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# SafeFITS

## *A Road Safety Decision-Making Tool*

*Working Party on Transport Statistics*

*Geneva, 12-14 June 2018*

**TRANSPORT**

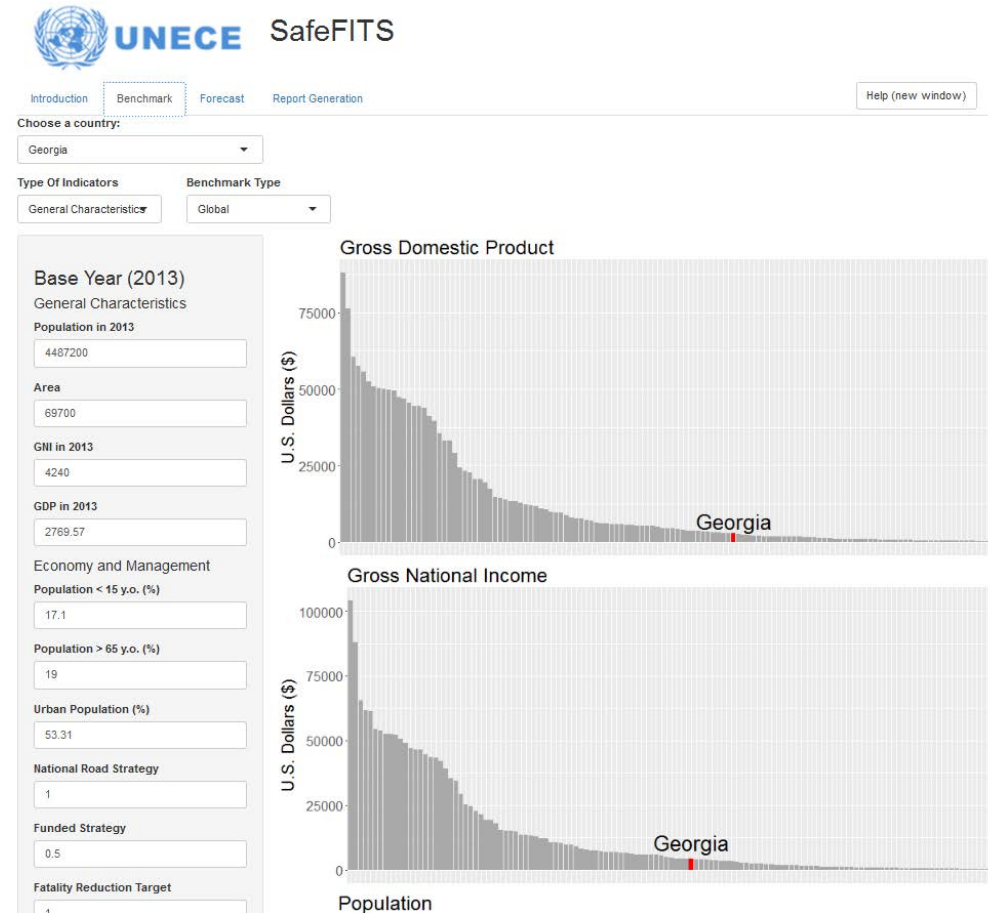


- **Road safety decision-making tool**

- Aim to assist governments and decision makers
- Database on road safety indicators (i.e. fatalities and injuries, performance indicators, road safety measures, economy and background) for all countries worldwide
- Statistical model of global causalities allowing “intervention”, “forecasting” and “benchmarking” analyses

- **Current Status**

- Model finalized (after June 2017 peer review)
  - [www.unece.org/trans/theme\\_safefits.html](http://www.unece.org/trans/theme_safefits.html)
- Final version of web application presented at Inland Transport Committee (ITC) February 2018
- **Pilot studies being conducted in Albania and Georgia**



# Conceptual framework



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- Based on five pillars of WHO Global Plan of Action and improved version of SUNflower pyramid

## SafeFITS layers

1. Economy and Management
2. Transport Demand and Exposure
3. Road Safety Measures
4. Road Safety Performance Indicators
5. Fatalities and Injuries

