

CADRE

Vehicle routing and traffic speed models for the real world

JUNE 2008



Project Aims

The initial aim of the CADRE project was to investigate improving vehicle routing by developing a road speed model and routing algorithm that would replace the use of fixed road speeds with the use of dynamic ones - where the speed on individual roads varies with the day of the week and time of day. This provides a more accurate prediction of journey times as well as more accurate vehicle routing, as routes are selected according to the traffic conditions on relevant roads at the required times.

However, during the project, through discussions with a number of industry players, we realized that there is also considerable use for the speed model in its own right, in particular for roads other than the motorways and trunk

roads. The project aims can therefore be summed up as providing 'vehicle routing and traffic speed models for the real world'.

Journey Data

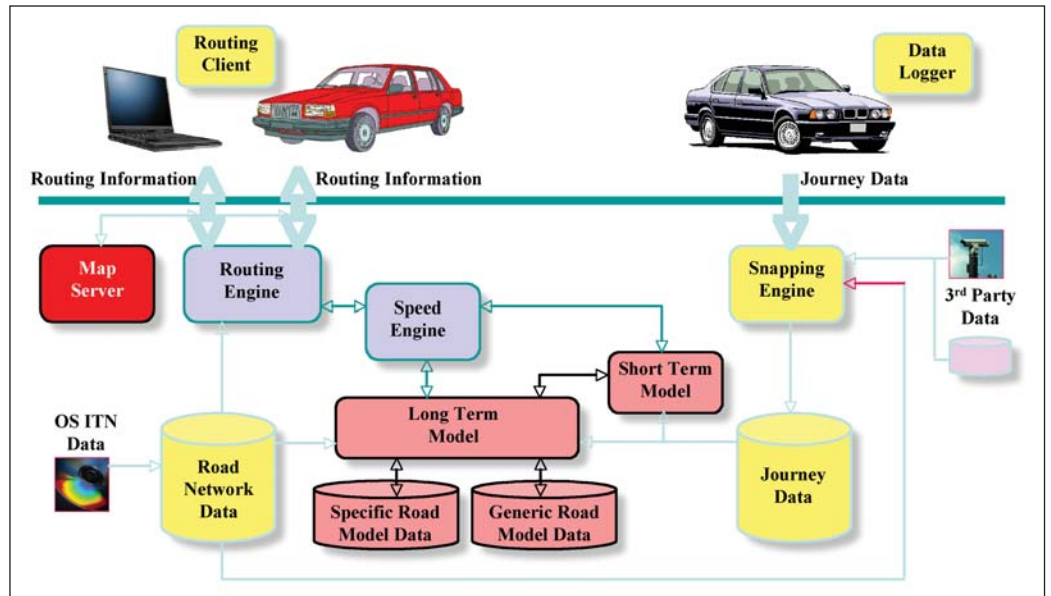
A key element of the CADRE system is that the speed model is based on actual vehicle speeds. Throughout the project and within our trials area, which was bounded by the M27, M3, A3 and M25, we therefore had a number of cars logging speed data, giving us around 2,100 journeys worth of speed information. In addition we used additional speed data from HATRIS for motorways. For future work we will expand this with speed data from IT IS, TrafficMaster and other sources of probe vehicle data.

Components

CADRE has been designed in a modular way, making it easy to develop, modify and extend as the need arises.

The key modules are:

- Road network database
- Speed model
- Routing engine
- Snapping engine
- Journey database



Modeling Speed

CADRE’s long term speed model uses actual traffic data to build up a model of traffic speeds, day by day and hour by hour. Where there is sufficient quantity and quality of data, a model is created for each road segment in the network, otherwise similar road types are grouped together (by factors such as road type, speed limit etc.) and a generic model is produced for the group of roads.

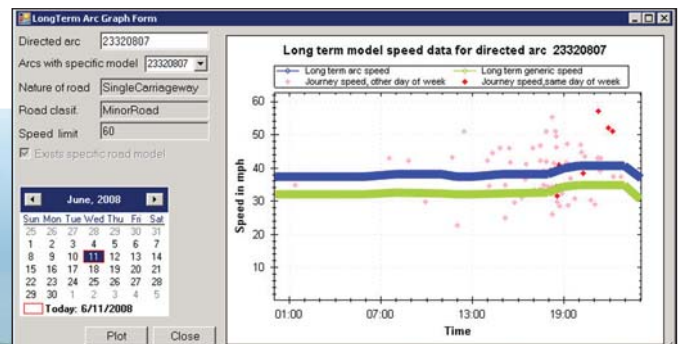
The short term model is currently being developed to build on this. It receives real time traffic feeds and compares traffic speeds against the long term model, to detect any significant congestion. Once detected, a short term predictive speed model is used to modify the long term model, based on the actual speed of the traffic.

