

# OPTIMIZE TRAIN OPERATING COSTS



Innovative Scheduling

OPTIMIZATION IN ACTION

Innovative Train Scheduling Optimizer (ITSO) is an interactive, web-based decision support system that designs train schedules for freight railroads while it simultaneously optimizes locomotive, crew, and railcar costs. ITSO determines:

- ➔ Origins, destinations, and routes of all trains
- ➔ Train arrival and departure times and train operating days
- ➔ Locomotive assignment to trains
- ➔ Assignment of blocks to trains by day of the week
- ➔ Crew assignment to trains
- ➔ Trip plans of all railcars

# INNOVATIVE TRAIN SCHEDULING OPTIMIZER



## INNOVATIVE TRAIN SCHEDULING OPTIMIZER HANDLES THE FOLLOWING:

- Develops a clean-sheet (zero-based) set of train schedules
- Suggests minor, incremental changes to an existing train schedule
- Adds and removes trains and observes the impact of changes on resources and network capacities
- Changes train timings, frequencies, and blocks train assignments to improve resource utilization or reduce costs

Innovative Train Scheduling Optimizer considers all important network constraints related to line capacity, train capacity, yard capacity, locomotives, and crew districts. Its objective function includes cost terms due to train miles, car miles, car days, block swaps, locomotives, and crews. Though ITSO is designed primarily for large freight railroad companies, it can be adapted for passenger train scheduling or other domains where movement of multiple resources must be optimized simultaneously.

**MAJOR CONTRIBUTIONS.** Train scheduling is a very large-scale mixed integer programming problem containing trillions of decision variables and billions of constraints. At Innovative Scheduling, we have developed a customized solution involving innovative use of decomposition, linear programming, network flows, and heuristics. It designs the train schedule by optimizing flow in three space-time networks: railcar network, locomotive network, and crew network. This technique can solve the train scheduling problem within a few hours on a laptop or a workstation.

**CASE STUDIES.** ITSO has been tested on the data provided by several railroads. It consistently demonstrates significant savings in railcar, locomotive, and crew costs. The solutions obtained reduced yard congestion, and improved crew and locomotive balance. ITSO is a software tool for railroads to reduce train operating costs, increase network capacity, and improve efficiency.

**FEATURES OF THE DECISION SUPPORT SYSTEM.** ITSO is a web-based system that enables the train schedule to be published on the web and viewed by the entire organization. The user can create several scenarios and compare any two scenarios. Powerful forms enable the user to drill down into any solution and various reports, charts, and maps allow network-wide, terminal-wide, or train-wide analysis of any solution. The user can print any part of the solution.



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