



# Synthetic environments in managed motorways

Competition for SBRI contracts  
July 2009

Department for  
**Transport**

**HA** HIGHWAYS  
AGENCY

**SBRI** Government challenges.  
Ideas from business.  
Innovative solutions.

SBRI is a programme that brings innovative solutions to specific public sector needs, by engaging a broad range of companies in competitions for ideas that result in short-term development contracts.

Joint funders:

*Department for*  
***Transport***



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## Summary

The Department for Transport and the Highways Agency are launching a Small Business Research Initiative (SBRI) to explore the use of synthetic environments applied to transport, in this case, modelling and managing complex traffic situations on motorways.

This competition is open to all companies, including those not currently engaged in the transport sector.

Elements of such an approach can already be seen in the tools developed and exploited by the computer games industry as well as synthetic environment techniques currently used in the defence arena. These tools model the physical environment and introduce a human element that adds a new dimension, bringing the model to life as a virtual environment for interactivity. Such a tool has the potential to provide an important asset to aid decision-making and help to deliver best practice for a range of transport challenges.

The new SBRI is a cross-government programme for the procurement of technology projects, including the demonstration and evaluation of new technologies. Development projects will be 100% funded. Suppliers for each project will be selected by an open competition process and will retain their Intellectual Property Rights. Companies will need to demonstrate the feasibility of their technology in this environment within a period of approximately six months.

## Background and challenge

The Department for Transport (DfT) and the Highways Agency (HA) are exploring synthetic environment technologies and how they might be applied to help address transport challenges. DfT did some initial work in 2007 (Report: "Synthetic Environments in Transport") and wanted to identify a transport-based case study where this area might be further explored. DfT and HA have identified such a case study – Active Traffic Management (or "Managed Motorways").

As traffic volumes continue to rise over the longer term, the UK is faced with the challenge of managing the road network more effectively. Investing in new infrastructure is often difficult to introduce because of economic, environmental or social reasons. Improving the use of the current network through better management can also deliver more sustainable benefits. In the trial of Active Traffic Management (ATM) on the M42, the "managed motorway" approach has demonstrated how, at peak times, opening up the hard shoulder and introducing variable speed limits delivers reduced congestion, better journey times and improved local air quality.

It may be possible to improve efficiency by understanding how Highways Agency staff in the control room and the travelling public make decisions and their impact on the ATM system. Currently there is a complex flow of data on which these decisions are based. Data gathered from the network needs to be assessed to determine which management measure should be applied, for example opening the hard shoulder, variable speed limits, etc. This in turn feeds information to the driver who may consider a number of actions, for example change lanes, overtake, etc., which may affect other vehicles in the vicinity and influence the flow of traffic.

Currently only certain elements of this complex system can be modelled. Consequently, DfT and HA are seeking to test new modelling and visualisation techniques that can be applied in this context and used to understand how human behaviour and the physical infrastructure interact, so that better decisions can be made in the management of the road network. There is a large amount of data available to create synthetic models and this will be made available to potential companies. In order to facilitate data collection and interaction, the model should use Visual Interactive Simulation (VIS).

The **strategic aim** of the proposed project is to provide a tangible example of how *Synthetic Environment (SE)* technologies can be adapted for a transport application, in particular to:

