## Mechanism Design for Locating a Bridge Between Regions with Prelocated Facilities

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**Abstract.** In many urban planning projects, social planners require to construct a bridge to connect two regions separated by obstacles such as rivers or highways. Further, if there are facilities in separated regions, agents on both sides can choose to go to the nearest facility through the bridge to receive service. Naturally, how to locate the bridge is crucial for agents to reach a facility quickly.

This paper studies the mechanism design problem for locating a bridge between two separated regions, each of which has been equipped with a facility. There are a set of agents located in each region and each agent has her location as private information. Once the bridge is built, the agents will go to the nearest facility to receive service and each agent's cost is the distance from her location to the nearest prelocated facility via the bridge. We aim to design strategy-proof mechanisms that incentivize agents to truthfully report their locations under the social objectives of minimizing the maximum cost and the social cost. For the maximum cost objective, we characterize the optimal solution and prove it is strategy-proof. For the social cost objective, we propose a 3-approximate deterministic strategy-proof mechanism and a  $\frac{7}{3}$ -approximate randomized strategy-proof mechanism. We also obtain the lower bounds of 1.5 and 1.1 for any deterministic strategy-proof mechanism and any randomized strategy-proof mechanism, respectively.

Keywords: Mechanism design · Prelocated facility · Strategy-proof