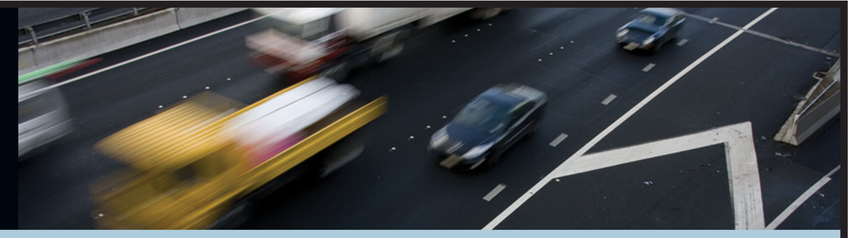
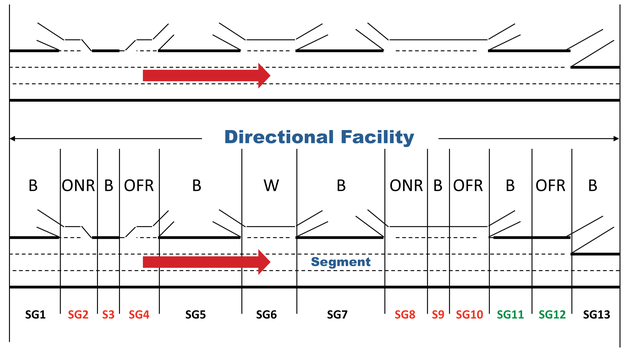
Macroscopic Motorway Modelling

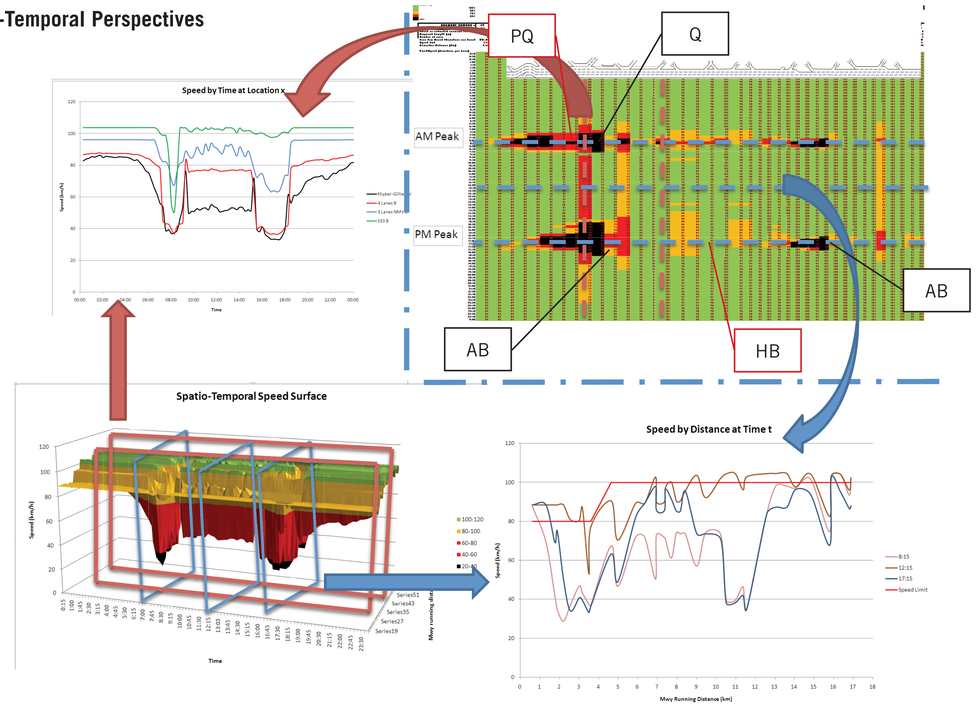


Facility and Segments



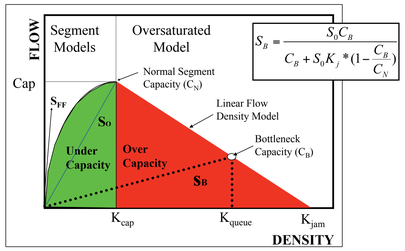
The Highway Capacity Manual [HCM] provides operational analysis methods to estimate the capacity and other operational measures of effectiveness such as delays, queues and Level of Service for a wide range of transportation facilities. The 2010 edition of the HCM will be published later this year. As well as revisions for the methods of analysing individual motorway segments such as basic (B), on-ramp (ONR), off-ramp (OFR) and weaving (W) segments in under-saturated conditions, there is an updated freeway facilities chapter which is able to combine these discrete motorway segments into a directional corridor, and now extend the analysis to over-saturated conditions with bottlenecks and their associated queue formation and dissipation patterns over space and time.