## SafeFITS pillars

1. Road Safety Management
2. Road Infrastructure
3. Vehicle
4. User
5. Post-Crash Services

		PILLARS				
		1. Road Safety Management	2. Road Infrastructure	3. Vehicle	4. User	5. Post-Crash Services
LAYERS	1. Economy & Management	Economic Developments, Strategy & Targets, Regulatory framework (compliance with UN regulations)	Existence of motorways, of non-paved roads, of road tunnels, Existence of guidelines (for design, RSA etc.), Legislation on speeding	Number of registered vehicles, Vehicle age, Technical inspection legislation (maintenance, roadworthiness, overweight, ADR)	Requirements & regulations on drivers' licensing, Drivers' training, Medical exams of drivers, Legislation on alcohol / use of seatbelts / use of helmets	Trauma management sector level of development, Number of hospitals / doctors / Intensive Care (IC) beds per population
	2. Transport demand & exposure	Transport Modal Split (road/rail, passenger/freight, private/public), Share of urban areas, Weather conditions	Exposure with regard to road type, Length of road per road type, Share of Motorway length out of the total road network, Number of railway level crossings	Exposure with regard to vehicle type, Share of PTW, HGV / carriage of dangerous goods vehicles in the vehicle fleet	Exposure with regard to age & gender	
	3. Road Safety Measures	Assessment of measures, Data collection & analysis, International comparisons, Vehicle taxation, Road pricing	Treatment of High Risk Sites, Road Safety Audits, Tunnel Road Safety Management, Improvement of signage, Installation of road restraint systems, Lighting, Speed limits in urban areas Traffic Calming	Renewal rate of vehicle fleet, Measures for second-hand vehicles, Vehicle related roadside controls, Automated driving	Enforcement, campaigns, Road safety education, Training	e-call, First aid training, Existence & organisation of trauma centers
	4. Road Safety Performance Indicators	Safety targets, stakeholders' involvement, detail of analysis for intervention selection, economic evaluation	Number of RSAs conducted, Percentage of High Risk Sites treated	Global NCAP score, Mean age of the vehicle fleet per vehicle type, Existence of safety equipment, e-safety	Speeding / Drink & drive infringements, Seatbelts use, Helmets use, Driver distraction, Driver fatigue	Emergency response time, Type of field treatment, Speed of treatment in hospital, Number of ambulances per population, Number of good samaritans per population
	5. Fatalities & Injuries	Fatalities / injuries per million inhabitants, fatalities / injuries per million passenger cars, fatalities / injuries per 10 billion passenger-km	Fatalities / injuries in motorways, in 2-lane rural roads, in urban roads	Share of motorcycle fatalities out of the total fatalities	Share of pedestrian / bicyclist / motorcyclist fatalities out of the total fatalities, drink-driving related fatalities	Death rate, Hospitalization in IC Unit, Total length of hospitalization



- **Data for 130 countries**

- Population greater than 2.8 million
- From international databases: WHO, UN, IRF, OECD and others
- Refers to 2013 or latest available year

- **Availability**

- Data available for large majority of countries and indicators
- Low data availability in some cases
  - Restraint use rates
  - Fatalities attributed to alcohol use and fatalities by road user type
  - Transport demand and exposure indicators
- Imputation where value missing – mean value of countries with similar road safety and socio-economic characteristics

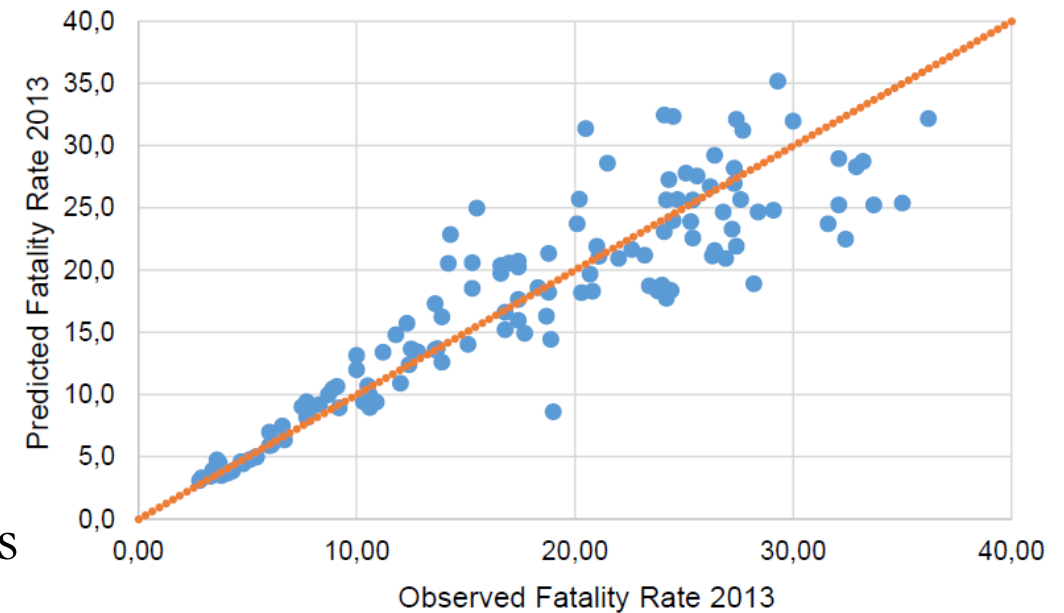


- **Two-step modeling approach**

- Estimation of composite variable for each layer
- Development of regression model by correlating road safety outcomes with composite variable
- Other considerations
  - Previous year fatality rate
  - GNI per capita
  - Country grouping by socio-economic characteristics

- **Modeling assessment**

- Mean percentage prediction error – 15%
- More robust for countries with lower fatality rates
- Model cross-validated with subset of full data set



# Introduction



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## Welcome

### Introduction

The project *Safe Future Inland Transport Systems (SafeFITS)* aims to facilitate knowledge-based transport policy decision-making related to reducing road traffic injuries. It was planned with the primary objective to assist governments and decision makers, both in developed and developing countries, to decide on the most appropriate road safety policies and measures in order to achieve tangible results in improving road safety.

