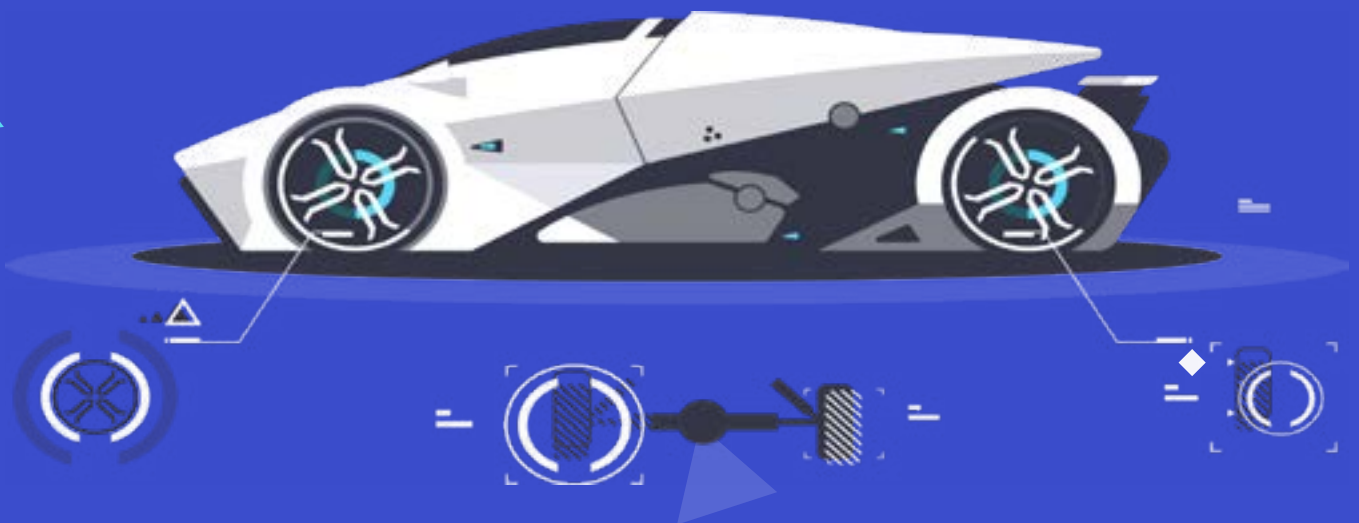# PERFORCE

2019 State of Automotive Software Development Survey Results

2019 State of Automotive Software Development

Introduction

Welcome to the 2019 State of Automotive Software Development.

We're excited to bring you the results of the 2019 State of Automotive Software Development Survey.

This year, we surveyed over 400 professionals working in the automotive industry. They shared their top concerns in automotive software development today. And they shed some light on the impact of new trends (connected/autonomous vehicle development) and longstanding requirements (ISO 26262 compliance).

We hope this information will help your development team innovate faster and improve quality — while maintaining compliance.

Thank you to everyone who participated in the survey!

Tim Russell
Chief Product Officer, Perforce

SURVEY HIGHLIGHTS

Safety Is Paramount.

Connected/Autonomous Vehicle Development Is Important (But Not Everyone Is Focused On It).

ISO 26262 Is a Requirement For Most — But Fulfilling Safety Requirements Is a Challenge.

MISRA© Is Still the Top Coding Standard.

A Majority of Teams Are Leveraging Model-Driven Development and Agile.

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2019 State of Automotive Software Development

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What Is Keeping Automotive Software Developers Up at Night?

Software Drives Automotive Development Today

And teams building that software have plenty to worry about.