Spatio-Temporal Perspectives



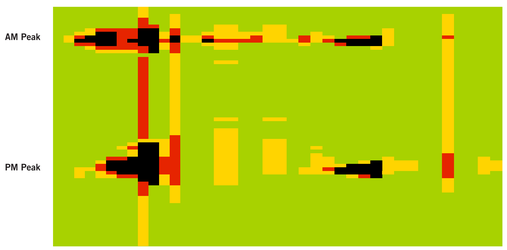
Outputs can be viewed in 3D by time and distance or a 2D representation. Black “stop and go” segments are 0% to 50% of free flow speed (ffs), red congested segments 50% to 70% ffs, yellow undersaturated segment 70% to 85% ffs, and green uncongested segments 85% to 100% ffs. Actual Bottlenecks (AB), Hidden Bottlenecks (HB), Queuing (Q), and Partial queuing (PQ) are indicated.

Flow Models



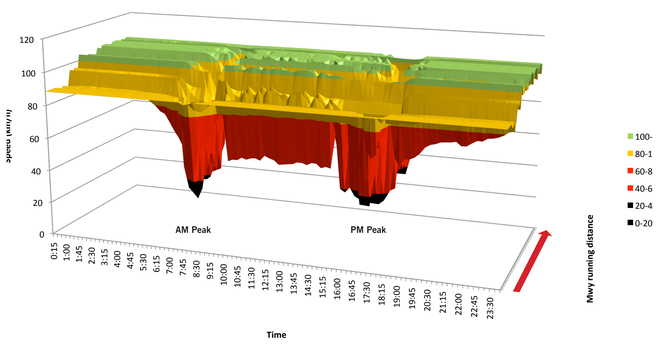
Macroscopic speed-flow-density model uses shockwave theory to model queue formation and dissipation rates.

Scenario: Base Case



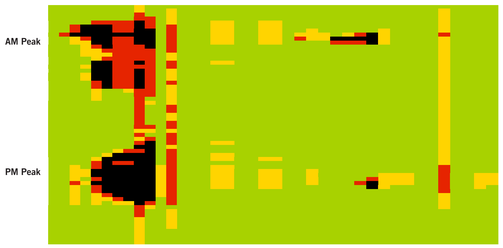
Calibrated model of the motorway with no external factors applied.

Spatio-Temporal Speed Surface



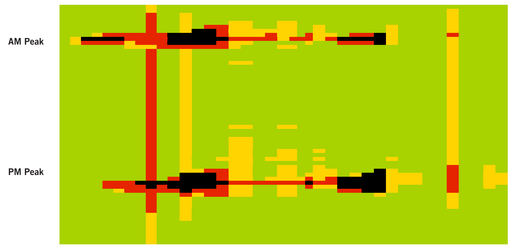
Three dimensional plot of speed outputs across the time and space domain.

Scenario: During Construction



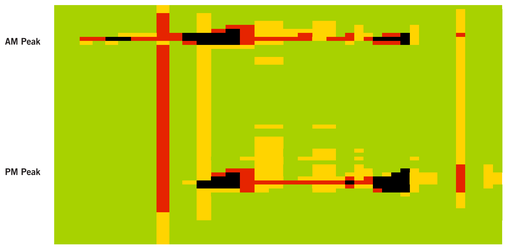
The modelled effects of a long term construction project on capacity. A major bottleneck has been created and the resulting queuing is evident.

Scenario: After Construction



After construction, the queues have dissipated, and been pushed downstream to the next (previously hidden) bottleneck.

Scenario: After Construction with Intense Ramp Metering



Theoretical plot whereby ramp metering was intensified to improve the mainline motorway movements. However, the resulting queuing on the local street network is significant. Fre-eval can report the on-ramp delays if required.

Fre-eval spreadsheet - straightforward coding, cost effective, more scenarios

What the Highway Capacity Manual freeway facility methodology can do:

- Represent oversaturated and undersaturated conditions
- Account for active and hidden mainline bottlenecks
- Track queues as they form and dissipate across segments and time intervals
- Account for time-variant demand and capacity
- Represent the effect of short term incidents and work zone effects if properly calibrated
- The Fre-eval spreadsheet is fully consistent with the HCM freeway segment chapters for Basic, Ramp and Weaving segments, if d/c < 1.0

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