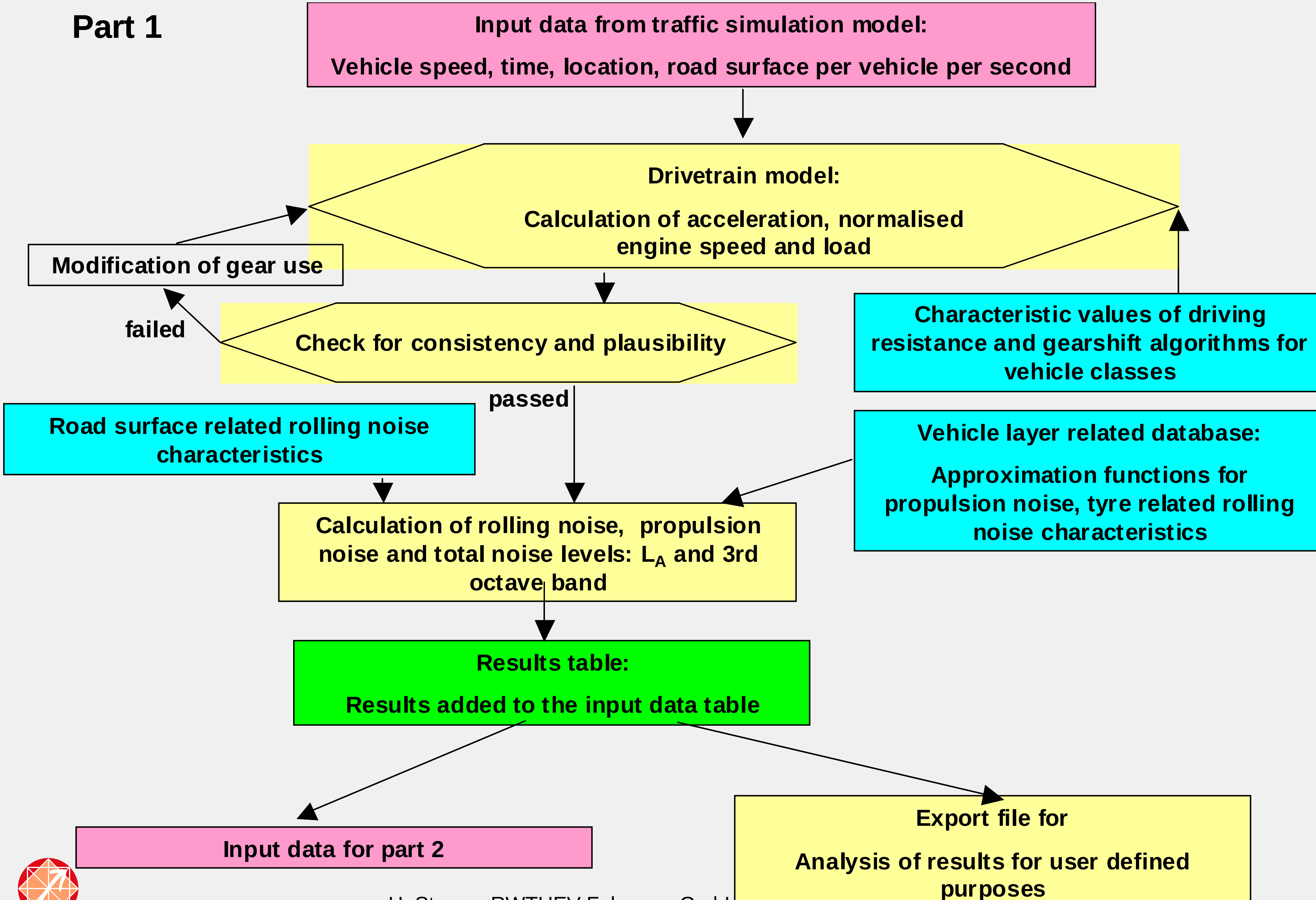
# Overview:

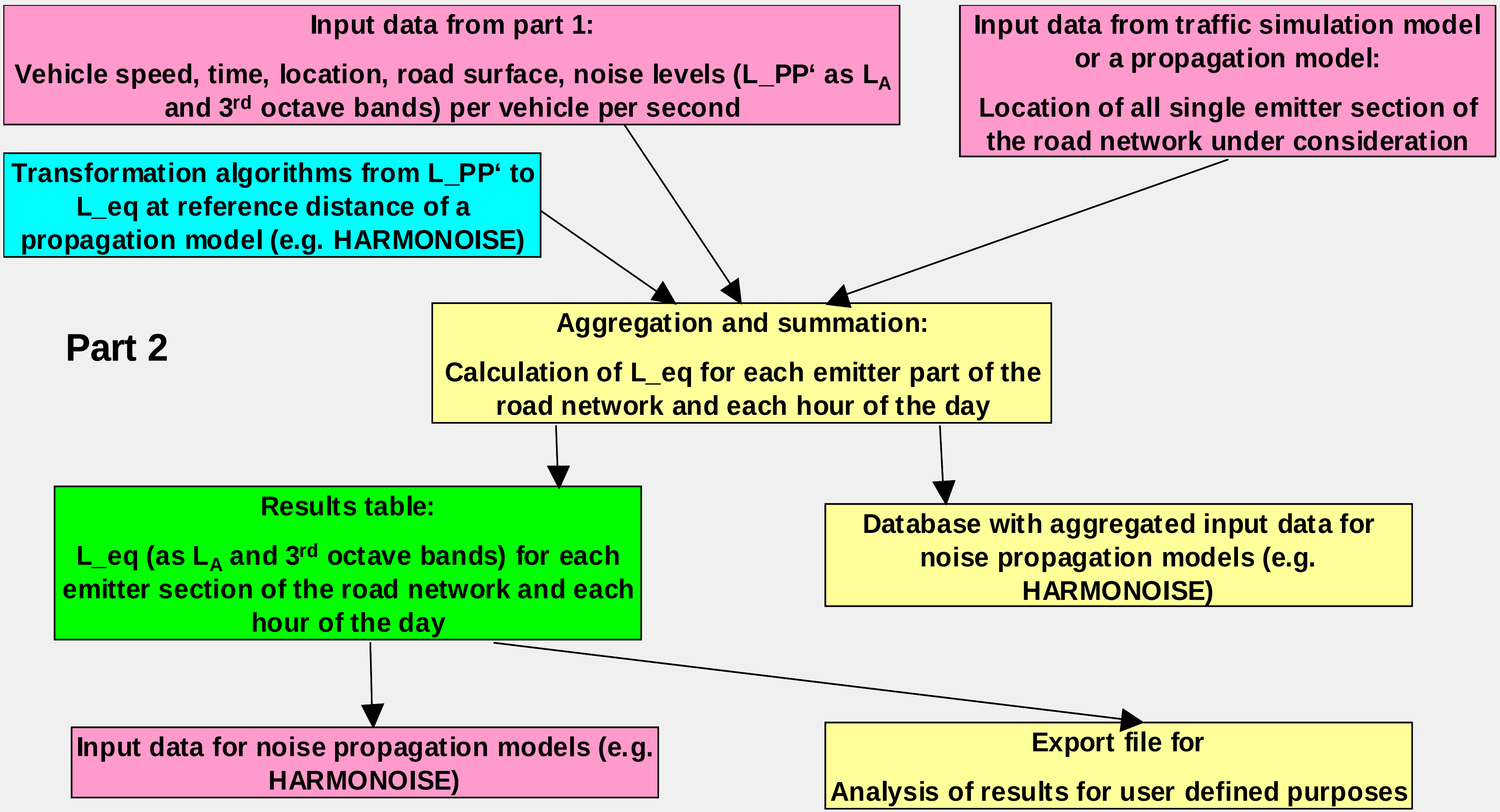
- The general design of the model,
- The drivetrain model,
- Modelling of tyre/road noise,
- Modelling of propulsion noise,
- Calibration measurements.

