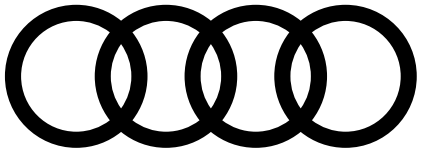


RDE-Testmatrix on an engine testbed with virtual components – model based testing in the engine development

13.10.2020 Jochen Petters, Steffen Clement, Pascal Glaser

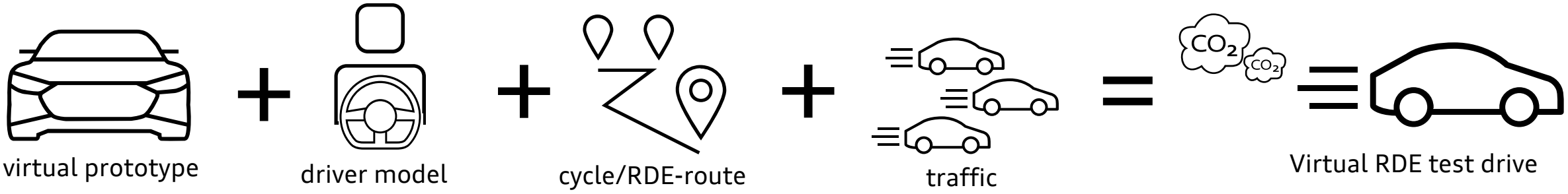
Challenges of RDE-legislation

Vehicle tests on public roads with everyday traffic

- High number of different influences and conditions (driver, traffic, weather, ...)
- Huge effort for vehicle testing
- In case of dataset changes, no repeatability

→ Demand for new RDE-testing methods

Vehicle testing on the engine testbed with virtual components



Testing environment similar to vehicle setup

Coldstart

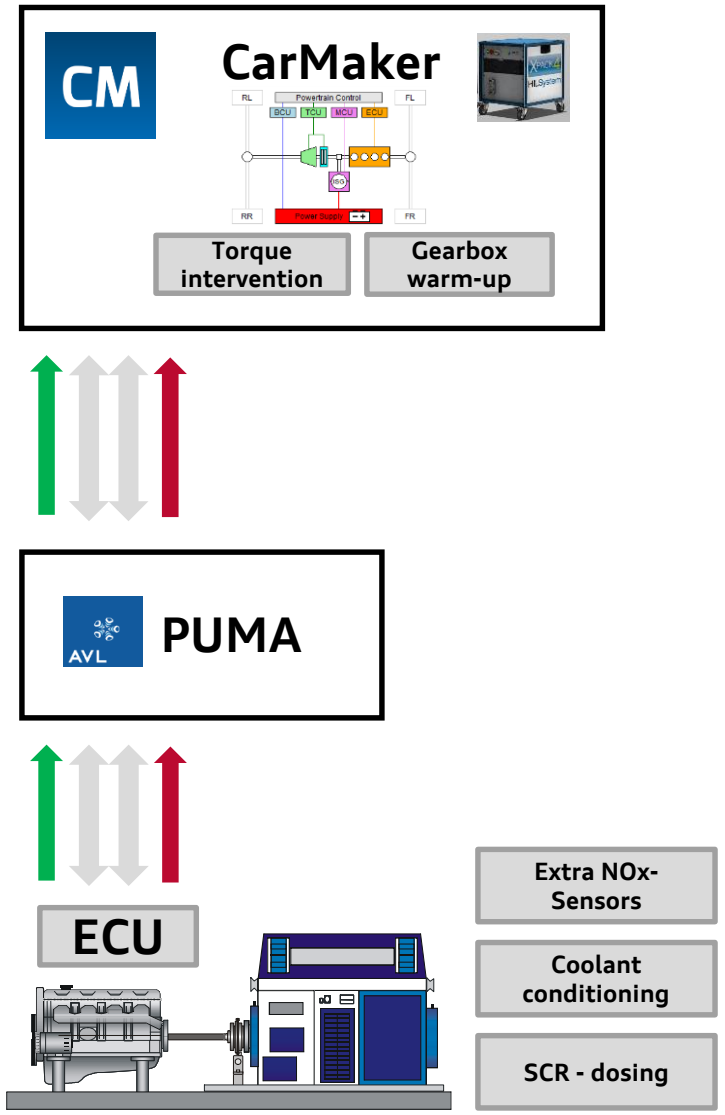
- Oil and coolant conditioning
- Gearbox warm-up model

Testbed automation

- 24/7 ready for use
- Automatic conditioning of exhaust gas system
- ....