Here are the top concerns from the software development professionals we surveyed:

IN YOUR OWN WORDS
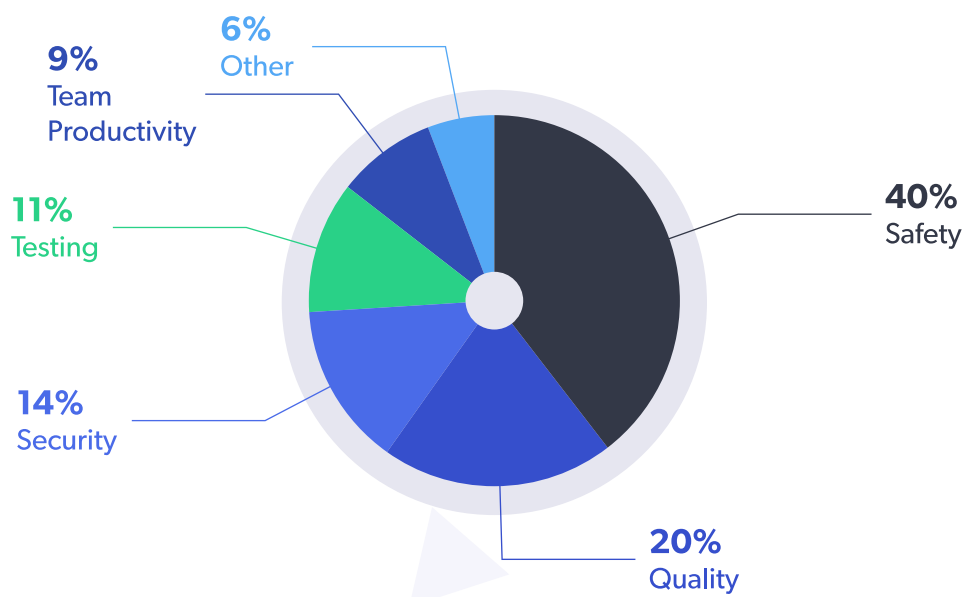
"All of the above."

"Complexity management / full car integration (software-driven devices from 30+ different vendors in one car)."

"Constantly changing requirements from OEM."

WHAT IS YOUR BIGGEST CONCERN IN AUTOMOTIVE SOFTWARE AND TECHNOLOGY DEVELOPMENT TODAY?

6% Other

9% Team Productivity

11% Testing

14% Security

40% Safety

20% Quality

#1 Concern: Safety

40% of those we surveyed cite safety as their top concern in automotive software development. This does not come as a surprise, as safety concerns in automotive software dominate the media. For example, in June 2019, Ford recalled 123,000 F-150 vehicles (from 2013) after a botched software update.

Of those who cited safety as their top concern, 49% focused on how difficult and time-consuming it is to fulfill every ISO 26262 requirement.