## WP 40, The general design of the model

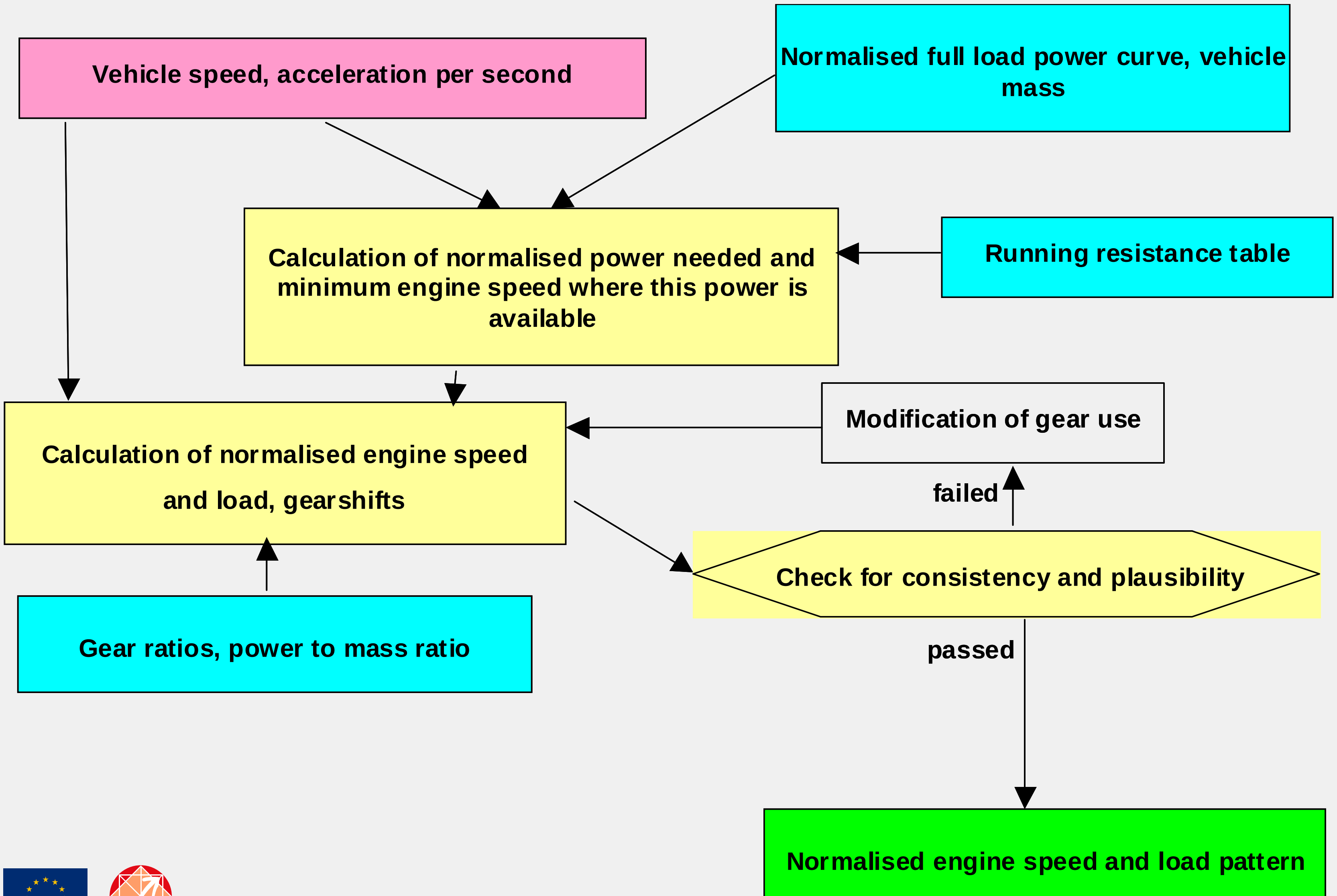
### Part 1



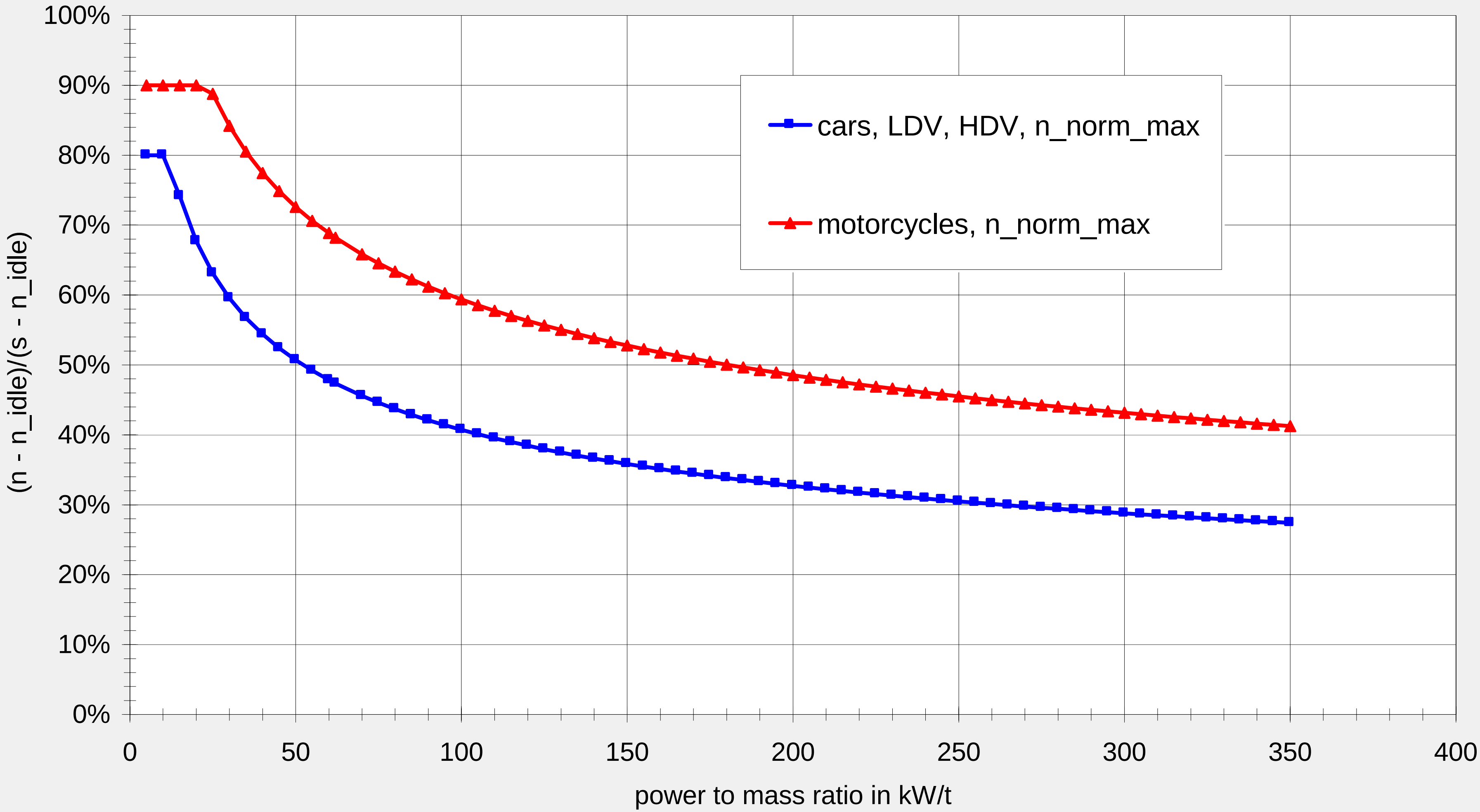
## WP 40, The general design of the model



## WP 40, the drivetrain model



## WP 40, the drivetrain model, upshift speeds for cars, LDV and motorcycles



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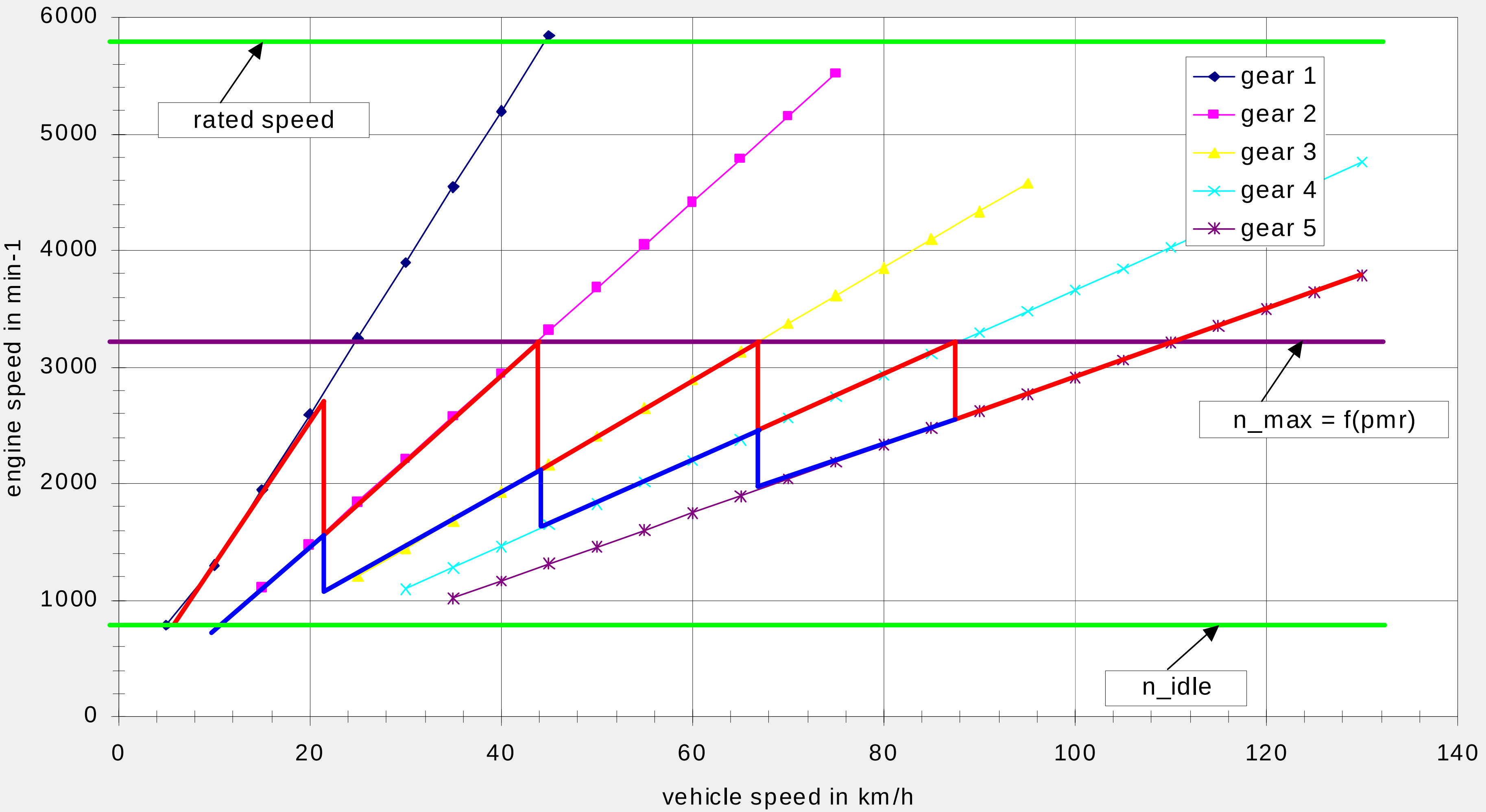
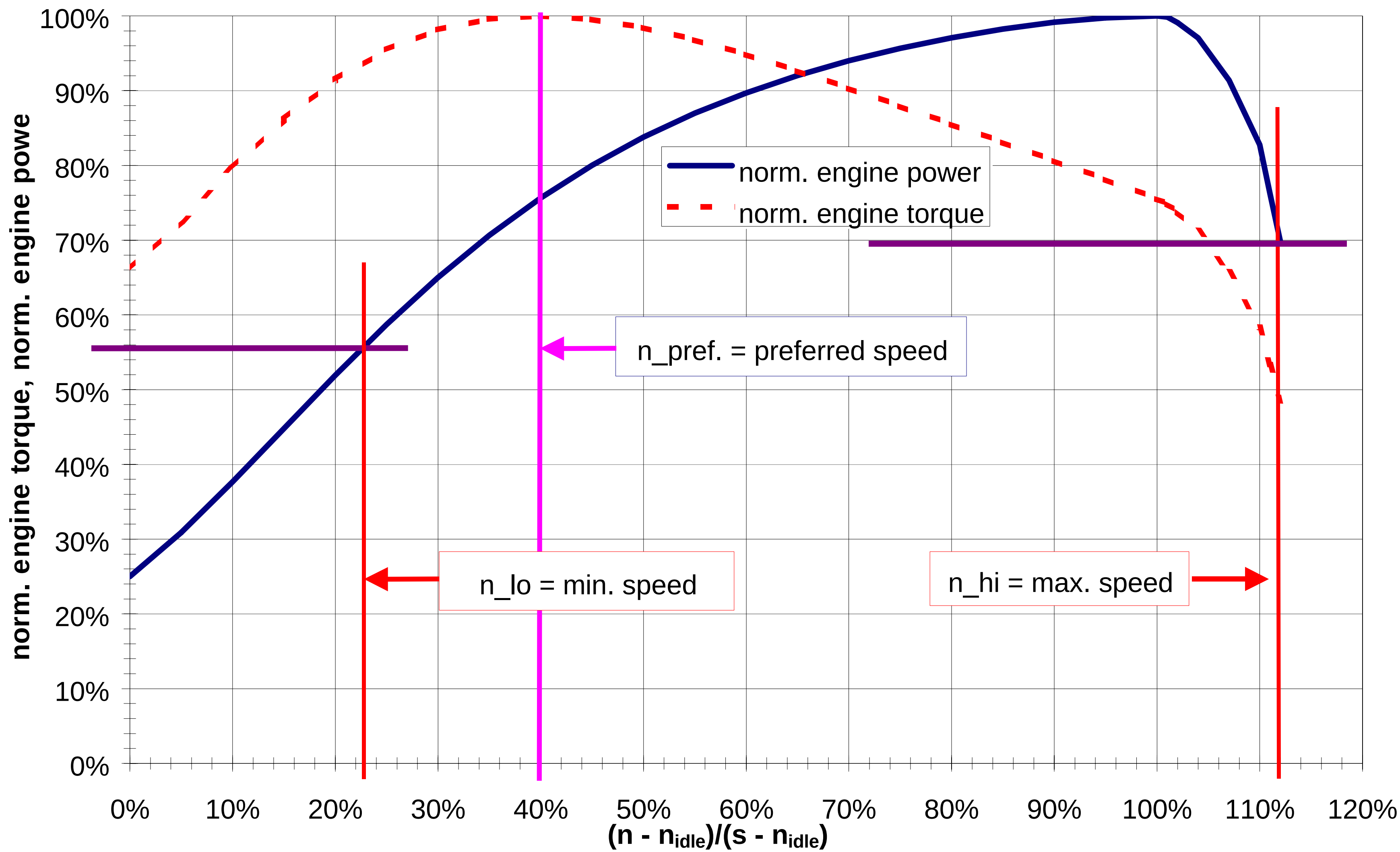