In 2010, the United Nations General Assembly proclaimed the Decade of Action for Road Safety 2011-2020. Its goal is to stabilize and reduce the forecasted level of road traffic fatalities globally by increasing road safety activities at the national, regional and global levels. The SafeFITS project supports United Nations Member States in achieving the goals and targets outlined in Global Plan for the Decade of Action as well as in the 2030 Agenda for Sustainable Development:

- SDG target 3.6, which aims to reduce global road traffic deaths and injuries by 50% by 2020
- SDG target 11.2, which aims to provide access to safe, affordable, accessible and sustainable transport systems for all by 2030

The SafeFITS model is based on historical road safety data and relationships between several road safety parameters, and provides information on different road safety scenarios.

The SafeFITS application provides a user interface for the exploration of the results of measures and interventions that a country could adopt in order to reduce the fatalities in the near future.

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.

**The SafeFITS Project was implemented with the financial support from the International Road Transport Union (IRU).**



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## User Manual

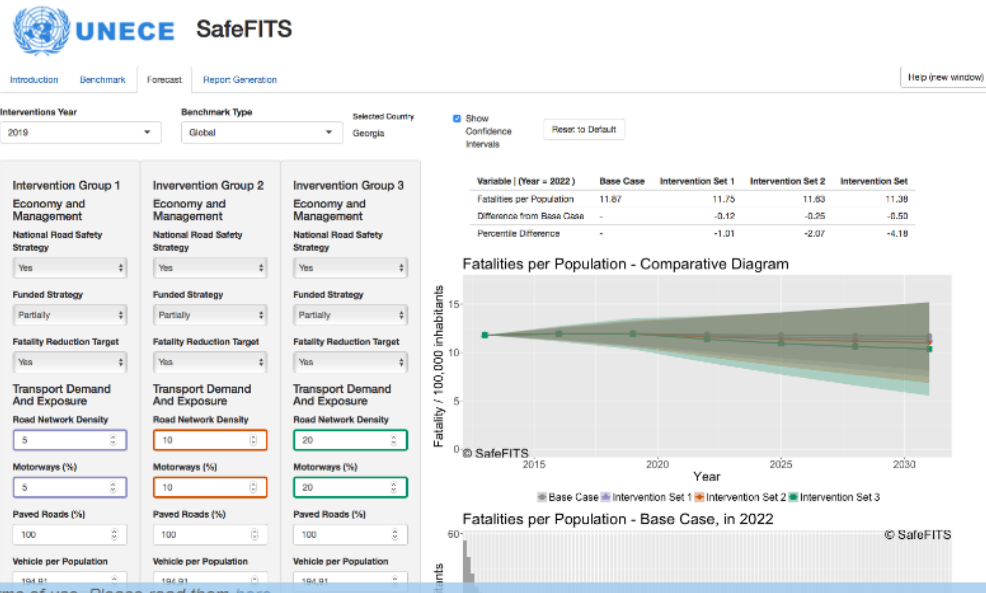
### Welcome to the SafeFITS application

Congratulations, you are running the application. There are four tabs on the top navigation bar:

- **A. Introduction:** Provides background information on SafeFITS development, as well as a disclaimer for the use of the results of the model and these user guidelines
- **B. Benchmark:** Provides an overall view of the database, specifically where a country stands in terms of policy inputs to the SafeFITS model with respect to other countries at a global level or with respect to countries in similar socio-economic circumstances.
- **C. Forecast:** For the country that was selected in the previous step, users can choose three distinct groups of interventions and view tables and plots for the resulting projected fatality rates for the forecasting period.

When users change input parameters, the changed values in each intervention group are highlighted with the same colour, which is also the colour of the curve in the line graph. The graph itself shows the result of the model with an uncertainty band also plotted, which ranges from +/- 30 per cent in 2031 - the final forecast year - to +/- 0 per cent in 2013 - the baseline year).

Figure 1. Screenshot of Forecast tab



# Definitions



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### Definitions of indicators

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i..Variable	Description
GNI per capita	The Gross National Income (GNI) per capita is the US dollar value of a country's final income in a year divided by its population.
Population	Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates.
Population < 15 y.o. (%)	Indicates the number of inhabitants aged below 15 years old as a percentage of the total population of the country.
Population > 65 y.o. (%)	Indicates the number of inhabitants aged over 65 years old as a percentage of the total population of the country.
Urban population (%)	Indicates the number of inhabitants living in urban areas as a percentage of the total population of the country.
National road safety strategy	The variable provides information on whether a road safety strategy at national level exists and is implemented in the country (yes / no / partially implemented).
Funded strategy	The variable indicates whether the national road safety strategy is funded (yes / partially funded / no).
Fatality reduction target	The variable indicates whether the national road safety strategy defines specific quantified targets concerning the reduction of road traffic fatalities (yes / no).
Road network density	The variable indicates the ratio of the length of the road network per 1 km2 of the total area of the country.
Motorways (%)	The variable indicates the length of the motorways as a percentage of the total road network length. Motorways are considered the roads, specifically designed and built for motor traffic, which do not serve properties bordering on it, and which: (a) are provided, except at special points or temporarily, with separate carriageways for the two directions of traffic, separated from each other, either by a dividing strip not intended for traffic, or exceptionally by other means; (b) do not cross at level with any road, railway or tramway track, or footpath; (c) are especially sign-posted as motorways and are reserved for specific categories of road motor vehicles.