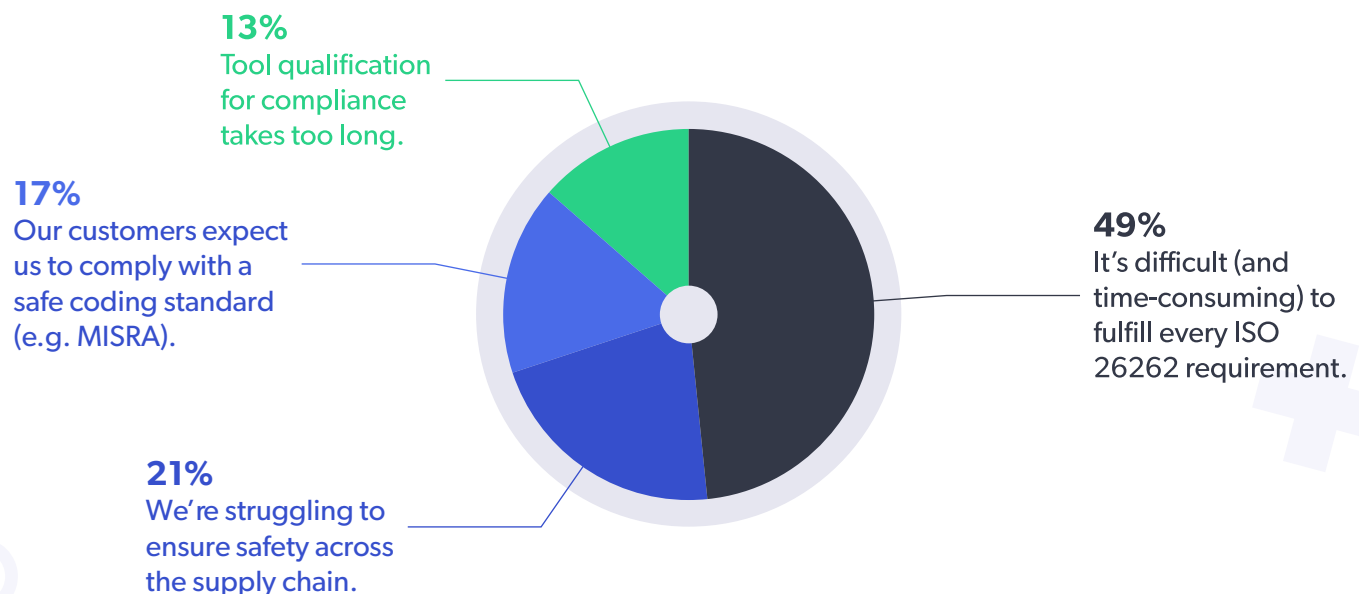ISO 26262 is a complex functional safety standard. And complying with it can be time-consuming. In fact, verifying and validating software was the most time-consuming task for 29% of those surveyed. And documenting work was second (at 20%). Both of these activities are key for ensuring safety and proving compliance.

Using the right tools in software development can help accelerate the ISO 26262 compliance process.

RESOURCE

How to Accelerate ISO 26262 Compliance

WHICH BEST DESCRIBES YOUR SAFETY CONCERNS?

13%
Tool qualification for compliance takes too long.

17%
Our customers expect us to comply with a safe coding standard (e.g. MISRA).

21%
We're struggling to ensure safety across the supply chain.

49%
It's difficult (and time-consuming) to fulfill every ISO 26262 requirement.

#2 Concern: Quality

Quality is the top concern for 20% of those we surveyed. Customers expect high quality — and maximum functionality and connectivity in cars. This puts development teams under pressure to deliver cutting edge technology in shorter development cycles.

42% of participants concerned with quality responded that their testing efforts are not exhaustive. And it is difficult to enforce coding best practices (35%). This can compromise quality.
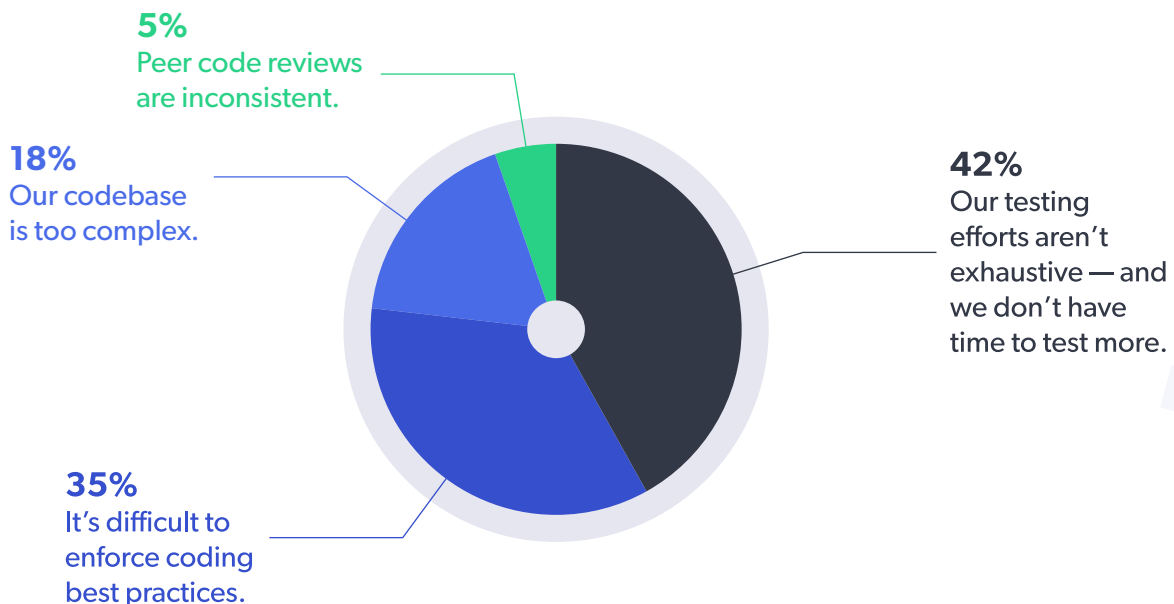
Quality should start in the code — and be emphasized early in development. Development tools, such as static code analysis and version control, can improve code quality.