## WP 40, the drivetrain model, shiftspeeds for HDV



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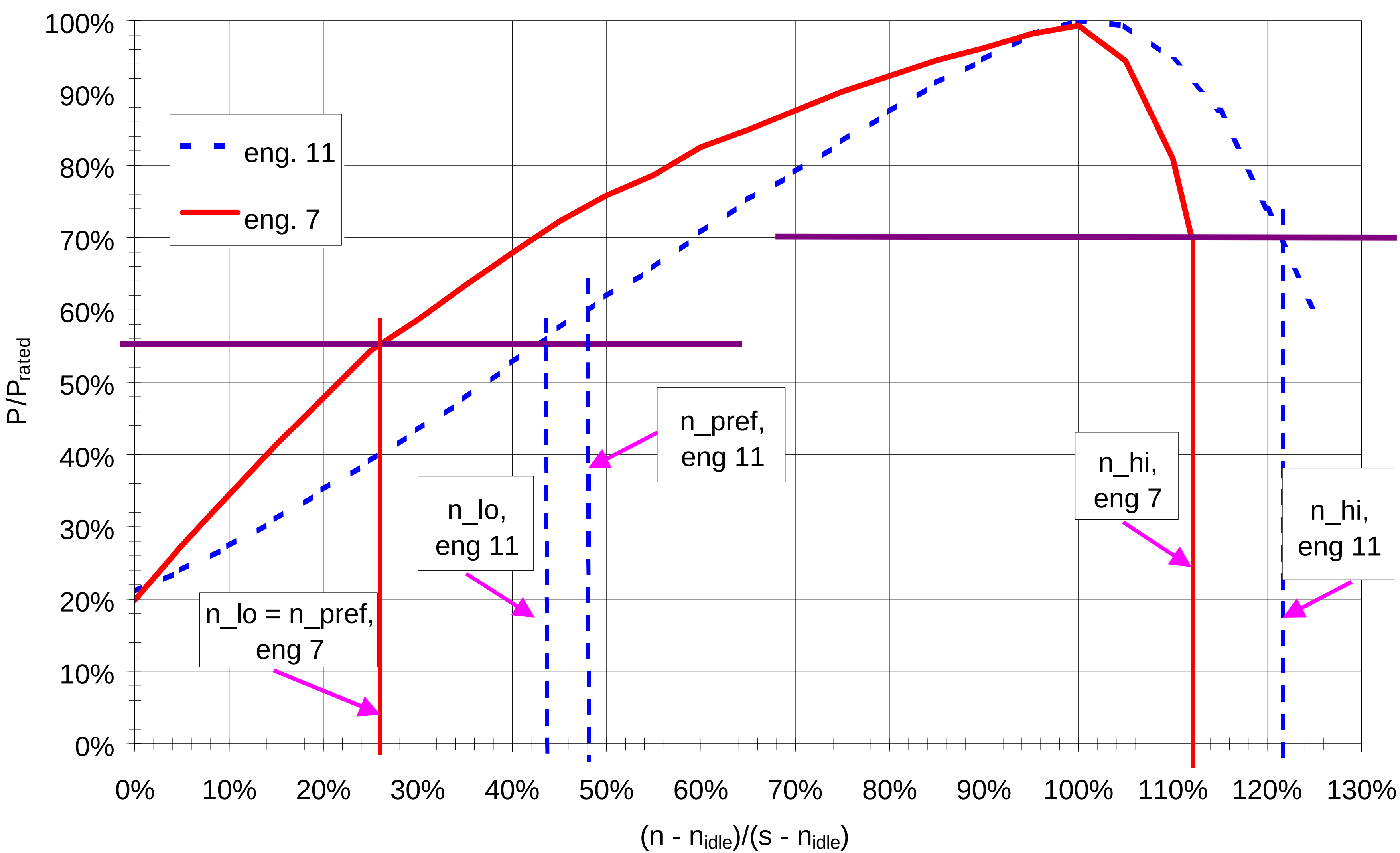
## Status Report, WP 40, the drivetrain model, shiftspeeds for HDV



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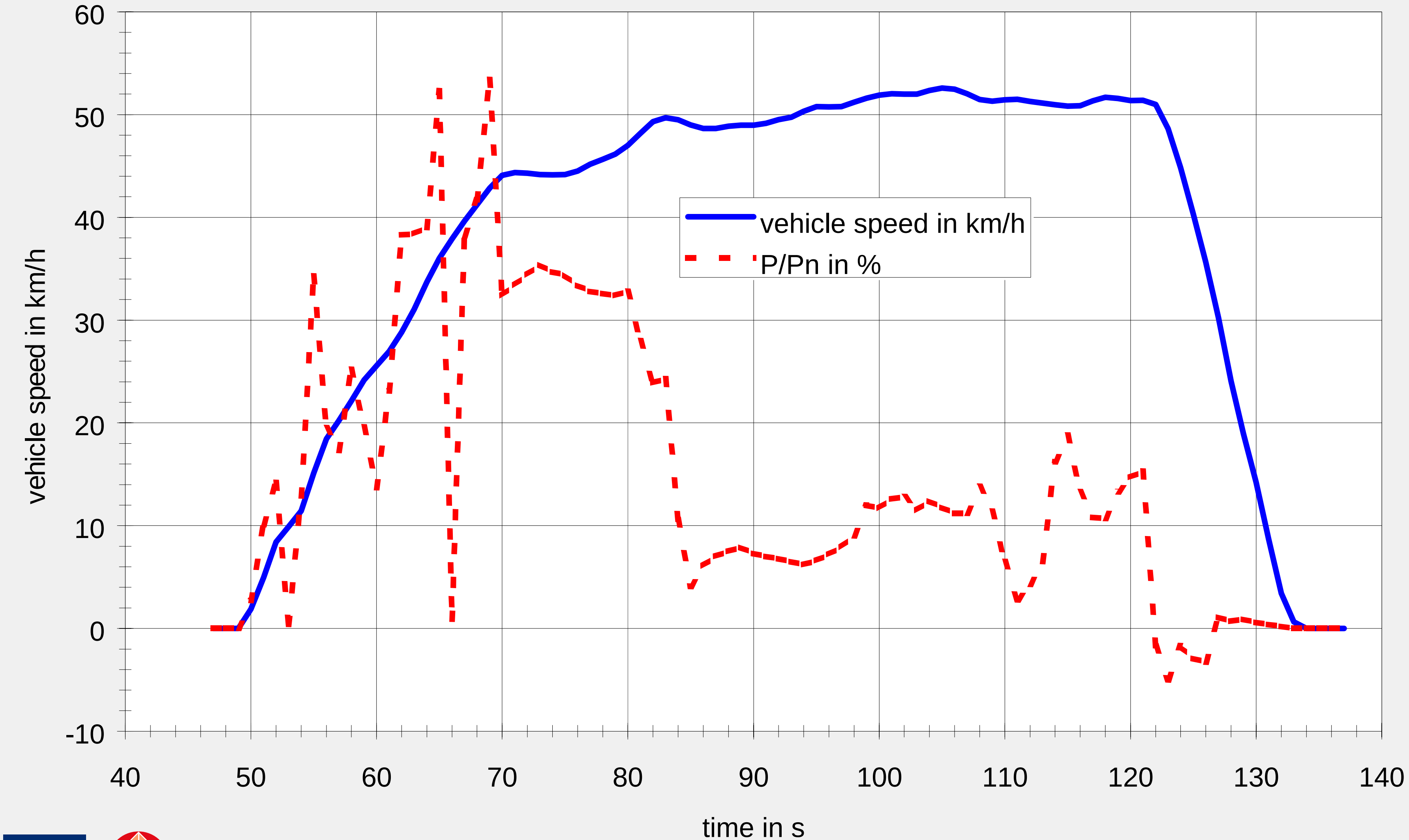

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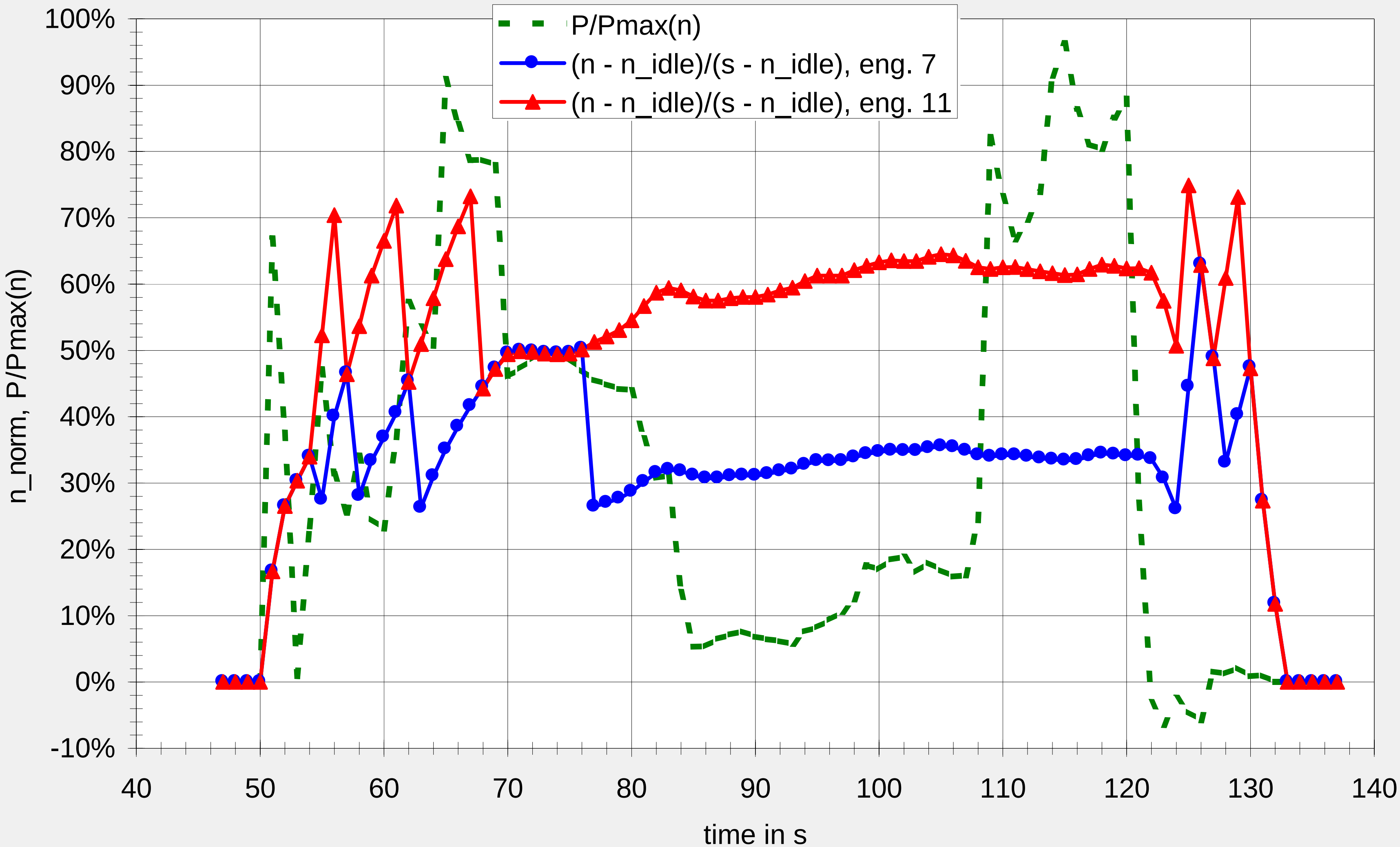
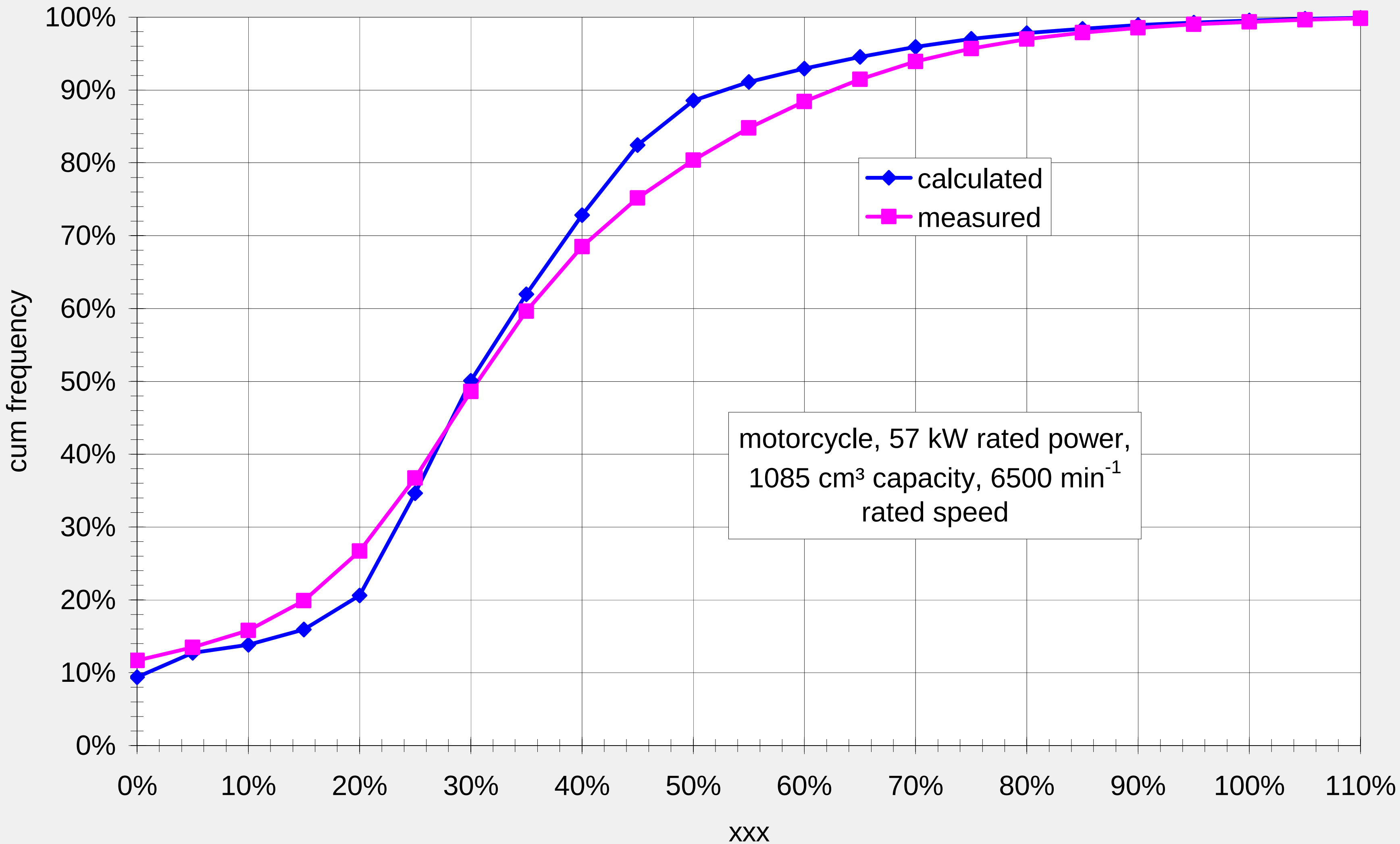


