Vehicle Recalls, Supplier Quality, and the Cost of What We Don't Know

FROM UNCERTAINTY TO EVIDENCE

Recent recalls raise questions beyond defective components: What did the manufacturer know about the product? What did the supplier know about its process? What did testing demonstrate? And could the organizations connect that evidence to the vehicles ultimately delivered to customers?

This issue examines our analysis of NHTSA recall data and two recent cases: Volkswagen ID.4 high-voltage batteries and Ford F-Series instrument clusters. The common theme is understanding what failed, why it failed, how it escaped, and what evidence supports corrective action.

U.S. vehicle recalls: What the NHTSA data tells us

Our analysis compares two complete six-year periods, 2014–2019 and 2020–2025. Raw recall totals alone can mislead because new-vehicle sales, registered vehicles, and campaign sizes change over time.

Measure	2020–2025 vs. 2014–2019
Annual recall campaigns	+5.5%
Campaigns per million new-vehicle sales	+19.7%
Campaigns per registered vehicle	−1.1% (essentially flat)
Average affected units per campaign	−29.4%

Campaign frequency rose relative to new-vehicle sales but remained approximately flat relative to the registered vehicle population. Campaigns also became smaller on average. These observations do not, by themselves, demonstrate that vehicles are becoming less safe.

A separate NHTSA extract covering January 2020 through September 2026 contains 6,038 unique campaigns and 157,103 vehicle-application records. A vehicle application is a make/model/model-year association, not a count of individual vehicles. Our mechanical, electrical, software and battery groupings are analytical classifications rather than official NHTSA categories.

A safety recall is a legally regulated action to address a safety defect or noncompliance; manufacturers often administer it under an internal campaign number. Not every service or customer-satisfaction campaign is a safety recall.

Volkswagen ID.4: Known hazard, uncertain mechanism

The recent ID.4 high-voltage battery recall covers approximately 22,524 U.S. vehicles, with a larger reported international population. The concern involves cells that may not conform to manufacturing specifications

and could fail, potentially creating a fire risk. An interim charging limit of 80% is a risk-reduction measure while a permanent remedy is developed—not proof that the underlying defect is fixed.

Earlier Volkswagen investigations identified electrode misalignment in a different battery recall. It is an investigative lead, not an established root cause for the newer campaign. The distinction between confirmed evidence and engineering hypothesis is essential.

Battery exploration: From cell variation to thermal propagation

To understand the battery concern, we should distinguish the initiating defect, the cell-level failure mechanism, and the pack-level consequences. A cell can be out of specification without immediately failing; some manufacturing variations may reveal themselves only after aging, repeated cycling, vibration, temperature exposure, or particular states of charge.

Plausible failure pathways to investigate—not confirmed findings

- Electrode alignment and separator integrity: shifted layers, contamination, or separator damage can increase the possibility of localized internal shorts.
- Coating and calendaring variation: uneven electrode loading or pressure can create local current-density and heating differences.
- Metallic particles, burrs, or assembly damage: conductive contamination or mechanical damage can compromise internal isolation.
- Lithium plating and aging: charging conditions and temperature can influence deposition, degradation, and subsequent internal-short risk.
- Thermal propagation: a failing cell can transfer heat to adjacent cells if the module and pack barriers do not sufficiently contain the event.

An 80% charging restriction may reduce exposure to certain electrical or thermal stresses, but it does not establish which physical mechanism is responsible. Nor should an internal short be presented as confirmed until teardown, electrical characterization, process records and reproducible tests support it.

What evidence should the investigation produce?

- Cell-lot and production-line genealogy, including tooling, materials, operators, dates, process deviations and equipment maintenance.
- Destructive teardown, CT imaging where appropriate, electrical and thermal characterization, and comparison with known-good cells.
- Measurement-system analysis and process capability for critical-to-quality cell characteristics; review of PFMEA and Control Plan detection controls.
- Reproduction of the failure across temperature, state of charge, aging and charging profiles, with documented test configurations and limitations.
- Validation of containment and permanent corrective action, including whether the remedy prevents initiation, limits propagation, or both.

The central question is whether product validation and production conformity are connected by evidence. Passing design tests does not prove every subsequent production lot is equivalent to the validated configuration.

From the forthcoming battery white paper: A test pass is not a safety argument

A particle, a folded separator, a weak electrical joint, an inadequate cooling path, or an uncontrolled software change can begin as a local condition and emerge much later as a vehicle-level failure. The problem is rarely contained within one engineering discipline. It crosses cell manufacturing, pack design, battery management, validation, service, and field feedback.

In my forthcoming white paper, Preventing Automotive Battery Failures: An Engineering, Manufacturing, and Validation Framework for Reducing Launch, Field, and Safety Risk, I explore why nominal test results cannot substitute for evidence across the complete battery lifecycle. Requirements must connect to hazards, design and process FMEAs, verification results, production controls, and the actual product configuration. A validated prototype does not establish that every production cell meets the same assumptions.

A central distinction is between measures of performance and measures of effectiveness. Charging time, usable energy, temperature distribution, and diagnostic response time tell us how the system performs. The ability to complete its intended duty reliably, retain useful service over time, and control hazardous fault consequences tells us whether the system is effective for its intended purpose. Counting completed tests, approved PPAP submissions, or closed corrective actions is not the same as demonstrating those outcomes.

