

Road Traffic Control System

Problem Abstract:

The commute time for the average commuter in the United States in 2000 was 26 minutes, up from 22 minutes in 1990. In larger cities, the situation is much worse and, in some cities, the average can be as high as 39 minutes. It is not unheard of for a person to commute as long as 2.5 hours each way, each day. It is estimated that traffic jams are costing Americans \$68 Billion a year in lost time and productivity. In a study of 75 major cities, rush hour is lasting an average of 7 hours each day, up from 4.5 in 1982. But what can be done to remedy this escalating situation? There are countless causes of delays and accidents that could be done away with by removing the human factor. Consider tailgating, reckless driving, unsafe speeding, unsafe lane changes, rubber-necking delays, drivers talking on cell phones, eating, or adjusting the stereo, and the countless other bad decisions made by drivers on the road every day. These delays and hazards are all results of human operators, rather than the infrastructure within which they operate.

It is the not-so-distant future (3-5 years). In the metropolitan area of Los Angeles, the number of cars on the road during peak times reaches as many as 30 million. In addition to the fact that the road systems are near capacity handling such volume, diminishing fuel availability and air-pollution concerns have caused the city to institute a Road Traffic Control system. The purpose of this system is to remove the human element in road traffic, and thus optimize traffic flow, reduce traffic violations and accidents to near zero, and improve fuel efficiency by centrally controlling the movement and routing of all the cars in the metropolitan area. They have asked your working group to design it.

The system consists of three major divisions: a control center, "smart" vehicles and a network. It behaves in the following general manner. The central control center is responsible for routing vehicles, determining velocities and correcting for deviations from designated routes. The vehicle is responsible for following the routing and velocity commands issued by the control center, as well as updating the control center as to its position and velocity. In addition, the vehicle performs self-diagnosis and alerts the control center of relevant information concerning fuel and oil levels, tire pressure, engine temperature, personal stops, obstacles in the road, etc. The central controller uses this information for active re-routing. Each vehicle communicates with its neighbors to ensure proper following distance and to alert each other of emergency stops. It also receives location information from active mile-markers on the road, which it then provides to the control center. All of this must be done within certain design constraints to be provided. The goal is an affordable, incident-free traffic network that operates at all times with optimal fuel and time efficiency.