Internal Report 9

Description of Transport Model

(WP3. T3.1)

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SYSTRA

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InSMART

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Internal Report

on the Transport Model for INSMART

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	**PP**
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Executive Summary:	
Basic transport model description.	
Keywords	Transport model

1. INSMART Transport Model – Inputs and Outputs

1.1 Spatial Disaggregation

- The transport model will use the system of N sectors being used by the four cities (NB 'N' will vary by city and will typically be between 10 & 20) - – NB these sectors may be referred to as 'districts' in other Work Package documentation;
- The sectors will cover the agreed geographic scope of the city and the relevant surrounding area;
- The inputs and outputs to the model will be in the form of N x N matrices, with the rows representing the production of trips by the residents of the N sectors and the N columns representing the 'attractions';
- A single home-based production-attraction trip for a given purpose will represent the two 1-way trips (eg the initial from-home-to-work and the subsequent from-work-to-home trip);
- An additional N x N matrix will be used to represent 1-way trips which do not form part of simple home-based pairs (ie journeys which form part of 'trip triangles' (Home –> Work –> Shop –> Home) or more-complex tours;
- The model will assume that the mode of travel of the from-home and to-home halves of the simple home-based pairs will be the same;
- The model for each city will include all modes which are used by at least 5% of the Travel Diary trips recorded in the travel surveys, plus an additional two user-defined 'new modes' which can be used to represent new future-year public transport sub-modes (eg a new tram network) and/or an additional 'zero-emission' mode (eg for introducing 'future-year' cycling to models where the base-year cycling levels lie below the 5% mode-share threshold; and
- The model will NOT attempt to provide outputs for the underlying transport networks (traffic levels on specific roads/routes, number of passengers on specific public transport services, location of traffic emissions etc).

1.2 Temporal Disaggregation

- The model will represent the travel on a typical day, with no attempt to separately model different days of the week or 'peak' and 'off-peak' travel conditions; and
- Models will be produced to represent 'current' (2014), short-term (2020) and medium-term (2030) travel conditions.

1.3 Inputs

The main inputs (for each of the modelled years) will be as follows:

Provided by the Cities

- Resident population of each of the N sectors by economic status (Student, Employed, Unemployed (including 'Home Duties' and 'Carers') and Retired;

- Number of 'households' in each of the N sectors by household car ownership (No car, 1 car and 2-or-more cars);
- Number of jobs located in each of the N sectors (ie based on the location of the workplace, not the workers' home location);
- Retail floorspace in each of the $N_{sectors}$ (m^2);
- Details of the changes to transport networks to represent the various future-year scenarios – see the Scenarios section below for further details.

Derived from the Travel Surveys

- Attraction adjustment factor for 'Other' trips (ie trips which are neither commuting or shopping trips) – the default values for these will be derived from the Travel Diary surveys, but may be adjusted to represent future-changes in the relative attractiveness of sectors for these non-work/non-shopping trips;
- Trip generations and distributions by sector.

Derived from Census or national statistics and or TIMES model

- 'Relevant' details of the current and future-year vehicle fleet (assumed to be the same across all geographic sectors) - these 'relevant' details are those which are needed to convert vehicle kms into fuel and energy consumption and, if required, the emissions of agreed pollutants (possibly NO_X and particulate matter (PM_{10}s and/or $PM_{2.5}$s);
- The details of these required fleet mix proportions will be confirmed when the set of emissions to be predicted from the model outputs has been agreed – see separate discussion paper for details – however, this is likely to include a disaggregation of the fleet by fuel type (diesel, gasoline, diesel hybrid, Compressed Natural Gas (CNG), electric (full or diesel hybrid) etc), age and Euro Emission band;

1.4 Outputs

The main outputs of the model for a given year and scenario will be N x N matrices (in an agreed format) for the following variables:

- The number of simple home-based pairs by mode (eg Zero emission, public transport, car driver, car passenger and, where relevant 'Other') and sub-mode (eg bus, rail, tram);
- The number of additional '1-way person trips' by mode and sub-mode – these will be reported both as an origin-destination matrix (based on the sectors where the trips start and finish) and as a vector aggregated by the home location of the trip-makers;
- The number of trip kilometres by mode and sub-mode;
- The energy use by mode and sub-mode – in the case of car driver, these will be created as a 3-step process disaggregating the car driver Kms by energy type (electric, combustion and 'Other', estimating fuel consumption by fuel type (diesel, gasoline, CNG/bio-methane, hydrogen etc) and converting the fuel consumption into corresponding energy estimates – the total energy used by the public transport sub-modes will be distributed geographically using the corresponding demand matrix patterns;
- The total emissions for the agreed emissions types ($CO_{2(e)}$ and any agreed air quality pollutants – see separate Discussion Note for details;
- The distribution of trips for each sector in a spider diagram format.

- Goods vehicle demand (total veh kms), energy use and emissions (based on assumed fleet proportions by vehicle emission class).

By selecting a particular origin sector it will be possible to display the relevant row of the various matrices using the main GIS tool, using the standard set of GIS tools for displaying sector-based attributes (ie there could/should be a GIS layer attaching values to the agreed 'destination' sectors for each row of the various output matrices described above.

2. Definition of Scenarios

Changes to the future-year transport supply for a given scenario will be entered as matrices representing the change in time and/or monetary cost of each origin-destination trip by the relevant sub-mode.

The model will automatically predict changes in average car speeds resulting from changes in the number of car driver trips for each sector to sector movement.

This automatic estimation of changes in future-year congestion will NOT include the impact which changes in travel demand in one OD pair may have on average speeds for other OD movements (eg the impact which additional car drivers to the city centre might have on trips travelling through the city centre – these 'network-based' impacts will therefore need to be specified via the scenario cost change matrices described above).

The model will not automatically predict the impact of changes in congestion on bus (or tram) journey times, so these will need to be added manually via the scenario cost matrices described above.

The types of scenario intervention which can be tested by the model include:

- Changes in the distribution of population, employment, retail and/or the attractors of 'Other' trip purposes;
- Changes to the time and/or money costs of specific sub-modes for some or all of the sector-to-sector movements (as described above);
- Introduction of 'New Modes' (new public transport and/or a new 'zero-emission' sub-mode); and/or
- Changes to the fleet proportions (in addition to the default rolling improvement produced by 'Business as Usual' fleet renewal)[1].

Other Interventions that can be tested include:

- New Road or public transport infrastructure;
- Alternative public transport or parking charging regimes;
- Traffic management and vehicle restrictions on the highway network;
- Travel planning and publicity regimes.

[1] The default assumption is that the current age profile of the fleet will be maintained, so that the proportion of EURO VI will increase over time, as the proportion of post-2015 vehicles increases over time

A full list of schemes for Nottingham will be developed and tested before the next meeting and these will be discussed at the next meeting to inform the future year scenario decision making processes for the remaining cities. This may include additional schemes to those identified above.