Using the Speed Model

CADRE’s speed model is a useful tool in itself, as well as providing the necessary input to the routing engine.

Having a day by day, hour by hour model of the traffic enables you to detect bottlenecks and rat runs, as well as areas where speeding is a problem. The data can also be used as an input when considering design changes to the road network.

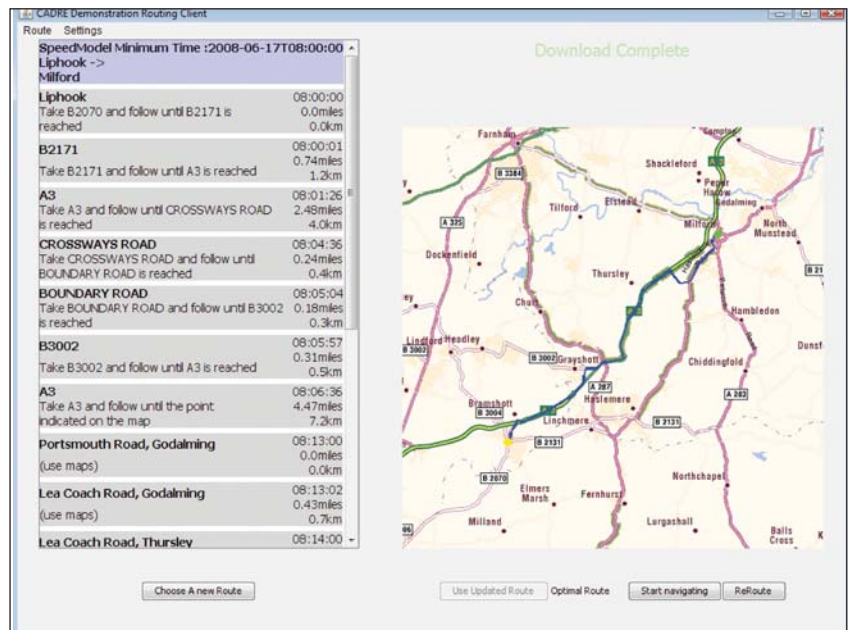
The short term model can report actual traffic speeds in real time. Where there is sufficient traffic, it can also detect congestion, and give a quantitative measure on the congested speeds.



Intelligent Routing

In CADRE's routing engine, standard routing algorithms have been extended to take into account how traffic speeds vary by day of week and time of day on individual roads. This information is provided to the routing engine by the CADRE long term speed model to give better route calculations for your planned date and time of departure or arrival. At present, routing can be carried out for minimum time or distance, but this can easily be extended to other criteria such as minimum cost or minimum CO² emissions.

This approach means that journey times are given more accurately and better routes are calculated that take account of the typical traffic conditions for your time of travel. You may find, for example, that the optimal route varies with the time of day, as traffic speeds vary across the network. Also, when planning a journey you can look at different departure times and see how this could affect your travel time.



With the use of the short term model, if you are caught in congestion the routing engine can decide whether it pays to take an alternative route (which could be longer or on slower roads), or to sit and wait in the congested traffic.

Routing Applications

In route planning, whether web-based for the personal traveller or as part of a route planning tool for commercial vehicles and logistics companies, the CADRE routing engine will give an accurate journey time for the day and time of your journey, as well as giving you the best route to take. Where journey times are flexible, you can examine different departure times to get the best time to travel.

When en route and if your schedule changes, then your journey plan can be recalculated to take into account the changing traffic conditions. In using the short term speed model, any congestion on the road network can be taken into account and you can be diverted away from it if this is the best option. It is also envisaged that you could elect to send back your own vehicle's speeds to the CADRE speed engine, thereby helping the short term model pick up any congestion you yourself may encounter.



Where Next?

We are currently at the stage where we have a solid pilot development framework. This, combined with our speed and routing engine modelling, we believe demonstrates that CADRE is a viable concept for further development and commercialization.

Our next stage is therefore a more thorough investigation and assessment of the potential commercial markets for CADRE - with the objective of homing in on an initial target market sector, developing a business plan for it and finding suitable sources of further development funding. We also intend to hold discussions with potential partners in areas such as supply of map data and sources of live/historical vehicle speed reports.

On the technical side, we also need to scale up the system and to run larger scale trials, as well as further developing those aspects of the system required to enter our initial market sector. We anticipate a smooth transition to this second phase of development, at the end of which we will be in a position to provide a commercial service.



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