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A Strategic Assessment Tool for Evaluating European Transport Policies – the HIGH-TOOL Approach

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Abstract

Decisions on transport policy measures proposed by the European Union (EU) have long-term and important impacts on economy, environment and society. Transport policy measures can lock up capital for decades and cause manifold external effects – thus, policy measures may have a tremendous scope, especially if proposed on a European level. In order to allow European policy-makers to evaluate transport polices, a strategic assessment tool has been developed to compute economic, environmental and social impacts of transport policies.
After summarizing key requirements of the tool and its overall structure, the paper illustrates the methodologies applied for the individual modelling entities of the strategic high-level transport policy assessment instrument HIGH-TOOL, which cover the following areas: Demography, Economy & Resources, Vehicle Stock, Passenger Demand, Freight Demand, Environment and Safety. Further illustrates how these principles have been applied for accessing the HIGH-TOOL model. Furthermore, the paper

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*Keywords:*impact assessment; transport policy; economic, environmental, social impacts; assessment tool; European Union; model; decision support.

1. Introduction

Decisions on transport policy measures proposed by the European Union (EU) as addressed by the White Paper on Transport (European Commission, 2011) have long-term and important impacts on economy, environment and society. Transport policy measures can lock up capital for decades and cause manifold external effects – thus, policy measures may have a tremendous scope, especially if proposed at the European level. In order to allow European policy-makers the identification of the most advantageous transport policies and the evaluation of transport policies, a strategic assessment tool is required to compute economic, environmental and social impacts of transport policies. The strategic assessment tool needs to be responsive to EU transport policies – for instance addressed by the European Commission's White Paper on Transport (European Commission, 2011) –, while the tool's output indicators are required to reflect policy documents such as the EU's Impact Assessment Guidelines (European Commission, 2009). The increasing importance of such impact assessment tools as decision support instruments for policy makers is recognized by various authors such as Sieber et al (2013), Nilsson et al. (2008) and McIntosh et al. (2011).

This paper addresses the development of such assessment tool, namely the development of the strategic transport policy assessment tool HIGH-TOOL (high-level strategic transport model), which has been developed for the European Commission. The paper is a complementary paper to the paper by Szimba et al. (2015): While Szimba et al. (2015) gives an overview of the overall concept and approach for the development of a strategic policy assessment tool, the current paper deals with model implementation, particularly in terms of methodology, user interface and the reporting of assessment results.

The paper is structured as follows: Chapter 2 provides an overall summary on tool requirements and overall concept of the assessment instrument in terms of structure and key features. Chapter 3 explains the methodology behind the individual modelling entities. Chapter 4 addresses general user interface design principles, and illustrates how these principles have been applied for accessing the HIGH-TOOL model. The paper concludes with chapter 5, the summary and conclusions.

Nomenclature

BAU	Business-as-usual	GHG	Greenhouse Gas
CGE	Computable General Equilibrium	GVA	Gross Value Added
DG MOVE	Directorate General for Mobility and Transport	HDV	Heavy-Duty Vehicle
		LDV	Light-Duty Vehicle
EC	European Commission	NUTS	Nomenclature of Territorial Units for
EMC	Expected Minimum Cost	O-D	Origin-Destination
EMU	Expected Maximum Utility	TPM	Transport Policy Measure
EU	European Union		
EU28	28 Member States of the European Union		

2. Tool Requirements and Overall Tool Concept

2.1. Tool requirements

The main purpose of the assessment tool is the strategic evaluation of transport initiatives by the European

Commission in economics, environmental and social dimension. Supposed to be applied by the transport policy specialists of the European Commission, Directorate-General Mobility and Transport (DG MOVE), the tool has to be user-friendly, intuitively useable and well documented.

During a user survey the following policy categories were prioritized for consideration by the strategic assessment tool (Vanherle et al, 2014):

- Policy measures relating to the objectives of the internal market;
- Internalization of external costs;
- Infrastructure charging;
- Multimodal transport;
- Safety.

Regarding scope of impact variables, Table 1 provides an overview of impact criteria which have been identified as relevant.

Table 1. Relevant impact indicators

Category	Impact indicator
Demography	» Labor force
	» Population
Economic impacts	» GDP
	» GVA
	» Consumption per capita
	» Trade
	» Labor supply
	» Wages
	» Income
	» Emissions
	» Resource use
	» Household consumption
	» Taxes
	» Capital returns
	» Capital stock
	» Price index
Freight Demand	» Transport performance (ton-kilometer)
	» Mileage (vehicle-kilometer)
	» Transport volume (tons carried)
	» Costs
Passenger Demand	» Transport performance (passenger-kilometer)
	» Mileage (vehicle-kilometer)
	» Transport volume (number of trips)
	» Costs
Environment	» Emissions (CO_2, CO, NO_X, SO_2, VOC, particulate matter)
	» Fuel consumption
Safety	» Accident costs
	» Fatalities

	» Slight & serious injuries
Vehicle Stock	» Cost components per vehicle-kilometer/ passenger-kilometer/ ton-kilometer » Fuel costs per litre/gramme » Vehicle stock » Detailed mileage (vehicle-kilometer) » Vehicle purchase costs

A more detailed elaboration of user needs is provided by Vanherle et al. (2014) and Szimba et al. (2015).

2.2. General tool features

As summarized by Szimba et al. (2015), the assessment tool is designed as a high-level strategic assessment tool which is partly based on existing tools, and where necessary, complemented by new models. Due to its character as a strategic high-level instrument it does not cover detailed networks. The core of the model are transport demand models for passenger and freight, following the structure of the classic transport model (e.g., Ortúzar and Willumsen, 2011), however without assignment of flows on networks.

Its geographic and spatial scope is the level of NUTS-2 for all EU Member States (EU28), Norway and Switzerland, NUTS-0 for EU neighboring countries, and country bundles for intercontinental transport. In order to ensure consistency with the long-term horizon of the White Paper, the tool's timeline is represented by 5-years steps from 2010 (base year) to 2050.

All modes of transport are covered and differentiated by vehicle technologies. In order to take into account demand segment specific preferences and characteristics, passenger demand is differentiated by four trip purposes and freight demand by NST-2 commodities. To facilitate consistency with White Paper targets, the demand is subdivided into three distance bands.

The baseline scenario, i.e. the scenario the transport policy measures are to be assessed against, is the EU Reference Scenario 2013 (European Commission 2013), which runs until 2050.

The tool is responsive to transport policy measures and is thus sensitive to a set of independent variables. As far as is feasible, its results for the base year and the baseline scenario are in line with EU transport in figures and other national statistics, as well as the EU Reference Scenario 2013, respectively.

The general tool features are summarized by Table 2.

Table 2. General tool features.

Model feature	User requirement
Type	Strategic high-level model derived from existing tools, models, equations and elasticities; where necessary enriched by new models; no detailed network model
Geographic Scope	EU28, Norway and Switzerland: NUTS-2; EU neighboring countries: NUTS-0; other countries worldwide: country bundles
Timeline	5-years steps from 2010 to 2050
Modes	Passenger: air, rail, road (passenger car and powered 2-wheelers), long-distance coach, urban public transport, slow modes; further differentiation by vehicle technologies
	Freight: air, rail, road, maritime, inland waterways, maritime transport; further differentiation by vehicle technologies
Transport Types	Passenger by trip purpose (business, private, vacation, commuter; for intercontinental passenger trips only business and non-business). Freight transport commodity (NST2, for air no commodities)

Distance Bands	0–300 km, 300–1000 km, 1000+ km
Model Sensitivity	The dependent variables of a module are sensitive to a variety of independent variables to model transport policy measures
Validation	EU Reference Scenario 2013, EU transport in figures/ Statistical Pocketbook; ETISplus
Baseline	EU Reference Scenario 2013

2.3. Structure

The contents of the current paragraph are largely based on Szimba et al. (2015). The conceptual framework for the strategic policy assessment tool follows a modular approach. The following modules form the core of the modelling part:

- Demography (DEM)
- Economy & Resources (ECR)
- Passenger Demand (PAD)
- Freight Demand (FRD)
- Vehicle Stock (VES)
- Environment (ENV)
- Safety (SAF).