Engine ECU dataset

- No special testbed dataset
- Deactivation of non-existing components (eg. airbag, ...)



Source: AVL, IPG

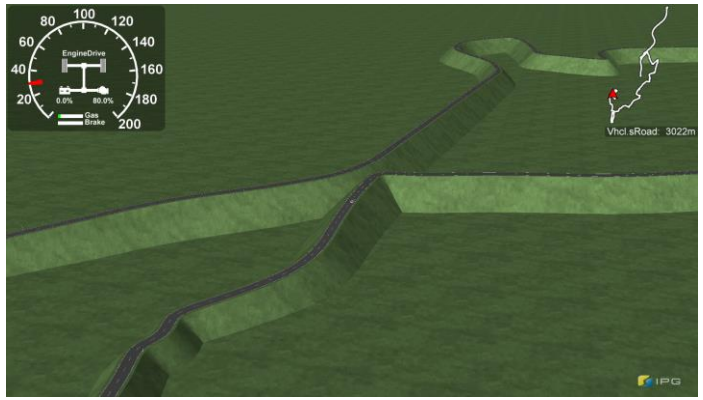
Integration of real road data and traffic

Road

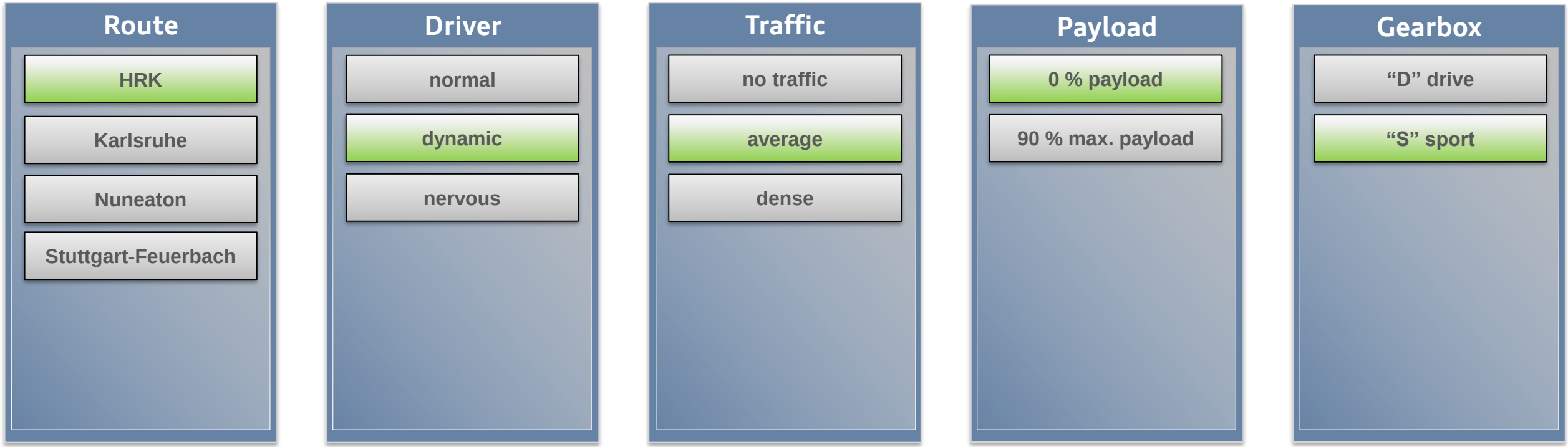
- Current RDE-route (HRK, „Heilbronner-Rundkurs“)
- Export from ADASRP including
  - Traffic lights
  - Speed limits
  - Grades
  - Curves