A few team members expressed concern with ensuring quality in a complex codebase (18%) — likely filled with legacy code or open source code. And a handful mentioned struggles with peer code reviews (5%).

RESOURCE

How to Solve Quality Challenges

WHICH BEST DESCRIBES YOUR QUALITY CONCERNS?

5%
Peer code reviews are inconsistent.

18%
Our codebase is too complex.

42%
Our testing efforts aren't exhaustive — and we don't have time to test more.

35%
It's difficult to enforce coding best practices.

#3 Concern: Security

Security is the biggest concern for 14% of those surveyed. And there are plenty of good reasons for teams to be worried about security today.

The biggest security concern by far is hackers (cited by 55% of those concerned with security). As more software comes onboard a vehicle, there is a greater risk that hackers could infiltrate onboard/offboard systems. In fact, cyberattacks have grown rapidly in recent years. There were 6x as many cyberattacks on vehicles in 2018 as 2014.
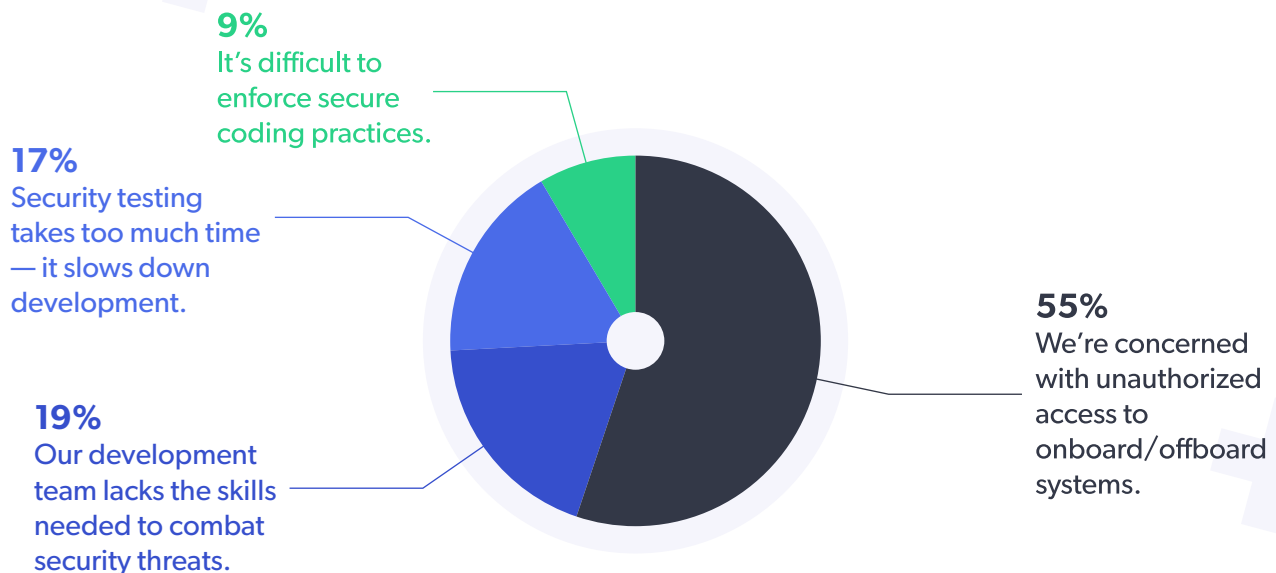
Other teams expressed concerns with education for developers (19%) and the time it takes to do thorough security testing (17%). Some noted the difficulty to enforce secure coding practices (9%).