The Data Stock ensures the data exchange between these modules, provides exogenous input for the modules and stores intermediate and output data. Finally, the user interface allows the operation of the model and provides access to assessment results. Fig. 1 displays the structure of the assessment tool and reflects the interdependencies of the modules' components.

A sequential approach of module interaction is applied. The sequential solution reduces the computation loops, as results for a period t are passed to computations in t+1. An iterative process would be much more time consuming as the modules would interact, re-compute, store and read data several times until the results for a certain time period become available and the model can move forward to the next time period. The sequence starts with DEM to produce demographic outputs for all forecast years 2015-2050. Subsequently ECR is run, fed by DEM results of time step t and by VES, PAD and FRD outputs of time step t-1. Afterwards VES is activated, on the basis of DEM/ECR (step t), and PAD/FRD (step t-1) outputs. Subsequently, PAD and FRD are run, using results from DEM/ECR/VES, and ECR/VES, respectively. Finally, results by PAD, FRD and VES are delivered for all years to ENV for the computation of the environmental impacts and by PAD and FRD to SAF for the computation of the safety impacts. The tool's base year is 2010. Thus, the first time step 2015 is partly driven by 2010 results, and 2020 by 2015 results etc. Fig. 2 illustrates the chronological sequence of a model run.

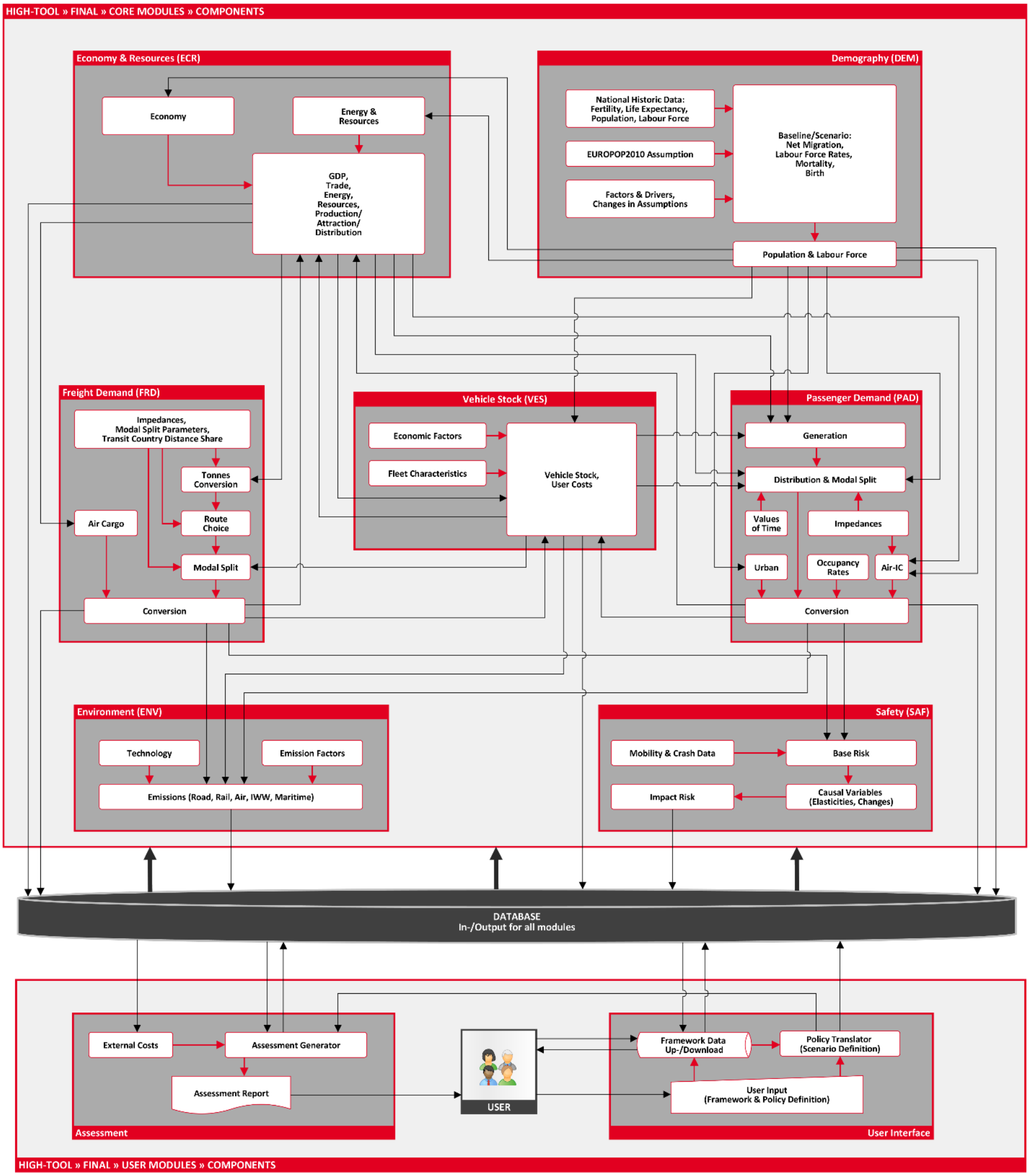


Fig. 1. Structure of the assessment tool.

