

## ARAI | VIRTUAL CALIBRATION CENTRE AIMS TO IMPROVE CAPABILITY



The Indian automotive industry is in overdrive mode. OEMs are racing against time to ensure they are in a position to adhere to BS VI emission norms by April 2020. It is important to understand that fulfilling BS VI emission norms require significantly higher calibration efforts as well as prolonged development time given the complex engine and aftertreatment controls. Simultaneously, the industry is also focusing on addressing fuel efficiency, performance, component safety at different operating conditions and competitive total cost of ownership. Pune-based Automotive Research Association of India (ARAI) had recently unveiled its Virtual Calibration Centre to meet these diverse industry requirements. Auto Tech Review spoke to **Rashmi Urdhwarshie, Director, ARAI** to understand this better.

### BUILDING CAPABILITIES

The virtual test bed (VTB) facility at the Virtual Calibration Centre (VCC) has been set-up with ARAI's internal funding, and is an integration of three different areas – simulation, HiL (hardware-in-the-loop) based testing and electronic control unit (ECU) calibration, said Urdhwarshie.

The virtual calibration process is useful throughout the development process, including concept investigation, core calibration tasks (engine-out emissions calibration, after-treatment system calibration, OBD calibrations, vehicular performance and field trials), calibration for not-to-exceed (NTE) emissions, real drive emissions (RDE), in-service conformity (ISC) cycles and also for high altitude and different ambient conditions.

During the virtual calibration process the physical vehicle, engine and aftertreatment systems are replaced by real time predictive models. Real and important actuators are interfaced with the engine and aftertreatment models in the HiL environment. The calibration and testing is performed on the real ECU/ACU.

As soon as the virtual calibration process achieves a certain maturity level, the ECU data set can be directly taken up for fine-tuning on the engine dynamometer, chassis dynamometer or in the field. The ARAI Director said that this significantly reduces real testing requirements.

As far as advanced calibration programmes like BS VI emission-compliance projects are concerned, the centre conducts many activities simultaneously rather than sequentially, and subsequently these are to be integrated together to reduce development time. Such an approach requires higher number of prototypes, more test facilities and other resources. Based on the various activities that require to be conducted, the virtual calibration facility can attain a different degree of calibration maturity, thus eliminating the need for higher number of prototypes and other hardware.

She said that for conducting activities such as OBD calibration, around 70 % of the total calibration task can be completed on the virtual test bed. If the parent rating work is completed, then in case of variant rating, around 40 % of overall calibration can be completed on the virtual test bed, she explained. The concept investigations and pre-calibrations are carried out by leveraging basic models. Further, the calibrations are performed using refined models. The transient trends are properly captured and all important parameters, including emission outputs are within 5 %.

Further, longer occupancies on conventional labs having high-end engine dynamometer as well as chassis dynamometer and subsequently field tests would pose time as well as resource constraints. Urdhwarshie said in order to meet the stringent timelines, virtual calibration has to be extensively leveraged complementing the conventional real testing for reducing development time and cost involved in such complex projects.

### IMPROVED CALIBRATION

Additionally, virtual calibration offers improved calibration quality because of high reproducibility

and good extrapolation capability. The ARAI Director pointed out that the development time further reduces due to the flexibility in set-up preparation and ensures continuous runs without the need of preparation between the tests.

The ARAI Director said that the virtual calibration facility is well equipped to configure various types of engines ranging from single cylinder to eight cylinders with all power capacities. The facility can also configure diesel oxidation catalyst (DOC), NOx after-treatment (SCR, LNT), diesel particulate filter (DPF), gasoline particulate filter (GPF), etc. Diesel and petrol engines with after-treatment solutions are simulated using semi-physical predictive models.

This facility can also be used for other applications required to meet next level emission norms, for example, off-road engines for Trem IV and Trem V compliance. Further, engines using alternate fuels such as CNG, diesel-CNG dual fuel, ethanol, methanol, etc and also electric hybrid vehicles can also be developed here.

### ROUND-UP

The virtual calibration facility is focused on achieving significant reduction in the overall development time for BS VI compliance projects. This facility drastically reduces the total number of prototypes required in a development project and minimises time to market. The virtual calibration also reduces the need for carrying out real testing at costly test facilities, stated Urdhwarshie. Given the different legislative and diverse market requirements globally, the calibration robustness is extensively checked under laboratory as well as different non-standard conditions. Off-cycle emissions are also tuned carefully with extensive trials. All these tests require special test facilities and specific testing locations. Hence, to reduce time and cost, virtual tools are being globally used widely and effectively.

The VCC caters to areas beyond product development and can be also used for production consistency assessment and also reduces fuel consumption and other consumables due to minimised usage of expensive real test facilities. This centre improve calibration quality with reduced efforts and associated costs, she added.

TEXT: Suhril Barua