

China Road Transport Emission Model (HBEFA China) Modelling urban transport emissions for better air and climate protection

Chinese transport and city planners can now use the **China Road Transport Emission Model** to estimate road transport-related greenhouse gas emissions and air pollutants in their cities. It is based on the **European Handbook for Emission Factors (HBEFA)** and was developed by GIZ in cooperation with its partners. Because of its extensive database and model features, cities can use the model to estimate emissions of transport activities even as detailed as to street level and analyse scenarios for cleaner urban transport systems.

The increase in individual mobility is a constant challenge for China's transport planners. Every day they must make decisions in order to design urban travel as efficiently and user-friendly as possible. Their aim is to avoid traffic congestion as much as possible; but this alone is no longer enough. During recent years, additional demands that transport should not only be efficient and smooth, but also as low-carbon and low-polluting as possible have gained increasing importance.

It is feasible to design effective measures for less polluting urban transport systems. This requires, however, understanding of the drivers of emissions i.e. which vehicles are on city roads, which and how much fuel do cars and buses consume, in what traffic situations vehicles emit less than in others and accumulating data on the total kilometres travelled by each vehicle type.



HBEFA China can calculate emission impacts of traffic congestion

No climate protection or better air without data

Only very few Chinese cities systematically calculate their transport emissions. Until recently there was no detailed, publicly available data set on Chinese road transport emissions so cities could not easily calculate which vehicles emit what quantity of emissions. Consequently, they could not identify the main emitters. Since road transport emission factors for China will be freely available shortly, every Chinese city will be able to use them to estimate the emission impacts of road transport in their constituencies and design effective measures to address them – at no additional cost.

This has been made possible thanks to a multi-year cooperation between the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and transport planners, scientists and transport experts in four cities, including Beijing and Shenzhen. The project is part of the Sino-German government cooperation and funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. Chinese, German and Swiss transport experts from INFRAS developed the China Road Transport Emission Model (HBEFA CHINA) together - an emission model with an integrated database which includes emission factors to enable detailed calculations of road transport emissions in Chinese cities. In addition, the model includes a fleet module with an average Chinese vehicle fleet for Chinese cities which can either be used as a default or adapted to local characteristics to be more accurate.

With a China-adapted version of the European Handbook for Emission Factors for Road Transport (HBEFA in short), experts in Chinese administrations can now easily link their traffic data with emission data included in HBEFA China and be able to calculate emissions from hundreds of vehicles. “We did not have to start at zero to develop HBEFA China”, says Daniel Bongardt, project coordinator at GIZ. “Luckily, the vehicle fleets in China and Europe are very similar so we could build on the

research from Germany and many other European countries. This way we saved a lot of time and money.”

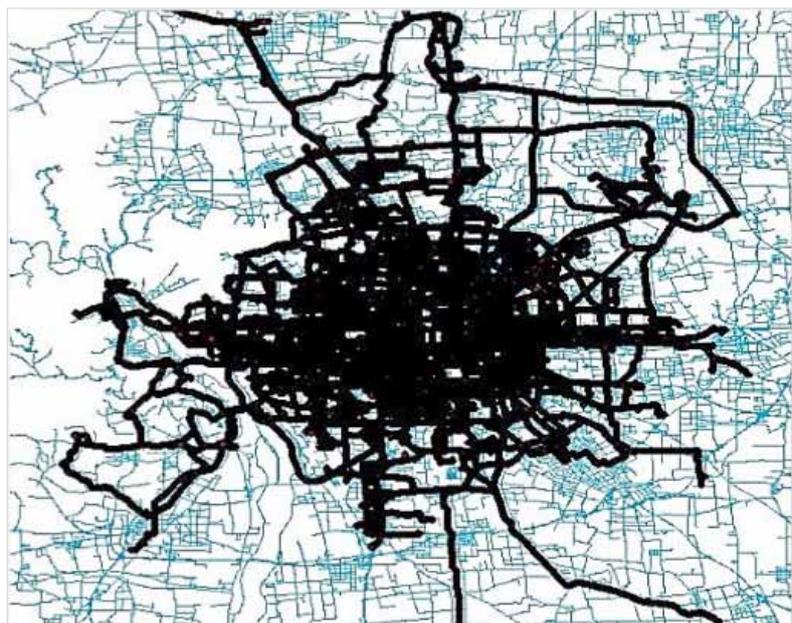
HBEFA was developed by the Swiss consulting group INFRAS based on multiple national measurements financed by the environmental protection agencies of Germany, Austria, Norway and Switzerland, the Swedish Transport Administration, the French Environment and Energy Management Agency, as well as the Joint Research Centre of the European Commission. Today, HBEFA is the standard reference for road transport emissions in Europe. HBEFA represents the collective know-how of 20 years of cooperation between leading European transport experts.

“Almost all European countries contribute their data to HBEFA. This is why we have a very high quality of emissions data upon which almost all larger European cities draw”, says the project manager in charge at INFRAS, Martin Schmied.

Whereas the European HBEFA distinguishes four different traffic situations or so-called Levels of Service (LOS), HBEFA China includes a fifth one for heavy

„Adapting the methodology of the European HBEFA enables us to identify the most effective measures to reduce Beijing’s transport emissions.”

Guo Jifu, Director of Beijing Transport Research Centre



Coverage of GPS data collected in Beijing



Start screen of CRTEM/HBEFA China

stop-and-go traffic. Almost non-existent in Europe, heavy stop-and-go situations make up 5 – 10% of urban traffic in China's large metropolises. This matters because cars emit significantly more in highly congested traffic – up to three times more than in free flow situations.

