TRAFFIC MODEL
"THERMAIKI KYKLOFORIA"

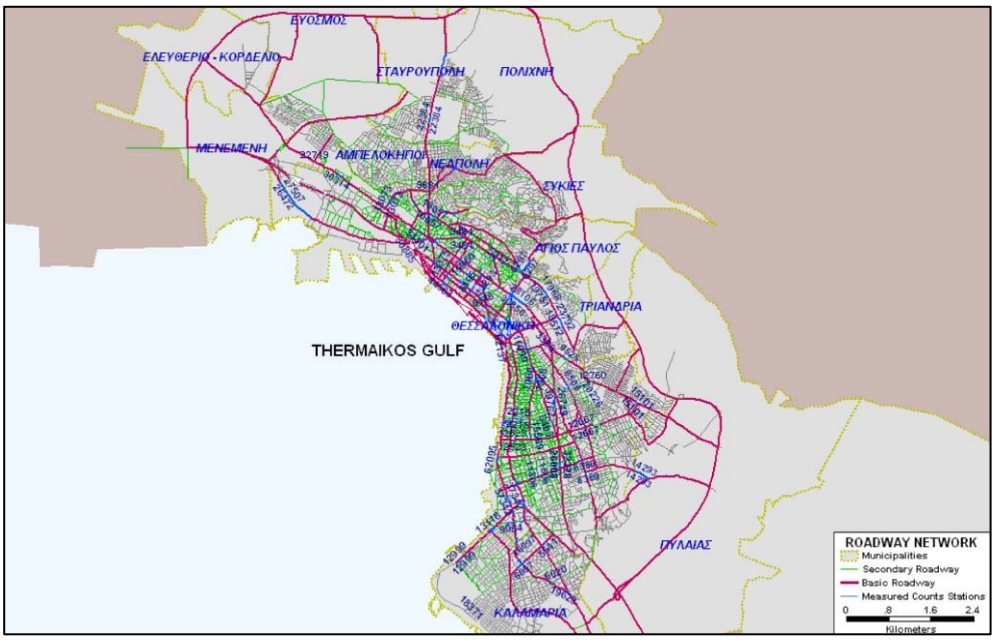
The traffic model for the Thessalonica Metropolitan Area had been developed under contract with the Joint Venture ***Thermaiki Odos***. *IMPETUS' Engineering, SA* was the traffic consulting engineering organisation that provided all necessary traffic related information to the Joint Venture for the offer of the ***'Thessalonica Submerged Artery'*** to be submitted to the Ministry of Environment and Public Works. The consulting team (IMPETUS) investigated the situation in Thessalonica from many perspectives in relation to the existing data, studies, and other information and developed a GIS model with all related information (capacities, speeds, on street parking, peak period and 24–hr volumes, signalisation, etc) for the Thessalonica Metropolitan Area.

The Traffic Model

Modelling Software

The traffic model was developed and implemented using TRANSCAD s/w 4.7. TRANSCAD is a GIS-based transportation-modelling suite, which is developed in USA by the CALIPER organisation.

The model network is shown in Figure 1.



Methodology

The methodology, which was employed for the traffic model followed the typical process of modeling a city network and consists of the following steps, utilising primarily the traffic model data developed under the 1999 traffic study:

Study Area and Zoning

The study area coverage in the traffic model reflected all the competing parallel routes up to the peripheral (by-pass) ring road.

The zoning system was based on the one used in Thessalonica transportation study 294 zones without the trips coming from abroad which makes a total of 326 zones) and it was suitably adapted – Impetus model utilised 244 traffic zones after aggregation, for the specific project.

Network Definition

The network has been coded (as mentioned above) using GIS+ of TRANSCAD s/w (v4.7) transport simulation model for the network around the Tunnel Artery and in "buffer" mode for the network beyond the zone of influence, to include all the links that can be competing to the project. For the buffer, every link was associated with speeds, capacities, volumes, utilised lanes, etc.

The assignment algorithm used, allowed multi-routing and a number of iterations in order to reach user equilibrium. The level of toll (whether in base year 2008 or in future years, i.e., 2016, 2024, 2032) was divided by the Value of Time (VOT), which has been extensively studied (as well as investigated and assessed from earlier studies, the new SP survey, etc).

