# 5 Things You Should Be Doing with Your Pre-Production Vehicle Data



Industry-leading manufacturers are using these techniques to streamline testing, reduce costs, and improve vehicle quality.

**Save millions by quickly finding and fixing issues**

**Shave months off warranty resolution time**

**Improve vehicle quality by analyzing thousands of signals at 200 Hz**

**Decrease costs associated with recalls and repairs**

Today's vehicles generate more data than ever before. Those with advanced driver-assistance systems (ADAS) and autonomous vehicles can generate a terabyte of data every hour, or more.

Manufacturers understand that this data is extremely valuable because it can help them improve quality and reduce warranty expenses. Smart engineering teams are collecting and analyzing as much data as they can from their test vehicles.

But they don't always extract as much value as they could from that data.

Because Aptiv Connected Services works with more than 70% of the world's leading vehicle manufacturers, we have insight into what manufacturers are doing with data — and what they should be doing. We've seen what kinds of data and analytics are helpful — and which are not. And we can say with confidence that organizations following best practices are seeing significantly better results.

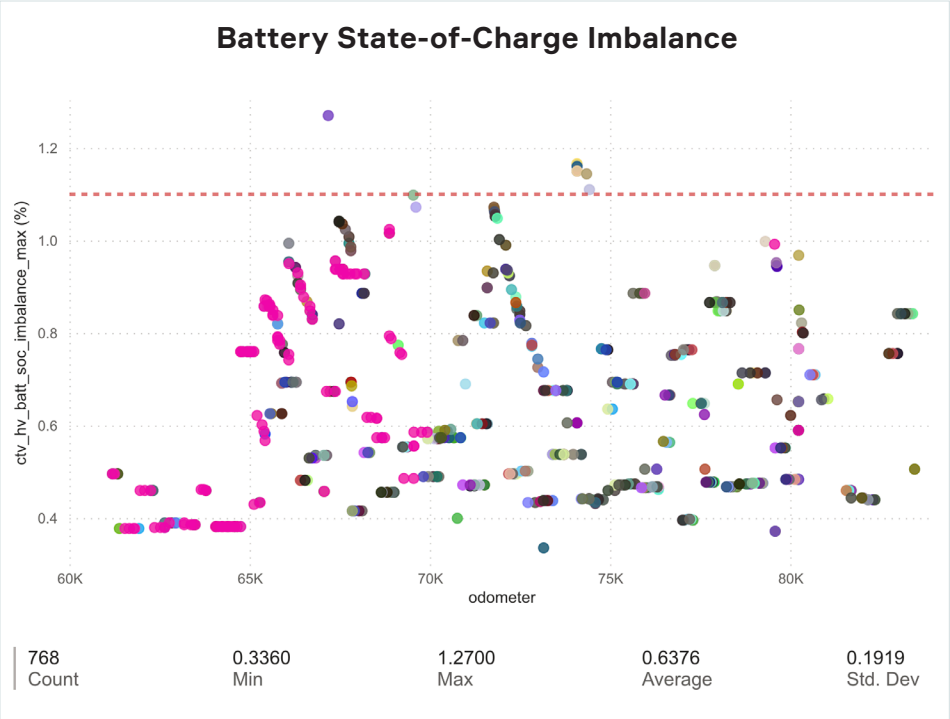
So what are today's best practices? If you aren't doing these five things, you aren't getting as much benefit from your vehicle data as you could be:

## 1. Create visualizations with your DVP&R data

You undoubtedly have established processes for ensuring that you comply with your design verification plan and report (DVP&R). If your organization is like most, you probably rely on a fairly simple system — like a spreadsheet — to ensure that you have met all the requirements.

However, ensuring that you have "checked all the boxes" on the spreadsheet is a time-consuming,

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tedious task. The engineer(s) responsible for the DVP&R usually has to look up and analyze a lot of separate datasets that were collected in many different ways. The data might exist in many different applications, and combing through it all, while necessary, takes quite a bit of time.

Organizations following best practices have started creating visualizations for their subsystem validation reports. This allows engineers to quickly see if they have met a particular functional requirement. For example, if you are validating the high-voltage batteries on an electric vehicle, you want to keep the variation in state of charge among the battery cells as low as possible to maximize performance and battery life. Plotting the state-of-charge imbalance across all your test vehicles with color-coding to identify product lines makes it very easy to identify which products have met the requirements and which have exceeded your thresholds and need further analysis. (See above.)