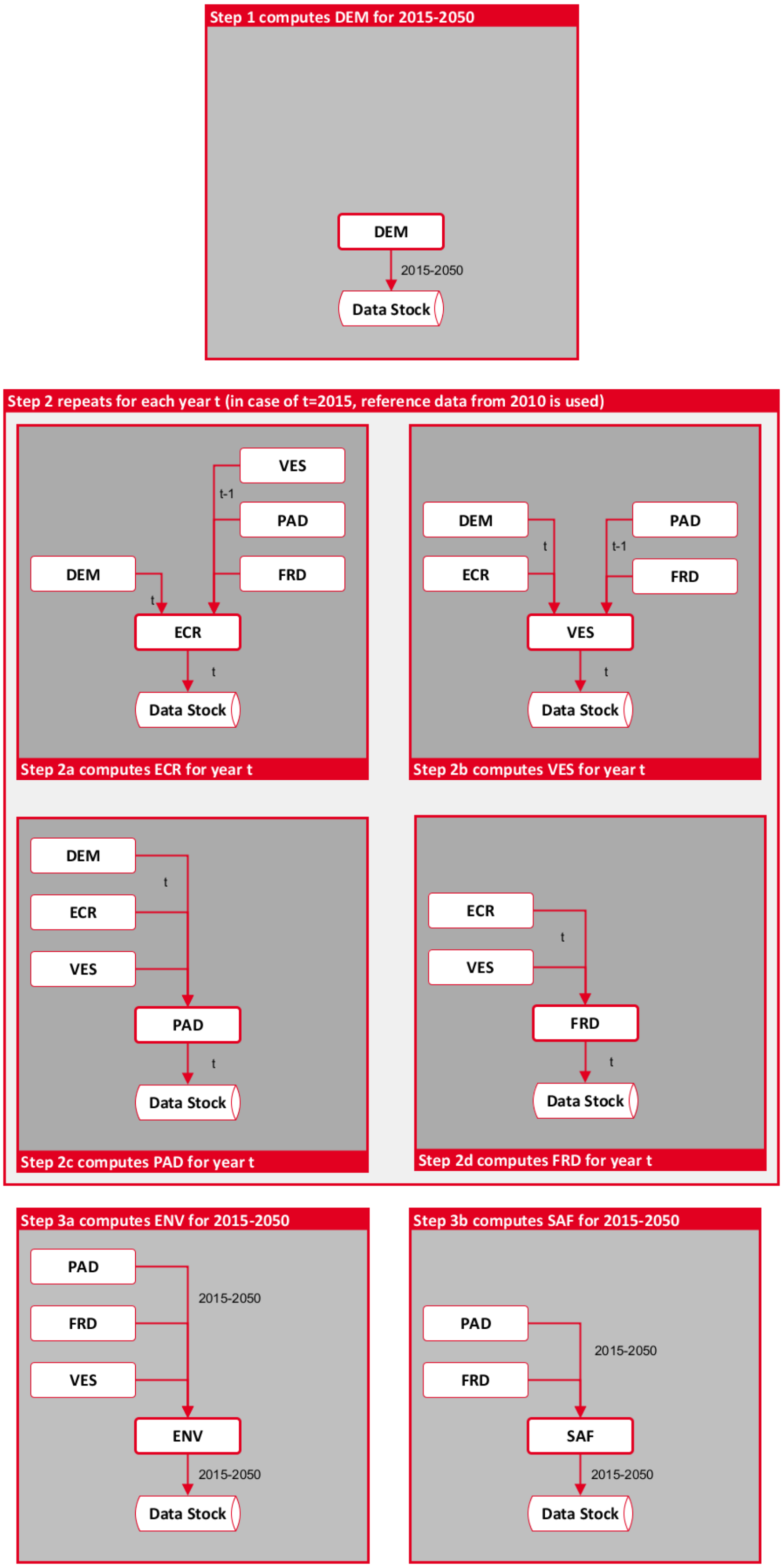


Fig. 2. Chronological sequence of a model run.

3. Methodology

3.1. Overview

The modelling approach follows the modular structure as illustrated in the previous chapter. The module-specific methods are briefly presented in this chapter. A more detailed description of the methodologies can be found in Van Grol et al. (2016).

3.2. Demography module

The Demographic module (DEM) reflects the demographic development of the regions considered within HIGH-TOOL: the module estimates the projected regional (NUTS2) population and labour force for the EU28 countries as well as Norway and Switzerland and provides the UN projected figures for the other countries worldwide, following the HIGH-TOOL zoning system.

Calculations for EU28, Norway and Switzerland are performed at the level of countries (NUTS-0 level), using the EU Reference scenario assumptions on fertility rates, life expectancies at birth and net migration (European Commission 2013). The projected population values are thereafter disaggregated to zones at NUTS-2 level based on demographic historic trends. At the same time, the net migration distribution at NUTS-2 level uses socio-economic data and specifically income and employment historic figures. The development of the population at NUTS-0 level is simulated by the Demography module with a cohort component model that takes the effects of demographic drivers and migration into account.

Regional disaggregation of the population excluding migration is performed based on the 2010 historical regional distribution. Net migration is then regionally distributed using a distribution proxy based on income and employment rate. Labour force estimation is carried out on the basis of the labour force percentage defined in the EU Reference Scenario and its underlying assumptions.

Fig. 3 provides an overview of the structure of the Demography module.

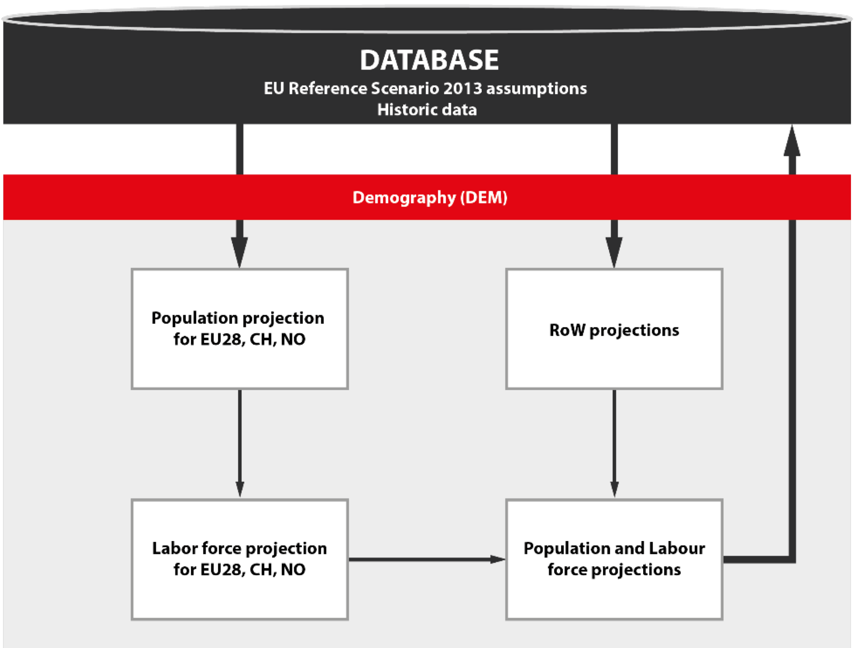


Fig. 3. Structure of the Demography module.

3.3. Economy & Resources module

The Economy & Resources module (ECR) consists of the three components: 'Economy', 'Resource', and the combinatorial component 'GDP, Trade, Energy, Resources, Production/Distribution'. The 'Economy' model gives an estimate of total output, capital stock and labour use in the economy, in which the general drivers (i.e. GDP, household income per capita and population) are exogenously defined by the EU Reference Scenario 2013. The module disaggregates these drivers from NUTS-0 to NUTS-2 level, based on ETISplus data (i.e. regional GDP, regional population, and labour force). The combinatorial component provides an estimation and projection of employment, trade, (resource) consumption and purchase power under different transport policies. 'Resources' calculates several environmental indicators (without combustion) using the EXIOBASE database (CO2, NOx, SOx, PM, biomass, fossil fuel use, metal use, mineral use, wood use, and water use).

A draft of the ECR module is displayed by Fig. 4.

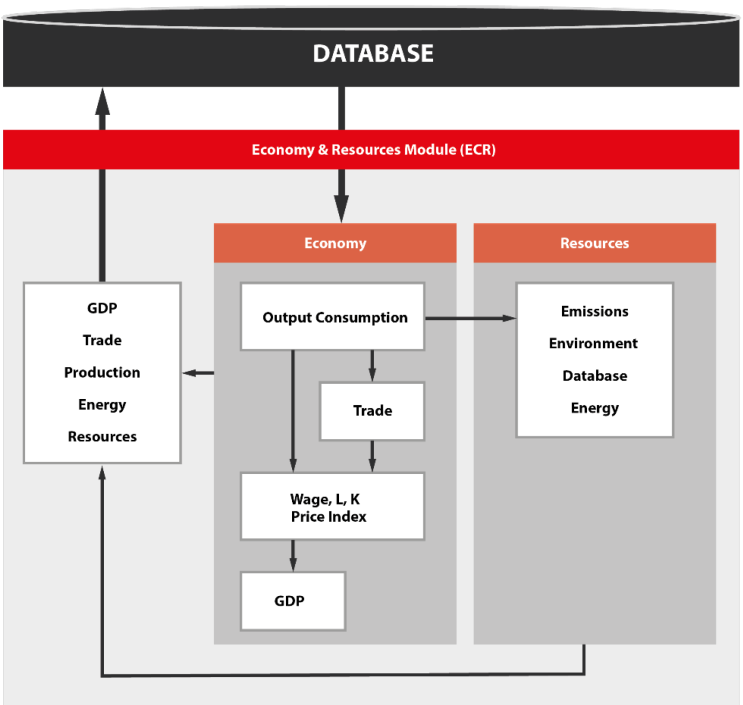


Fig. 4. Structure of the Economy & Resources module.