Leading indicators—such as process drift, declining thermal margin, or overdue revalidation—may offer an opportunity to intervene before a field event. Lagging indicators, including confirmed escapes and battery-related interruptions, show what has already happened. Neither should be interpreted without configuration, operating conditions, exposure, and measurement uncertainty.

The practical challenge is to build an evidence chain that survives supplier handoffs, engineering changes, production variation, aging, and real-world use. When a battery fails, that chain helps teams determine not just what happened, but where the initiating condition arose, why it escaped, and whether corrective action truly worked.

COMING SOON — The full Value Transformation white paper, Preventing Automotive Battery Failures, will examine engineering margin, battery failure mechanisms, APQP/PPAP, verification and validation, thermal propagation, manufacturing genealogy, and field corrective-action effectiveness. Watch valuetransform.com for the publication announcement.

Ford F-Series: A small defect population, a large recall

Ford is recalling approximately 102,159 trucks for analog instrument clusters whose speedometer or tachometer needles may stick or display incorrect information. The estimated defective population is roughly 1,000 clusters. Reporting associates the issue with manufacturing-process deficiencies at supplier Visteon, although the precise physical mechanism remains incompletely characterized publicly.

The gap between approximately 1,000 suspected defective clusters and more than 102,000 recalled trucks illustrates the cost of uncertain containment. Even detailed part genealogy may not narrow a population if the process failure itself cannot be bounded.

The investigation should connect tooling history, dimensional characteristics, measurement capability, end-of-line test coverage, supplier process changes, cluster serial numbers and installed VINs. Knowing an approximate defect rate is not the same as identifying which units are affected.

Two recalls, four questions

Question	Volkswagen battery	Ford cluster
Failure mode	Battery failure / fire risk	Incorrect analog indication
Physical mechanism	Not yet established for this recall	Not fully characterized publicly
Process source	Suspected cell nonconformity	Supplier manufacturing deficiencies
Escape / containment	Cell controls, test coverage, genealogy	Inspection, process history, part-to-VIN traceability

A disciplined investigation separates (1) the customer-facing failure mode, (2) the physical root cause, (3) the process root cause, and (4) the escape cause. Neither an identified hazard nor a recall announcement proves that all four questions have been answered.

What manufacturers and suppliers should do differently

- Treat product quality as a hypothesis to challenge, not a conclusion to confirm.
- Connect requirements, risk analyses, design revisions, process changes, tests, defects, corrective actions and field evidence.
- Use APQP, DFMEA, PFMEA, Control Plans, MSA and SPC as living evidence systems rather than compliance paperwork.
- Distinguish measures of performance (tests completed, inspections conducted) from measures of effectiveness (demonstrated safety and reliability).
- Verify corrective-action effectiveness and preserve uncertainty, dissenting evidence and residual risk in release decisions.

Testing, transparency and organizational learning

These examples connect to my upcoming conversation with Rachel at Automotive Testing Expo USA about testing, transparency, hypotheses and decision-making. Technically capable organizations can struggle when evidence is incomplete, disconnected, misunderstood or unavailable to the people who must act.

Transparency does not require knowing every answer. It requires communicating accurately what is known, what remains uncertain and what evidence is needed next.

Testing should not be a ceremony for demonstrating that we were right. It should be a disciplined effort to discover where our assumptions may be wrong.

Closing thought

The Volkswagen and Ford events involve different technologies and potential mechanisms, but both demonstrate that product quality cannot be separated from manufacturing capability, verification evidence, supplier management and configuration traceability. The question is not simply whether a product passed its tests. It is whether the organization can understand the risk, identify the affected population and demonstrate that the corrective action works.

Design. Build. Learn. Improve.

Jon M. Quigley, PMP, CTFL | Founder, Value Transformation LLC

valuetransform.com | testingexpo-usa.com

Sources and interpretation notes

NHTSA recall trend analysis: Value Transformation, US_Recall_Trend_Analysis_2014-2025.xlsx; NHTSA ODI recall flat file; FRED ALTSALES; FHWA MV-1 registration data. 2026 campaign summary: US_Vehicle_Recalls_2020-2026.xlsx, data through September 30, 2026.

Case references: NHTSA campaigns 26V630000 (Volkswagen ID.4) and 26V653000 (Ford F-Series); public recall reporting discussed October 2026. Technical battery pathways are investigative hypotheses, not confirmed causes. Recall scope and remedies may change as investigations progress.

Better decisions depend on better evidence. Build the capacity to learn, preserve what you discover, and verify what you deliver.

Books, Training, and Consulting for Real-World Results

Selected books and reference works supporting product development, project management, embedded systems, configuration management, quality, risk, and automotive engineering.



About Value Transformation LLC

Value Transformation LLC helps organizations improve how they conceive, develop, test, launch, manufacture, and support products. We connect product and project management, systems engineering, supplier coordination, configuration management, quality, and testing so strategy becomes evidence-based execution.

From Concept to Production

Practical experience for complex products, regulated environments, multiple suppliers, and real-world delivery constraints.

Value Transformation LLC

Lexington, NC
336.963.0119
www.valuetransform.com

In This Issue

- Strategic Planning
- Risk
- Document, Document, Document
- TIEMPO

PRODUCT | PROJECT | QUALITY | TESTING | MANUFACTURING