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# Disclaimer



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## Disclaimer

The SafeFITS model was developed on the basis of the most recent and good quality data available internationally, and by means of rigorous statistical methods. However, as always, data and analytical methods have limitations, which should be kept in mind when using the model:

- The **fatality data** used for the model development are in some cases estimated numbers, and in all subject to under-reporting (the degree of which is mostly unknown, and likely to vary between countries).
- **Missing values were addressed by imputation**, in order to be able to develop the model. These missing values were replaced by the regional known mean value. Indicators related to exposure (e.g. percentage of motorways of total road network) and road safety performance (e.g. protective systems use rates) had the most missing values, which concerned at greater extent the less developed countries (mostly African and Asian). Thus, the outcome in these countries may be more sensitive to indicators change in the testing of such interventions.

Moreover, the optimal use of the model depends on a number of **recommendations** in order to minimize errors and inaccuracies in the model outcomes.

- The model is based on the extrapolation of short-term developments in the future; this approach was taken as there were not sufficient long time series available for the vast majority of the indicators. **Confidence intervals** for the predictions are calculated to reflect the uncertainty in this extrapolation, on the basis of the mean prediction error of the model, which is considered to increase as the prediction horizon extends. Confidence intervals for the predictions have been calculated based on the mean predicted error (15%) of the model, which is considered to gradually start from 0% on the base year to 30% up to 2030.
- It is recommended to start from the **Base Case scenario**. This aims to provide a baseline country forecast of road safety outcomes in a case where the situation remains unchanged (with no new developments in road safety management and with the same programmes and interventions that will be implemented in the future), and where only economic developments are being taken into account. This scenario is a reference point for the effect of their planned programmes and interventions (scenarios).
- The model included as many of the available indicators as possible in order to allow the testing of various scenarios and care was taken to account as much of the correlation between indicators as possible. However, some of the indicators may be still correlated, and this may affect to a small extent the prediction estimates. Most importantly, the effects of interventions do not reflect the unique contribution of each separate intervention. It is strongly recommended to **test combinations of "similar" interventions** (e.g. several vehicle standards, several types of enforcement or safety equipment use rates) and always consider "**what else would be likely to change, together with a given change?**" The cumulative effect of "similar" indicators is more likely to accurately reflect true effects than testing one single indicator.
- Relatedly, the model has been **calibrated only for changes in interventions within historical ranges**. Based on historical data and knowledge of policymaking processes, users should reflect on the reasoning behind projected future interventions when applying the model.
- The model may not fully capture the effects on **countries with very particular characteristics** such as very low GDP, or a very high share of motorcycle or cyclist fatalities. Although every effort was made to customize the model for different geographical or geopolitical groups, as well as for such particularities, the available data in the international databases and the available information in the literature were not sufficient to allow for such customization.
- The outcomes in developing countries are expected to be more sensitive to indicators change in the testing of interventions, than developed ones. There are several industrialized countries that already have very high values on all indicators, and their GDP is expected to keep



Choose a country:

Georgia

Type Of Indicators

General Characteristics

Benchmark Type

Global

Base Year (2013)

General Characteristics

Edit Base Case

Population in 2013

4487200

Area

69700

GNI per capita

4240

GDP per capita

2769.57

Economy and Management

Population < 15 y.o. (%)

17.1

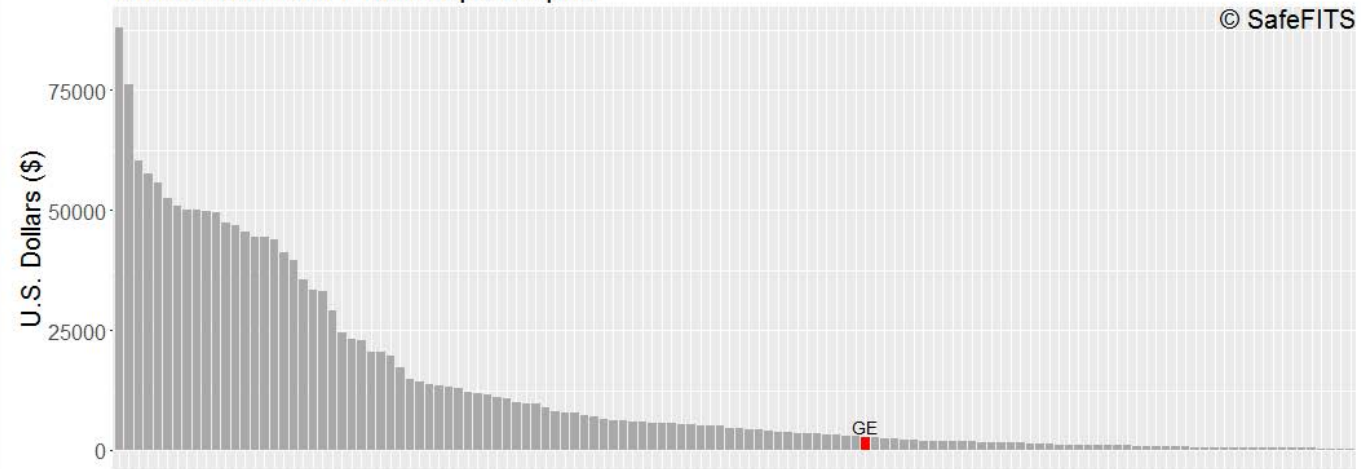
Population > 65 y.o. (%)

