1. Publishable summary

This third periodic report of the TransTools project (TT3) describes the activities carried out between March 2013 and August 2014. The project is developing the third upgraded version of the European transport demand and network model, TRANSTOOLS.

TT3 builds partly on data from the ETISplus project - another EU project that ran partly in parallel with TT3. Dialog with ETISplus continued in this reporting period in order to sort out remaining data issues. Eventually, it was decided that the TT3 project would use data made available from ETISplus, while having to initiate a substantial data collection of additional data. This data collection was carried out during this reporting period. An amendment of the TT3 Grant Agreement Annex I became necessary to allow for the successful implementation of the project, involving an extension of 22 months and a revised budget, time schedule and production plan.

1.1 Summary description of project context and objectives

The objective of the TT3 project is to upgrade and further develop the current TRANSTOOLS model (TT2) to a new and improved European transport demand and network model (TT3).

The project will improve the methodological basis of TRANSTOOLS, improve and validate its data foundation, deal with known deficiencies of the existing model, make the software faster and more efficient, and focus on the user needs, model documentation and model validation. In addition, the model will update the current TRANSTOOLS model - from 2005 as base year- to 2010 as base year based upon ETISplus and other data, which include transport networks (all modes), traffic counts, transport matrices (passengers, vehicles/coaches, freight in volumes and monetary values), zonal data (including socioeconomic data), and the geographical coverage of the model will be larger. In particular, a number of world zones will be included, and intercontinental sea transport (freight) and air transport (passengers) included.

The level of detail with regard to the rail, maritime and air transport modules will be increased, including explicit modelling of transfer at multimodal terminals. This allows for better analysis of costs, capacity and externalities of transport. Finally, the impact assessment model will be improved.

When finalised, the TT3 project will deliver a validated, well-documented and user-friendly model that will provide policy makers with a tool for assessing and developing better transport policies. The final model of TT3 will be free, and more transparent than the present model (but building on ArcGIS and Windows).

The TT3 project consortium consists of 14 partners. For more information about the project, please consult the project web-site: http://www.transtools3.eu/

1.2 Work performed since project initiation

Within the first three and a half years of the project, the TT3 consortium focused on:

- Establishment of project coordination structures, systems and procedures to ensure proper execution of the project;
- Development of the overall model design as well as sub-model designs;
- Preparation of data, including specification of data needs and clarification of the extent to which the TT3 project had access to adequate data of a sufficient quality;
- Application, acquisition and validation of national data and other non-ETISplus data for TT3 modelling;
- Validation of preliminary data – both ETISplus and other data;
- Base software development of sub-models;
- Initiation and implementation of a systematic network validation procedure where all partners by means of a dedicated web-based network editing tool have edited the entire European network. This includes the network for all modes.

The project is organised in 12 work packages (WPs) including project management and cross-cutting activities.

WP1: Consortium Management and WP2: Cross-cutting activities: The objective of WP1 and WP2 is to ensure an effective overall management and coordination of the TT3 project that will cater for an efficient and successful implementation of the project.

The activities in the third period of the project focused mainly on collecting, preparing and organising a solid data foundation for the modelling work including the activation of all possible resources within the consortium for providing and validating data . In addition, an amendment of the TT3 Grant Agreement was drafted and approved.

WP3: Architecture and configuration: The objective of WP3 is to design the changes necessary to the overall model structure of TT2 in order to ensure a modular and flexible model implementation.

As much work as possible was done on the development of the software architecture and data structure; i.e. developing generic parts, and now await input from the sub-model specific WPs. The design of the simple user interface is completed and the detailed user interface is ready for application by the sub-models.

The overall software architecture was redesigned compared to prior versions of TransTools in order to accommodate the user requirements in a better way. In order to provide better usability, some of these options thus require additional user software licenses.

Rather than spreading out data over many mdb-files as in the prior versions, the new version adopts the approach successfully applied by the Danish National model, where all scenario

data and all results are stored in a single SQL Server database. For larger organisations, the master-database will typically be on a separate computer, which only houses this database. The Master database handles all input scenarios and all results. This makes it easy to compare and combine data between scenarios – even from model runs, which were executed on separate computers, since everything exists in one database. Networks use a master-network concept, where there actually only is one single network for all scenarios – with attribute data which manages active/non-active and changing attributed. This gives a far better basis for difference-maps and guards against inconsistencies in editing. This approach also makes a clear distinction between input and output data.

Another benefit of this shift in paradigm is that a "scenario manager" is provided, which makes it easier for users to compare scenarios – and rerun scenarios if data are edited. This overall framework has been implemented and is ready for use, when all sub-models are finalised and validated.

