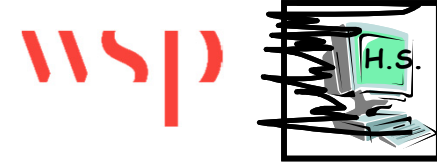


# ERMES Plenary Meeting

## 14.05.2019

---

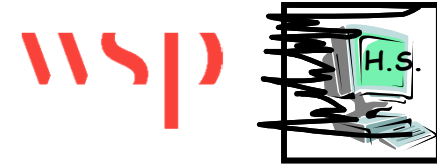


### WG driving behavior

## Overview of the updates of the traffic situation schema for HBEFA 4

13.05.2019

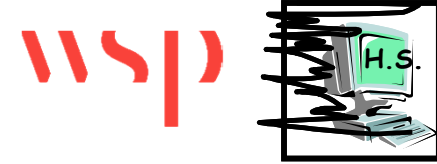
# Overview



## Description of tasks:

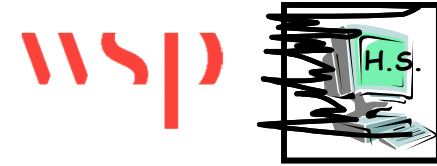
- **Task 1: General review of traffic situation scheme,**
  - **New structure and description of road types in HBEFA 4.1,**
  - **Extensions of existing traffic situation scheme,**
- **Task 2:**
  - **Assessment of potential split of driving cycles assigned to the different traffic situations, namely for RT and AT/TT, possibly for LCV,**
  - **Development of preconditioning cycles,**
- **Task 3: Validate cycles per traffic situation(s),**

# Overview



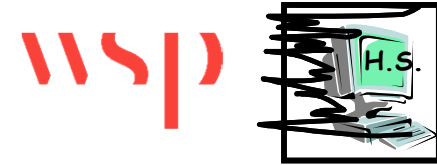
- 
- **Task 4: Review the driving cycles assigned to the traffic situation scheme,**
    - **Cycle review,**
    - **New cycles with speed limits of 30 km/h and 40 km/h for urban distributor and local streets,**
    - **Addition of LoS 5 (heavy stop&go),**
    - **Addition of conditioning cycles.**
  - **Final validation New cycles – to measured data.**
- WSP is responsible for tasks 1 and 3, HSDAC is responsible for tasks 2 and 4.**

# Task 1



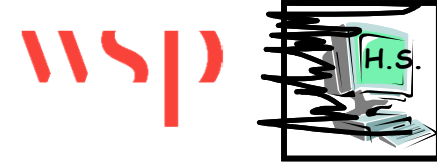
- **Based on a review of the description of the traffic situation scheme a new structure of the road types in the scheme is introduced.**
- **The new structure aims at separating the dimensions “Road hierarchy” and “Road design”. Furthermore, some other descriptive variables that affect the traffic situation have been added, e.g. the kind of vehicle mix that are allowed/occur on different road types.**
- **New road types have been added for speed limits 30 and 40 km/h. In HBEFA 3.3 those speed limits were only included for local access roads. Today speed limits 30 and 40 km/h are increasingly common in larger parts of the road network in urban areas. Thus, HBEFA needs to include those speed limits for urban main roads as well.**

# Task 2, cars and LCVs



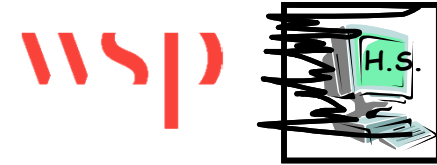
- 
- **Up to now, the driving cycles assigned to the different traffic situations and used in the PHEM model for the emission factor calculations are identical for cars and LCV on one hand and also identical for RT and AT/TT on the other hand.**
  - **For the first mentioned group (cars and LCV) the split into separate cycles was also discussed within the development of the WLTC, the new driving cycle dedicated for the measurement of pollutant exhaust emissions and CO<sub>2</sub> emissions during type approval.**
  - **The world-wide WLTP in-use driving behaviour database was analysed with respect to the acceleration behaviour of its individual vehicles.**

# Task 2, cars and LCVs



- 
- **Since it could be shown that there was no difference in the acceleration behaviour between cars (M1 vehicles) and LCV (N1 vehicles) and that the acceleration behaviour did not even show a power to mass ratio dependency for power to mass ratios above 35 W/kg, the WLTC development group decided to develop one common cycle for M1 and N1 vehicles.**
  - **Based on this result it is recommended to abstain from a split of the cycles for cars and LCV and to maintain the current system (identical cycles for both vehicle categories).**

# Task 2, RT and AT/TT

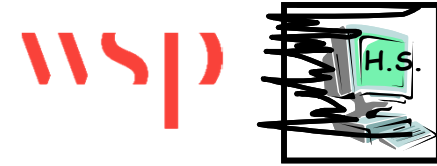


---

**For RT and AT/TT the situation is slightly different.**

- It was already stated in the report of the last UBA/IFEU project (Nr: 3711 45 105, April 2015, AP 200), that the driving behaviour between RT and AT/TT is different, but it should be assessed to what extent this would influence the emissions.**
- The main difference is the acceleration behaviour. At a given speed the average acceleration of AT/TT is significantly lower than the average acceleration of RT because the actual power to mass ratios in real traffic are lower for AT/TT than for RT.**
- But it can be assumed that full load acceleration is used in both cases and this limits the differences in the emissions.**