Teams can become even more efficient by combining multiple subsystem visualizations into a single report that automatically provides the relevant information. The end result is that you get vehicles to market faster while also improving quality.

## 2. Use driver comments to create helpful context

Your test drivers know a lot about what is happening in your vehicles. Unfortunately, most organizations are never able to fully profit from this invaluable data because they don't have a safe, foolproof way to capture important information as it happens.

Making handwritten notes or typing on a laptop during the drive isn't safe. Expecting the driver to remember everything isn't practical. And adding a second person in every vehicle might not be the best use of resources.

Some manufacturers are solving this problem with tools that allow the driver to record audio comments during the drive. Ideally, these comments are time-coded so that they can be synced with the data on the vehicle network and used for troubleshooting.

The most advanced teams are also using voice-to-text technology and analytics in conjunction with these audio recordings. That allows them to see if certain words are appearing repeatedly with certain problems. For example, in the image below, the word cloud allows you to see that the highway assist system (HAS) has been disengaging frequently on sunny days as vehicles go under bridges. This is invaluable information for the team that is fine-tuning the vision system and software.

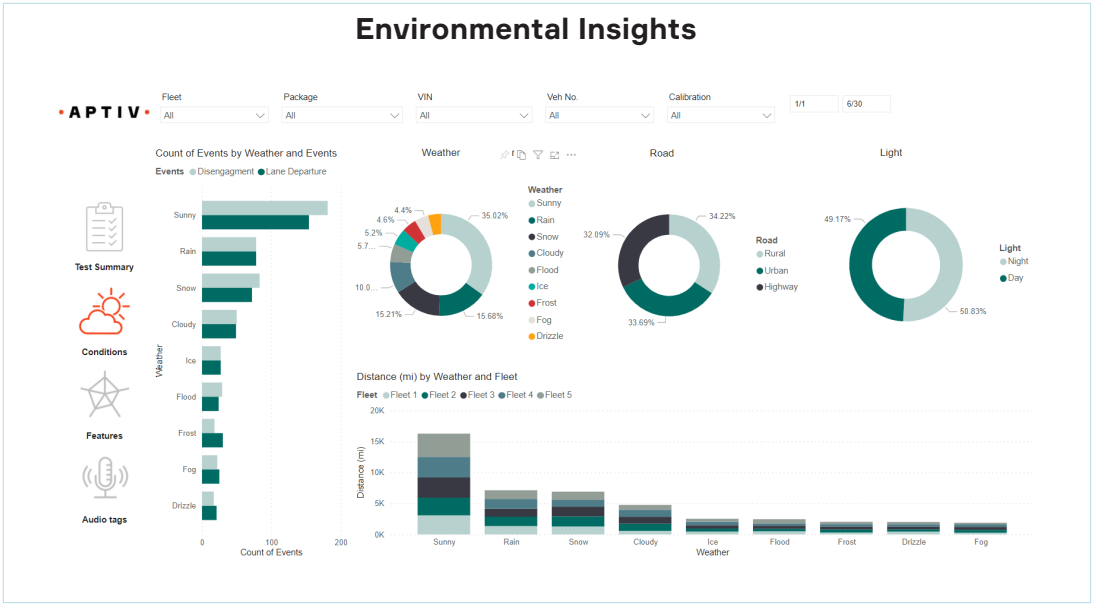
## 3. Incorporate relevant external data

Your test vehicles don't exist in a vacuum. External factors like traffic, weather, and road conditions play a role in how well vehicles perform, especially with ADAS. If you don't know what's happening around your vehicles, you are blind to how these environmental factors might be impacting performance.

For example, by incorporating weather data into a dashboard, you can see how many tests you have run in various weather conditions, as well as if you are experiencing issues in particular situations.



Fortunately, external services make weather, road, and traffic data available. Other relevant external data might include video or audio files (like the driver comments mentioned above) or external GPS data that you can use to test the accuracy of your onboard systems. Aptiv Connect Qualifier offers an Environmental Insights service that makes it easy to incorporate external data with your vehicle data. And gathering this external data happens automatically so that you don't have to rely on manual processes.




## 4. Characterize the mission profile of your drives

Manufacturers need to be certain that their vehicles perform well under a variety of conditions—highway, city, altitude, temperature, etc. That's why your team probably puts together a test coverage plan that details specific duty cycle conditions.