WP4: Flexible modelling framework: WP4 deals with the linking of all sub-models developed in the project into one complete modelling system, which will make it easy for users to create and run different configurations of the model framework.

Initial design considerations and implementations were made in the beginning of the period including a methodology for calculation of key figures and a prototype for automatic map creation.

Whereas WP3 designed the overall architecture and structure of the model framework, WP4 merge all sub-models into this framework. The main work effort in WP4, i.e. to connect the different sub-models, will thus according to the plan take place when the sub-models have been developed.

WP5: Data collection and validation: The objective of WP5 is to prepare data for TT3 and in particular to validate ETISplus data, and collect and prepare data from this project for estimation and calibration of TT3.

The validation of ETISplus data continued into this third reporting period with clarifications made during the summer 2014. The general conclusion of the validation of ETISplus was that only for very few attributes the ETISplus data was found to be of sufficient quality to enter the model framework directly. This was partly the case for the ferry network and inland waterways network. For most other data attributes it was found that alternative data sources to ETISplus were needed. Hence, it has been necessary to identify and develop new data collecting procedures and define validation processes.

There were several activities in the third reporting period, including network validation for all modes where the effort was distributed among partners according to geography and modes, validation of harbours, stations and intermodal terminal layers, establishment of world zones and intercontinental air- and sea networks, as well as initial work on validation of demand matrices.

WP6: Scenario generator: The objective of WP6 is to support the development of "boundary data" to be used when using the model for forecasting. This includes population data, work force data, GDP data, car ownership, etc.

Definition of boundaries between the scenario generator and the various sub-models was outlined across WPs and a model design note prepared laying the ground for future work in the WP. The software side of the scenario generator was dealt with by Rapidis in WP3. WP6 thus mainly addresses the definition of the scenarios as such. This awaits the final data structure and input from the sub-model related WPs.

WP7: Freight models and logistics: The objective of WP7 is to develop a new freight model, based on 2010 data. In the third year of the project, the level of activity was limited; however, the design of the freight and logistics model was completed and disaggregate data were acquired. A preparatory descriptive analysis of two main disaggregate data sets (ECHO from France and the Commodity Flow Survey 2009 from Sweden) was started. Most work on WP7 has been postponed since 28.02.2013 owing to the unavailability of data (transport time and cost between zones; matrices of transport flows) and the subsequent Grant Agreement amendment. Further work in WP7 has been ongoing from September 2014 and the model design and the work on the trade model and the transport cost functions is progressing as expected.

It was decided to use TT2.5 LoS data for the logistics model estimation due to delay in LoS matrices, in order to save time by making it possible to work on the traffic assignment and freight models in parallel. This estimation work thus started at the end of the reporting period.

WP8: Passenger demand model: The objective of WP8 is to re-estimate the passenger demand model from TT2, update the base year of the model and take nonlinearities into account.

In the third period of the project, work concerned the definition of value-of-time estimates to apply for the model (this also relates to WP6 and WP10). In addition, work on the design of the short-distance model was carried out, which for a large part is intra-zonal. It was foreseen that ETISplus data for intra-zone trip distances should be applied. This strategy, however, was unsuccessful due to poor quality of ETISplus data. Specifically, the design of the distance bands in ETISplus and the number of travelers within each distance band were tested. E.g. it was notable that Stockholm shares the same distance profile as Halland and Jonkopings Lan, which is unlikely as it is a comparison between a highly urbanized area and rural areas. Also, the distribution for Copenhagen was dubious. All too many trips were based in the 0-3 KM band.

Finally, with respect to the long-distance model it was decided to estimate the model on the basis of TT2.5 data. Prior to this decision the quality of the TT2.5 data was revised and it was concluded that it was fairly good compared to ETISplus. An alternative would have been to use newly generated data based on the new network models and the new zone system. However, although this would have been difficult in terms of the time-schedule it would also give the problem of translating these data back to the old NUTS III system to match the zone system on

which the DATELINE study was collected. **WP9: Traffic assignment:** The objective of WP9 is to improve the route choice and traffic assignment component of TRANSTOOLS.

The main effort in the third year of the project was to analyse the design of the traffic assignment models in TT2, and design the traffic assignment models in TT3 from a general framework perspective as well as from each specific mode. This work is completed.

Since existing software will be used in TT3, the main effort in WP9 will be to calibrate the models and an effort will be made to speed up the calculation time with various techniques.

