

# Pulling it all together - Swansea Traffic Management Plan!

In a ground-breaking Action Plan that brings together cutting-edge technology from a number of different fields, the City and County of Swansea is introducing a traffic management programme to both improve traffic flow and reduce pollution in the Lower Swansea Valley area of the city. This area was declared an Air Quality Management Area and the development of the Action Plan forms the basis of the authority's obligations under the Environment Act 1995. It is hoped that this 3-year capital programme will be the forerunner of similar measures to be taken in critical areas across the city.

The primary routes through the Lower Swansea Valley road network are major commuter links to the city centre. Due to the topography of the area the lower valley has its own meteorological conditions particularly in winter when inversions cap layers of pollution at the bottom of the valley. It is planned that, when the programme is in place, drivers using these routes will be advised in advance not only of traffic congestion, but also of pollution levels along the route. Available car parking space both in the inner city parking places as well as the authority's Park and Ride sites will also be broadcast to Variable Message Signs strategically sited along the road network. This will allow drivers to make informed decisions on alternative routes and/or encourage commuters to use the authority's Park & Ride services.

Led by Environmental Health Divisional Officer, Huw Morgan and Environmental Management Systems Development Manager, Phil Govier, the scheme brings together the latest developments in air quality monitoring, near real-time traffic emissions forecasting, automatic radio service traffic counting, and variable message sign technology.

Central to the Action Plan is the construction of a working, near real-time traffic emissions forecast model. The software chosen for this work is the "Nowcaster" traffic model from Opsis AB of Sweden distributed in the UK by environmental monitoring specialist, Enviro Technology Services plc (ET). The Nowcaster module is one of a number of modules that comprise the OPSIS Enviman environmental management software package. The Opsis model will compute pollution loadings along the primary routes every hour - or more frequently if this proves necessary. An interface with the Variable Message Signs system will broadcast specific messages to specific signs to influence traffic flow. An emissions database is presently in the process of construction and will eventually identify and classify every road within the City & County of Swansea giving detail of road width, pavement width, distance and height of buildings etc. All industrial, point and area sources will be defined and included onto the database. Emission factors will then be assigned to each source.

Detailed information of traffic flow is an essential part of the data input to the "Nowcaster" model and 23 General Packet Radio Service (GPRS) Automatic Traffic Counters (ATCs), manufactured by Golden River Traffic Ltd, have been installed within the Lower Swansea Valley area to provide this data. Powered by solar panels, the ATCs have been configured to produce an EUR6 standard, vehicle by vehicle classification together with the speed and direction of each vehicle - this information is then transmitted every 5 minutes via the GPRS network to dedicated FTP computer servers.

Meteorological data will be received via FTP from the Danish Met Office and will span three days as hourly time series. The forecasts will be updated four times a day and will include: wind speed and wind



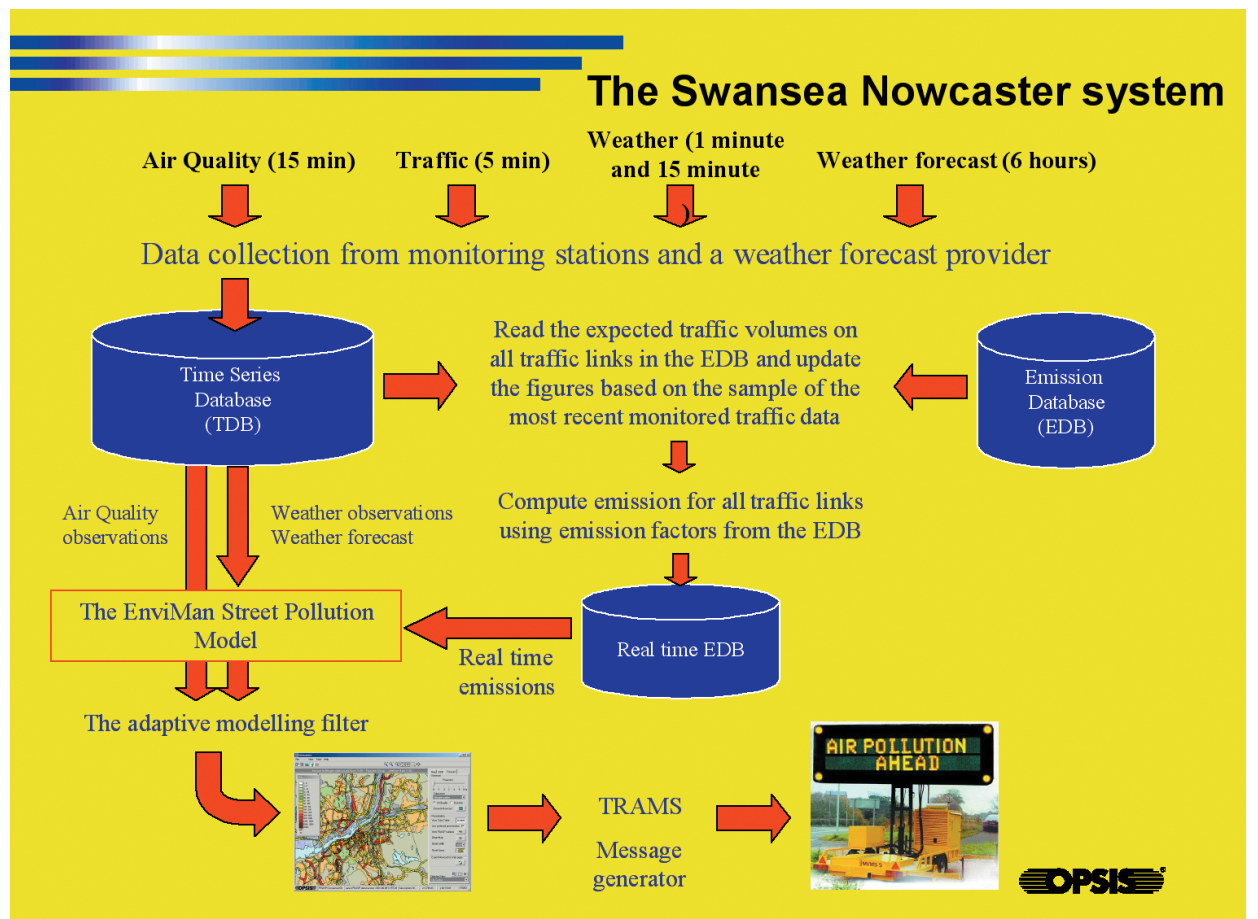
Typical congested Swansea street – Neath Road, Hafod

