United Nations Informal ITC (2017) No. 5

Economic and Social Council

Distr.: General

February 2017

Original: English

Economic Commission for Europe

Inland Transport Committee

Seventy-ninth session
Geneva, 21-24 February 2017
Item 5 (c) of the provisional agenda
Strategic questions of a modal and thematic nature
Road safety

Safe Future Inland Transport Systems – Phase III

Note by the secretariat

I. Background

1. The road safety model "Safe Future Inland Transport Systems (SafeFITS)" aims to facilitate knowledge based transport policy decision making related to road casualty reduction. The primary objective was assist governments and decision makers to decide on the most appropriate road safety policies and measures in order to achieve tangible results in improving road safety, in both developed and developing countries. The model would be based on historical road safety data and relations between several road safety parameters and it is expected to provide information on results of different road safety scenarios based on the chosen policies and measures.

2. The research and development nature of SafeFITS imposed the necessity for project implementation in phases. Previous phases of the SafeFITS development were presented in the ITC document ECE/TRANS/2017/14 and this document presents latest activities in the SafeFITS Project Phase III.

II. SafeFITS Phase III

3. Building on the results of Phase I and II, on-going Phase III included statistical analyses and models development, and preparation of web-based application - which will represent SafeFITS tool once completed. The SafeFITS includes two background components, namely (see Figure 1):

- A **database** with data on indicators from all layers of the road safety management system.

- A **set of statistical models** fitted on the database indicators to produce the SafeFITS outputs.

4. The SafeFITS model is composed of three modules as follows:

- **Intervention analysis**: allows the user to examine the effects of single interventions at national or regional level.
- **Forecasting analysis**: allows the user to define own scenarios (i.e. combinations) of measures in a country and obtain medium/long term road safety forecasts for each scenario.
- **Benchmarking analysis**: allows the user to benchmark a country against a group of countries (e.g. all countries, geographical regions, countries of similar economic or road safety performance etc.).

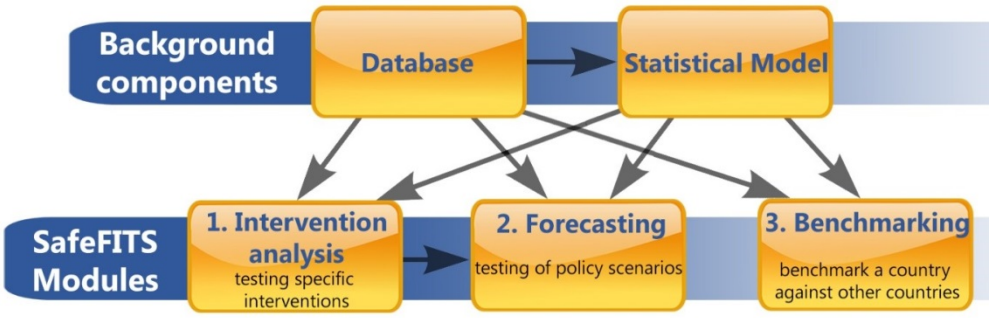

Figure 1. Overview of background components and modules of SafeFITS

5. The developed **database** consists of indicators for 129 countries, grouped into the five layers:

- Economy and Management (12 indicators, e.g. GNI per capita in US dollars, Percentage of urban population, Existence of road safety lead agency etc.),
- Transport Demand and Exposure (13 indicators, e.g. Road network density, Number of vehicles in use per population, Traffic volume etc.)
- Road Safety Measures (29 indicators, e.g. Existence of ADR law, Existence of national drink-driving law, Training in emergency medicine for doctors etc.)
- Road Safety Performance Indicators (9 indicators, e.g. Effectiveness of seat-belt law enforcement, Helmet wearing rates for drivers, Number of hospital beds per population etc.)
- Fatalities and Injuries (9 indicators, e.g. Estimated number of road traffic fatalities, Distribution of fatalities by road user type-pedestrians, Attribution of road traffic deaths to alcohol etc.)