19

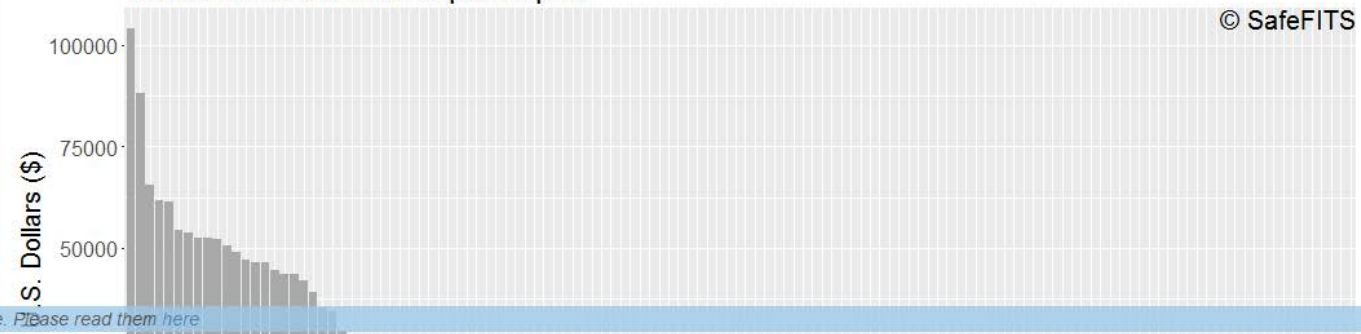
Urban Population (%)