Traffic

- Traffic simulation using speed limits with RDx Testgenerator

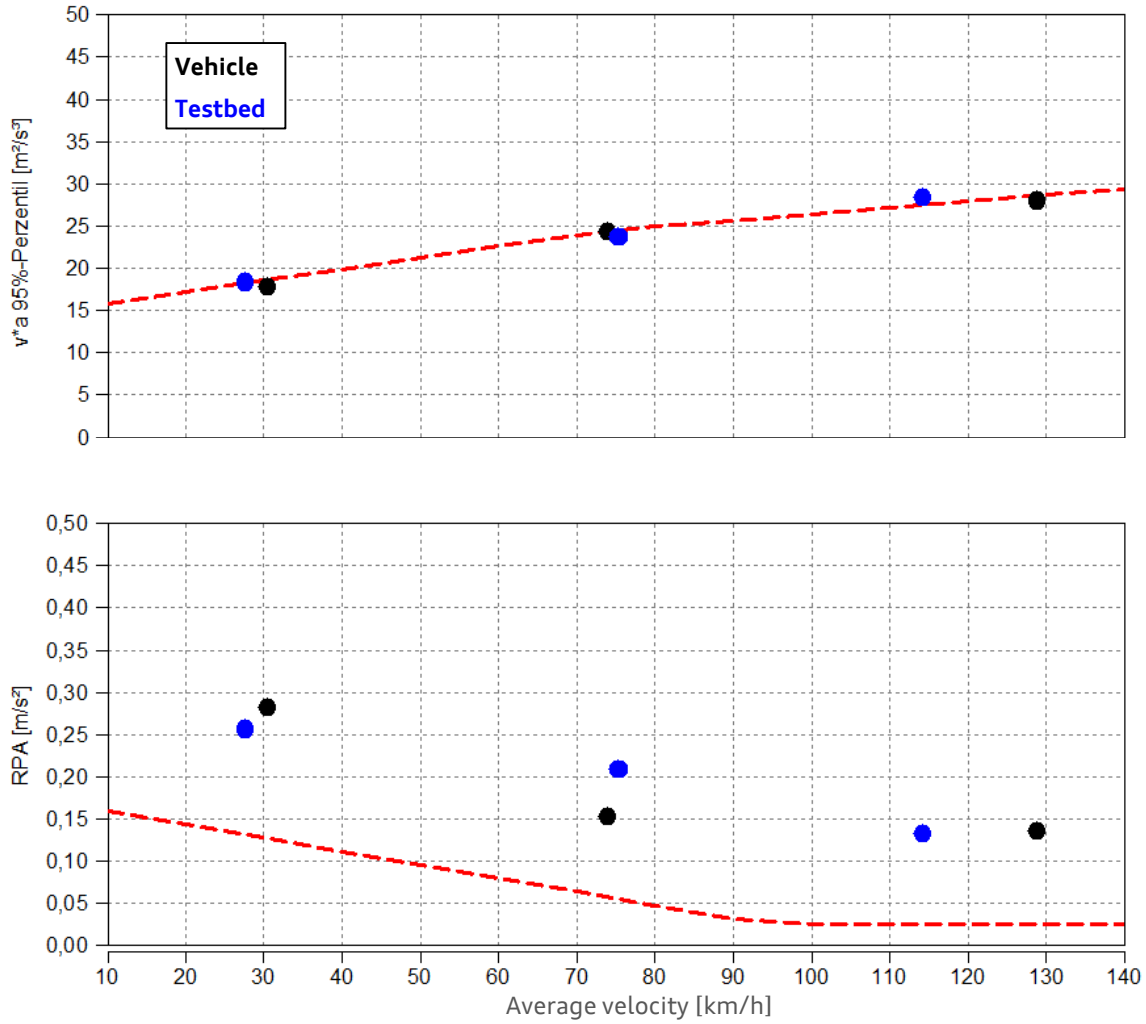


Testmatrix allows many variations of the reference measurement



Good match of v*apos 95% percentile

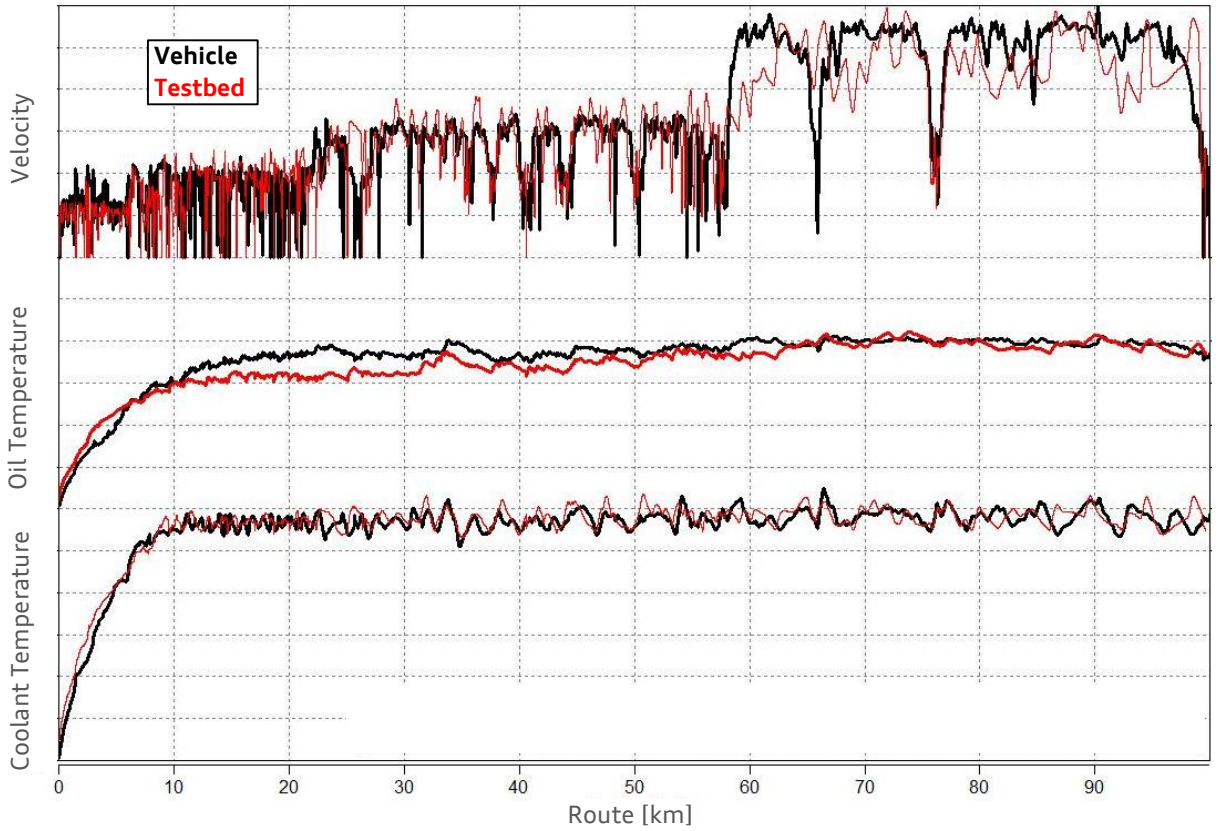