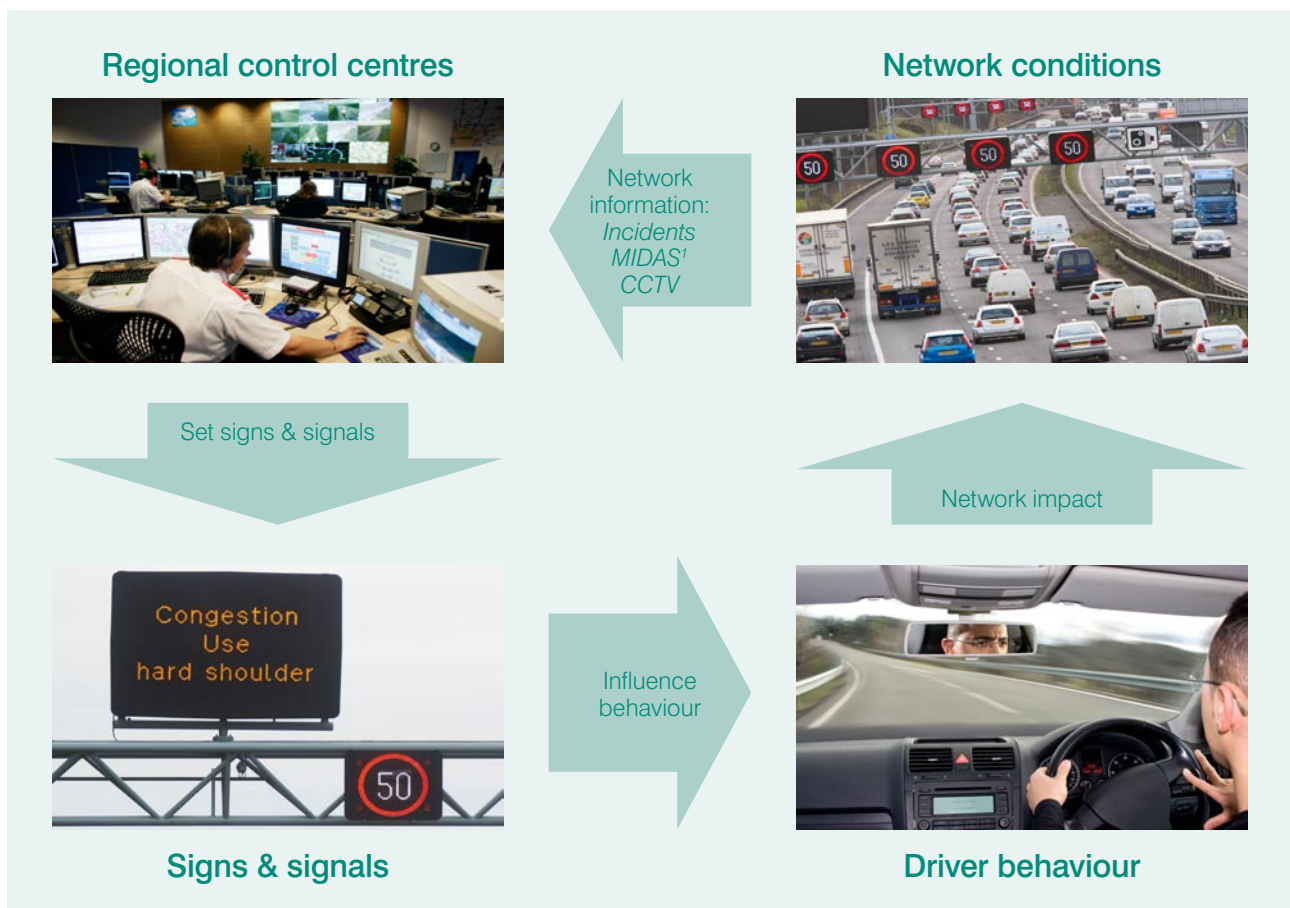
- learn any generic lessons from developing such an application, especially compatibility with existing systems;
- establish feasibility of short time-to-implementation; and
- develop applications around existing cross-Government Enterprise Architectures, particularly open source and scalable.

The **applied objectives** focus on assessing the feasibility of *SE technology* for solving operational challenges in the HA, in particular to:

- capture the knowledge and data needed for modelling each operator's decision-making strategy for opening and closing the hard shoulder on the M42;
- understand and model operators' strategies for opening and closing the hard shoulder on the M42;

- use the scenario planning capability of the SE system to identify best practice by measuring the long term performance of each alternative existing decision strategy based on a simulation evaluation;
- use the scenario planning capability of the SE system to refine existing best practice by combining and testing strategies used by different operators; and
- use the SE system and the best practice recommendations as a knowledge management tool for training new operators and for informing the design of new procedures (for example procedures for the ATM and for the managed motorways programme).

The environment and information flows that need to be incorporated within the project are illustrated below. Part of the design will be to develop relevant decision models for both the Regional Control Centres (in response to network information) and driver behaviours in response to prevailing network conditions and signs/signals. The opportunity to feed in operator and driving simulation models should also be considered in order to capture and validate the decision processes within the final model.