53.31

### Gross Domestic Product per capita




### Gross National Income per capita



# Benchmark – edit base case, compare against country cluster



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Choose a country:  
Czechia

Type Of Indicators: General Characteristics  
Benchmark Type: Country's Cluster

**Base Year (2013)**  
General Characteristics  
 Edit Base Case

Population in 2013: 10514272

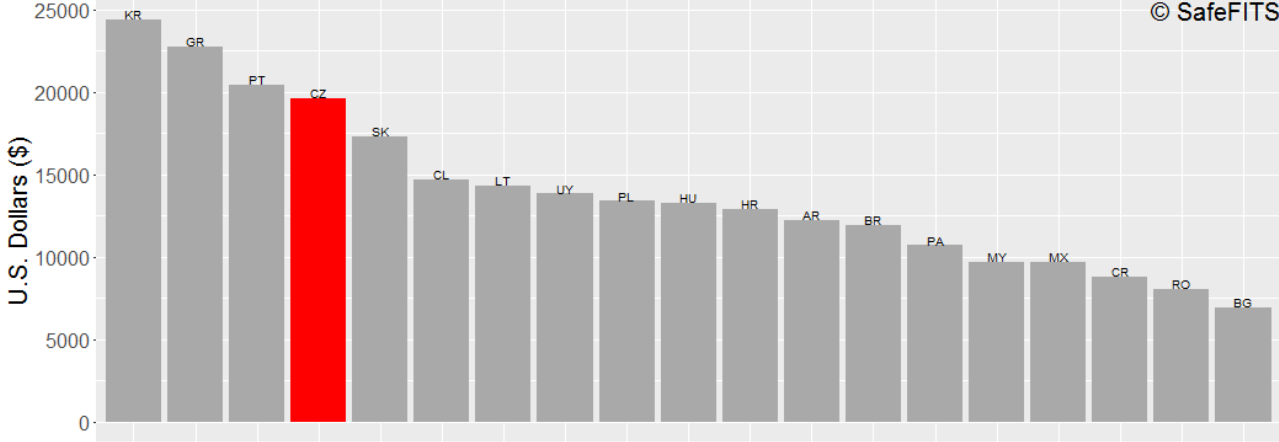
Area: 78870

GNI per capita: 19170

GDP per capita: 19595.7

**Economy and Management**  
Population < 15 y.o. (%): 14.7  
Population > 65 y.o. (%): 24  
Urban Population (%): 73.06

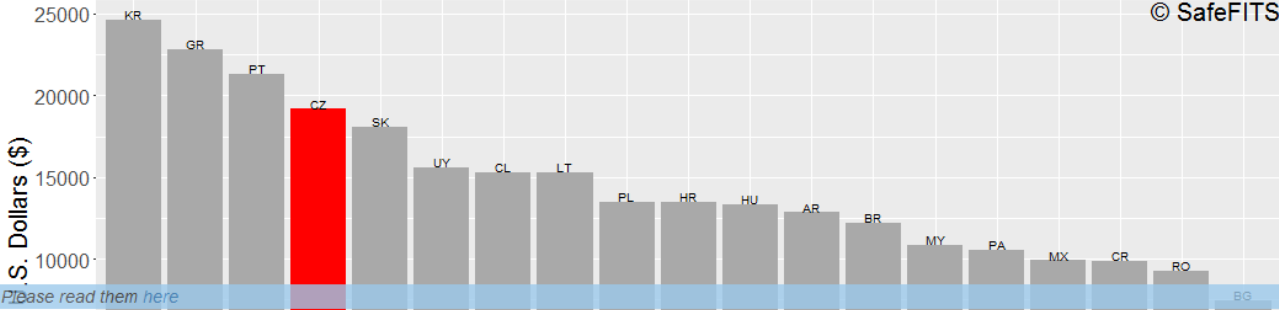
### Gross Domestic Product per capita



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Country	GDP per capita (U.S. Dollars)
KR	24500
GR	23000
PT	20500
<b>CZ</b>	<b>19500</b>
SK	17500
CL	15000
LT	14500
UY	14000
PL	13500
HU	13500
HR	13000
AR	12500
BR	12000
PA	11000
MY	10000
MX	10000
CR	9000
RO	8500
BG	7500

### Gross National Income per capita



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Country	GNI per capita (U.S. Dollars)
KR	24500
GR	23000
PT	21500
<b>CZ</b>	<b>19500</b>
SK	18500
UY	15500
CL	15000
LT	15000
PL	13500
HR	13500
HU	13500
AR	13000
BR	12500
MY	11000
PA	10500
MX	10000
CR	9500
RO	9000
BG	8500

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# Benchmark – compare Transport Demand and Exposure indicators



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Choose a country:

Czechia

Type Of Indicators

Transport Demand And Exposure

Benchmark Type

Country's Cluster

Base Year (2013)

General Characteristics

Edit Base Case

Population in 2013

10514272

Area

78870

GNI per capita

19170

GDP per capita

19595.7

Economy and Management

Population < 15 y.o. (%)

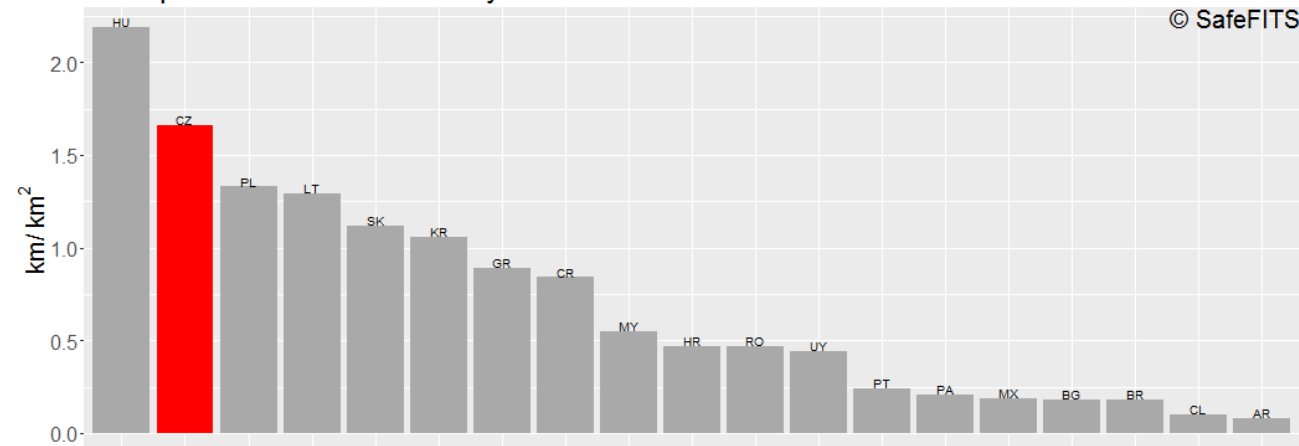
14.7

Population > 65 y.o. (%)

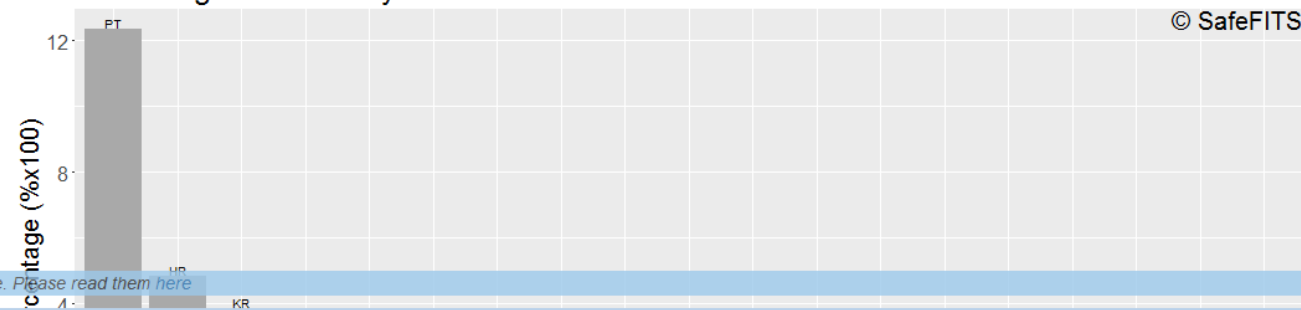
24

Urban Population (%)

