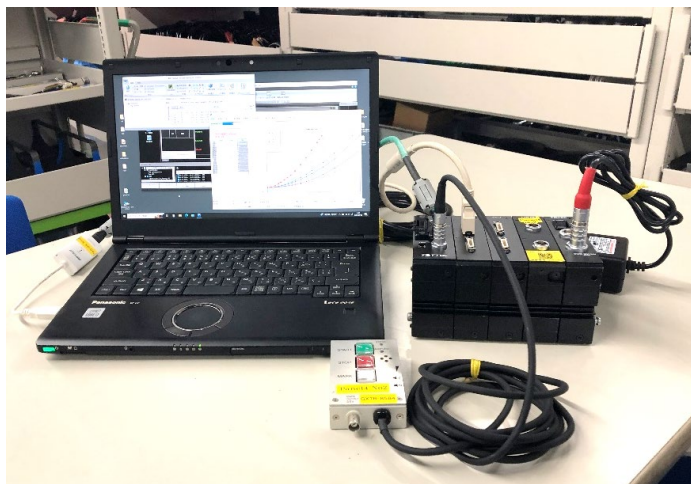


Major efficiency improvements through tool optimization!



Toyota Motor Corporation
Vehicle Development Center BR-GDP
Integrated Vehicle Dynamics Group
Mr. Horiuchi, group manager

◆What type of work do you do?

I work on the development of vehicle dynamics and operability (steering feel), focusing on how Toyota and Lexus vehicles behave and respond to driver steering operations.

Because our hands are extremely sensitive, even subtle differences in steering operability are easily perceived by many people. To control a vehicle precisely as intended, the steering wheel must feel comfortable to operate. One of the key factors influencing these characteristics is the performance of the electric power steering (EPS) system. Our role is to tune the system to meet quantitative performance targets while also refining the subjective qualities that cannot be fully expressed by numerical metrics.

◆Tell us about the challenges you face in your work

In recent years, the automotive industry has often been described as undergoing a once-in-a-century transformation. As market trends and customer expectations evolve both rapidly and dramatically, there is growing pressure to develop higher-performing vehicles in a shorter timeframe and with greater efficiency. However, our traditional development processes could not be considered particularly efficient. We are responsible for both meeting quantitative performance targets and developing subjective performance characteristics, all within tight development schedules. A major challenge was the considerable time required to tune the vehicle to its quantitative target specifications. We would conduct measurements on the proving ground, return to our desks to do analytical work, use different tools for inspections . . . Such tasks became repetitive work that continued until we met our goals. Creating more efficient work processes will open up more time we can allocate to perception performance. Moreover, the less people that are needed to handle these tasks, the more personnel we may produce to focus on new-era technology, such as electric vehicles and automated driving.

What are the requirements for solving issues?

- 1) Tool consolidation: End-to-end operations with a single tool
- 2) Automation: Reducing unnecessary manual work and waiting
- 3) All tasks completed on the vehicle: Reducing time spent on trips back to the office