Using the right tools ensures secure coding practices — and keeps software safe from security risks.

RESOURCE

Intro to Secure Coding Standards

WHICH BEST DESCRIBES YOUR SECURITY CONCERNS?

9%
It's difficult to enforce secure coding practices.

17%
Security testing takes too much time — it slows down development.

19%
Our development team lacks the skills needed to combat security threats.

55%
We're concerned with unauthorized access to onboard/offboard systems.

#4 Concern: Testing

11% of those surveyed are most concerned about testing — and specifically testing efficiently (the top cause of concern for 48% of those concerned about testing).

The testing process is time-consuming. It often does not happen early enough in development, so bugs are found too late (21%). It is difficult to coordinate efforts across teams (17%) — and document those efforts for compliance (14%).

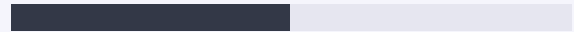Using the right tools — such as test case management — can help you better manage your testing process.

RESOURCE

How to Test Efficiently With the Right Tools

WHICH BEST DESCRIBES YOUR TESTING CONCERNS?

48%
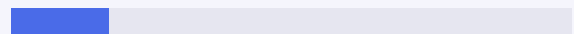We're struggling to test efficiently — testing and software validation are time-consuming.

21%
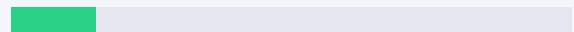We're not testing early enough in development, so we find bugs too late.

17%
Coordinating testing efforts is difficult across global teams.

14%
It's difficult to document our automated and manual testing efforts for compliance.

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#5 Concern:
Team Productivity

9% of those surveyed are most concerned about team productivity. Their top concern is for hardware and software teams who need to share assets. Ensuring that these teams can reuse IP is a challenge (44% of those concerned with team productivity).

Using the right version control tool can help you improve productivity across teams. You can use it to manage and share digital assets across teams — while securing IP.

RESOURCE

How Version Control Helps
Manage Assets and IP

WHICH BEST DESCRIBES YOUR TEAM PRODUCTIVITY CONCERNS?

44%
We need to manage design and IP assets across hardware and software teams — and facilitate reuse.

28%
QA cycles are long, so we're often waiting for testing to be complete.

22%
It's difficult to keep code reviews on schedule, and we're often left waiting.

6%
Our team needs to copy files from one site to another.

How Much Are Developers Really Affected by Connected/Autonomous Vehicles (and AI)?

Connectivity Is Key

Those we surveyed say their product design is most impacted by connected vehicles. Connectivity is expected today, and it's a big driver of a vehicle's overall value. And that need for connectivity is impacting how both software and hardware are designed.

Of those surveyed:

- 44% are working on some connected components.
- 30% are working extensively on connected components.

Surprisingly, 26% responded that they are not working on connected components. Some might be working on systems less impacted by connectivity, such as drivetrain systems. For others, this likely to change in the next 5–10 years. By 2025, it is expected that there will be 470 million connected cars on the road.

TO WHAT DEGREE HAVE CONNECTED VEHICLES IMPACTED YOUR PRODUCT DESIGN?

44%
Somewhat — we're working on some connectivity components.

30%
Extensively — connected vehicles are driving our design.

26%
Not at all — we're not working on connected vehicles today.

Autonomous Vehicles Are Coming

Autonomous vehicles are coming. But the fully autonomous vehicle is not here yet. Not every development team is focusing on autonomous components.

Many of those who responded to the survey are working on autonomous components.