Within each layer, the available indicators included all five pillars of the UN Global Plan for Action: Road Safety Management, Road Infrastructure, Vehicle, User and Post-Crash Services. Data were collected from various sources: WHO Global Status Reports on road safety, UNECE, OECD, IRF, etc. and carefully cross-checked and processed.

6. The SafeFITS model methodology was developed based on the use of composite variables, in order to take into account as many indicators as possible, and develop

regression models to describe the relationships between these composite variables. A two-step approach was implemented:

- In the first step, factor analysis techniques were implemented on the indicators of all road safety system layers for the estimation of composite variables.
- In the second step, the development of a model linking road safety outcomes with the estimated composite variables was pursued.

This methodology allowed simultaneous and efficient prediction of the effects of numerous indicators on road safety outcomes.

7. In SafeFITS the time dimension was taken into account by implementing a medium-term forecasting approach. The developments over the last few years, for which data is available, are taken into account to forecast future developments over the next few years, taking into account the recent road safety trends which are likely to continue in the near future. By applying the same approach on the medium-term forecasted outcomes, long-term forecasts may be obtained.

8. For the calculation of the composite variables several approaches were tested, however, factor analysis constrained to yield one factor per layer was selected (confirmatory factor analysis). As a result, four composite variables were estimated on the basis of 43 collected indicators:

- Comp_EM: the composite variable on economy and management, including 6 related indicators.
- Comp_TE: the composite variable on transport demand and exposure including 7 related indicators.
- Comp_ME: the composite variable on measures, including 21 related indicators.
- Comp_PI: the composite variable on safety performance indicators including 9 related indicators.

9. Several alternative model specifications were tested for the selection of the final model. The best performing model was a model whose explanatory variable is the logarithm of the fatality rate per population for 2010, GDP per capita for 2013, together with the four composite variables: economy and management, transport demand and exposure, measures, and safety performance indicators.

10. The developed model is robust, with satisfactory performance and acceptable prediction errors. The mean absolute prediction error is estimated at 2.7 fatalities per population, whereas the mean percentage prediction error is estimated at 15% of the observed value. A cross-validation of the model was undertaken with very satisfactory results. However, it has to be stated that the Model has some limitations which should be taken into account, and specific recommendations are made for optimal use of the model (e.g. combinations of policy scenarios).

11. The draft SafeFITS model is prepared to yield forecasting and benchmarking estimates for two types of scenarios:

- For “no interventions” scenario, solely on the basis of GDP projections (either official projections, or user-defined); this scenario serves as a reference case for assessing the effects of interventions.
- Policy scenarios with interventions (up to maximum 8), in addition to GDP developments; this allows to assess the cumulative impact of these interventions on the forecasted road safety outcomes, and the country’s position globally or regionally.

12. Overall, the following steps and recommendations for the testing of policy scenarios are made:

- Step 1: Analysis should start by testing the base scenario and the values of the indicators for the base scenario should be carefully examined.
- Step 2: A forecast without any intervention, based on the GDP projections available for the period of interest. This will allow obtaining of the forecasted road safety performance in a "no new interventions" scenario, before testing interventions.
- Step 3: A forecast with the interventions. This will allow testing of a first intervention for an indicator of interest and to examination of the model results. Then introduction of a second intervention and comparison of the results, introduction of a third intervention, etc.
- Step 4: To obtain the most realistic results, for each intervention introduced, adding all the correlated interventions that would be expected to take place at the same time e.g. changes in several vehicle standards, improvement in several areas of enforcement, introduction of a group of measures, demographic changes affecting several indicators in the database etc. should be considered. In total, the consideration of policy scenarios with more than 8 interventions are not recommended.

13. The next steps of the SafeFITS Project will be oriented towards development of web-based application, provision of the Model peer review by two renowned road safety experts and model improvements based on the peer reviewer recommendations. A road safety round table on road safety modelling will be organized to launch an initial version of the SafeFITS model. Initial version will be tested in pilot-tests of a few selected countries and updated based on the testing results.