<sup>1</sup>Motorway Incident Detection & Automatic Signalling

## Scope

The competition aims to stimulate interest in technologies from the sectors specifically associated with synthetic environments. The Department for Transport's Chief Scientific Advisors Unit did an initial study on the use of synthetic environments in November 2007 and this has formed the basis of their interest in this area. This report "Synthetic Environments in Transport" is available as context documentation. However, the scope of this competition is open to all ideas for modelling the motorway network. Proposals should include a visual demonstration of proposed technology (a presentation will form part of the selection process).

The project involves the development of a simulation model of the process involved in opening and closing the hard shoulder on the M42. The model will simulate the attributes that operators take into account when making decisions.

In order to determine the effect of each decision-making strategy, the simulation will represent a series of different network conditions and scenarios including:

- adverse weather;
- debris on the hard shoulder seconds before opening the ATM;
- incidents after opening the hard shoulder;
- need for diversions; and
- National Exhibition Centre events.

Motorists' behaviour in relation to all these events should also be modelled using agent-based approaches.

Proposals that help identify and refine the current best practice of ATM and inform the design of operational procedures and training of operators are particularly encouraged. This will contribute to the successful roll out across other parts of the network.

Once the simulation model is developed, the operators will interact with the model. A data set of decisions and attributes will be collected and used to develop a decision model for each operator. Assessment of the methodology will have five generic stages:

1. understanding the decision making process;
2. data collection;
3. determining the decision makers' decision making strategies;
4. determining the consequences of the decision making strategies; and
5. seeking improvements.

Whilst proposals will be based on the ATM challenge, they should also include features addressing the strategic objectives as detailed above.

Details on specific deliverables will be provided in subsequent documents.

## Application process

The competition is being run through the Technology Strategy Board's Small Business Research Initiative.

SBRI is a mechanism for bringing novel solutions to government departments' challenges, by engaging innovative companies that might not be reached in other ways. SBRI:

- enables government departments and agencies to procure new technologies faster and with managed risk;
- provides vital funding for a critical stage of technology development through demonstration and trial – especially for early-stage companies; and
- runs an open and transparent competition that will result in direct contracts between successful companies and the Department for Transport.

The SBRI scheme is particularly suited to small to medium size businesses, as the contracts are relatively small value and short timescale for Government Departments. It is an opportunity for new companies to engage a public sector customer. The Intellectual Property Rights are retained by the company, with certain rights of use retained by the Department for Transport and Highways Agency.

The application process is run through the Technology Strategy Board's website: [www.innovateuk.org/sbri](http://www.innovateuk.org/sbri). Companies need to register their interest first to be sent an application form. Completed application forms need to be returned by post to the Department for Transport.

The Department for Transport and the Highways Agency aim to award up to three contracts for this project, enabling potentially three different solutions to the same challenge.

Applicants should note that, due to the nature of this project, rigorous data handling requirements will be applied. Details will be available in subsequent documents.

## Key dates

Competition opens	9 July 2009
Deadline for registration	7 August 2009
Deadline for applications	11 September 2009
Assessment	Mid September 2009
Feedback provided by	End September 2009
Presentation interviews	Late Sept – Early Oct 09
Contracts awarded	October 2009

## More information

For more information about this and other SBRI competitions, and details on how to register and apply, visit: [www.innovateuk.org/sbri](http://www.innovateuk.org/sbri)

For specific enquiries, please e-mail: [SEenquiries@dft.gsi.gov.uk](mailto:SEenquiries@dft.gsi.gov.uk)

## References

- Department for Transport, Synthetic Environments in Transport, 2007, at [www.dft.gov.uk/pgr/scienceresearch/futures/synthetic](http://www.dft.gov.uk/pgr/scienceresearch/futures/synthetic)

### Technology Strategy Board

North Star House  
North Star Avenue  
Swindon  
SN2 1UE  
Tel: 01793 442700  
Email: [enquiries@tsb.gov.uk](mailto:enquiries@tsb.gov.uk)

[www.innovateuk.org](http://www.innovateuk.org)

The Technology Strategy Board is a business-led executive non-departmental public body, established by the Government. Its mission is to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business, in order to increase economic growth and improve the quality of life.