- 48% are working on some autonomous components.
- 22% are focused on designing a fully autonomous vehicle.

That leaves 30% who are not working on autonomous components today. This is also likely to change as autonomous vehicles become more mainstream.

TO WHAT DEGREE HAVE AUTONOMOUS VEHICLES IMPACTED YOUR PRODUCT DESIGN?

48%
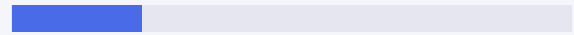Somewhat — we're working on some autonomous components.

30%
Not at all — we're not working on autonomous vehicles today.

22%
Extensively — we're focused on designing a fully autonomous vehicle.

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AI and Machine Learning Deliver Advantages

AI and machine learning deliver advantages to development teams. Leveraging AI and machine learning has the potential to transform the industry.

Most of those we surveyed said AI and machine learning are impacting product design:

- 43% are using AI and/or machine learning for some development.
- 17% are using AI and/or machine learning extensively to drive innovation in development.

40%, however, are not using AI or machine learning today. There is opportunity for these teams to leverage AI and machine learning in their development processes.

RESOURCE

The Role of AI in the Automotive Industry

TO WHAT DEGREE HAVE AI AND/OR MACHINE LEARNING IMPACTED YOUR PRODUCT DESIGN?

43%
Somewhat — we're using AI and/or machine learning for some development.

40%
Not at all — we're not using AI and/or machine learning today.

17%
Extensively — we're using AI and/or machine learning to drive innovation.

Concerns About Connected/Autonomous Vehicles

The development professionals we surveyed have some concerns about connected and autonomous vehicles.

The top concern for the software development professionals we surveyed is safety (44%). This is followed by 22% who are concerned about security and avoiding cyberattacks and 18% who are worried about delivering innovative software on time. Only 12% named keeping development costs under control as a top concern.

IN YOUR OWN WORDS

"Safety — actually being safe, never mind the regulations!"

"Public perception/meeting consumer expectations."

"Poor validation due to immature models and nondeterministic behavior."

WHAT IS YOUR BIGGEST DEVELOPMENT CONCERN WITH CONNECTED/ AUTONOMOUS VEHICLES?

43%
Safety — complying with regulations.

22%
Security — avoiding cyberattacks.

18%
Time-to-market — delivering innovating software on time.

12%
Development costs — keeping them under control.

5%
Other.

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Why Compliance Is Still King

The Automotive Industry is Highly Regulated

Complying with those regulations is paramount for many reasons, including maintaining a strong reputation among consumers and avoiding a costly recall.

Common automotive standards include both functional safety and coding standards.

ISO 26262 Remains Important

ISO 26262 has been a key functional safety standard for the automotive industry for nearly a decade. A majority of those we surveyed — 69% — are required to comply with ISO 26262.

For those who need to comply with ISO 26262:

- 52% need to comply due to a customer requirement.
- 27% need to comply due to a market requirement.
- 18% have an internal requirement.

ARE YOU REQUIRED TO COMPLY WITH ISO 26262?

69% Yes.

31% No.
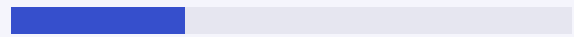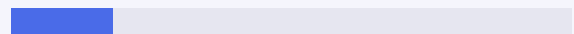
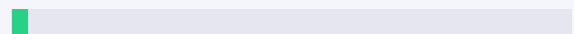### WHY DO YOU NEED TO COMPLY WITH ISO 26262?

52% Customer requirement.

27% Market requirement.

18% Internal requirement.

3% Other.

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What They Struggle to Prove

Proving compliance with ISO 26262 and other automotive standards can be a challenge.

Most of those surveyed (53%) struggle to fulfill safety requirements — and prove that those requirements have been fulfilled.

Others struggle with analyzing risk (17%). And, some struggle with documenting versions of files and assets (12%), enforcing coding standards (11%), and showing design history (4%).