- Testbed v*apos values close to target
- Simulated Autobahn traffic density is too high



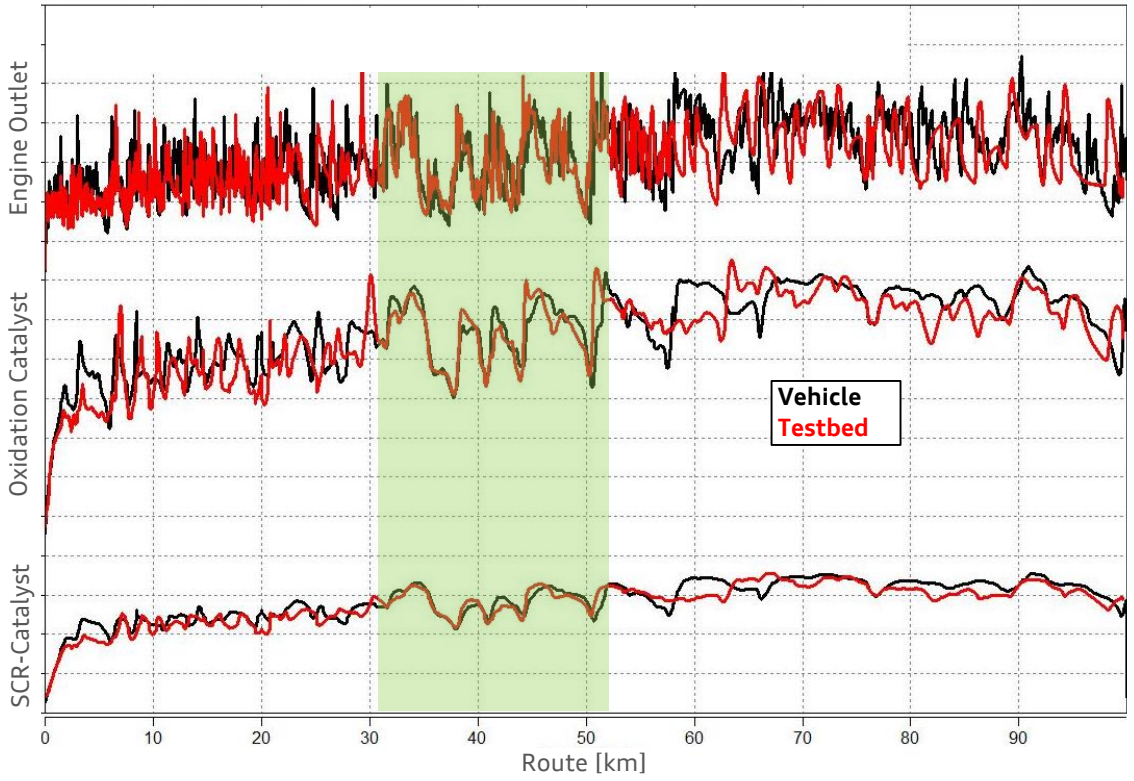
v*apos = product of velocity and positive acceleration
RPA = relative positive acceleration