## WP 40, Drivetrain model, validation work



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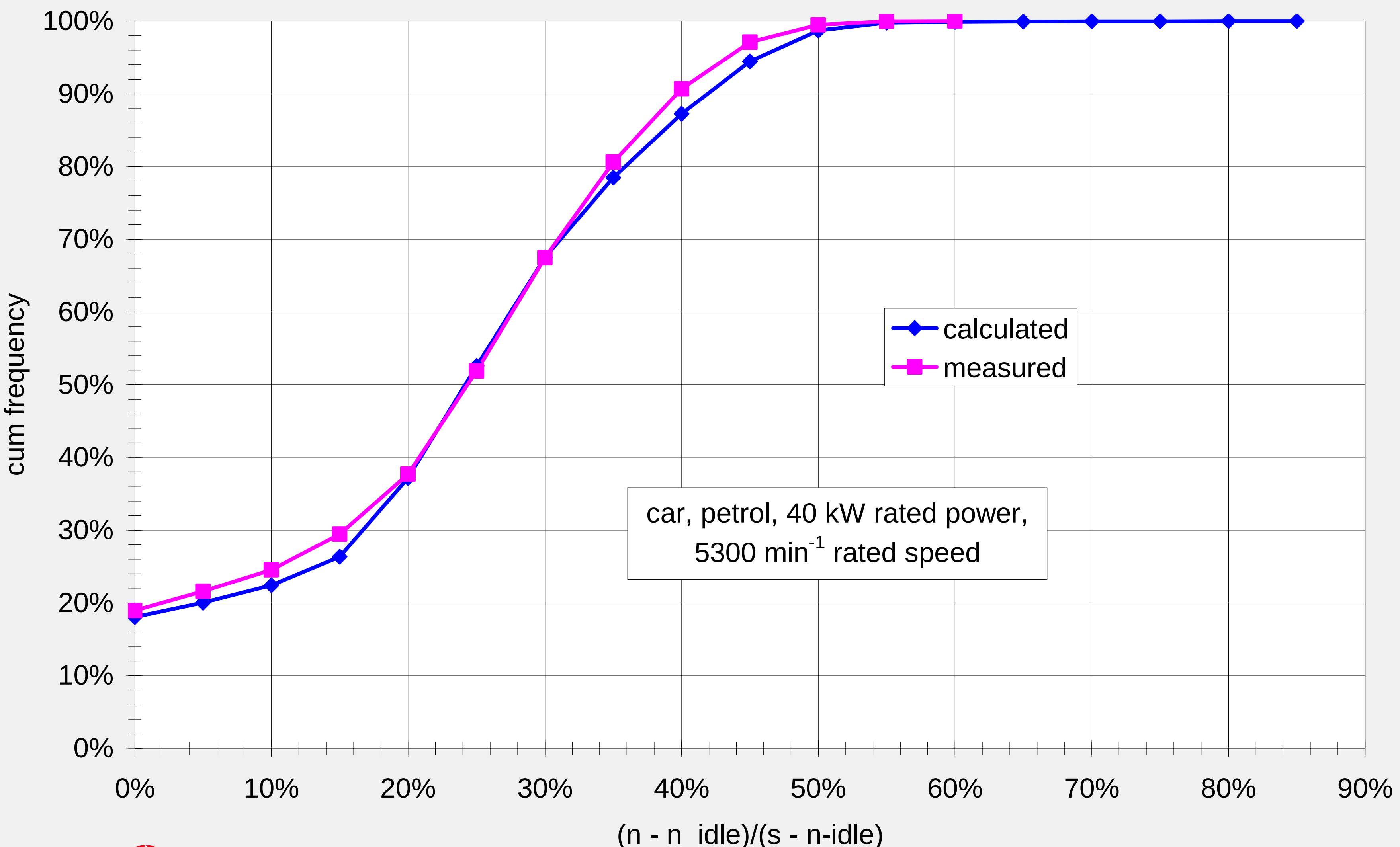

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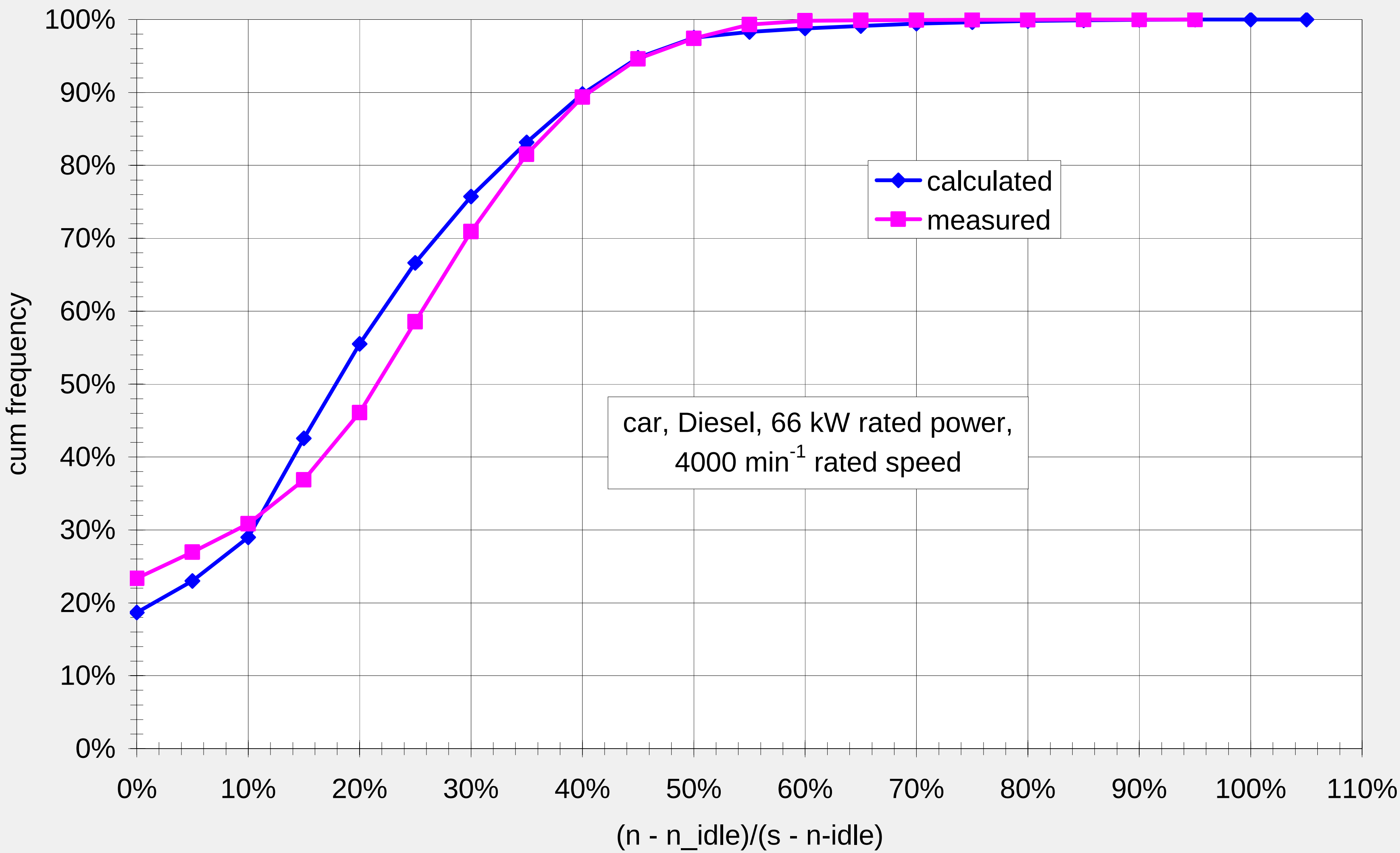

