Routing problems

(Toth - Vigo : Chap 1)

- Management of the provision of goods and services in distribution systems
- The use of optimization procedures allows substantial savings (from 5% to 20%) in the global transportation costs

Here we address Vehicle Routing Problems (VRP) or Vehicle Scheduling Problems : concern the distribution of goods from depots to final users (customers)

Typical applications : solid waste collection, school bus routing, dial-a-ride systems ... but also, for example, home care applications

General VRP formulation: given a set of customers, a fleet of vehicles located in one or more depots, and given a road network, determine a set of routes, each performed by a single vehicle that starts and ends at its own depot, in such a way as all the customer requirements are fulfilled, all the operational constraints (if present) are satisfied, by minimizing the global transportation cost.

- Let us describe some typical VRP characteristics by considering the main components, the different operational constraints that can be imposed, and the possible objectives to be achieved.

Typical VRP characteristics

Main components:

(1) **Road network**: it is described by means of a **graph**, where **nodes** correspond to road junctions, and to depot and customer locations, and where **arcs** represent streets.

- Arcs can be
  - **directed** (e.g. to model one-way streets)
  - **undirected** (traversal in both directions)

- Each arc is associated with:
  - a **cost**, which generally represents its length
  - **travel time**, which may depend on the vehicle type or considered period