### Transportation Network Density



### Percentage of Motorways



# Forecast



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Interventions Year

2013

Benchmark Type

Global

Selected Country

Kyrgyzstan

Show  
Confidence  
Intervals

[Reset to Default](#)

Intervention Group 1

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Yes

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

10

Paved Roads (%)

90

Vehicle per Population

136.09

Passenger Cars (%)

Intervention Group 2

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Partially

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

1.34

Paved Roads (%)

52.19

Vehicle per Population

136.09

Passenger Cars (%)

Intervention Group 3

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Partially

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

1.34

Paved Roads (%)

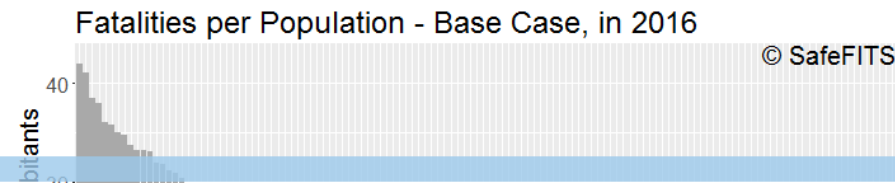
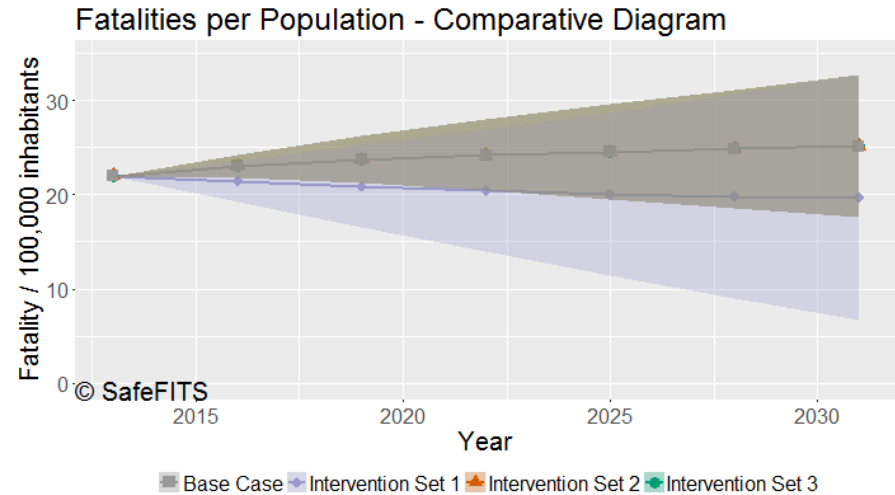
52.19

Vehicle per Population

136.09

Passenger Cars (%)

Variable (Year = 2016)	Base Case	Intervention Set 1	Intervention Set 2	Intervention Set 3
Fatalities per Population	23.03	21.45	23.03	23.03
Difference from Base Case	-	-1.59	0.00	0.00
Percentile Difference	-	-6.88	0.00	0.00



# Forecast – change intervention year



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Interventions Year

2022

Benchmark Type

Global

Selected Country

Kyrgyzstan

Show Confidence Intervals

Reset to Default

Intervention Group 1

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Yes

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

10

Paved Roads (%)

90

Vehicle per Population

136.09

Passenger Cars (%)

88.72

Intervention Group 2

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Partially

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

1.34

Paved Roads (%)

52.19

Vehicle per Population

136.09

Passenger Cars (%)

88.72

Intervention Group 3

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Partially

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

1.34

Paved Roads (%)

52.19

Vehicle per Population

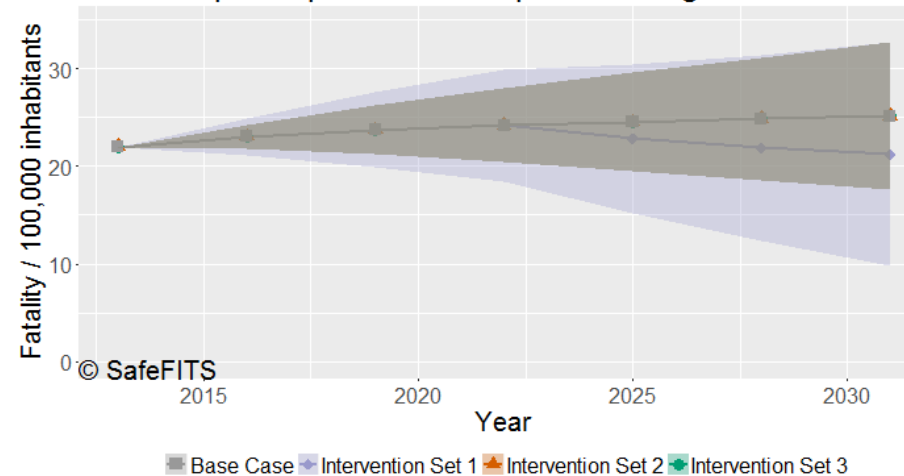
136.09

Passenger Cars (%)

