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Strategic questions of a horizontal policy nature:

Policy dialogue and technical assistance

to countries with economies in transition

Safe Future Inland Transport Systems

Note by the secretariat

Summary

Technical assistance activities in transport focus on strengthening the capacity of member States. Special attention is given to landlocked countries and countries with economies in transition and to the implementation of United Nations transport legal instruments, norms and standards. This paper presents the state-of-the-art of the SafeFITS road safety tool that can identify the most appropriate road safety policies or measures that may lead to improved road safety.

The Inland Transport Committee **is invited** to:

- Discuss this paper; and
- Encourage Member States to use the SafeFITS model, and
- Give guidance to the secretariat to explore possibilities to further improve the Model and the related road safety database.

I. Background

1. Road accidents are a major problem in modern societies: annually almost 1.25 million people are killed and 50 million injured globally.¹ Road traffic injuries are estimated to be the eighth leading cause of death globally, and more than half the people killed in traffic accidents are young adults aged between 15 and 44 years, thus heavily implicating people who are entering their most productive years. Approximately 90 per cent of those killed in road crashes are from low- and middle-income countries; yet they own around 54 per cent of the world's motor vehicles. Current trends suggest that, unless action is taken, traffic injuries will become the fifth leading cause of death by 2030, with the disparity between high- and low-income countries further increasing.² These losses are largely preventable and they underscore the urgent need for action to improve road safety globally.

2. 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.

3. At the same time, two major United Nations Development Account (UNDA) financed projects were completed under the leadership of the Economic Commission for Europe (ECE):

- Improving Global Road Safety project: setting regional and national road traffic casualty reduction targets, led by UNECE Sustainable Transport Division, was finalized in 2010 and resulted in a set of road safety measures that are focused on specific targets with proven results in improving road safety.
- For Future Inland Transport Systems (ForFITS): finalized in 2013 to facilitate knowledge-based CO₂ reduction for decision makers of transport policies. The tool estimates the expected amount of CO₂ generated by the inland transport modes for different transport policy options.

4. 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 Goals; target 3.6 aims to reduce global road traffic deaths and injuries by 50 per cent by 2020, and
- Target 11.2 aims to provide access to safe, affordable, accessible and sustainable transport systems for all by 2030.

5. The ECE Sustainable Transport Division drafted a concept note for the Safe Future Inland Transport Systems (SafeFITS) project taking into account requirements of the 2030 Agenda for Sustainable Development, the Decade of Action for Road Safety and the results of the two UNDA-financed projects.

6. The road safety 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 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;

¹ WHO, 2015

² Ibid.

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. The completed SafeFITS model should assist governments and decision makers to anticipate expected outcomes of the road safety programmes (the scenarios in terms of the model) and to evaluate whether they can meet targeted values. A set of road safety variables will represent one scenario in the SafeFITS model and determine one road safety policy, the results of which will be calculated. The International Road Transport Union (IRU) has agreed to finance the development of the SafeFITS tool.

II. Methodological Framework

7. In the SafeFITS model, the road safety management system is disaggregated into 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.

8. The layers:

- 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.

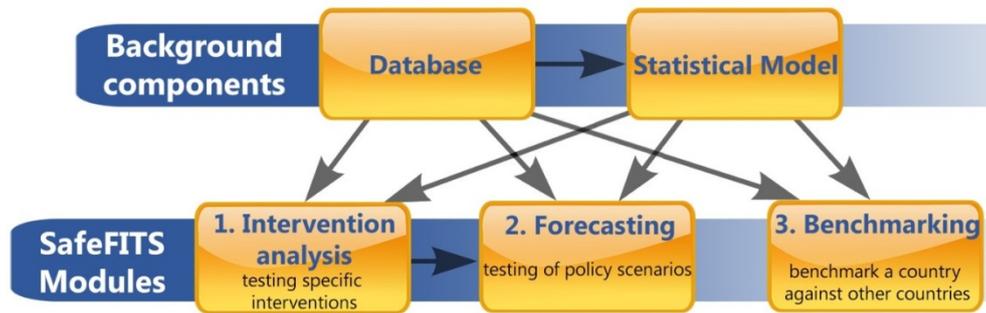
III. Development of SafeFITS

9. The research and development nature of SafeFITS and the relative rarity of global research projects dealing with predictions of the outcomes of road safety strategies imposed an implementation of the project in four phases. Each phase consisted of a separate research and development project and only after completion of the given phase — based on that phase's deliverables — was the Project Steering Committee able to decide on the direction of the continuation of the project implementation.

