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Technical assistance to countries with economies in transition

SafeFITS – A road safety decision making tool

Note by the secretariat

Background

1. In 2010, the United Nations General Assembly proclaimed the decade 2011-2020 as the Decade of Action for Road Safety, and set a goal to stabilize and reduce the level of global road traffic fatalities by increasing safety programmes at the national, regional and global levels.
2. General Assembly resolution A/70/L.44, adopted in April 2016, reaffirms the targets of road safety in the 2030 Agenda for Sustainable Development:
 - Sustainable Development Goal 3, Target 3.6 aims to reduce global road traffic deaths and injuries by 50 per cent by 2020, and
 - Sustainable Development Goal 11, Target 11.2 aims to provide access to safe, affordable, accessible and sustainable transport systems for all by 2030.
3. Having in mind requirements of the Decade of Action for Road Safety 2011-2020 and the 2030 Agenda for Sustainable Development, UNECE Sustainable Transport Division developed the Safe Future Inland Transport Systems (SafeFITS) model.
4. The SafeFITS model aims to facilitate knowledge-based transport policy decision making for road casualty reduction. The primary objective is to assist governments and decision makers to identify the most appropriate road safety policies and measures that lead to tangible results and improved road safety records. SafeFITS tool should provide information on different road safety scenarios based on a selection of policies and measures, e.g. safer vehicle fleet-by-fleet renewal and enforced periodic vehicle inspection;

safer roads, e.g. reduction of high-risk road sections; traffic rules enforced by the use of safety belts and helmets according to international standards, etc.

5. The SafeFITS model should assist governments and decision makers to anticipate expected outcomes of the road safety programmes. A set of road safety variables will represent one scenario in the SafeFITS model and determine one road safety programme. The model will calculate effects of selected scenario and evaluate whether it can meet targeted values. The development of the SafeFITS tool was financially supported by International Road Transport Union (IRU).

The SafeFITS Model

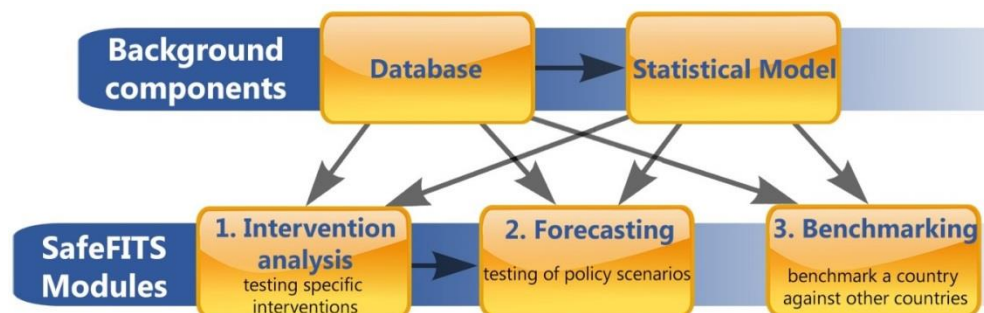
6. The road safety management system, imbedded in the SafeFITS model, is presented through five layers, i.e. economy and management, transport demand and exposure, road safety measures, road safety performance indicators, fatalities and injuries, and into five pillars i.e. road safety management, road infrastructure, vehicle, user and post-crash services.

7. The layers are the following:

- **Economy and Management:** the first layer reflects the structural, economic, cultural and regulatory characteristics (i.e. policy input) of the country, in relation to road safety performance;
- **Transport demand and Exposure:** the second layer reflects the characteristics of the transportation system and the population exposure from urbanization and urban sprawl, modal split, road network types, share of traffic, etc. which are related to road risk.
- **Road Safety Measures** (policy output): the third layer includes the specific road safety programmes and measures and their characteristics;
- To link the three layers to the final outcome, the intermediate fourth layer specifies the operational level of road safety in the country, and contains **Road Safety Performance Indicators (RSPIs)** on the five pillars;
- The final outcome, fifth layer provides projected **fatalities and injuries** (road casualties) to give an understanding of the scale of the problem.

8. Architecture of the SafeFITS model has two background components (presented in the figure bellow):

- A **database** of 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.