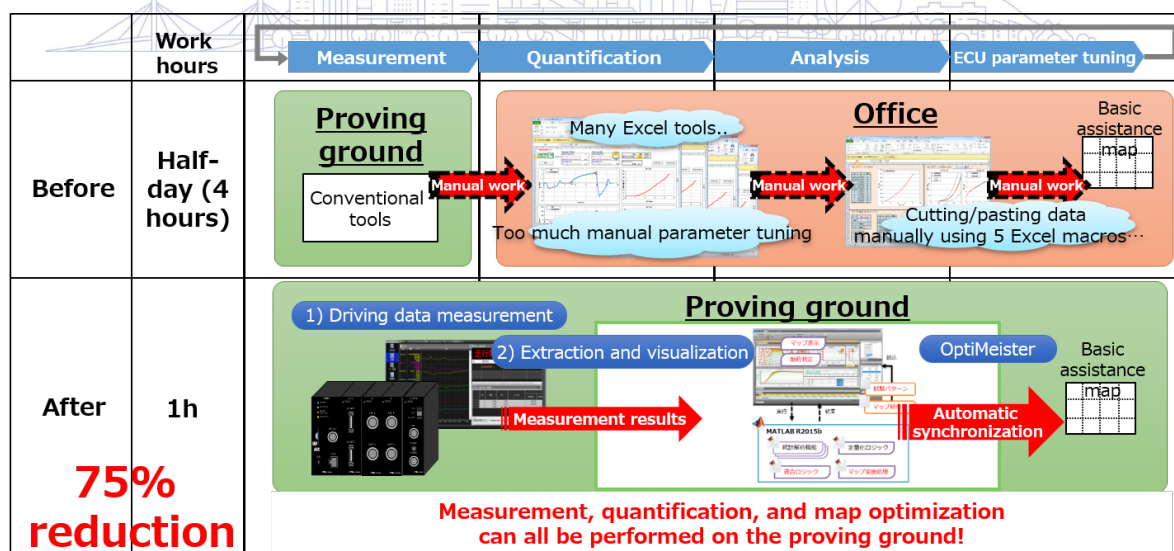


How measurement looks

◆Tell us why you chose TTDC

There are two reasons why we chose to work with TTDC. The first reason is that TTDC's engineers are very skilled with both hardware and software. TTDC develops analysis software for us, but creating these tools also requires an in-depth understanding of measurement hardware, as well as the communication interfaces between the ECU, interface units, and other system components. The second reason is because TTDC has already provided us with excellent work in the past. They created a database capable of sharing design values and test results between design and test engineers and on-site technicians. We recognized their technical expertise and have built mutual trust.

Contributing to steering feel through an analysis tool utilizing the knowledge of vehicle hardware/software!



◆ Could you share a general overview of the tool?

We used TTDC's existing measurement equipment Panel4 as the foundation to create a plugin capable of quantifying measurements, analyzing, and adjusting ECU parameters. The following is the general work flow (in accordance with the numbers in the above image):

- 1) Measure the operational data provided by Panel4.
- 2) The measurement results are automatically extracted by the tool. The results are then visualized, making it easy to identify any discrepancy with the target.
- 3) New constants that compensate for deviations are calculated automatically, eliminating the need for cumbersome manual work by the operator, and the map is optimized automatically.

Thanks to this, tasks can now be completed in the test vehicle on the proving ground.

◆ What were the benefits of adopting it?

Consolidating everything into this single tool has allowed us to complete tasks from measurement to analysis in much less time. The processing speed is also much faster, which has drastically increased efficiency. In recent years, due to an influx in models being developed and annual refinements, the work that needs to be completed within one month has increased dramatically. For example, where 15 projects were usual in the past, it is now normal - even expected - to handle 20 or more. If we hadn't brought this tool into the picture, the amount of time we would be able to spend on subjective performance would be much lower. Now we are able to spend sufficient time on manufacturing and provide our customers products with much more confidence. Consolidating everything into a single tool and making it easier to use allows personnel outside of our team to conduct the same work we do, which has been another benefit of adoption. Automated work has become a major contributing factor of flexible operation on an organizational scale.

◆ Are there any other benefits you would like to share?

Of course, the support we receive is extremely courteous. They are always quick to offer help when we ask for it, even going as far as coming on-site. Their expertise with both hardware and software is felt through this support. The root of problems is always determined accurately, and if there is an issue with hardware, they consult with specialists to propose solutions. They even keep an eye on recent trends around the world, considering what kind of tool refinement will be needed at Toyota and make proposals to accommodate those needs. We hope to continue our collaboration and consider what may come up in the future.

◆ Could you tell us about your plans for the future?

Working with TTDC and other electrical and mechanical design engineers allowed us to develop a more efficient measurement and calibration system (called XCP* calibration). This approach is expected to become the mainstream method, and we would like to continue refining it by providing feedback on its usability in actual product development. We also look forward to TTDC's support in enabling more efficient vehicle development worldwide through the deployment of these tools both domestically and internationally.

※ XCP: universal measurement and calibration protocol



From the left, Mr. Ando (TTDC), Mr. Horiuchi, Mr. Ito (TTDC)