**Abstract**

Federal and local governments are investing in methods to discourage use of disposable containers in order to reduce waste generation and protect the environment. In this project we propose the use of reusable takeout food containers as a replacement for disposable takeout food containers. Reusable takeout container systems may use barcode or RFID (radio frequency identification) technology to track and manage the distribution, collection, cleaning, and end-of-life recycling of reusable takeout food containers. Such systems will require the use of container collection bins. The design and optimization of a network of container collection bins is the topic of this project.

We propose a method to optimize the location network of collection bins at a Smart City. As a case study we use data collected in the city of San Luis Obispo, CA. The reusable container use cycle can be described as follows. A company provides the reusable takeout food containers to restaurants. The restaurants distribute these containers to their customers. After the container is used a customer drops it off in a convenient location for the company to pick it up and wash it. Since convenience of container drop off is crucial to customer participation, strategically placing the drop off bins around the city such that they are highly visible and easily accessible will maximize user satisfaction and benefit to the city.

Determining the optimal set of container collection bin locations was performed using a linear programming model that optimized the bin network visibility and accessibility. Visibility and accessibility were measured by traffic volume, pedestrian volume, and population density. The optimization model included varying the quantities of drop-off bins, as well as varying bin sizes and costs. An economic analysis was used to determine the optimal combination of quantity of bins, bin size, and bin cost that maximized the benefit to the city.

We simulated the potential container collection routes in order to estimate collection and transportation times and determine the optimal set of collection routes. Similar to the linear programming model, the simulation model also had variable input capabilities. The flexibility of our models may prove useful for future efforts to plan reusable container systems for Smart Cities.