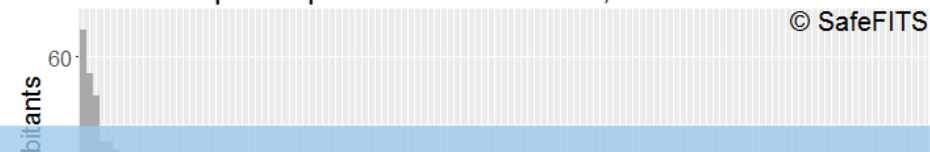
88.72

Variable (Year = 2025)	Base Case	Intervention Set 1	Intervention Set 2	Intervention Set 3
Fatalities per Population	24.52	22.84	24.52	24.52
Difference from Base Case	-	-1.69	0.00	0.00
Percentile Difference	-	-6.88	0.00	0.00

Fatalities per Population - Comparative Diagram



Fatalities per Population - Base Case, in 2025



# Forecast – no confidence intervals



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Interventions Year

2022

Benchmark Type

Global

Selected Country

Kyrgyzstan

Show Confidence Intervals

Reset to Default

Intervention Group 1

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Yes

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

10

Paved Roads (%)

90

Vehicle per Population

136.09

Passenger Cars (%)

Intervention Group 2

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Partially

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

1.34

Paved Roads (%)

52.19

Vehicle per Population

136.09

Passenger Cars (%)

Intervention Group 3

Economy and Management

National Road Safety Strategy

Yes

Funded Strategy

Partially

Fatality Reduction Target

Yes

Transport Demand And Exposure

Road Network Density

0.17

Motorways (%)

1.34

Paved Roads (%)

52.19

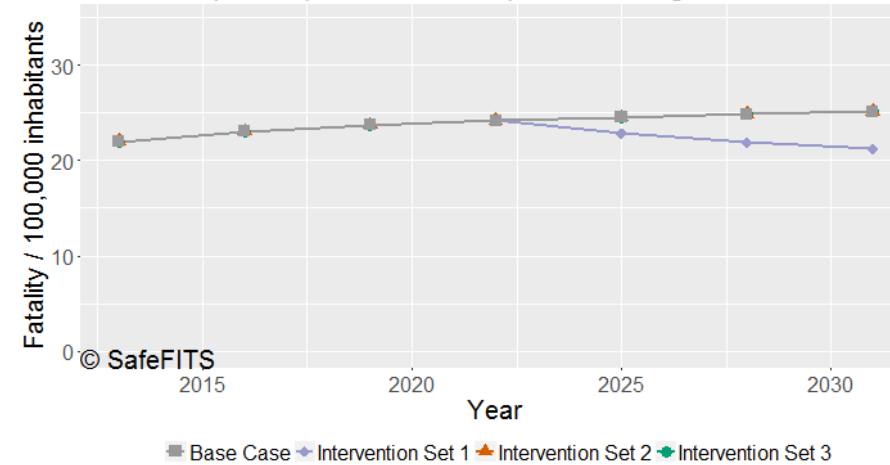
Vehicle per Population

136.09

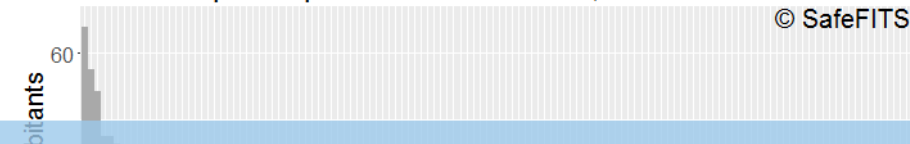
Passenger Cars (%)

Variable   (Year = 2025 )	Base Case	Intervention Set 1	Intervention Set 2	Intervention Set 3
Fatalities per Population	24.52	22.84	24.52	24.52
Difference from Base Case	-	-1.69	0.00	0.00
Percentile Difference	-	-6.88	0.00	0.00

Fatalities per Population - Comparative Diagram



Fatalities per Population - Base Case, in 2025



# Report Generation



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## Report Options

The SafeFITS app has some options that are considered useful for the reporting

Note that it might take a while to generate the report.

- Include the General Characteristics benchmarking plots
- Include the Economy and Management benchmarking plots
- Include the Transport Related-related benchmarking plots
- Include the model parameters
- Include the forecasting plots

## Document Options

You can choose one of the following options for the plot

Note that it might take a while to generate the report.

### Document format

PDF  HTML  Word

[Generate report](#)





- **Model developed with best available data**
  - But data missing for some countries – imputed using cluster averages where necessary
  - Outcomes for countries with very particular characteristics (eg, low GDP, high modal share of motorcycles) may not be properly captured
- **Output based on extrapolation of short-term developments**
  - Take into account confidence intervals!
  - Use base case scenario as reference point
  - Test combinations of similar interventions – what would be likely to change together?
  - Note when changes or interventions are outside of historical norms – model not calibrated for these inputs
- **Model currently based on 2013 data – to be updated with 2016 WHO data as published this fall**





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**Suggestions?**

**Comments?**

**Contact UNECE**

*[stat.trans@unece.org](mailto:stat.trans@unece.org)*

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