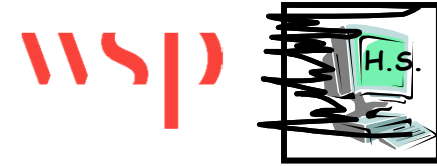
## Task 2, RT and AT/TT



- 
- **A corresponding analysis showed that the differences are in any case much smaller than the differences for a particular truck caused by the possible payload span.**
  - **Therefore, it was decided to skip the split of the HDV into these two groups and not distinguish different driving cycles.**
  - **The resources originally foreseen for this task were used for a new task that became necessary during the project:**
  - **Development of conditioning cycles to be used prior to the actual cycles in order to ensure a proper functioning of the PHEM model for advanced exhaust gas aftertreatment systems like SCR.**

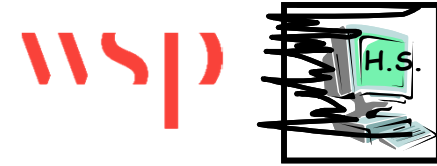


# Task 3



- 
- **Driving pattern data for different traffic situations have been collected from several studies.**
  - **The driving patterns from these studies were classified into HBEFA traffic situations and driving pattern parameters for different traffic situations were compared.**
  - **The measured driving pattern parameters at different traffic situations were compared to the corresponding parameters for the driving cycles representing the traffic situations in HBEFA 3.3.**
  - **The data also included measurements for some of the new traffic situations with speed limit 30 and 40 km/h that were to be included in HBEFA 4.1.**

# Task 3

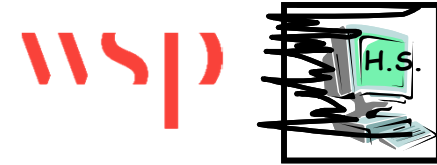


---

The results can be summarised as follows:

- It can be concluded that there are still some differences between the HBEFA values and the confidence intervals of the in-use measurements but compared to HBEFA 3 the situation has been improved.
- Some differences between the HBEFA cycles and the measured data used for the validation part may be attributed to different separation criteria used for the LoS in the different parts of the project.

# Task 4

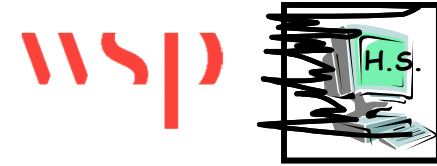


---

**The review of the existing driving cycles focused on cars and light duty vehicles and the following issues:**

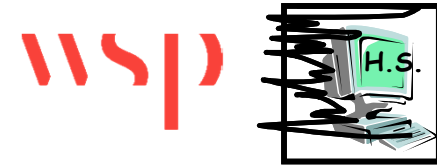
- **Winding roads (rural local sin. and rural distributor sin.). The cycles were criticized for having too low average speeds in general.**
- **LoS 3 (saturated traffic) and partly also LoS 2 (heavy traffic) because of too high average speeds and too low RPA values compared to validation data.**
- **Elimination of inconsistencies like decreasing RPA values from free to heavy or heavy to saturated traffic.**
- **New cycles with speed limits of 30 km/h and 40 km/h for urban distributor and local streets were added to the traffic situation schema.**

# Task 4



- 
- **A 5<sup>th</sup> level of service, LoS 5 (heavy stop&go) was added to the traffic situation schema and corresponding cycles were derived.**
  - **The modelling of advanced exhaust aftertreatment systems like SCR made it necessary to add conditioning cycles to all driving cycles in order to achieve appropriate temperature conditions at the beginning of the cycles.**
  - **The new cycles for the traffic situation scheme were compared to the data set with the validation data, a round of modifications was performed before the final version of the traffic situation scheme was launched.**

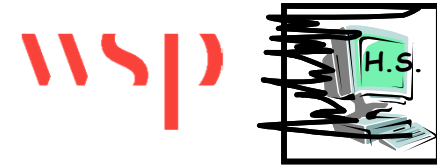
# Suggestions of future improvements and developments



**Despite the work been done in WP2 there is still a need for further improvements that was not possible in WP2 due to restrictions in time and finance. List of future work:**

- It would be of great value if HBEFA members, at future data collections, bear in mind the possibility to perform studies in a way that enables further validation and review of the HBEFA traffic situations.**
- That means systematic data collections that includes possibilities to connect the driving patterns to HBEFA traffic situations, road type and traffic flow class (LoS).**
- It would be of particular value if data were collected for traffic situations that are not at all or not enough represented in previous measurements.**

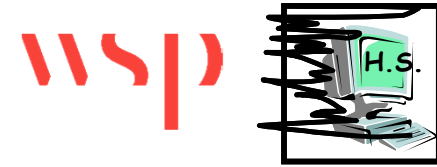
# Suggestions of future improvements and developments



- One first step would be to create a handbook for data collection concerning driving pattern data in connection to HBEFA.
- It has become clear during the work that the classification into LoS induce confusion for users as well as experts.
- The issue divides into at least two parts:
  1. To estimate traffic flow conditions at different times of day based on overall parameters as average daily traffic, ADT, type of road and diurnal traffic load curves.
  2. To estimate the LoS for a specific driving pattern where one or several of the parameters needed for using diurnal curves is missing.

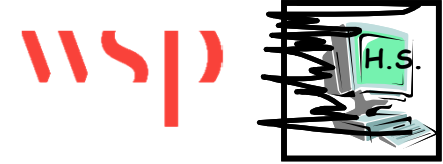
# Suggestions of future improvements and developments

---



- In discussions between other members of HBEFA, and between WSP and HSDAC differences in the interpretation of the different LoS became obvious.
- Therefore, a specific project in the framework of HBEFA to clarify the notion of LoS and how they can be estimated is suggested.

**End**



---

**Thank you for your attention!**