

**•Research Objectives:**

1. To develop a solution methodology for the planar facility location problem with generalized congested regions (GCR), vis-à-vis unifying existing restricted facility location literature.
2. To mathematically model and solve the problem of variable capacity sizing and selection/location of links (or connections) between departments/cells in a facility layout cost to minimize material handling system costs.

**•Approach**

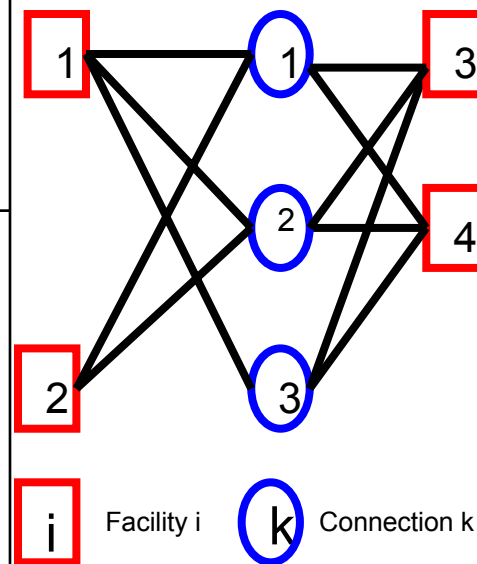
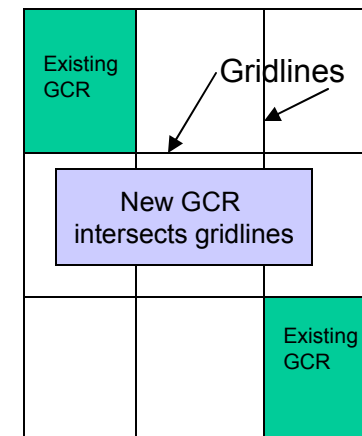
1. For the planar facility location problem with GCRs, we propose to construct a network on which a finite set of points could be potential locations of the new facility.
2. For the problem of capacity sizing and selection, Lagrangian Relaxation (LR) algorithms were developed for the case of discrete size option and also for the case of continuous service rate (while viewing connections as M/G/1 queueing systems).

**•Broader Impact:**

1. The planar facility location problem with congestion finds applications in large scale urban transportation networks where the level of congestion can vary with time of day to represent rush hour traffic.
2. The Connection Location Problem (CLP) can be applied to distribution network design such as warehouse location/sizing, product routing, etc.
3. On the application front, this work will provide practitioners with a tool (software) for location/layout design.

**•Significant Results:**

1. A polynomial time solution procedure has been developed for the problem of placing a rectangular GCR of known area but unknown dimensions in the presence of other rectangular GCRs.
2. For CLP with discrete size option, the LR approach can deal with up to 3000 flows, 200 candidate connection sites with 6 size options in about one hour. The average heuristic gap is less than 2%.
3. For CLP with continuous service rate, we established the equal utilization rate property. A solution method based on this property can solve large size problems with 0.22% heuristic gap.

**•Graphic:****Connection-Location Problem****Planar Facility Location problem with GCRs**