M25 Controlled Motorway

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Motorway Control Systems

The Highways Agency’s Network
Highways Agency Network

- England only!!
- 5,800 miles of motorways and trunk roads
- Value - £55 billion (£55,000,000,000)
- Budget £1.5 billion pa
- <5% of English road network
- >30% of traffic (veh/km)
- >60% of HGV traffic (veh/km)
Motorway Control Systems

Development of Motorway Control
Background

- M6, Birmingham – late 1980s
  - Advisory 50mph limits
  - Flow monitoring, manual control
  - Poor compliance, no impact on congestion
- Lessons – to be effective need...
  - Automatic Control
  - Mandatory Speed Limits
  - Enforcement
Motorway Control Systems

The Highways Agency’s Network
Why M25?

• ‘Busiest Motorway in Europe’
• Gantries and Enhanced Message Signs already installed
• Communications available
• Only D4 motorway at that time
The Theory

- Speed/flow curve
- Higher flow, reduced speed
- Max throughput @ 52mph?
- Unstable, flow breakdown
- Much lower throughput

Control speed >> maintain flow?

Go slower to get there faster!
Key Features

• Mandatory Signals
• Automatic Enforcement
  ♦ Radar & 35mm ‘wet’ film
• Automatic Control – MIDAS
  ♦ Flow (& speed) based control algorithm
Mandatory Signals

- Controlled Motorway Indicator
- Gantry/post mounted
- Fibre-optic based
- High visibility
- Higher reliability
- Optional interface to enforcement
- Very well received
M25 Controlled Motorway Pilot

Mandatory Signals
Safe roads, Reliable journeys, Informed travellers
Enforcement System

- 35mm ‘wet’ film
- Radar speed detection
- Gantry mounted
- Individual lane monitoring
- Enforce all limits (20-70mph)
- Flash is essential!
M25 Controlled Motorway Pilot

M25 Enforcement System
MIDAS System

- Loops (or alternatives)
- Roadside/central computers
- Algorithm
- Traffic data
MIDAS Data

- 2 Loops per lane, every 500m
- Queue detection
- Traffic Data
  - Count (flow) per lane (4 length categories)
  - Speed
  - Headway
  - Occupancy
- Gigabytes of data!
- How to understand?
Motorway Control Systems

MIDAS Data and MTV
What is MTV?

MTV – Motorway Traffic Viewer

- A tool for viewing traffic data
- Portrays a vast amount of data in an easily readable form
- Many plots to research/understand different aspects of traffic behaviour
- Check the operation of the MIDAS system
- Check the performance of the system
- Identify congestion ‘hotspots’
MTV – Motorway Traffic Viewer

Speed-Flow Algorithm Enabled
M25 Clockwise(A) Monday 17-Mar-97

Background: Offside-1 lane speed
M25 ‘Hot Spots’ Plot (Star Trek)

Figure D7 - Weekly Lane Flow Plot (Mar-96)
M25 Traffic Counts and Summary Statistics  6:00hr to 11:00hr

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<th>Monday</th>
<th>Tuesday</th>
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<th>Thursday</th>
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Total A (clockwise) Vehicle kilometers = 3,586,723
Total B (anti-clockwise) Vehicle kilometers = 3,178,797

Total A (clockwise) Vehicle Hours Delay(50) = 8,871
Total B (anti-clockwise) Vehicle Hours Delay(50) = 952
Driver Assessment

• Drivers like it!
• More comfortable (less tailgating?)
• More even headways
• Less lane changing/better lane use
• Perception of shorter journey times
• Perceived benefits are greater than actual benefits!
M25 J10-16 – Initial results (’03)

- Takes time for drivers to trust system - >2 years
- Peak throughput reduced slightly
- Less flow breakdown
- Fewer shockwaves, smoother journeys
- More reliable journey times
- Fewer incidents to clear up
M25 Controlled Motorway Results

- Safety improved by at least 10% (95% confidence level), probably around 15%
- Total Killed or Seriously Injured reduction of around 25-30%
Safe roads, Reliable journeys, Informed travellers

Discussion