In order to generate economic output and environmental data, the ECR module uses demographic and labour data at regional level provided by the DEM module, transportation costs provided by the FRD module, the type of vehicles purchased provided by the VES module, passenger demand provide by PAS. These generated economic and environmental indicators are used by other modules. Economic indicators are an important driver of passenger and freight demand, as well as demand for vehicle stock. Hence, there exists a feedback between ECR and PAD, FRD and VES. The ECR module generates updated employment and income data used in the DEM module in order to ensure consistency of population distribution and spatial economic development.

3.4. Vehicle Stock module

The main task of the Vehicle Stock module (VES) is to convert passenger and freight demand into the vehicle fleet size. This fleet size is disaggregated by vehicle type and vehicle age cohort, which is crucial for emission and energy use calculations. The adopted classification of vehicle types is based on both propulsion and fuel type. In total, the Vehicle Stock module covers 61 road and 12 non-road vehicle types. The considered cohorts range from 0 to 29 year old vehicles. The results of the fleet stock calculations are pro-vided at NUTS-0 and at NUTS-2 levels for each of EU28 countries and for each time period (in 5-years intervals) within the model time horizon. Apart from fleet stock forecasts, the Vehicle Stock module also delivers forecasts of average fixed and variable generalized costs for each transport vehicle type as well as total tax revenues per country. The methodology underlying the Vehicle Stock modules is aligned with TRACCS (Papadimitrio et al. 2013) and TREMOVE (Ceuster et al. 2007).

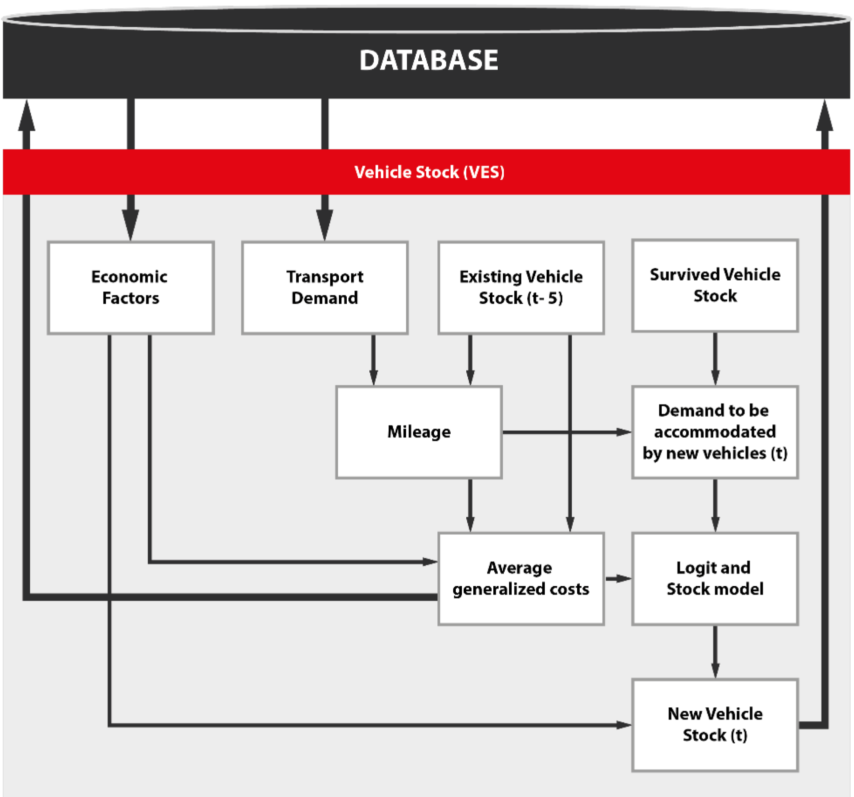


Fig. 5. Structure of the Vehicle Stock module.

Fig. 5 provides an overview on the structure of the VES module. The module's main input is transport demand from the previous period, i.e. period (t-5). Knowing the detailed existing vehicle stock from the same period of (t-1) including the number of survived vehicles from that period, the average mileage in term of the average kilometres per vehicle is calculated. The difference between the demand that can be accommodated by the survived vehicle stock and the demand of (t-5) period furnished as input by the freight and passenger demand modules makes the demand that needs to be accommodated by new vehicles in period t. The logit and the stock dynamic model inside the vehicle stock module use the calculated average generalized costs to define the shares of the different types of new vehicles entering the market as well as their numbers. This calculation produces the detailed existing vehicle stock of the year t.

3.5. Passenger Demand module

The core Passenger Demand (PAD) module consists of four sub-models: generation, distribution, modal split and conversion. The generation model computes the trip demand for each origin. In the distribution model the origin-destination trip matrix is computed, which by the modal split model is further divided into transport modes. The conversion model derives transport performance indicators such as passenger-kilometers and vehicle-kilometers. The core PAD module is complemented by the urban demand and the intercontinental air passenger module (see Fig. 6).

