



## Integrated Vehicle Routing and Vehicle and Crew Scheduling Optimization

### Generating Profitable Delivery Operations

Success in a transport business is heavily dependent on the ability to reduce the costs of operating a fleet of vehicles and drivers whilst maintaining satisfactory service levels. The high degree of complexity in distribution operations requires advanced solutions that can be tailored to a transport company's specific situation. The solution used must also be sufficiently flexible to quickly adjust to new circumstances, such as changes in fleet size and mix, driver availability and shift regulations, overtime costs, depot location and service levels. These are all characteristics that must be considered when developing, maintaining and producing a cost efficient, robust solution and distinguish PlanOp from other solutions.

### The PlanOp Solution

The PlanOp Vehicle Routing Optimizer (VRO) and the Vehicle and Crew Scheduling Optimizer (VCSO) are proven transport optimization solutions that minimise the total cost of a transport operation, where both vehicle and driver, fixed and variable costs are important. The solution is also flexible, and can quickly adjust to new circumstances, such as changes in vehicle fleet, delivery requirements, and driver work rules. It also provides possibilities of simulating the complete operation as a decision support tool.

The PlanOp can:

- reduce costs
- optimize and streamline transport networks
- successfully improve service standards
- decrease vehicle mileage and operating costs.

### PlanOp Vehicle Routing Optimizer

The PlanOp Vehicle Routing Optimizer (VRO) is used to solve vehicle routing problems ranging

from the pick up and delivery of small volumes, to the transportation of large containers. It is ideal for postal and courier operations and also suitable for logistic distribution companies. The VRO engine is a proven transport optimization solution that minimises the cost of operation and has consistently generated solutions that outperform competing vehicle routing packages.

It is distinctive in that it produces optimized, robust vehicle routes and delivery plans quickly whilst being easy to use and configure. The Vehicle Routing Engine is also capable of taking a set of disparate vehicle links and forming complete and optimal vehicle tours from them.

The VRO engine takes into account many facets of transport planning such as:

- maximum vehicle tour durations and multiple tours for a given vehicle
- driver breaks and maximum shift duration if drivers do not change vehicles during a shift
- modelling specific fleet size, mix and alternative facility locations
- costs of using different vehicle types at different depots
- hard and soft time windows for delivery
- operations at multiple depots with varying, vehicle availability and opening/closing times of sites
- time of day variations for travel times and costs (e.g. to model peak traffic periods)
- loading and unloading models which can include fixed and variable components
- transshipping of product en route (at intermediate transport hubs)
- disallowed product type vehicle type combinations
- both return to base and non-return to base route construction.

## The PlanOp Vehicle and Crew Scheduling Optimizer

For distribution networks where drivers can change vehicles during a shift and/or vehicles are used by more than one driver within a given period, an efficient, robust and compatible set of vehicle and crew schedules is essential to achieving the lowest total operating cost.

The PlanOp Vehicle and Crew Scheduling Optimizer (VCSO) is used to solve the combined vehicle and crew scheduling problem where a minimum cost set of compatible vehicle and driver schedules needs to be created to cover a given set of transport routes. The VCSO solves the vehicle and crew scheduling problem simultaneously allowing both fixed and variable costs of vehicles and drivers to interact and therefore be modelled accurately.

Often the transport routes to be covered by vehicles and drivers may be able to slide in time (within certain limits) whilst still ensuring all transports are delivered legally. Furthermore there may be a range of vehicle types that can be used to cover a given route. Exploiting these two properties, the slidability and vehicle substitutability of the set of routes to be covered, when generating vehicle and crew schedules is crucial to finding the lowest cost solution.

In addition to those features already modelled by the VRO, the VCSO can model:

- multiple vehicle depots, crew depots and vehicle types
- overtime rules and costs
- vehicle and driver type depot targets
- any slideability and vehicle substitutability of the routes to be covered
- driver shift legality regulations (shift lengths, maximum times before and after break etc.)
- drivers changing vehicle at depots whilst ensuring the set of vehicle schedules created always returns each vehicle to its home depot.

## What Differentiates PlanOp

PlanOp's competitive edge comes from the fact that:

- PlanOp is a proven system
- The PlanOp suite is state of the art optimization technology, that is constantly undergoing intensive research and development to ensure a dynamic application
- PlanOp incorporates extensive data validation, interrogation, animation and diagramming tools
- A wide range of operational restrictions can be modelled by both optimizers
- VCSO solves the vehicle and crew scheduling problem simultaneously
- VRO incorporates specific algorithms to solve the full range of vehicle routing problems
- PlanOp also includes a Geocoder which can geocode locations by matching street addresses or intersections using street level mapping data incorporating phonetic string matching capability and advanced conflict resolution
- PlanOp also includes a travel time calculator which calculates travel times between geocoded locations using street level mapping data.

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