The demand was segmented by trip purpose and user class/segment. The analysis had been undertaken at the hourly and daily (24 hour) level. However, even though the hourly level is more appropriate for congested urban traffic and charging systems, the daily modeling provided additional information for the total revenues. Total revenues were also obtained from aggregating to daily level using the user classes, and annualised according to the monthly/seasonal demand profile of traffic in the city.

The Model

The model for the Metropolitan Thessalonica area (Study Area) used O-D data from the Thessalonica Transportation Study (1999), which was updated through the new MCCs (Measured counts, 2003-2004). The model covered the Urban Group of Thessalonica, including all competing (parallel) routes, of the city centre of Thessalonica, to the proposed tunnel from the coast to the inner by-pass road.

The model has been developed using TRANSCAD software and has been based on the 1998-99 OD data, updated by a new set of traffic count data that either were measured or provided by 3rd DEKE. This matrix has then to be expanded to current traffic flows.

The trip matrix (OD pattern) was expanded to future target (design) years. A without-tunnel network was coded, where the capacity on alternative routes had to be reduced in order to reproduce the envisaged traffic calming / management measures, and maximise the diversion to the Tunnel Arterial. Another set of with-tunnel options was developed for testing using the model.

This option provided with detailed information on all the entry/exit points of the Tunnel Arterial and also enabled scenarios of differential charging by time-of-day and by direction to be examined. It also enabled the assessment of remedial measures upstream and downstream of the proposed Tunnel Arterial, which were required to avoid the traffic congestion on the feeder roads and thus maximise the throughput and revenues of Tunnel Arterial traffic.

The resultant matrix had been developed as a 'prior matrix' and it was calibrated – using Matrix Estimation- to the 'calibration' traffic counts along the routes. With the additional counts available, a comparison was made of the assigned to observed flows at those 'validation' count sites. It has been established that the model validates well.

There have been criteria by which model calibration and validation was deemed to be acceptable, through estimating a parameter (GEH) that compares assigned to observed flows. The GEH, in fact the square root of Chi Square, represents the goodness of fit, and there are industry standards for what range of values are acceptable given different levels of flow. This is the technique that has been employed by Impetus team, in order to ensure the robustness of the developed model. Since this has been achieved the model now can be used in a predictive mode.

Traffic & Revenue Forecasts

The socio-economic data and growth scenario input into the modeling and forecasting included indicators such as GDP, population, employment, production, and car ownership (motorisation).

A number of runs were carried out in order to achieve the preferred Central Case, for which final predictions were to be taken forward.

The model results for the artery are shown in Figure 2.

Once that was accomplished, we intended to undertake traffic predictions for four design years:

Initial year, which could be the planned opening year - 2008

Two intermediate years – 2016, 2024

Fourth year, which could be related to the end of concession – 2032

The socio-economic data and growth scenarios were based on several data sources including the 2001 national census, macro-economic forecasts by various institutions, outlook of the entire region, established economic models.

The socio-economic parameters such as population, employment and GDP and number and distribution of vehicles would forecast through a desktop study, on the basis of available data. The task covered basic research into these parameters to a sufficient degree to ensure that plausible forecasts were obtained.

Growth factors were applied to produce forecast traffic figures. Forecasts were prepared for the different user classes. This provided forecasts in units of annual average daily traffic flows (AADT), classified into different vehicle types and would include for the effects of seasonal variation.

Revenue (in real and nominal terms) was estimated from the trip matrix and toll imposed

Scenarios and Toll Strategies

The forecasts were undertaken for three 'growth' Scenarios: a Central (or Reference) Case, with an optimistic and pessimistic range. These scenarios were generated through different assumptions of GDP resulting in traffic growth, or assumptions on development, and were carried out in conjunction with the Financial Advisor to represent the Banking Case. Overall the traffic growth in the previous studies and the ones that were used by the Ministry was 2.2 % per year for the development of Thessalonica (tendency scenario) per year until 2014, and the second scenario (development) was calling for a 3.4% per year until 2014+ (meaning that even after 2014 the growth factor remained pretty high).

IMPETUS model TK has utilised two different conservative scenarios, based on growth, land use development, car ownership tendencies, etc, which was 1% per year and 2% per year which was our second scenario for Thessalonica (optimistic).

Several model runs had been carried out in order to optimise the Central Case in terms of the toll level and strategy to be adopted.