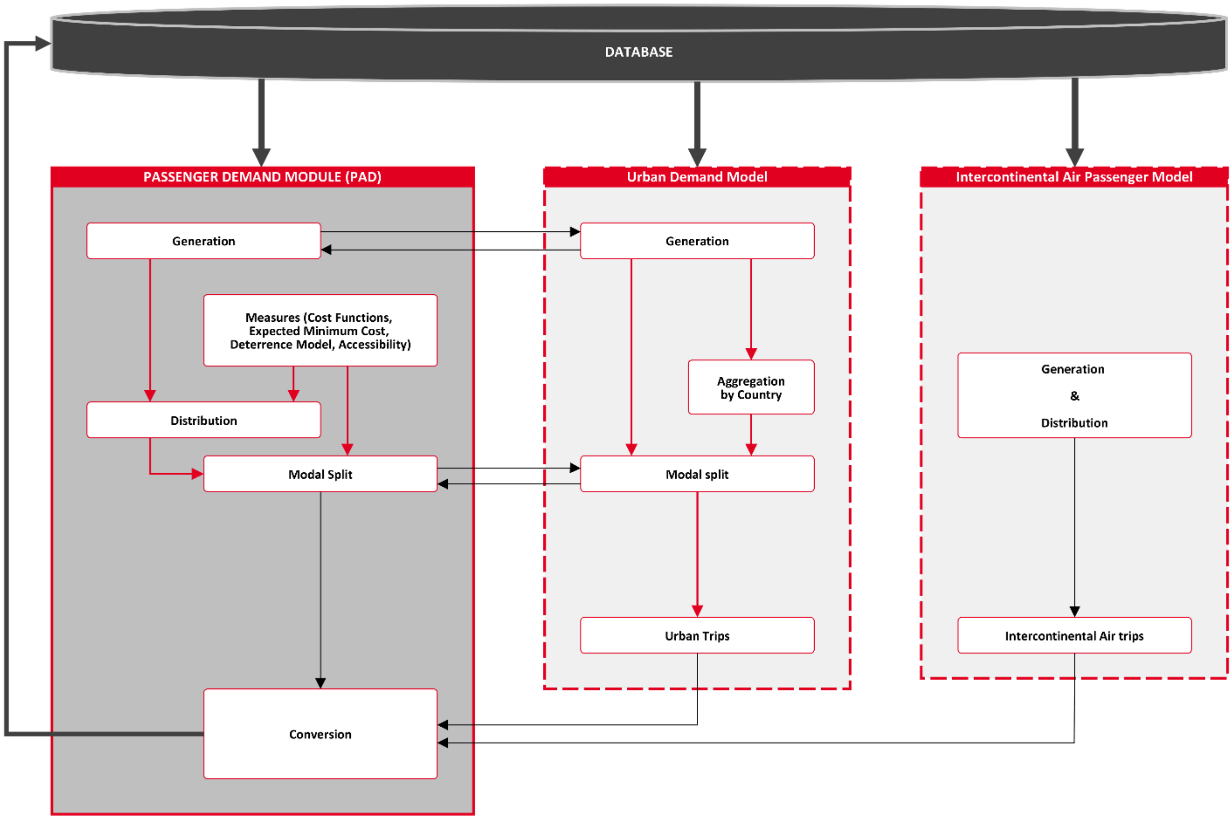


Fig. 6. Structure of the Passenger Demand module.

The core PAD module largely follows the classical “four-step approach” of transport demand modelling (Ortúzar and Willumsen, 2011): generation, distribution, modal split and assignment. Instead of the assignment step, the PAD module translate number of trips into transport performance by the conversion.

Trip generation is carried out by a regression approach. The distribution and the model split components are integrated by using the Expected Minimum Cost (EMC) measure which relies on the Expected Maximum Utility (EMU) or logsum measure that is more frequently discussed in economic literature (De Jong et al., 2007). For the cost functions, the concept of “generalised time” is used, i.e. cost unit refers to minutes and not to monetary terms. The computation of the EMC values is conducted under application of a Nested Logit model.

Road trips are subsequently split into trips by car and trips by powered two-wheelers, under the assumption of country-specific shares and country-specific motorisation levels.

The urban passenger demand module follows a generic, elasticity-based approach to estimate the urban transport demand. It covers following modes of transport: cars, powered two-wheelers, tram/ metro, bus, cycling, walking. Since urban trips are a subset of intra-zonal trips, the generation stage of the urban passenger demand module is linked to the core PAD module.

The intercontinental air passenger model estimates the number of intercontinental flows between European NUTS-2 regions and the intercontinental destinations by a regression-based approach.

3.6. Freight Demand module

The Freight Demand module (FRD) consists of four components: trade conversion, route choice, modal split and conversion. The trade conversion component converts trade values to volumes and extracts air demand from total trade between an origin and destination. The route choice and modal-split components distribute demand across transport chains and perform modal-split on the legs of the transport chains, while applying the effects of measures. The conversion model derives other transport indicators like tonne-kilometres and vehicle-kilometres. A sub-component determines the transport indicators relating to full-freight aircraft and feeds them to the conversion component. An overview of the module is provided by Fig. 7.

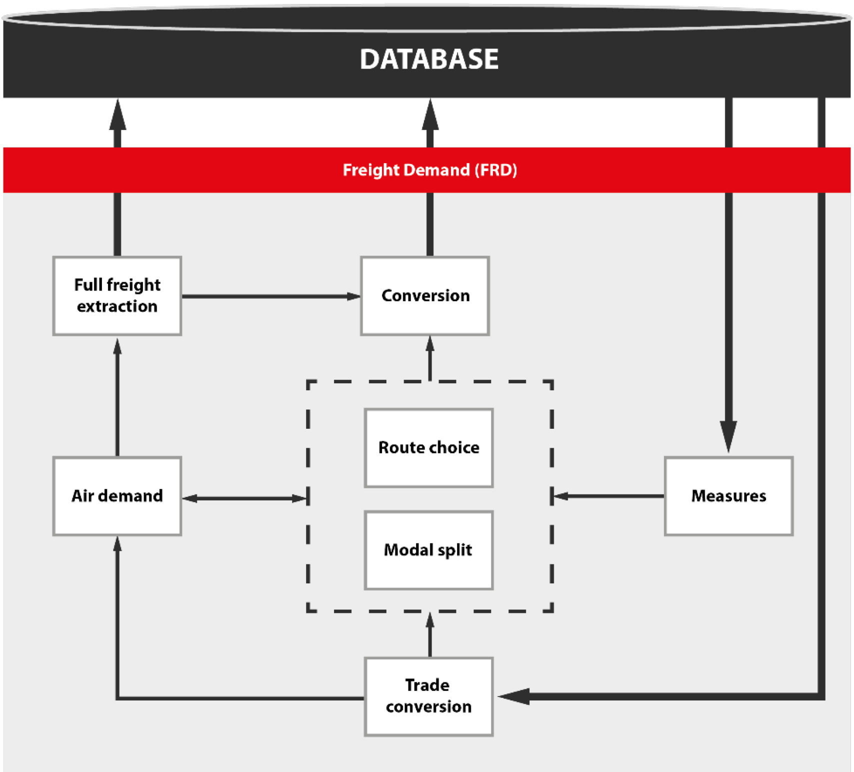


Fig. 7. Structure of the Freight Demand module.

The Freight Demand module together with the Economy and Resources module take an analogue approach to the classic four-step methodology of generation, distribution, modal-split and assignment where assignment is replaced by a calculation of performance indicators by the con-version component.

The ECR module delivers trade in value per Origin-Destination (O-D) relation to the FRD module. This is converted to volumes by applying volume density assumptions per O-D and commodity (assumed constant over time) extracted from ETISplus (Szimba et al, 2013). This step is schematically reproduced in Fig. 8.

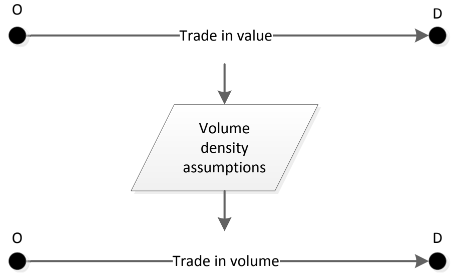


Fig. 8. Freight demand module trade conversion step.

The Air demand base matrix extracted from ETISplus is grown according to the growth of import/ export as delivered by the ECR module and subtracted from total trade, resulting in tonnes demand per Origin-Destination relation, per commodity.

Each Origin and Destination is connected by route chains extracted from the ETISplus database. These chains form a set of up to three legs that connect an origin and destination through up to two transshipment regions. For each of the legs obtained modal-split is performed in the Modal-split component. The Modal split component considers various cost elements influenced by the VES module that can be affected by policy measures to compute generalised cost per available mode M connecting an Origin and Destination of a leg through a multinomial logit function according to TRANSTOOLS (Burgess et al., 2008; NEA, 2007). This step is schematically illustrated in Fig. 9.

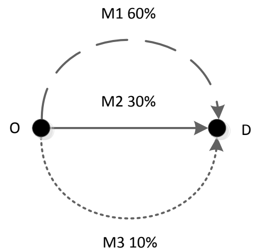


Fig. 9: Freight demand module modal-split step.

Subsequently based on total generalised costs for route chains connecting the trade relation's Origin and Destination, demand is distributed across the route chains connecting Origin and Destination through transshipment regions T in the Route choice component by applying a multinomial logit (see Fig. 10).