HBEFA China saves effort, time and money

Much of the road transport data – vehicle fleet categories or emission standards – is very similar in China and in Europe, so that GIZ and its partners could use the detailed HBEFA as a basis instead of starting from scratch. To adapt the emission factors, more than 2,000 hours of GPS data were gathered on Chinese traffic situations in several cities. These Chinese driving cycles were used to calculate the China specific emission factors for passenger cars and taxis, using the same methodology as HBEFA. Other vehicle categories are planned to be calibrated to Chinese characteristics starting 2015.

The big advantage for Chinese cities today – “They no longer need to conduct their own measurements but can rely on the data included in HBEFA China”, says Martin Schmieid. This not only saves a lot of effort and time, but also a lot of money.

Some data collection will nevertheless always be needed. To attain city specific emission values, cities need to insert data on their local vehicle fleets and related vehicle kilometres travelled into the emission model.

Features of CRTEM/HBEFA China

International best practice:

HBEFA China includes carbon emission factors for China's road transport and will include air pollution emission factors from 2015 onwards. The factors are CO₂, CO, NO_x, HC and several components of hydrocarbons (CH₄, NMHC, benzene, toluene, xylene), NH₃ and N₂O, NO₂, particle numbers (PN) and particle mass (PM). The model also calculates fuel consumption. It uses Microsoft Access as a platform and can be easily connected to existing travel demand models via a pre-installed interface to compute emissions street-wise.

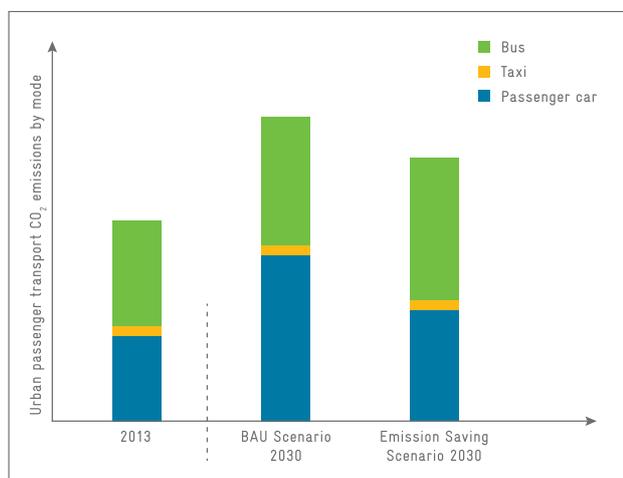
Flexible and ready for the future:

HBEFA China supports emission calculations from rough and aggregated to detailed data per street link based on travel demand models – all using the same tool. This means that cities can upgrade their analyses over the years with the ability to improve measurements in the future without the need to change the methodology. It can be used in all Chinese cities regardless of the level of data quality currently available. It even includes China-specific default values to fill local data gaps. A user guide is available in English and Chinese.

Supports decision-makers:

Not only can HBEFA China be used only for urban transport inventories, but also for calculating the greenhouse gas and pollution impacts of planned transport measures such as road pricing, new pollution norms and driving bans. Its features and methodology fulfil standard international requirements for emission calculations and will also satisfy future Chinese expectations of urban transport emission accounting.

Where cities already use travel demand models, model outputs can simply be inserted into the emission model via a special interface. The China Road Transport Emission Model then calculates detailed emission profiles of their transport networks, i.e. emissions are calculated for thousands of street-links. Cities without travel demand models can still use HBEFA China by gathering more aggregated data and estimate emissions based on average or default values – only a street-wise representation of emissions is not possible in this case. This is, however, only relevant for local pollutants; for greenhouse gas emissions knowing the overall amount is important.



HBEFA China can calculate emission impacts of policy scenarios

A detailed calculation of transport-related air pollution is, for instance, used by Shenzhen city. Because, in Shenzhen, all taxis are equipped with GPS devices that the city administration can access, it is possible to calculate the traffic situation on a minute-by-minute basis and thereby also when and where the pollution levels are particularly high or low. Shenzhen citizens can view the data online and plan their outdoor activities accordingly. This helps them lead healthier lives.

Imprint

Published by
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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HBEFA CHINA supports innovation and opens doors to international projects

So how can Chinese cities reduce emissions from urban transport? “Chinese cities are constantly planning new transport systems and preparing transport policies such as technology standards or bus rapid transit”, says Daniel Bongardt of GIZ. “With HBEFA China and the data therein, transport planners and environmental experts now have the tools to model the impact on air quality, fuel consumption and greenhouse gas emissions.”

Four large Chinese cities with a total of about 50 million inhabitants already work with HBEFA China and have further signalled a strong interest in doing so. “The interest in cleaning up the air and the need to reduce emissions in Chinese cities is considerable”, says Martin Schmied, “and therefore also the interest in the China Road Transport Emission Model”. Pressure on cities to trim down their carbon footprints and develop clean air plans is only going to increase. HBEFA China can help them identify the most effective strategies for accomplishing this.

By applying an internationally recognised methodology for emission accounting with China-specific emission factors, cities using HBEFA China are at the forefront of emission quantification. This gives them a competitive advantage when applying for national or international climate or development funds.

Our Services

- » Training on emission quantification in the transport sector and model application
- » Provision of the tool, including China road transport emission factor database, to any interested city
- » Technical support to adapt the model to city-specific needs (e.g. insertion of local vehicle fleets)
- » Policy consulting on sustainable transport development and travel demand management

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