9. The SafeFITS model was based on the use of composite variables, to consider as many road safety indicators as possible, and develop regression models on relationships between composite variables. The relationship between the composite variables can be expressed as follows:

$$\text{Log (Fatalities per Population)}_{ti} = A_i + \text{Log(Fatalities per Population)}_{(t-\tau)} + B_i * \text{GDP}_{ti} + K_i * [\text{Economy \& Management}] + L_i * [\text{Transport demand \& Exposure}]_{ti} + M_i * [\text{Road Safety Measures}]_{ti} + N_i * [\text{RSPI}]_{ti} + \epsilon_i$$

10. The SafeFITS model includes four composite variables which were estimated on the basis of 43 collected indicators:
- Comp_EM: composite variable on economy and management, includes 6 related indicators,
 - Comp_TE: composite variable on transport demand and exposure, includes 7 related indicators,
 - Comp_ME: composite variable on measures, includes 21 related indicators,
 - Comp_PI: composite variable on safety performance indicators, includes 9 related indicators.
11. The model is robust, with a satisfactory performance and acceptable prediction errors. The mean absolute prediction error is estimated at 2.7 fatalities per 100,000 population, whereas the mean percentage prediction error is estimated at 15 per cent of the observed value. A cross-validation of the model gave satisfactory results. Confidence intervals for the forecasts have been provided, to express the uncertainty factor.
12. The model fully exploits the currently available global data and analysis techniques to serve key purposes in road safety policy analysis: benchmarking and forecasting. However, modelling process has limitations. A low global availability of some data required estimates or imputations, and statistically not all identified relationships are “causal”. Also, the model may not fully capture the trends in some countries with particular characteristics, e.g. high number of vulnerable road users, very low or very high GDP, very good road safety performance already, etc. Therefore, the optimal use of the SafeFITS model strongly depends on a good knowledge of the national data and its limitations, and a good understanding of the model’s purpose and limitations.

The SafeFITS web-based tool

13. In the autumn of 2017, an initial version of the web-based SafeFITS tool was available for internal testing. The SafeFITS tool includes three complementary modules, all serving very common purposes in road safety policy analysis:
- An **intervention analysis module**, to allow the user to forecast the safety effects of a specific road safety measure or intervention for a given country and time period, all other things being kept constant.
 - A **forecasting module**, to allow the testing of combined scenarios of interventions (measures and programmes) at national level.
 - A **benchmarking module**, to allow the user to benchmark a country against other countries, by comparing the road safety outcomes in relation to the basic road safety indicators, and by identifying the priority areas that the country should focus on for improving its road safety.

14. After the pilot tests and adjustments, the full operation phase started in February 2018 and the SafeFITS model is available to the public at: <https://unecetrans.shinyapps.io/safefits/>.
15. In order to test different policy scenarios, users should follow proposed steps and recommendations:
 - Step 1: Test the base scenario and examine carefully the values of the indicators for the base scenario,
 - Step 2: Test forecast without any new intervention, based on the GDP projections available for the period of interest. This will obtain the forecasted road safety performance in a “base case” scenario, before testing interventions,
 - Step 3: Test forecast with interventions. This will allow testing of a first intervention for an indicator of interest and 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.
16. In order to test the SafeFITS model and web-based tool, two pilot projects were organized in Albania and Georgia in the first half 2018. The tests were used to fine tune the model, and analyze the road safety data collection mechanism and methodology in beneficiary countries. This process resulted with following recommendations:
 - There are more data at national level in both countries, than the ones that could be collected through international databases. But this additional data are also limited, as exposure and SPI indicators were still unavailable. **More Member States should be examined to conclude whether the critical indicators which are missing in international databases can be made available through national sources.**
 - There are some discrepancies between national data and the SafeFITS database, but these are sporadic and relatively small. However, regarding the dependent variable of fatality rates, the WHO-based data are in large discrepancy with national data in many Member States, obviously due to different definitions and data sources. However, given that WHO is the only source of comparable global fatality data, **it is recommended that the SafeFITS model remains to be based on WHO fatalities in the future.**
 - **Countries should pursue the improvement of their national data** both collected by the Police and the Vital Registration Data (VRD), in order to meet WHO and other international standards. This will allow further improvement of the SafeFITS in the future.
 - At national level, the fatality data are available in a detailed decomposition per age groups, road types, vehicle types, etc. This is not exploited currently in the SafeFITS conceptual framework, which resulted in the fact that some country specifics are not fully captured (e.g. a large share of vulnerable road users’ fatalities). **The enhancement of the SafeFITS database with more detailed fatality data** should be pursued in future developments.
 - Despite the fact that the differences between SafeFITS data and national data were limited, the model estimates, when using revised national data, were quite different. For instance, in the case of Albania, the initially estimated increasing

trend was inversed when national data for 2013-2016 were used. Updated estimation was in line with the actual observed trend. Although this can only be considered circumstantial, it highlights **the importance of updating the SafeFITS database with new data for the period 2013-2016**. This will be done after publishing of WHO Global Status Report on Road Safety 2018.

17. The full operation phase of SafeFITS tool started in February 2018 and from that time tool is available to the public. The SafeFITS Final Report was published in March 2018: http://www.unece.org/fileadmin/DAM/trans/events/docs/SafeFITS_Final_Report.pdf.
