AN ON-LINE OPTIMIZATION PROCEDURE FOR AN URBAN TRAFFIC SYSTEM

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INTRODUCTION

This paper describes a method for the on-line optimizing closed loop control of urban traffic systems. The method of approach is to use the theory of hierarchial systems as developed by Mesarovic and the decomposition of the system follows the pattern used in Madrid by Fuehrer.

SYSTEM DECOMPOSITION

Basically the approach used is to decompose the system into smaller units and by optimizing the performance of these units and coordinating them, an overall optimum or near optimum is achieved. The control system consists of sub-systems which are located on levels of authority which, in this case, leads to two discrete levels as shown in Figure 1. The supreme authority lies with the computer or the supremal unit at level one. A subordinate level of authority is vested in the local controllers or the infimal units at level two. The two levels are interactive in that the local controllers are influenced directly and explicitly from the computer such that the parameter settings in the local controllers are decided by the computer whose decisions are based on information fed from the local controller and the process.

DESCRIPTION OF THE OVERALL SYSTEM

The Process

The process consists of the total traffic area being controlled subdivided into sub-areas of common cycle length. Each sub-area consists of a small group of junctions and interconnecting roads. There are two types of signals in the process: (a) a control signal which relates to light settings, (b) inputs and outputs consisting of traffic flowing across the process boundary.

Local Controller

Each local controller controls a sub-process consisting of a junction of two or more interconnecting roads. The two inputs to the controller are: (a) a coordination input from the computer consisting of cycle length, optimum
offset, predicted inputs and a decision set to be specified in a later section, and (b) an input consisting of feedback information from the process. The output from the controller is the local control signal consisting of the green time (or split) allocated to one direction.

The Computer

The computer calculates the coordination vectors to all the Local Controllers based on the feedback information supplied to it from the process via the Local Controllers.

Feedback Information

1. Feedback from the process to the various local controllers, contains information about junction inputs and outputs.
2. Feedback received by the computer contains information concerning the behaviour of the local controller and the process.

COORDINATION

Introduction

This concept involves setting up conditions whereby the overall system is optimized or near optimized as a result of optimizing local problems.