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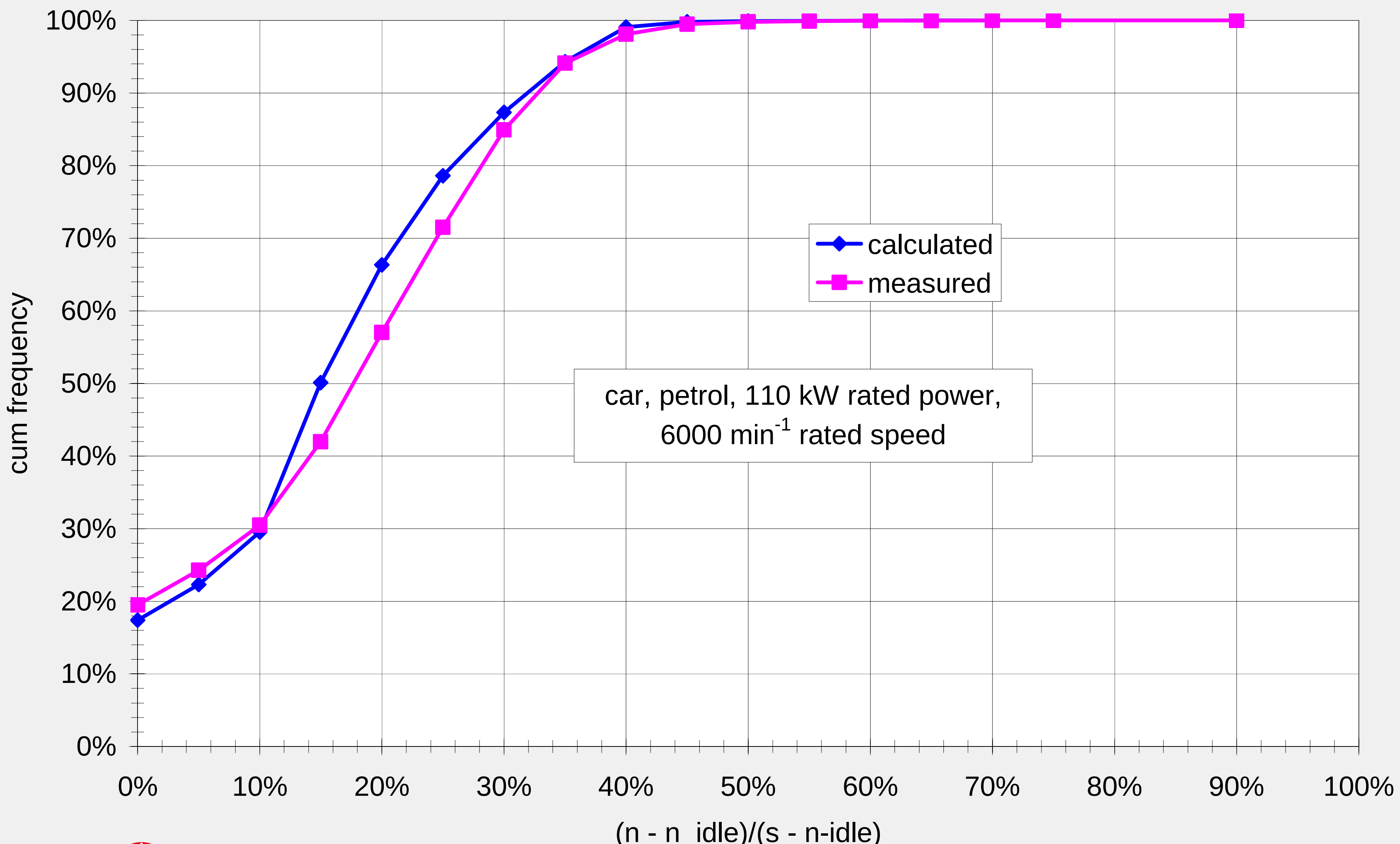

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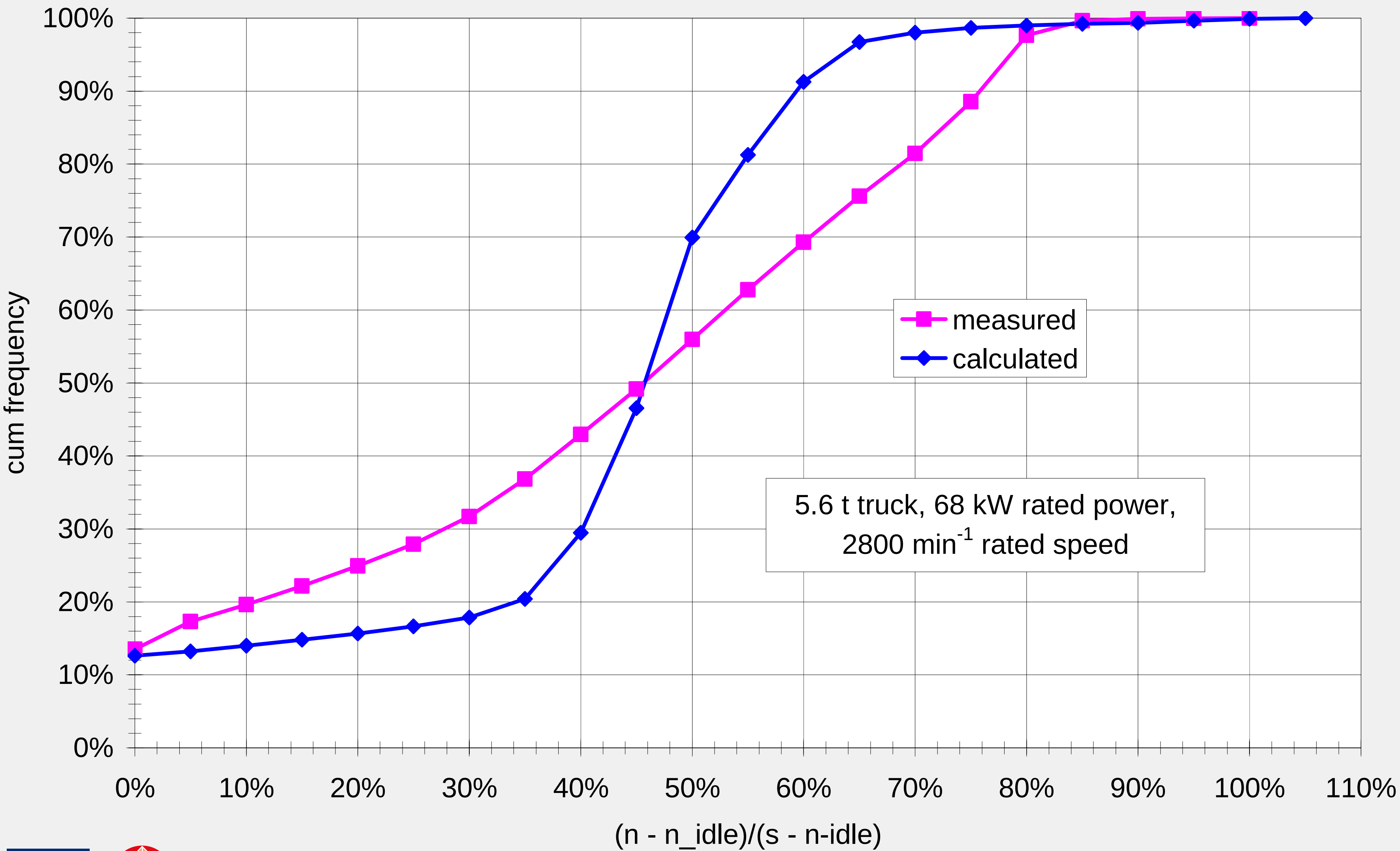

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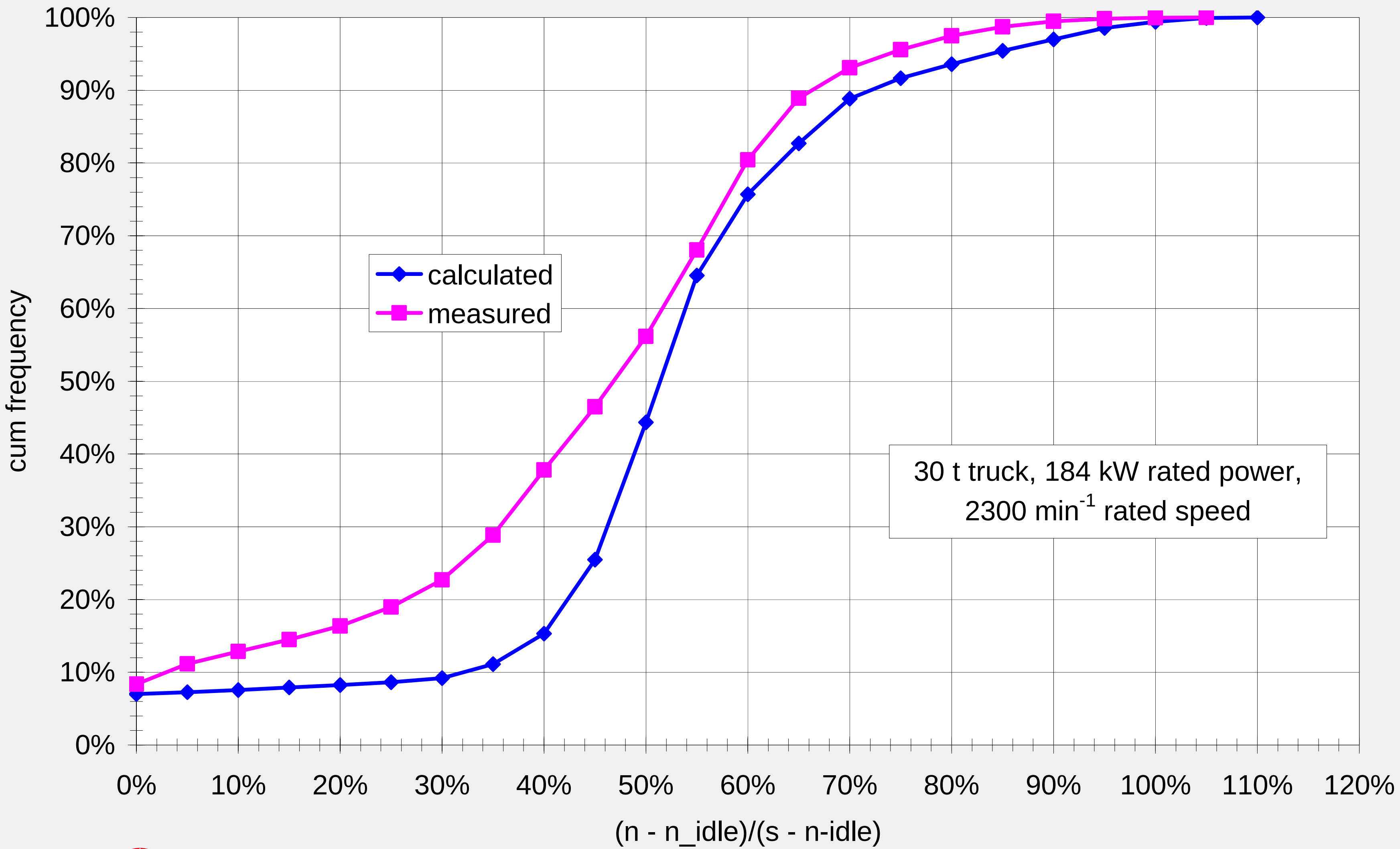

