

# **Solving Locomotive Network Flow Problem**

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## **ABSTRACT**

The problem of assigning locomotives to trains is very important for railway companies, in view of the high cost of owning and operating locomotives. The locomotive scheduling problem is to assign different types of available locomotives to each train in a fixed schedule so as to provide each train with sufficient power to pull the train from its origin to its destination. In this paper, we study the locomotive scheduling problem faced by BNSF Railway Company. We consider the locomotive network flow model, where we need to decide which set of locomotives to be assigned to each train, and we provide an integer programming formulation of this problem. The existing method used by BNSF needs about 5 hours to solve this flow problem and get an acceptable solution (about within 5% absolutely optimal gap). This solving speed is not satisfied to the BNSF users. Using cutting plane method, Lagrangian decomposition method and Benders decomposition method, we have developed a solution technique to solve this problem. We implement our solution technique using Java code into BNSF LISS system, and bring a huge improvement of solving speed and solution quality.