During the reporting period various technical improvements were developed while waiting for data. These improvements relate to matrix-thinning and the use of hierarchies in the assignment. The matrix thinning is an approach where cells in the trip matrices that have very small values are removed or moved to neighbouring zones in order to save calculation time. The hierarchies in the assignment model is an approach where drivers are assumed to know the more local network only in the start and end zones, whereas they prefer the main network during the trip. This approach also saves calculation time. Both approaches were tested and calibrated during the reporting period on the old 2005 TT2.5 matrices and network.

The overall implementation and testing of the new 2010 matrices and networks was postponed as the network data were first available in a validated form at the end of the reporting period.

WP10: Project assessment model: The objective of WP10 is to develop a project assessment model that will be able to evaluate physical infrastructure as well as tax policies and combinations of these.

As this model will use input from the other TT3 sub-models (WP6-9), the main testing will await these according to plan. The methodological approaches were discussed though, and a model design note produced.

WP11: Model validation: The objective of WP11 is to undertake proper validation of the overall model in order to rule out possible errors and to establish a common consensus on the outcome of the model.

WP11 will ensure that all models in TT3 are thoroughly revised and that there will be a validation of the complete model framework and of the user interface. This WP will not start until the other WPs have delivered models that can be validated. As such, the WP is planned to run the last half year of the project.

As the models are not yet finished no activities has been carried out.

WP12: Deployment, user guide, and maintenance: The objectives of WP12 are to provide a robust mechanism for the end user to install and uninstall TT3 and a comprehensive User Guide for TT3. Work will be carried out in parallel with WP3, 4 and 6-10; but the merging of all this will not take place until the final phase of the project.

As the models are not yet finished no activities has been carried out.

1.3 Results achieved and expected results

The following formal deliverables were submitted and approved:

- M3: D2.1: A project web page was developed and launched at www.transtools3.eu
- M4: D2.2: A format for a project newsletter was developed and four newsletters were published earlier at the project website and distributed by email to relevant stakeholders. Project newsletters will be published and distributed throughout the project. The fifth newsletter has been published.
- M14: D3.1: Guideline for model configurations.
- M14: D5.1: Note with specifications for ETISplus.
- M20: D3.2: User interface design documentation.
- M44: D5.2: Data description document.

From a project point of view, the main achievements of the first 42 months were the following:

- A set of model design notes (Milestone) were produced, distributed among key partners and submitted to DG MOVE for information. These notes lay the methodological foundation for the model development in the remaining part of the TT3 project.
- The need for software development was clarified, both within WP3 and WP4 and the cross-cutting WP6, and within the specific model components: WP 7-9 (freight, passenger and traffic assignment).
- The design of the simple user interface is completed and the detailed user interface is ready for application by the sub-model.
- The model architecture and framework was agreed upon with DGMOVE, described in a note. Following this, Rapidis has designed and tested this framework.
- There was an extensive dialogue with ETISplus. This included commenting on format specifications and meta-data in ETISplus.
- Alternative data sources for model estimation were identified and data access ensured; the Swedish Commodity Flow survey, French ECHO surveys as well as other national data were acquired and analysed.
- A web-based facility to produce network editing across partners was developed, set up and applied. The partners validated and edited the networks using this interface, and most of the validation work was completed during the reporting period. By far the largest activity in the reporting period was thus the data validation effort.
- Work was made on creating a world zone system (zones outside Europe) in order to model intercontinental sea transport (freight) and air transport (passengers). International harbours and airports outside Europe were selected to be included in the model.

- Construction of value-of-time estimated based on a META model.

1.4 Potential impacts and use of results

Despite massive data problems **the general ambition, impact and use of the model remains largely unchanged** due to reshuffling of activities and TT3 internal data collection.

As a result, the project still works towards producing one overall and final result: An integrated model that will cater for more informed transport policies and decisions. All WPs, tasks and activities in the project are targeted towards this end-result.

The main impacts – when the model will have come into use – are expected to be as follows:

- The project will have validated data on transport from ETISplus, and collected data from other sources, compiled and merged them into a joint TT3 database that describes transport in Europe. This provides a general knowledge on transport in Europe. All data will be available in an accessible format, whereby it can be of use – not only to DG MOVE – but to member states, transport organisations, NGOs, etc.
- The model area will have been enlarged in order to model intercontinental sea transport (freight) and air transport (passengers)
- TT3 can be used for assessing impacts of overall European Transport Policy, energy and/or fiscal/economic policies with focus on the transport sector, as well as of TEN-T and other infrastructure projects.

Finally, TT3 can be used in context of national transport models – in cases/countries where no national model exist - as a base for developing national models, or in order to describe international traffic to/from and through countries, especially in countries with much international transport or in border regions.