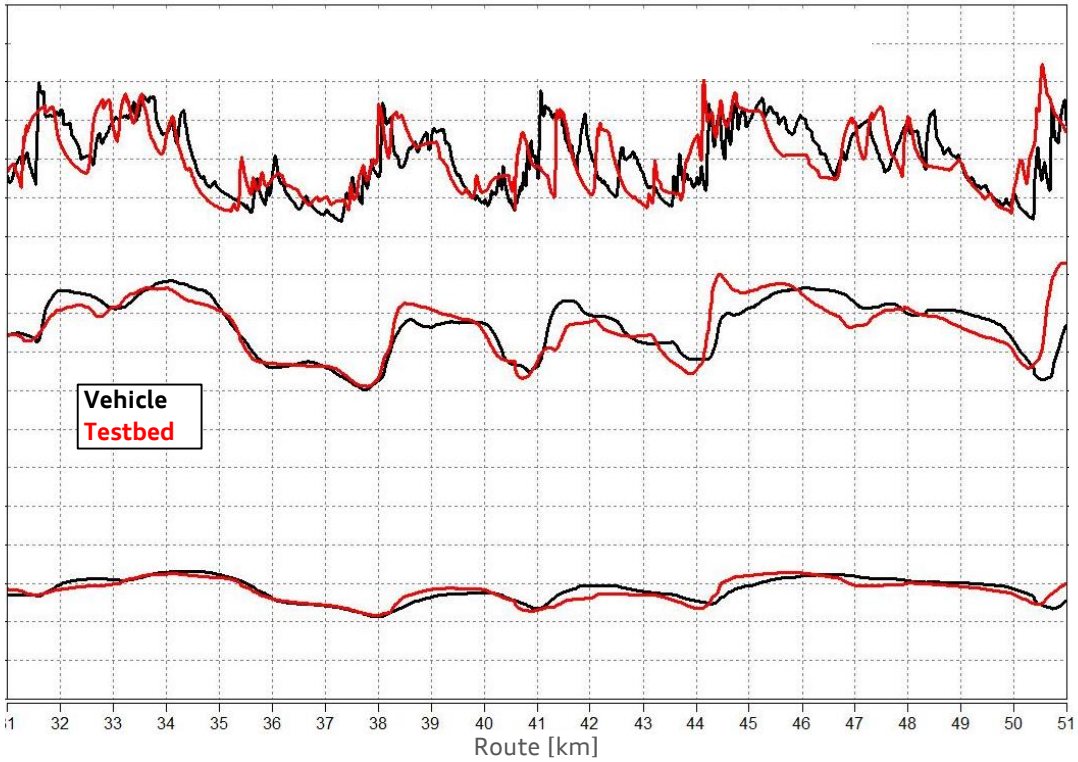
Cold start behaviour similar to vehicle

› Small differences in oil temperature and good match for coolant temperature