10. The SafeFITS model was developed in phase III and includes two background components, (see the figure):

- 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.

Overview of background components and modules of SafeFITS



11. The SafeFITS model is composed of three modules as follows:
- **Intervention:** allows analysis of the effects of single interventions at national or regional level,
 - **Forecasting:** allows user-defined scenarios or combinations of measures in a country and obtains medium- or long-term road safety forecasts for each scenario,
 - **Benchmarking:** allows an area-to-area analysis by selected variables (e.g. countries, geographical regions, etc.).
12. The **database** currently consists of indicators from 129 countries in the five layers:
- Economy and Management: 12 indicators, e.g. Gross National Income (GNI) per capita in United States dollars, percentage of urban population, existence of a 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 use 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..
13. In each layer, the available indicators include the five pillars of the United Nations Global Plan for Action: road safety management, road infrastructure, vehicle, user and post-crash services. Data were collected from various sources: the World Health Organization (WHO) Global Status Reports on road safety, ECE, OECD, the International Road Federation (IRF), etc. and carefully cross-checked and processed.
14. The SafeFITS model methodology was based on the use of composite variables, i to take into account as many indicators as possible, and develop regression models on relationships between composite variables. A two-step approach was taken:
- First step: factor analysis techniques were implemented on the indicators of all road safety system layers for the estimation of composite variables,
 - Second step: the development of a model linking road safety outcomes with the estimated composite variables was pursued.

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

16. The relationship between the composite variables can be expressed as follows, in case the fatality rate per population is used as “Fatalities & Injuries” indicator, and the difference between τ years is considered:

$$\text{Log (Fatalities per Population)}_{ti} = A_i + \text{Log(Fatalities per Population)}_{(t-\tau)} + B_i * \text{GDP}_{ti} + K_i * [\text{Economy \& Management}] + L_i * [\text{Transport demand \& Exposure}]_{ti} + M_i * [\text{Road Safety Measures}]_{ti} + N_i * [\text{RSPI}]_{ti} + \varepsilon_i \quad (1)$$

17. The calculation of the composite variables was tested in several methods, and a confirmatory factor analysis constrained to yield one factor per layer was selected. Four composite variables were thus 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.

18. Several alternative model specifications were tested for the selection of the final model. An explanatory variable, i.e. the logarithm of the fatality rate per population for 2010, GDP per capita for 2013, and the four composite variables: economy and management, transport demand and exposure, measures, and safety performance indicator provided the best performing model.

19. 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. However, some limitations should be taken into account, and recommendations are given for the optimal use of the model (e.g. combinations of policy scenarios). Confidence intervals for the forecasts have been provided, to express the uncertainty factor.

20. To test different policy scenarios, the steps and recommendations are:

- Step 1: Test the base scenario and examine carefully the values of the indicators for the base scenario,
- Step 2: A 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 “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.

IV. Current situation and the next steps

21. The SafeFITS model is the first global model to support road safety policy, allowing for global assessments (i.e. monitoring the global progress towards the United Nations road safety targets) and individual country assessments of various policy scenarios. The model fully exploits the currently available global data and analysis techniques to serve key purposes in road safety policy analysis: benchmarking, forecasting, etc. 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.

22. To provide feedback on the SafeFITS model and discuss road safety statistics and modelling, ECE and IRU, organized a SafeFITS round table (30 June 2017, Geneva) for the prominent representatives of the road safety scientific community (international organizations, academia, international financial institutions, etc.). During the round table, SafeFITS peer review reports prepared by two renowned road safety experts were presented. The round table: (a) concluded that much better global road safety data collection and dissemination is warranted and (b) provided recommendations for updating SafeFITS.

23. In the autumn of 2017, an initial version of the web-based application was ready for internal testing. Two pilot tests were organized in Albania and Georgia in the first quarter 2018. The tests will be used to fine tune the model, analyse the road safety data collection mechanism and methodology and recommend improvements. In that sense, SafeFITS will test recommendations defined through “Strengthening the national road safety management capacities of selected developing countries and countries with economies in transition” project, reaching synergy between two ECE-led projects.

24. After the pilot tests and adjustments, the full operation phase would start and the SafeFITS model would be available to the public. Based on user feedback, annual or bi-annual revisions of all SafeFITS components (database and statistical models) should take place. In the coming years, the Sustainable Transport Division will explore all possibilities to obtain more reliable SafeFITS inputs (global road safety statistics and information) and incorporate any new developments in the road safety field.