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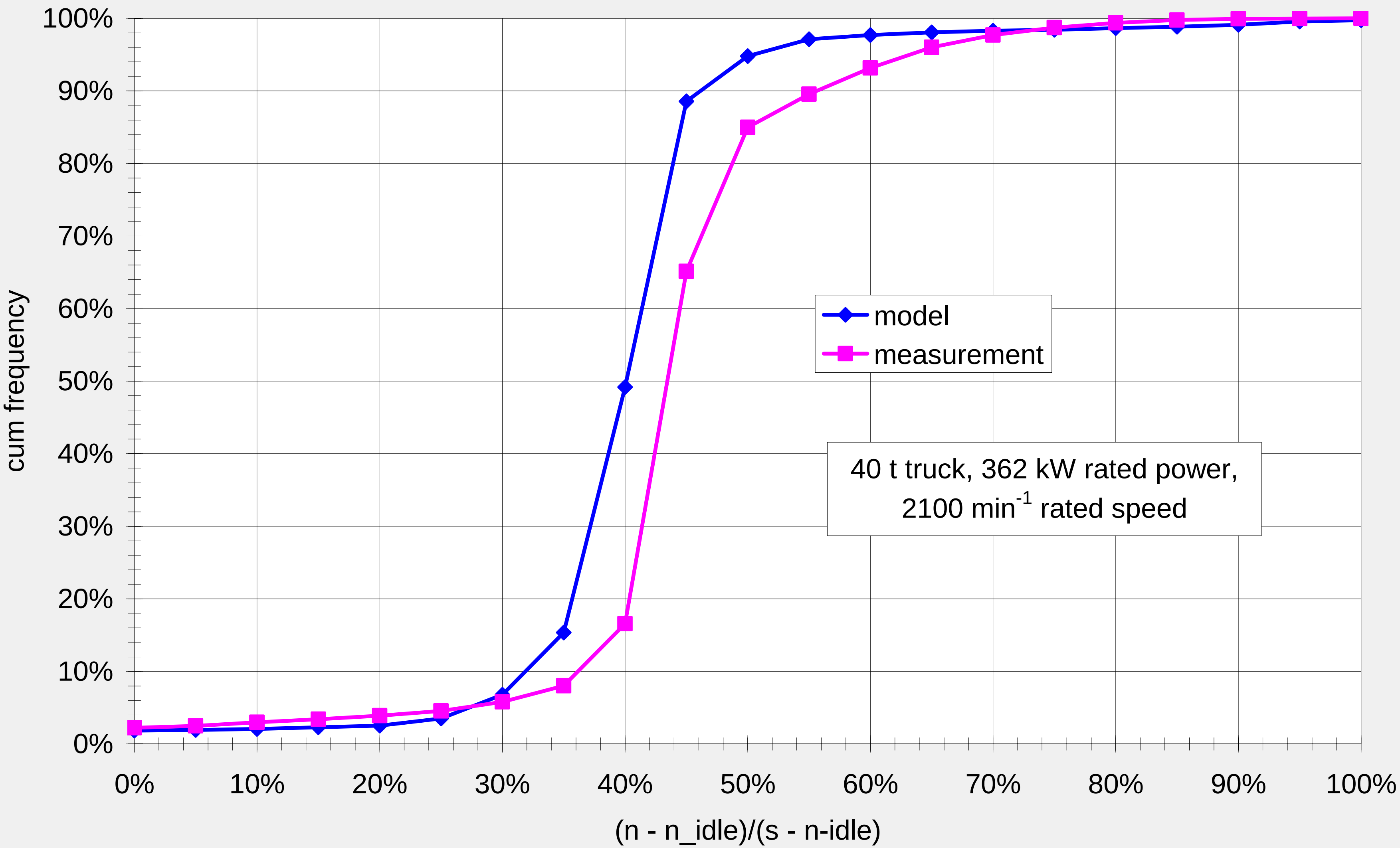


## The tyre/road noise is modelled as follows:

**$Lroll = L_{r50}(AC\ 0/11) + B*\log(v/50\ km/h) + DL\_surface$**

- **$L_{r50}$(AC 0/11) – Rolling noise at 50 km/h on asphalt concrete 0/11,**
- **v – vehicle speed,**
- **B – surface specific slope,**
- **DL_surface – surface specific supplement.**

WP 40, Tyre/Road Noise Calibration Measurements

| Road surface type | Identifier | DLsurface in dB(A) | |
|---|---|---|---|
| | | LDV and M1 | HDV |
| Asphalt concrete 0/11 | AC 0/11 | 0.0 | 0.0 |
| stone mastic asphalt 0/11 | SMA 0/11 | 0.0 | -0.3 |
| hot rolled asphalt | HRA | 2.0 | 1.0 |
| surface dressing 0/11 | SD | 1.5 | 0.5 |
| Gussasphalt | GA | 1.9 | -0.3 |
| Grip-surface | GR | 1.3 | 0.4 |
| Asphalt concrete 0/16 | AC 0/16 | 2.0 | 0.0 |
| Exposed aggregate | EA | 1.3 | 0.4 |
| Burlap treated cement concrete | CC burlap | 1.0 | 1.2 |
| Cement concrete longitudinally brushed | CCB lo | 1.3 | 1.7 |
| Cement concrete transversally brushed | CCB tr | 3.7 | 2.1 |
| Even pavement stones | PS even | 3.0 | 2.0 |
| Uneven pavement stones | PS uneven | 6.0 | 4.0 |

| Road surface type | Identifier | DLsurface in dB(A) | |
|---|---|---|---|
| | | LDV and M1 | HDV |
| Drainage asphalt 0/11 less than 3 years | DA 0/11 k3 | -3.1 | -3.7 |
| Drainage asphalt 0/11, 3 to 5 years | DA 0/11 3-5 | -2.0 | -2.0 |
| Drainage asphalt 0/11 more than 5 years | DA 0/11 g5 | 0.0 | 0.0 |
| Drainage asphalt 0/8 less than 3 years | DA 0/8 k3 | -5.8 | -3.7 |
| Drainage asphalt 0/8, 3 to 5 years | DA 0/8 3-5 | -3.8 | -2.0 |
| Drainage asphalt 0/8 more than 5 years | DA 0/8 g5 | -0.4 | 0.0 |
| Drainage asphalt 0/16 less than 3 years | DA 0/16 k3 | -2.0 | -3.0 |
| Drainage asphalt 0/16, 3 to 5 years | DA 0/16 3-5 | -1.0 | -1.5 |
| Drainage asphalt 0/16 more than 5 years | DA 0/16 g5 | 0.0 | 0.0 |
| Drainage asphalt twin layer less than 3 years | DA twin k3 | -6.0 | -4.5 |
| Drainage asphalt twin layer, 3 to 5 years | DA twin 3-5 | -4.0 | -3.0 |
| Drainage asphalt twin layer more than 5 years | DA twin g5 | -2.0 | -1.5 |

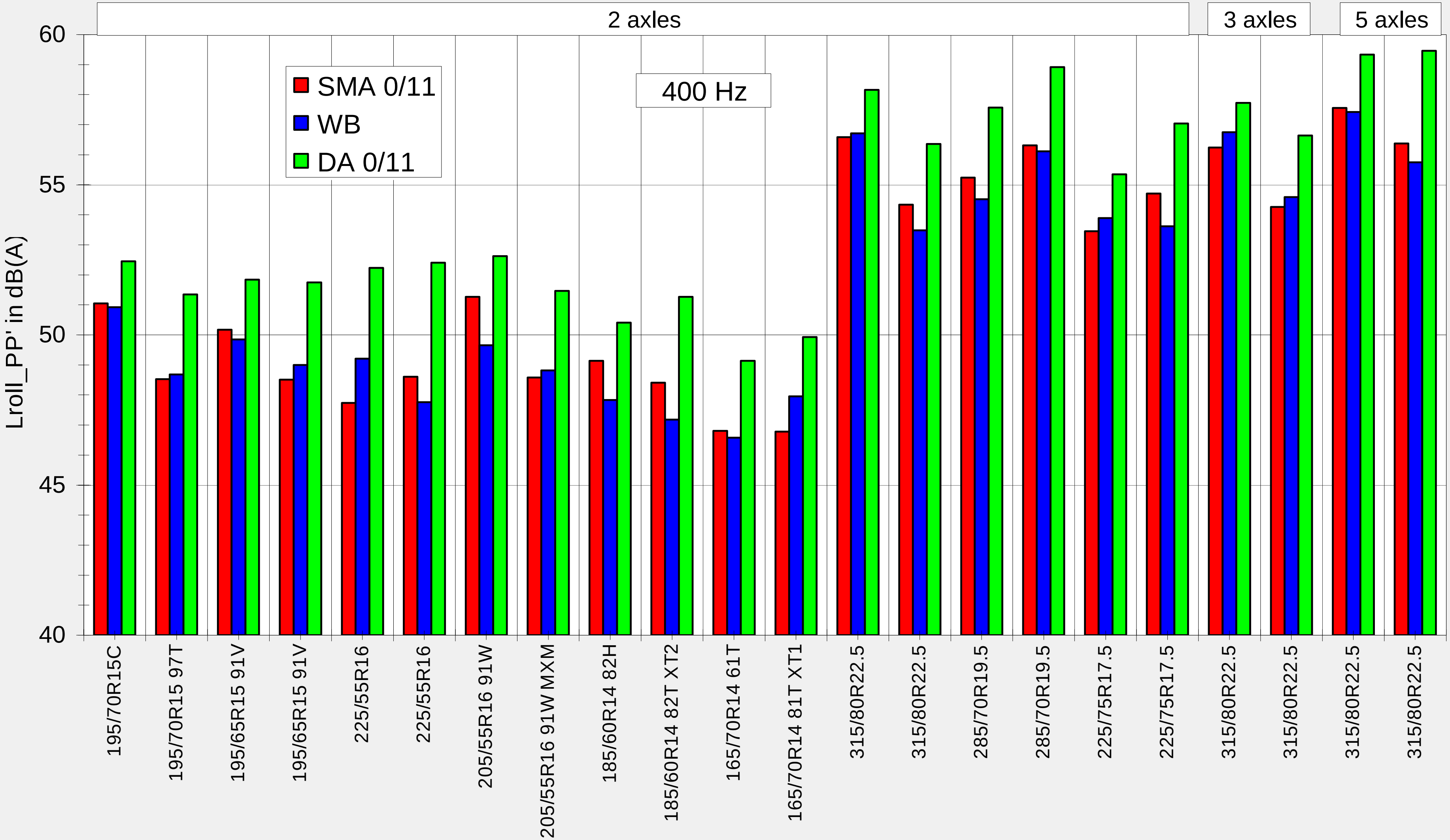
## WP 40, Tyre/Road Noise Calibration Measurements

**The tyre/road calibration measurements were finalised in 2003. The following road surfaces were examined:**

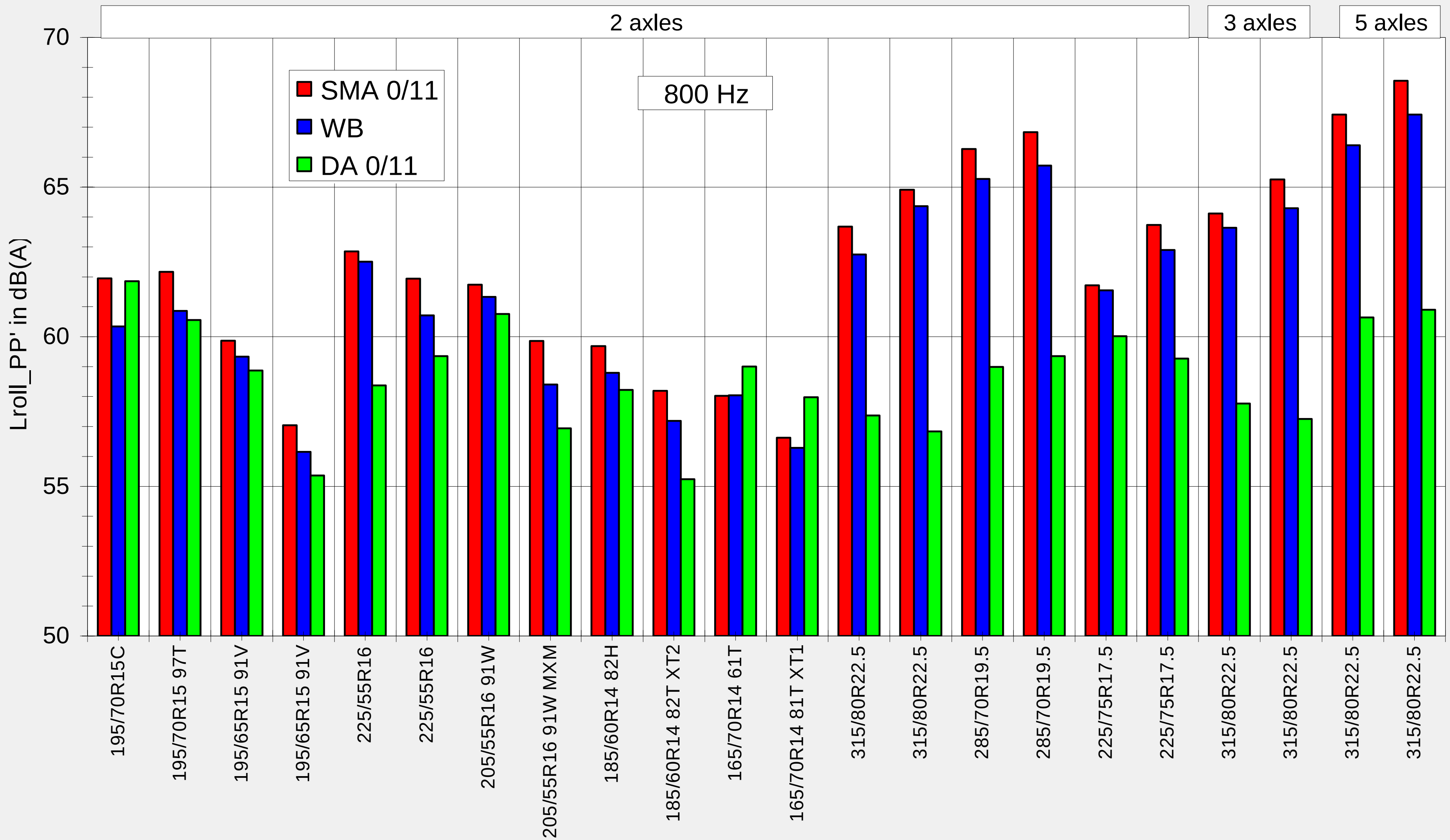
- **Stone mastic asphalt 0/11,**
- **Drainage asphalt 0/11,**
- **Exposed aggregate.**

