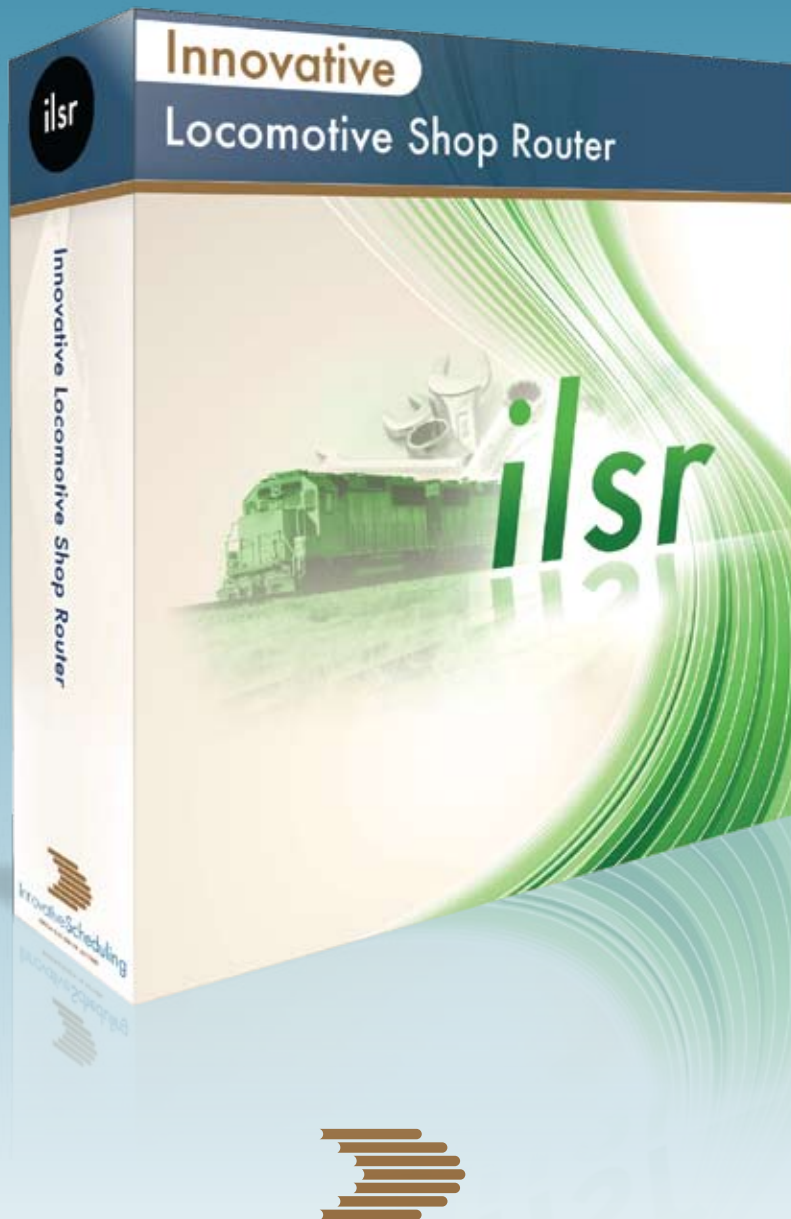


SCHEDULE LOCOMOTIVES FOR QUARTERLY MAINTENANCE



Innovative Locomotive Shop Router (ILSR) is a real-time decision support system that directs locomotives to shops due for quarterly maintenances. The ILSR takes in the real-time data of trains, locomotives, shop capacities, and determines:

- ➔ The date each locomotive should undergo its quarterly maintenance
- ➔ The shop the locomotive should be maintained
- ➔ The route of the locomotive from its current location to the assigned shop over the train network



Innovative Scheduling

OPTIMIZATION IN ACTION

INNOVATIVE LOCOMOTIVE SHOP ROUTER



INNOVATIVE LOCOMOTIVE SHOP ROUTER HANDLES THE FOLLOWING:

- Assists locomotive managers in routing locomotives to shops
- Reduces the number of locomotives that become dead (past-due-Q) before reaching shops
- Adjusts the flow of locomotives to shops consistent with shop capacities
- Improves resource scheduling by projecting availability of locomotive shop arrivals

Each locomotive must visit a shop within 92 days of its previous quarterly maintenance, otherwise, it becomes dead and needs to be pulled to a shop for maintenance. Each locomotive undergoes different types of maintenance: 3-month maintenance, 6-month maintenance, or annual-maintenance. A railroad has several shops in its network with different maintenance capabilities and capacities, and as locomotives are directed to shops for maintenance, the daily number of locomotives arriving at each shop must be consistent with the shop capacity.

ILSR runs like a Geographical Position System (GPS). It generates recommendations for each locomotive due for maintenance, which locomotive managers can overrule. If the locomotive manager overrules the recommendation, ILSR generates a new route for the locomotive, taking into account the locomotive manager's previous decision. ILSR also responds to disruptions taking place in the railroad network such as train delays, train cancellations, and locomotive breakdowns.

MAJOR CONTRIBUTIONS: Locomotive routing to shops is a complex decision-making problem that needs to account for current locations of locomotives, planned and actual train schedules, trains' power requirements, shop capacities and capabilities (types of locomotives that can be maintained or the types of maintenance that can be performed), and locomotive managers' previous decisions. Since it is a real-time decision support system, fast response time is needed. The Innovative Scheduling team has developed an algorithm to solve this complex decision problem using decomposition, network optimization, and mixed integer programming to generate optimal routings of locomotives to shops within a few minutes.

CASE STUDIES: ILSR is currently in production at CSX Transportation and is creating significant benefits. Since it went into production, the number of past-due-Q locomotives has decreased dramatically, and shops have a much more homogenous flow of locomotives to shops. This system is ready for customization and deployment at other railroads.

FEATURES OF THE DECISION SUPPORT SYSTEM: ILSR is a web-based decision support system. Mechanical personnel and locomotive managers can change inputs and parameters using web screens, and immediately see the impact of these changes in the next run of the system. Mechanical personnel can view projected shop arrivals and the route of each locomotive to shops. Locomotive managers can view the assignment of locomotives to trains on their screens. As new data becomes available, ILSR updates its recommendations and revises the previously generated routes taking into account the changes that have taken place since the last run.



Contact us to learn more about this or other Innovative Scheduling products:

info@InnovativeScheduling.com

352.334.7283, ext. 301

www.InnovativeScheduling.com