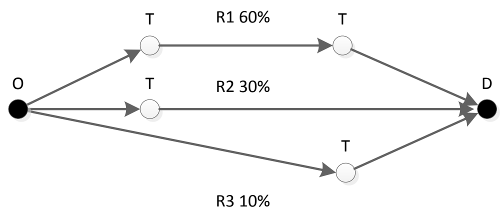


Fig. 10: Freight demand module route choice step.

The conversion module calculates tonne-kilometre and vehicle-kilometre performance indicators for the origin region and “on the territory” perspective. The latter is calculated by applying the share of distance in a leg performed in a country obtained from ETISplus.

Finally, assumptions on full-freight share and capacity of air freight transport are applied to ex-tract air freight transport by full-freight aircraft from the total demand for air.

3.7. Environment module

The main task of the Environment module (ENV) is to calculate wheel-to-tank (wtt) fuel consumption and emissions for each vehicle type. Fuel consumption or fuel intensity and emission factors or emission index are the key input variables in this calculation. These factors are distinguished into technologies which are represented in the model by the age-cohort or vintage. The module produces estimates for CO2 emissions as well as five other pollutants, i.e. CO, VOC, NOx, SO2 and PM2.5. Fuel consumption and emissions are calculated per origin country (NUTS-0 level) and thereafter disaggregated to zones i at NUTS-2 level. This disaggregation by NUTS-2 zones is based on the share of transport demand in each zone within a particular country. The Environment module receives input from the Passenger and Freight Demand modules and from the Vehicle Stock module (fleet size).

The Environment module has two main parts (see Fig. 11). First, the predicted transport demand is disaggregated by vehicle type and vehicle technology which is represented by the vehicle age cohort. Having the transport demand disaggregated into vehicle type and vehicle technology (age cohort) will allow to calculate fuel consumption and emission correctly as fuel consumption and emission factors as defined in the EC regulation for example are available at that level of detail. Second, fuel consumption and emissions are derived. Except for the first data year, information on fuel consumption and emission of the current year concerns only new vehicle, i.e. zero year-old vehicles or new vehicles entering the market. For a period that follows, fuel consumption and emission factors of the present year will be considered as the fuel consumption and emission factors of vehicles of a certain age.

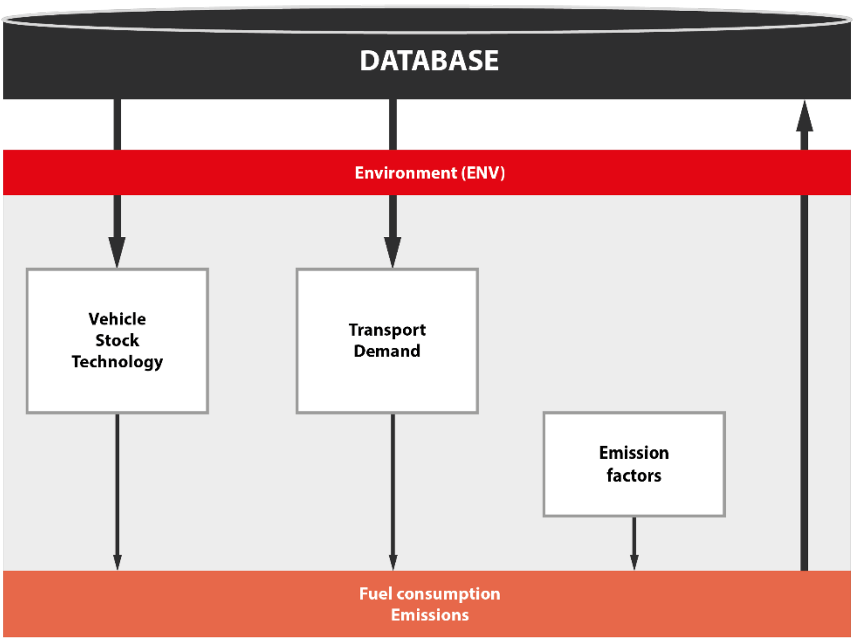


Fig. 11. Structure of the Environment module.

3.8. Safety module

For each mode, the structure of the Safety module (SAF) can be divided into two submodules. First, the Business-as-Usual (BAU) submodule calculates BAU safety risks and predictions based on risk trend lines (from historic mobility and safety data) and mobility predictions from the Passenger and Freight Demand modules. Subsequently, the scenario submodule adapts the BAU risks according to the anticipated effect of modelled safety measures. This effect is derived from changes to accident causal factors (which are the policy inputs) and the elasticities and equations relating these to changes in risk. Safety predictions for the scenario follow from these scenario risks and mobility predictions. While for road, fatalities, serious and slight injuries are predicted, for the other modes the model focuses on fatalities. For all modes the social costs are calculated. Fig. 12 shows the Safety module's structure.

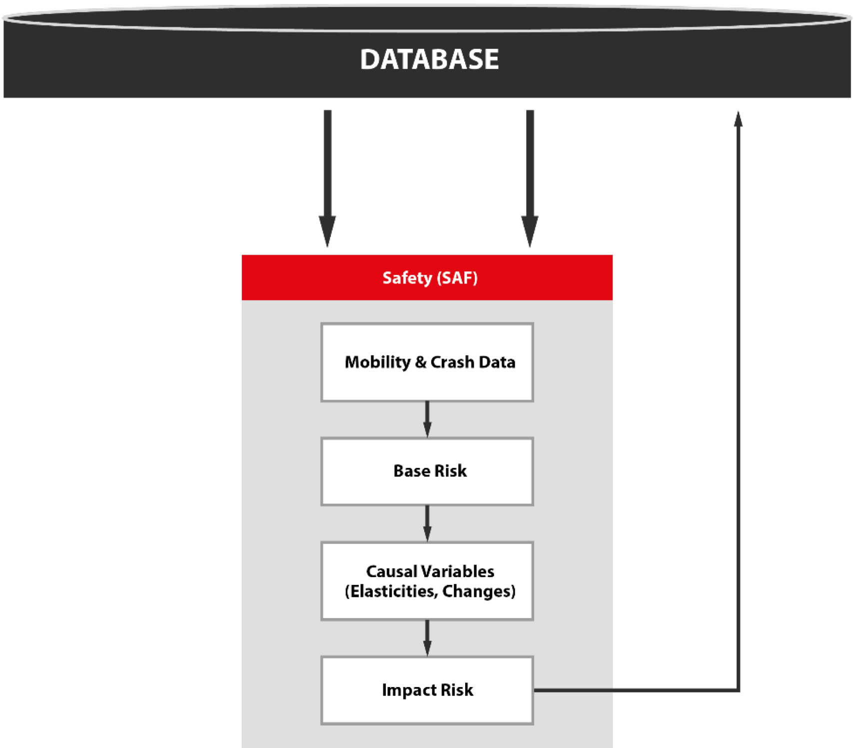


Fig. 12. Structure of the Safety module.

The Safety module (SAF) assesses the impact of transport policy measures on safety. This yields the prediction of numbers of fatalities (and injuries) as well as associated social costs. The required input includes historic mobility (from the Database), predicted mobility (from the Passenger and Freight Demand modules), and user input changes to safety risk and safety risk causal factors. Risk is defined as the number of "occurrences" (fatalities, injuries) per unit of mobility (in vehicle-kilometre or trips).The module distinguishes road and non-road modes, which are dealt with in different levels of detail. Road safety is treated most intricately since, besides fatalities, it also predicts the number of serious and slight injuries. The road mode is further split into car, truck, powered-two-wheelers, public transport, bike, and pedestrians (the latter two not yet in pre-final model). Regarding non-road modes, rail, air, short sea shipping, and inland waterways are considered. The SAF module presents results per country *ci* (NUTS-0) and time period *t* (in years). Both submodules share the following methodology and structure:

Firstly, BAU calculations:

- Calculating BAU risks (historic risks and future predictions);
- Calculating BAU safety predictions (number of accidents) based on BAU risks and mobility predictions.