WHAT IS YOUR BIGGEST CHALLENGE IN PROVING COMPLIANCE?

53%
Fulfilling safety requirements
(and proving it).

16%
Analyzing risk.

12%
Documenting versions
of files and assets.

11%
Enforcing coding standards.

4%
Showing design history.

4%
Other.

Most Use Coding Standards

72% of those surveyed are using a coding standard. The use of a coding standard is important for ensuring safe, secure, and reliable code. It is highly recommended and, for some software developers, a customer requirement.

Which Coding Standards Do They Use?

Many teams are using multiple coding standards. Most of those surveyed (53%) use MISRA© — closely followed by 45% who use AUTOSAR. The upcoming merger of MISRA C++© and AUTOSAR coding guidelines will be important for these teams.

Some of those surveyed use the following standards:

- 29% use C++ Core Guidelines.
- 15% use Embedded C (Barr Group).
- 9% use CERT.
- 7% use High Integrity C++.
- 5% use Google C++ Style Guide.

A few of those we surveyed stated that they do not know which coding standard they use.
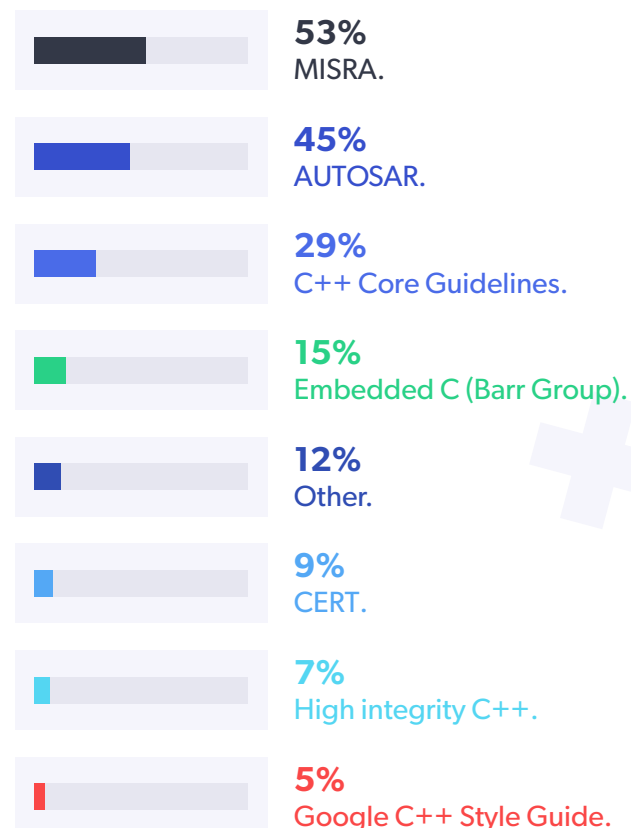

RESOURCE

How to Choose a Coding Standard

DOES YOUR TEAM USE A CODING STANDARD TODAY?

28%
No.

72%
Yes.
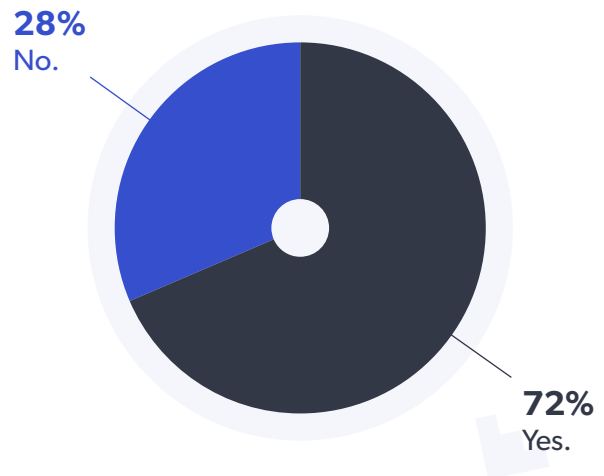
WHICH CODING STANDARD(S) DO YOU CURRENTLY USE?