Similar exhaust-gas temperatures in vehicle and testbed



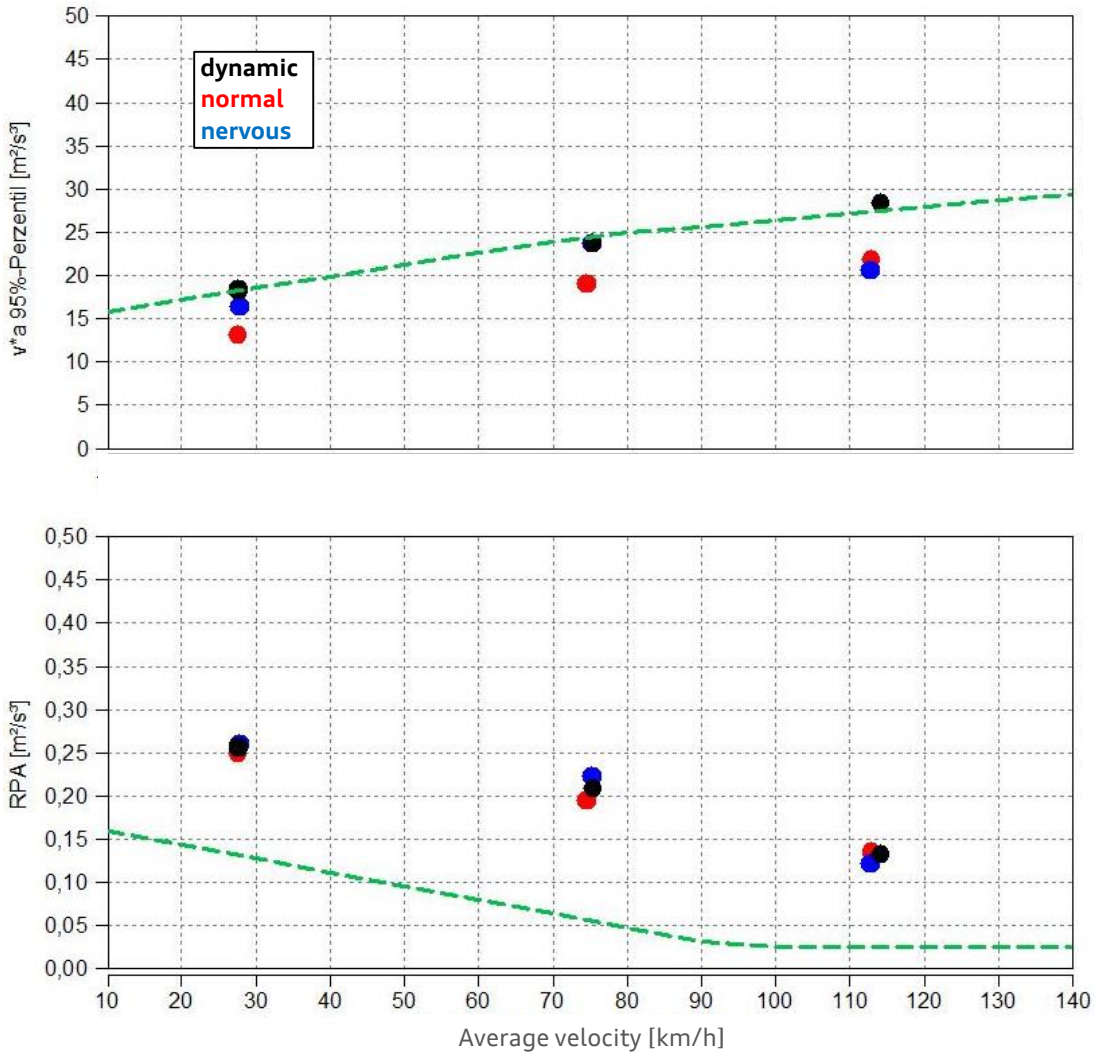


› Very good match to the reference measurement despite differences in environmental temperature