The stratification approach – i.e. defining more homogeneous groups for which risk numbers are computed jointly – adopted for the BAU risk predictions is based on the work of Stipdonk (2013).

Secondly, scenario predictions:

- Adapting the BAU risks in the scenario submodules according to the anticipated effect of modelled safety measures. This effect is derived from changes to accident causal factors (which are the policy inputs) and the elasticities and equations relating these to changes in risk. Only for the Inland Waterway and Short Sea Shipping submodules, the anticipated change in risk is used directly as policy input;
- Calculating safety outputs (number of accidents and costs) based on scenario risks and mobility predictions.

The general approach of adjusting risk trends based on changes in accident causal factors is based on ERSAP (Delhaye et al. 2010).

3.9. Database

The Database module is the major information exchange entity for all in- and output data the HIGH-TOOL modules need to perform the computation. The Database underlies an intensive exchange of data with all modules.

4. User Interface and Reporting of Assessment Results

4.1. User Interface design principles

The design principles adopted for the User Interface are based on the criteria outlined by Tognazzini (2013). They include: Anticipation, Visible Navigation, Efficiency, Consistency, Explorable Interfaces, Learnability, Readability, Intuitiveness and Self Explaining.

These criteria are addressed by the User Interface of the HIGH-TOOL model as follows (see Biosca et al 2016):

- Anticipation: The User Interface is designed to anticipate user needs. Users are not expected to search for information or evoke necessary tools, but the information and tools needed for each step of the process are provided to the users in a natural way. Default values provided by the HIGH-TOOL model are 'intelligent'.
- Visible Navigation: Navigation is reduced to a minimum. The User Interface is designed such that users can access configuration, hypotheses, calculations and result screens by a minimum number of clicks and actions. Navigation is clear and natural, allowing a user to quickly transition from novice to expert.
- Efficiency: The User Interface facilitates user's productivity, not computer's productivity. The application is designed such that task flows are comfortable, clear and optimal for the user, rather than organised according to programming needs.
- Consistency with user expectations:
  Logical procedures stay coherent along the application;
  Buttons, input fields and navigational controls are always located in the same position of the interface;
  Harmonious 'overall look' of the different screens.

- Explorable Interfaces: Users of the HIGH-TOOL User Interface are offered a line of least resistance allowing them to do just what they want, getting the job done in the quickest way possible, while still supporting those who want to explore further. This means stable visual elements to allow fast navigation, making actions reversible and always allowing a way out while making it easier to stay in.
- Learnability: The User Interface allows for a quick learning curve that supports the performance of tasks within the minimum time possible (Natural-User Interface, NUI).
- Readability: Texts displayed in the User Interface are incorporated in such a way that they can be read properly without effort, favouring dark text on pale backgrounds, avoiding grey backgrounds and using font sizes that are large enough to be readable on standard monitors.
- Intuitive and Self Explaining: The layout of the HIGH-TOOL model and the logic of processes in the User Interface are conceived in a way that makes it possible for users to run the tool on an intuitive basis. Contextual information provided by the User Interface, information made available through icons and tool-tip displays support the self-explaining property of the HIGH-TOOL model.

All design criteria together empower users to work efficiently with the HIGH-TOOL model while enjoying all features.

4.2. Selection of Transport Policies

A Transport Policy Measures (TPM) can be assessed by the HIGH-TOOL model for different policy intensities. Maximum and minimum recommended values for all variables are provided, as well as reference baseline values. TPMs can be defined in three ways:

- Single TPM, where the user can choose a pre-defined policy package.
- Combined TPM, where the user can combine two or more single TPMs.
- Customised TPM, where the user may choose any number of policy levers from all available ones in order to prepare a fully customised policy package.

The following information and options are provided (see Figure 13):

- A pagination bar groups individual Transport Policy Measures (TPMs) by different policy dimensions. The following dimensions are currently considered: Internal Market, Research and Innovation, Efficiency Standards and Flanking Measures, and Pricing;
- For each policy dimension, the individual TPMs are shown in a continuous list of boxes, with the variables associated to each TPM inside the same box.
- Individual parameter and variable values can be specified using the options in the variable editor of each TPM.

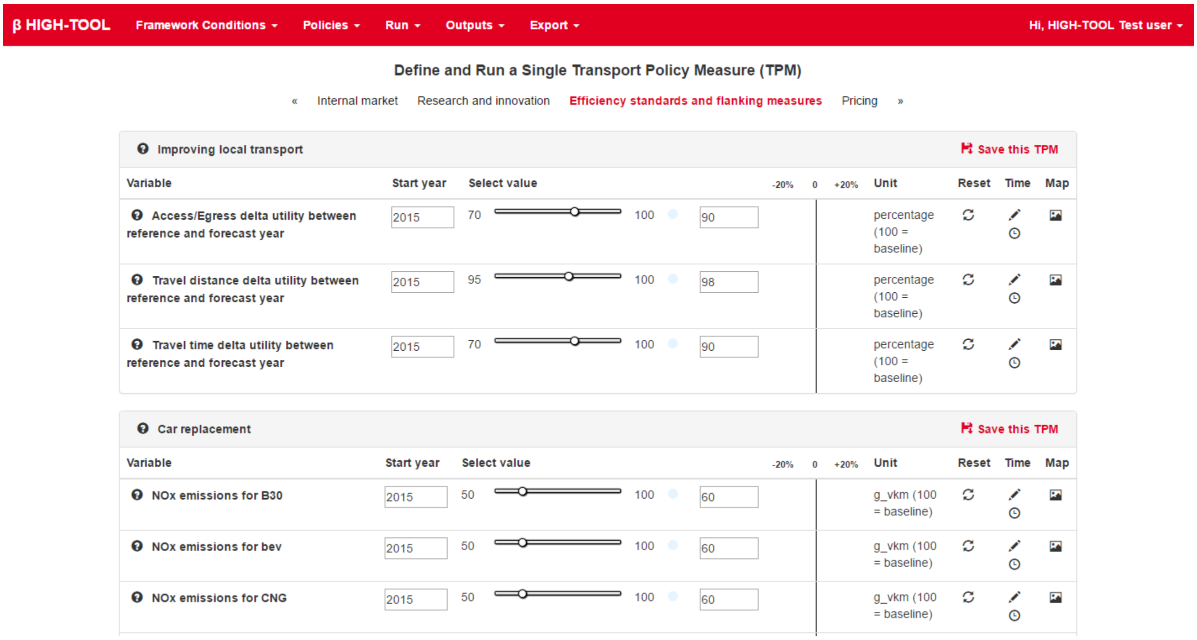
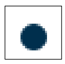


Fig. 13. Editing a Transport Policy Measure.

The variable editor is organised by rows, where each row corresponds to an input. The available options are summarised in Table 3.

Table 3. Available options in the HIGH-TOOL model variable editor.

