**URP 610/402: Urban Networks**

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Cities contain many interconnected networks for infrastructure, human mobility, and relationships. This elective introduces students to concepts and analytical methods for urban network analysis, including conceptualizing, analyzing, and visualizing cities as networks and fostering a critical perspective on how urban networks reflect and reproduce urban inequality. Specifically, students will engage with four types of networks: 1) non-geolocated social networks, such as friendships; 2) geographically embedded infrastructure networks, like roads; 3) mobility networks that represent flows between geolocated origins and destinations; and 4) spatial social networks that illustrate social relationships in space or track the spatial footprints (i.e., places people have visited) grouped by individual. Students will analyze these networks to understand their applications in urban transportation, social justice, and governance. Additionally, students will learn to employ the "Network Duality" framework for a critical examination of urban infrastructure through a network lens. The course will be taught with lectures and hands-on analytical labs. The labs will use Gephi, SNoMaN software, and the R programming language. Python submissions for coursework are permitted. Prior programming experience with R or Python is not required but highly recommended.

**Learning Goals**

By the end of the semester, students will be able to:

* Conceptualize cities as spaces comprised of various networks and flows.
* Grasp fundamental network concepts, such as shortest paths, network distance, community detection.
* Compute network statistics and visualize social networks using Gephi.
* Calculate routing distances and visualize routes on road networks by type.
* Analyze and depict origin-destination flows.
* Implement advanced spatial social network metrics and visualizations and with the SNoMaN software.
* Develop critical perspectives on urban networks and their associated infrastructure within the network duality framework.

**Course Requirements:**

This course primarily involves a series of weekly lectures for students to learn network concepts and methods, along with weekly hands-on, self-paced labs for practicing data analytics and visualization in Gephi, R, or SNoMaN. Beyond the labs, there will be a group assignment working in-dept with one of the four types of networks (i.e., social, infrastructure, mobility, and spatial social networks) and a final project that applies the network duality framework to conceptualize, analyze, and visualize an aspect of urban infrastructure.