direction at 10 metres, 80 metres and 800 metres; temperature at 2 metres, 80 metres and 800 metres; mean sea level pressure; precipitation; boundary layer height; friction velocity; surface heat flux; relative humidity; and cloud cover.

Real-time air quality data will be processed from the Swansea AURN and from two, ET-supplied, fully-automatic Groundhog monitoring stations at Morfa and Morryston which are equipped with API gas analysers for SO<sub>2</sub> NO<sub>2</sub> NO NO<sub>x</sub> CO and R&P PM<sub>10</sub> monitors. In addition API H<sub>2</sub>S and O<sub>3</sub> analysers are located at the Morryston station with an additional API O<sub>3</sub> analyser located at the Swansea AURN.

A vital requirement of the first phase of the project

is to validate the output of the "Nowcaster" model and this will be achieved by the measurement of real-time air quality along a typical street congested with slow-moving traffic. Utilising Differential Optical Absorption Spectroscopy (DOAS) open path technology, an Opsis AR500 will measure levels of NO, NO<sub>2</sub>, O<sub>3</sub> and benzene at first floor level – a height of approximately 3-4 metres, along a 200-metre section of terraced housing which fronts directly onto known problem street. This data will have a resolution of 3 minutes and will be used to determine and evaluate the atmospheric chemistry as well as the predictive output. As part of the validation process, vertical and horizontal wind speed and wind direction measurements will be taken at first floor level along the



street. Horizontal wind speed and wind direction will also be recorded from above roof ridge level. Global radiation, ambient air temperature and relative humidity will also be measured at first floor level along the street. These measurements will have a resolution of 1 minute and will aid the definition of the vertices and mixing capacity of the street "canyon" – vital information if the model is to be properly validated. Data from both the OPSIS DOAS and meteorological equipment will be uploaded via a broadband connection to the dedicated FTP servers within the authority every 5 minutes.

The "Nowcaster" model will have the Opsis "EnviMet" server module running in the background compiling climatological datasets from the street and also from both the authority's two Groundhog air quality monitoring stations and the OPSIS meteorological station located 10 metres above sea level at a coast side location.

Predictive output from "Nowcaster" will be in colour-coded graphical form on a pre-defined digital map. Pollution loadings for the various pollutants for each road link will be colour graded and uploaded on an hourly basis together with all air quality data and meteorological forecasts to web pages. This will provide the general public with visual indications of existing pollution levels together with hourly predictions for up to 8 hours into the future.

"Nowcaster" will be linked with the Variable

Message Signs interface TRAMS. TRAMS will be provided with a set of logical instructions to meet specific traffic management needs and optimise network capacity. Nowcaster will send status signals to TRAMS for those section(s) of road links that may exceed predefined pollution levels. Variable Message Signs will be sited strategically on the road infrastructure, initially within the Lower Swansea Valley area. Subsequent years of this project will see this provision expanded to other areas. TRAMS will have been pre-programmed with a set of logical instructions to determine which sign receives which message for the existing/predicted conditions, as not all signs will receive the same message. This ability to forecast conditions ahead, allows an opportunity for management of the traffic flows in the lower valley area and for the traffic to be redirected away from area(s) identified as likely to experience pollution incidents.

The Opsis software and expertise is at the core of the first phase of the programme. Hakan Tornevik from Opsis AB and Enviro Technology's environmental software and Opsis specialist, Paul Norman, have worked closely with Phil Govier to customise the "Nowcaster" modules to provide the automatic requirements of the data processing and reporting systems. Data transmission has been made "non-visible" to foil would-be hackers. As the project develops, further use of Opsis software in the overall traffic management programme will include the

"Planner" database and the "Finder" pollution module.

Commenting on the scheme, Phil Govier said "none of the components incorporated in the Swansea Action Plan is unique but we believe that we are the first authority to attempt to bring them together in a single, cohesive manner using the latest technology. We hope that the Lower Swansea Valley initiative will set the standard for future traffic management schemes in our area".

The Phase I data collection and model validation part of the Swansea programme is scheduled for completion by spring/summer 2004. The full scheme is expected to go live by 2005.

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