→ Successful transfer of vehicle measurement to testbed

Driver variation shows influence on v*apos values

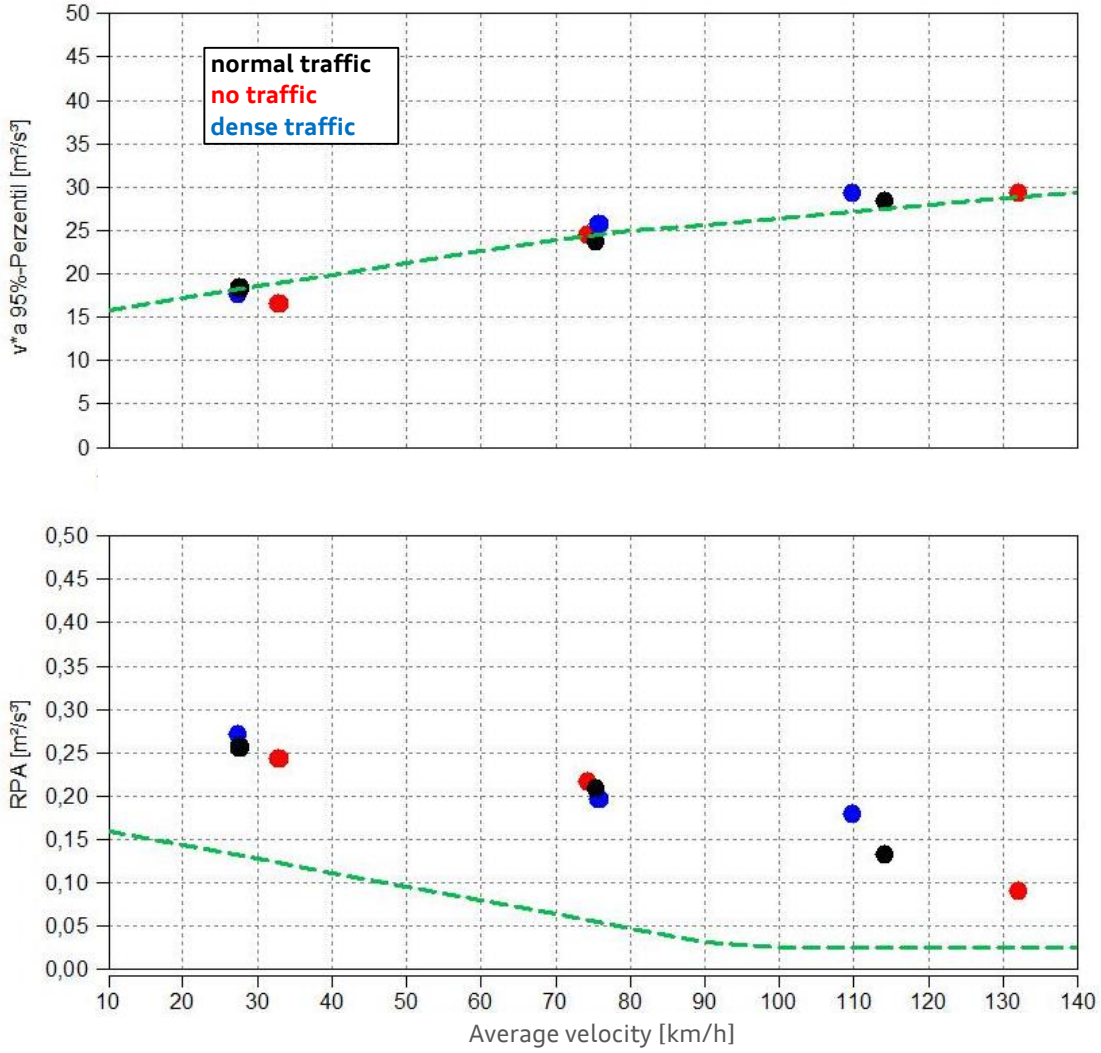
- All parameters have been fixed except of driver
- Acceptable values for normal and nervous driver



Minor impact on v*apos from traffic variation

- Main impact of the traffic density is on the average velocity
- Minor impact on v*apos

→ Driver causes main impact on v*apos



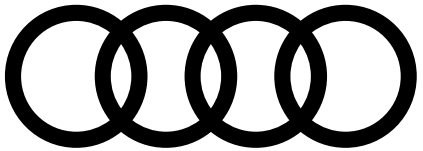
Summary

RDE-matrix on an engine testbed

- Feasability shown in a pilot project
- Good results for the transfer of a reference measurement
- Variation of different parameters works well

Next steps

- Exact replay of a reference measurement
- Coupling with vECU (gearbox control, etc)



Thank You