**22 vehicle/tyre combinations were measured (11 vehicles, 10 sets of tyres, from a small car to a 5-axle heavy duty trailer truck)**

## WP 40, Tyre/Road Noise Calibration Measurements



## WP 40, Tyre/Road Noise Calibration Measurements



**Vehicle noise calibration measurements:**

- **The vehicle noise calibration measurements were finalised September 2004. In total 59 vehicles were measured. The aim of these measurements was to provide data for the propulsion noise modelling in 3rd octave bands.**
- **In order to measure the propulsion noise without load on the engine the vehicles were placed in the middle of the test track for the pass by measurements with the microphones on both sides in 7.5 m distance from the centreline of the drive lane. the noise levels were measured at different engine speeds from idling to rated speed and from rated back to idling.**
- **A second curve that is needed is the propulsion noise level at full engine load versus normalised engine speed. To derive this curve the pass by noise levels were measured during wide open throttle acceleration tests. These tests were carried out at three different normalised engine speeds: 20%, 45% and 70%.**

## WP 40, Vehicle Noise Calibration Measurements

- **In order to minimise the rolling noise influence the vehicles were equipped with slicks.**
- **To make the results comparable with the stationary test results only the noise levels at PP' (microphone plane) +/- 1 m were taken into account.**

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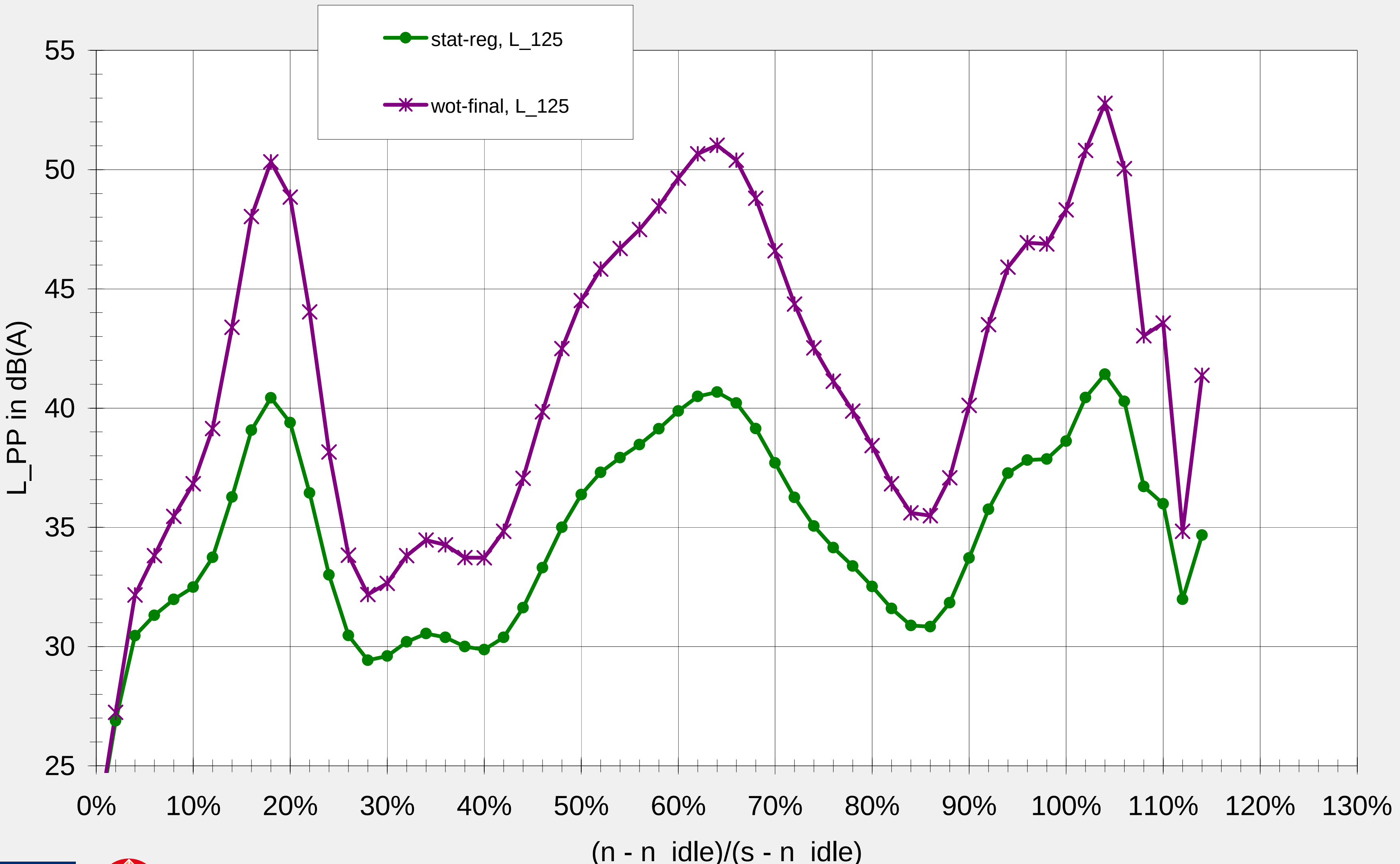
**WP 40, Propulsion noise modelling**



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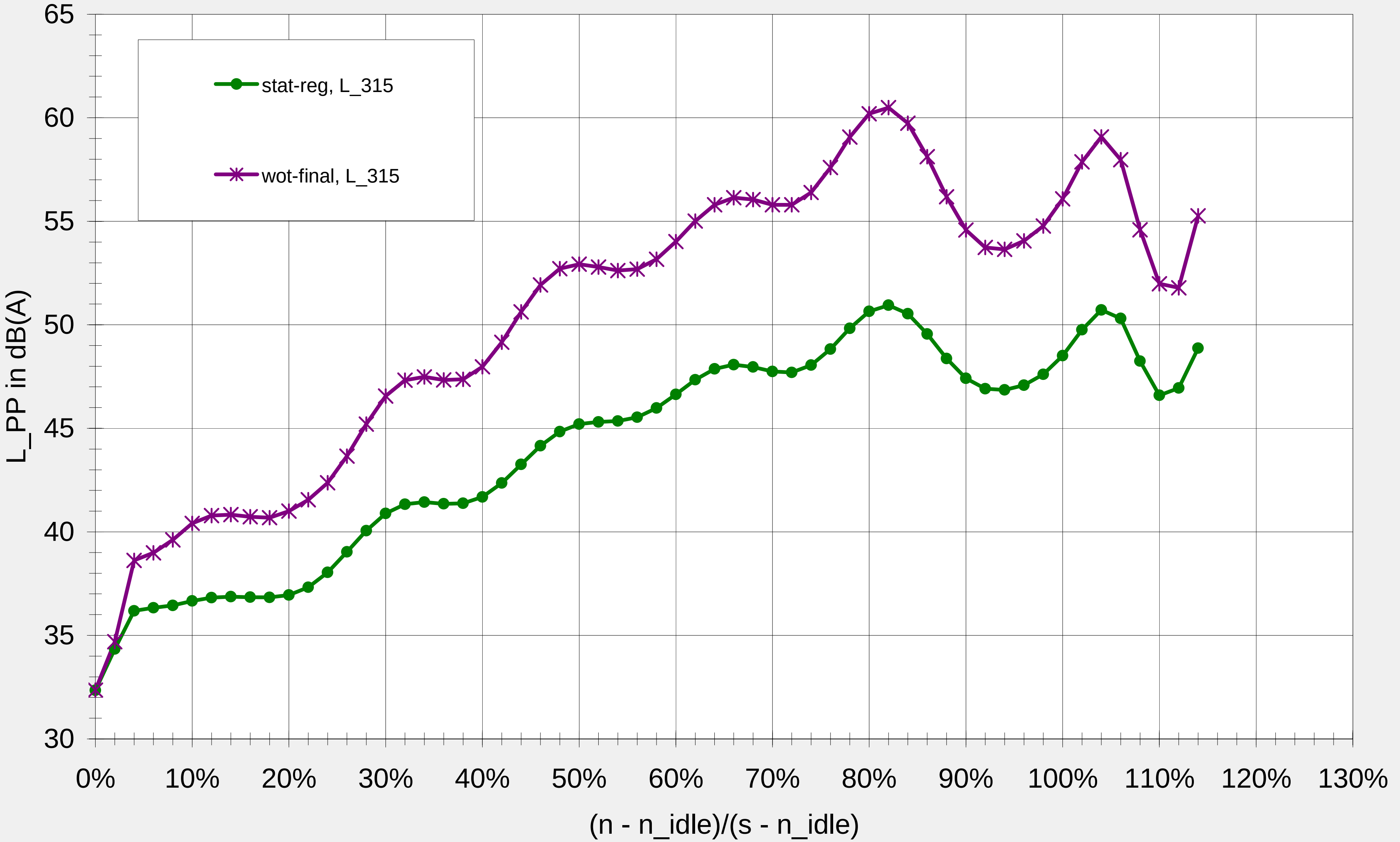
## WP 40, Propulsion noise modelling