Option	Interface Display
A help icon and the name of the input parameter or variable.	Better use of truck capacity
A selector for the year that the policy comes into full effect. By default this is always set to 2015.	2015
A slider allowing the user to select a value for the input parameter in the year chosen with the previous selector. Moving the slider left or right will set out a new value. Minimum and maximum values are established for each particular input field. By default it is assumed that the selected value is applied uniformly from 2015 up to 2050.	70 100
A colour semaphore. The colour of the semaphore is a linear gradient between the predefined value and the maximum and minimum values for the input field. Dark tones indicate that the selected value for the input filed is far from the default value, whereas lighter tones indicate being close to the predefined value.	
A quantitative reference value for the input field as orientation for the user. This value corresponds to "baseline" policy intensity, which could be identified in HIGH-TOOL with 2011 White Paper policy aims and actions. This value can be manually updated.	90
A visual indicator of how far the chosen value is from the reference value, measured in %. Thus a +20% indicates that the chosen value is 20% higher than the proposed reference value for that parameter.	-20% 0 +20%
The unit of the indicator.	eur_vkm (100 = baseline)

The reset button, that returns all values to its initial state for a given policy lever.	
The TIME Editor icon allows determining the evolution or trajectory of the input field in the interval 2010-2050 as a table.	
The TRAJECTORY Editor icon allows determining the evolution or trajectory of the input field in the interval 2010-2050 in a graphical way.	
The MAP Editor icon allows determining the geographic distribution of the input across Europe.	

Each policy lever on the interface targets a specific variable and a set of different dimensions (e.g., "Load time for rail" affects the average loading time of freight on rail mode). Most of the policy levers are measured in relative terms with respect to the baseline, but there are a few policy levers that are expressed in absolute terms (e.g. road tolls per country). In any case, this is indicated on the units of the lever.

4.3. Reporting of Assessment Results

Successful runs generate a Policy Assessment Report, which remains stored on the server. Also results from previous runs can be retrieved.

Within the Policy Assessment Report, users have the possibility to:

- Visualise Synthesis Indicators online, including the user inputs and critical results using a limited number of indicators. Synthesis Indicators are intended to be policy relevant. They ought to fully illustrate scenario results produced by a HIGH-TOOL model run.
- Download the full report in Excel format including all results disaggregated by territories and modes, supported by tables and figures.
- Download any table from the Data Stock either related to inputs or outputs of the model run, in csv format to be displayed in a spreadsheet editor.

A selection of the relevant simulation results are available in a report on MS Excel format, downloadable from the server through the User Interface. This report is generated automatically by the User Interface and designed as an interactive Excel report. Tables, graphs or single values can be imported to a presentation tool (MS Power Point) or a text editor (MS Word, Open Office) by using the ordinary copy and paste functionalities.

The full Policy Assessment Report contains the following elements:

- Contextual Information including the name of the Simulation package and its abstract, as well as the names of the Transport Policy Measures being simulated and the underlying socio-economic Framework Conditions.
- Synthesis of assumptions: Contains synthesis information related to a Transport Policy Measure applied. These are the user inputs and contain values for the policy levers, their time trajectories and the associated distribution maps.
- Full Results by thematic area: Results of each thematic area (demography, economy including resources, passenger transport, freight transport, safety, and environment) produced by the HIGH-TOOL model are presented by tables and charts, each on a separate page.

The following figures illustrate the assessment report produced based on preliminary results (Figure 14 to Figure 15).

Fig. 14. Main menu of the Policy Assessment Report in MS Excel.

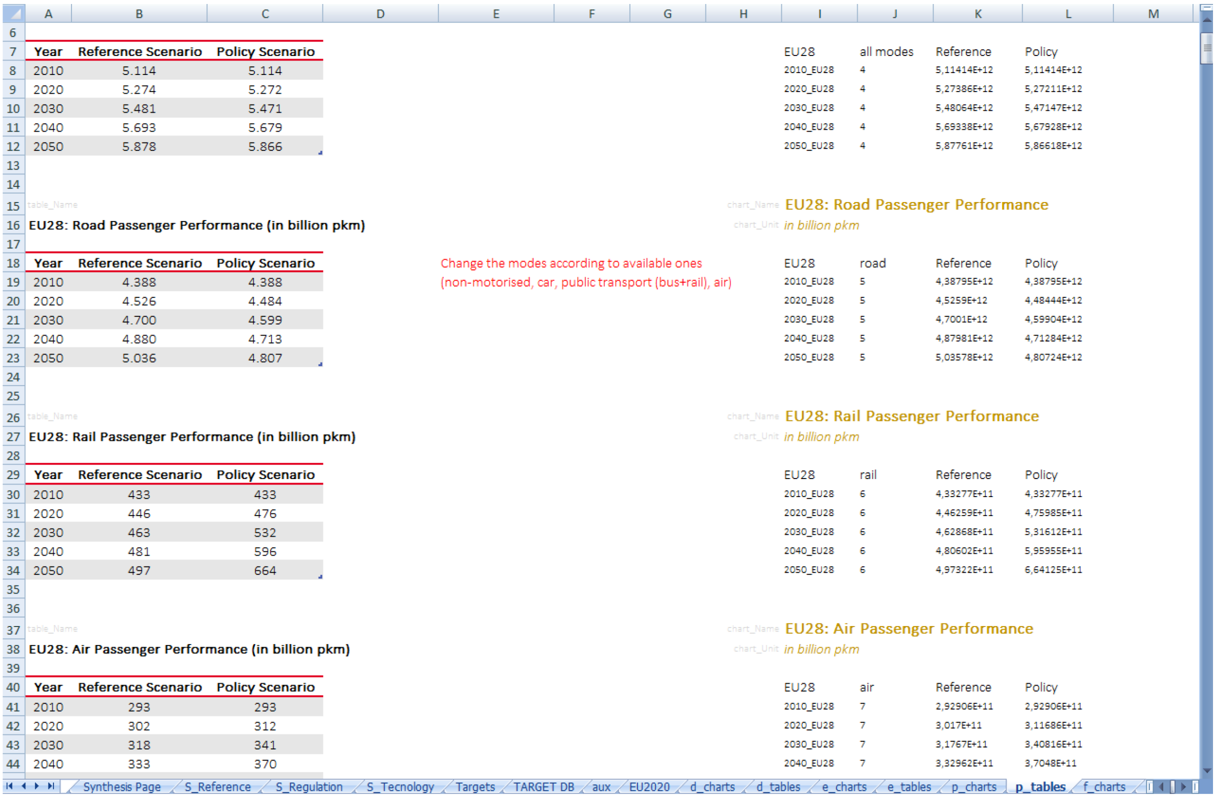


Fig. 15. Full results displayed in tables, on a per theme basis.

5. Summary and Outlook

The paper has provided an overview of modeling methodologies of the strategic high-level transport policy assessment instrument HIGH-TOOL, which is currently being completed on behalf of the European Commission.

The overall approach is characterized by a module-wise concept, allowing each module to apply a specialized and most advantageous modelling approach. Such decentralized model development approach presumes detailed and highly diligent planning before the model development. Particularly clearly defined data interfaces between the individual modules have proven to be crucial for overall model development. Both data exchange between modules, and between the tool and the user interface is facilitated by the database. Thus the database has been the central entity in the decentralized model development environment.

Experiences have revealed the importance of active user involvement in the model development process. In the HIGH-TOOL project, user involvement was mainly ensured by the organization of User Workshops and the conduction of surveys, in which requirements of the future tool users were collected and discussed, and in which early model versions were presented. In this context the concept of step-wise model development (prototype version – pre-final version – final version) has proven to be a useful approach, since this concept allowed the future users testing early model versions and providing comments on the basis of an already existing tool.

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