convergence Accelerator supports team-based, multidisciplinary efforts that address challenges of national importance and show potential for deliverables in the near future.

This Convergence Accelerator Phase I project focuses on the grand challenge of restoring and improving the U.S. national urban infrastructure by creating a Civil Infrastructure Systems Open Knowledge Network (CIS-OKN). This system will provide tools to assemble and analyze infrastructure data that can improve evaluation, planning, design, construction, and operation of our infrastructure systems. The project includes a multidisciplinary and multi-institutional team of civil engineering, data science, computer science, and social science experts and leverages industry and government partnerships to identify and harness the necessary data to enable safer, more efficient, and cost-effective construction, operation, and maintenance of U.S. infrastructure.

The CIS-OKN has the potential to transform the way civil infrastructure systems decision-makers and stakeholders interact with and use what were previously isolated and heterogeneous data. The project seeks to improve understanding of the factors contributing to infrastructure deterioration and to help decision-makers select and prioritize the operations necessary to maintain the reliability and improve the sustainability of the U.S. infrastructure system. The project team's strategic partnerships with industry and government agencies should enable them to produce an open knowledge network that can have an impact on civil infrastructure systems practices and thereby help meet the need for resilient and sustainable infrastructure systems.

Recent advances in data analytics and machine learning have created a unique opportunity to learn from past and current conditions to better assess and predict the conditions and sustainability of civil infrastructure systems. By linking, integrating, and analyzing the wealth of data that exist, the CIS-OKN will facilitate insights relevant to construction, maintenance, and investment decision-making. The research objective is to develop and test an open, shared, public cyberinfrastructure for locating and accessing civil infrastructure systems data from multiple sources and in heterogeneous formats to facilitate knowledge discovery, predictive analytics, and data-driven decision making. The effort will include semantically understanding the content and relationships of different types of data to each other and to the physical infrastructure components; extracting information about infrastructure system conditions from unstructured data sources; linking and fusing data from disparate sources, in different formats, and with different levels of technical and descriptive detail into a unified knowledge representation; and developing integrated querying, reasoning, and learning tools for these heterogeneous types of data. The CIS-OKN has the potential to enable new modes of data-driven discovery, transforming isolated data into forms that enable

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integrative data analytics across disciplines and institutional boundaries, potentially enhancing innovation across the civil infrastructure systems domain and beyond.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.