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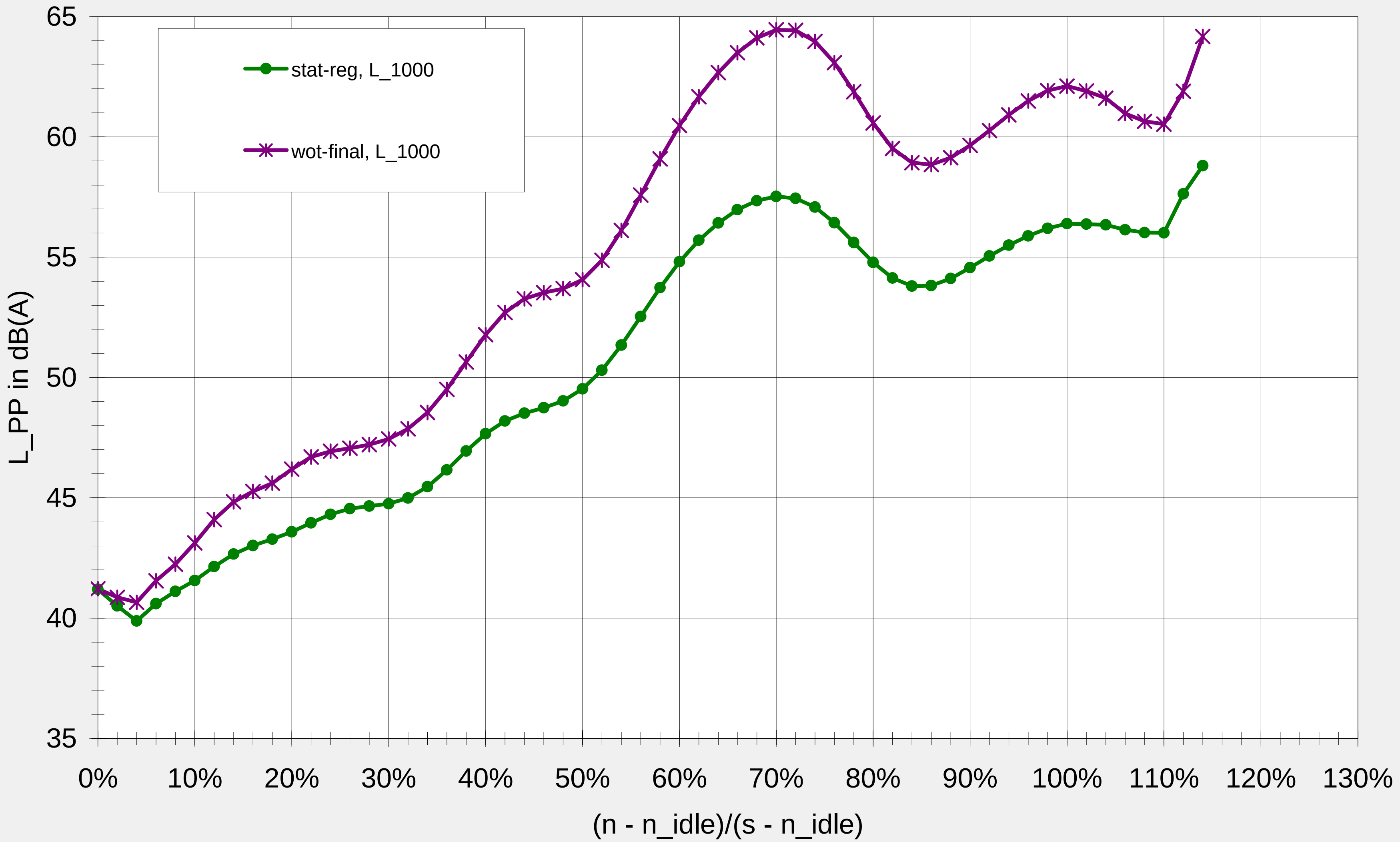

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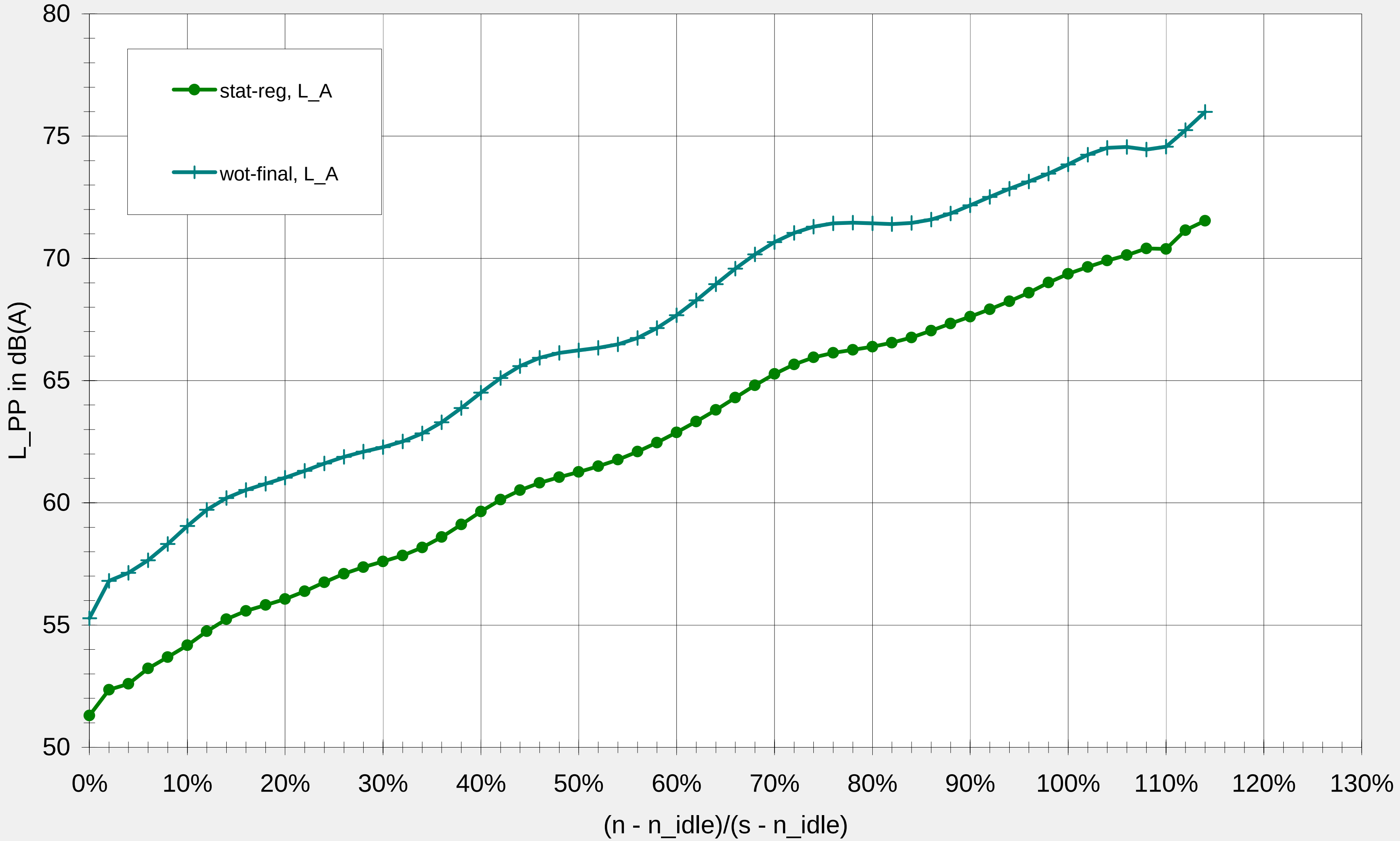

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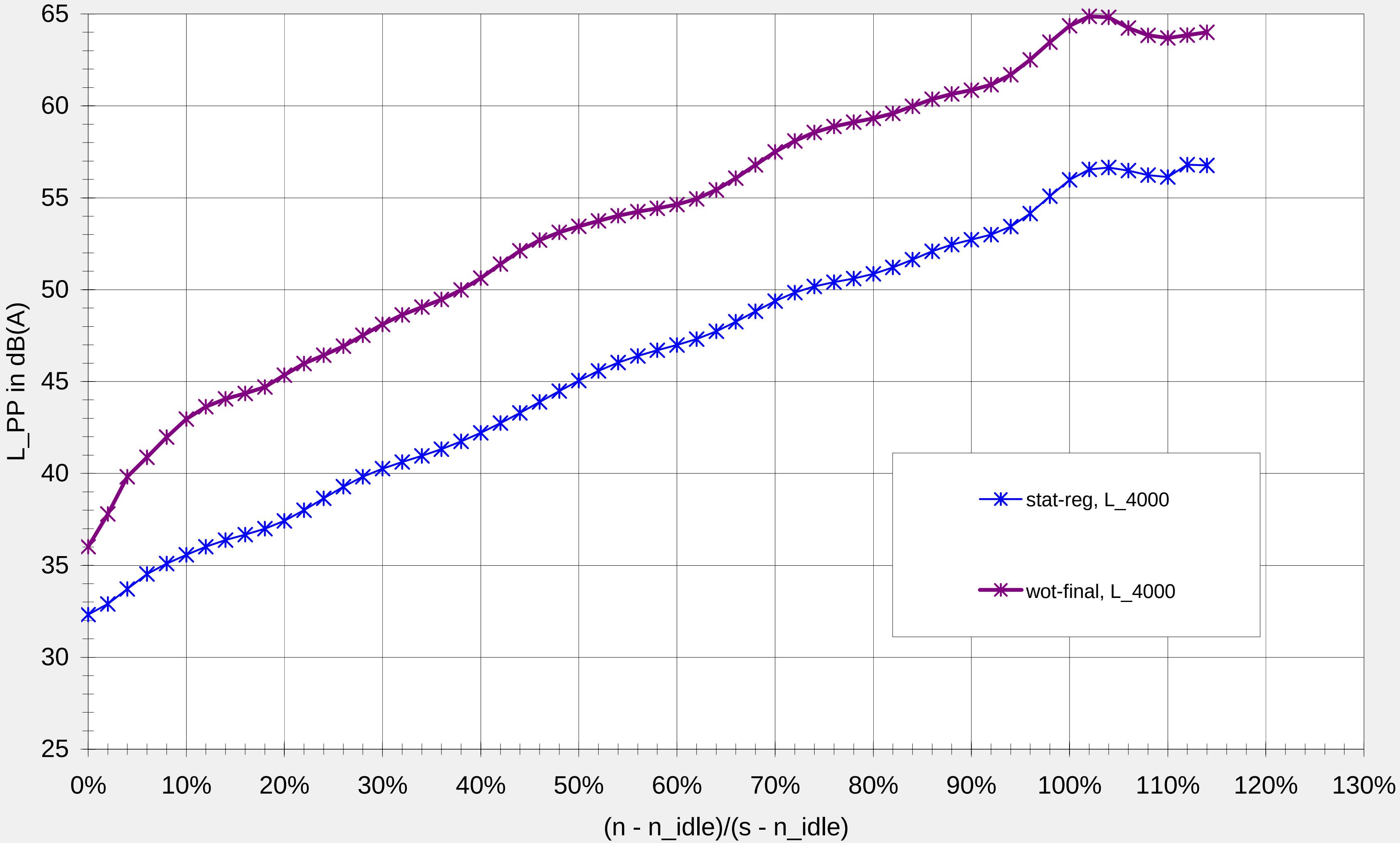

## WP 40, Propulsion noise modelling

| IDFSL | FSL_Name |
|---|---|
| 1 | car petrol <1,4 l |
| 2 | car petrol 1,4-2 l |
| 3 | car petrol >2 l |
| 4 | car petrol >2 l, high perf. |
| 5 | car Diesel <2 l |
| 6 | car Diesel >2 l |
| 8 | light duty vehicle petrol |
| 9 | light duty vehicle Diesel |
| 10 | rigid truck <7,5t |
| 12 | rigid truck 7,5-14t |
| 14 | rigid truck 14-20t |
| 16 | rigid truck 20-28t |
| 18 | trailer truck <= 32t |
| 20 | trailer truck >32t |
| 22 | public transport bus <=20t |
| 23 | public transport bus >20t |
| 24 | motorcycle <= 150 cm³ |
| 25 | motorcycle <= 150 cm³, manip. |
| 26 | motorcycle > 150 cm³ |
| 27 | motorcycle > 150 cm³, manip. |

**Remaining tasks (WP 40):**

- **Finalise analysis of vehicle calibration measurement results.**
- **Finalise derivation of average propulsion noise curves for vehicle classes.**
- **Extend the road surface influence table to 3rd octave bands.**
- **Combine the several modules (traffic simulation, drivetrain model, noise calculation).**
- **Aggregate second by second data to one hour resolution (Leq).**
- **Interface to Harmonoise propagation model.**

# Thank you