Unfortunately, as you've probably experienced, telling your drivers to follow a particular route doesn't guarantee that the drive will have all the characteristics you need for testing. Sometimes construction turns your highway drive into something more like a parking lot. Sometimes a mountain road is closed, and your driver has to take a detour that doesn't have the same elevation changes. Sometimes the driver hits all the green lights on your urban route, so you don't get as many stops and starts as you would have hoped.

Leading-edge engineering teams are mitigating these potential problems by using machine learning technology to automatically characterize trips. Aptiv's data science teams have built and trained models that can classify trips quantitatively rather than qualitatively. That data then feeds a dashboard in the Qualifier web application that allows the team to see if they have the test coverage specified in the plan.

With a solution like this in place, you don't have to assume that your plan worked as intended or that your drivers accurately categorized their trips. The technology does the work without intervention, reducing the amount of time you need to spend tracking test drives. And it helps you improve quality and reliability ratings by making sure you have adequate test coverage.

## About Aptiv Connect Qualifier

Aptiv Connect Qualifier is a complete, end-to-end vehicle data solution for pre-production validation, fleet management, and root-cause analysis. It includes

- Edge hardware that collects thousands of signals at 200 Hz
- Connect Edge software that processes data in the vehicle to keep data transmission costs low and transmit only the valuable insights to the cloud
- Developer software that allows Aptiv's customer service engineers (CSEs) to remotely configure your hardware to collect exactly the signals you need and change that data collection as necessary for an entire fleet or a single vehicle
- Qualifier web application that allows you to view your vehicle data, perform analytics, run reports, investigate root causes for issues, and set up alerts
- Professional services provided by our team of customer service engineers and data scientists that help ensure you achieve maximum value from your investment

Optional add-ons, such as four-camera video, the Qualifier ADAS Solution, Environmental Insights (road and weather data integration), Video Insights (video recognition), and AC-Dash (Android tablet app for in-vehicle use) extend Qualifier's capabilities.

For more information, visit aptiv.com/connected-services or email sales@aptivcs.com.

## 5. Aggregate your pre-production data

Most manufacturers have test fleets scattered in many different places around the world. The powertrain group may have a test fleet in one country, while the vehicle group has one in another. Maybe you also have a fleet of executives who are testing new vehicles or specialized fleets focused on emerging technology like ADAS or EV. It's not uncommon for a manufacturer to have dozens of different fleets, and sometimes each group uses different tools to capture and analyze vehicle data.

The problem with this setup is that some issues become apparent only when you look at a larger group of vehicles. If a particular problem is only happening on one vehicle in your small fleet, you might think it's just an outlier. But if it's happening on one vehicle in every fleet, then you know you have a more serious issue to resolve.

If you have an organized way to aggregate and analyze all this disparate data, you can catch these problems early — before the vehicles go into production. Ideally, you want a tool that lets you see the trends across all fleets but also to drill down into the details for a particular fleet or a particular VIN. That means all the vehicle data you are collecting needs metadata tags that allow you to filter based on the VIN, calibration, fleet, engine type, body type, etc.

With this kind of solution in place, you'll enable coordination across your teams and make it easier to spot and resolve problems.

## Improve Quality and Reduce Warranty Costs

Following these five best practices can give you greater confidence that when you sell a vehicle, it will perform as intended. That can help improve customer satisfaction and ratings, while helping you get more repeat business. These practices can also help you reduce warranty and recall expenses.

If you want to routinely create high-quality products, you need to establish the right processes throughout your validation and testing teams. By using tools that automate as much of the data collection and analysis as possible, you help establish accuracy and consistency across your entire organization and from one model year to the next. And it also means your team can spend less time on repetitive tasks, helping them become more efficient and productive.

As leading teams have discovered, a robust vehicle data collection and analytics program can have a dramatic impact on your company's bottom line.

### Test Coverage




## About Aptiv

Aptiv is a global technology leader with more than 190,000 people across 127 manufacturing facilities and 12 major technical centers worldwide. With a presence in 46 countries, we address mobility's toughest challenges through our deep software and systems integration expertise, delivering market-relevant solutions for our customers.

Our mission is to make the world safer, greener, and more connected than ever before. As these trends converge and the world of mobility changes, we will lead this change.

Mobility has the power to change the world, and we have the power to change mobility.