53%
MISRA.

45%
AUTOSAR.

29%
C++ Core Guidelines.

15%
Embedded C (Barr Group).

12%
Other.

9%
CERT.

7%
High integrity C++.

5%
Google C++ Style Guide.

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How Development Teams Manage Their Work

Most Use C/C++ Programming Languages

Most software developers working in the automotive industry are using C and C++. C and C++ are the most popular programming languages for embedded development.

There are some teams who are using Java and C#. And there were several write-ins for Python, as well as MATLAB for model-driven development.

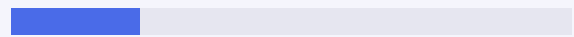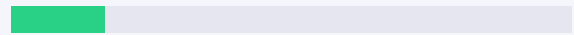**WHICH PROGRAMMING LANGUAGES(S) DOES YOUR TEAM CURRENTLY USE?**

56%
C.

51%
C++.

23%
Other (Python and MATLAB).

17%
Java.

12%
C#.

Many Teams Leverage Faster Methods and Processes

Many development teams are adopting methods and processes that will help them develop quality software faster. And model-driven development is the top method utilized across those we surveyed.

Far more development teams are using Agile development processes over traditional Waterfall development. This makes sense, as automotive development shifts from hardware to software — and software development teams aim to maximize productivity.
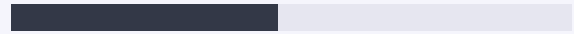
RESOURCE

Switching to Agile ALM

WHICH DEVELOPMENT METHODS AND PROCESSES ARE YOU USING TODAY?
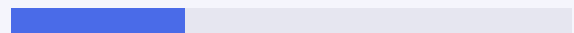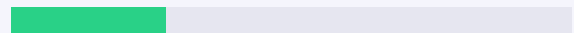
48%
Model-driven development.

46%
Agile development.
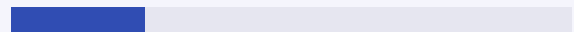
31%
Test-driven development.
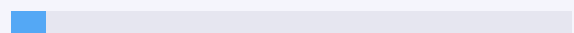
28%
Automatic code generation.

24%
Waterfall development.

6%
Other.

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How Hardware and Software Teams Work Together

The automotive industry is shifting from hardware to software. And, it is important that development teams can manage both hardware and software design and code assets. That can lead to some challenges.

Collaborating across teams is difficult, and distributed teams makes it more complicated. Plus, it gets challenging to manage multiple variants of all the technology components involved — hardware and software. Using the right version control software can help these teams solve these challenges and unite global teams.

RESOURCE

Solve Top Challenges For Hardware/Software Teams

IN YOUR OWN WORDS

"Communication due to large development team for complex software."
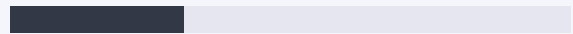
"Lack of experience from designers with process rigor of ASPICE and ISO 26262."

"Engineering resources — not enough people."

WHAT IS YOUR SINGLE BIGGEST CHALLENGE IN MANAGING HARDWARE AND SOFTWARE DESIGN AND CODE ASSETS?
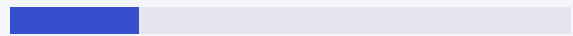
31%
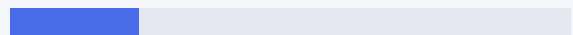Cross-team (hardware/software) collaboration.

23%
Management of multiple variants/releases of technology components.
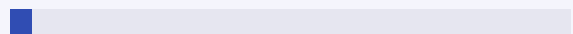
23%
Integration with engineering tools (design/test).

19%
Teams working from distributed locations.

4%
Other.

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The Right Development Tools Improve Quality

As the automotive industry evolves and the role of software grows, development teams will need to innovate in order to stay competitive. At the same time, they cannot lose sight of safety, quality, and security.

WHICH TOOLS THEY'RE USING

Using the right development tools is the key to success. The top tools for those we surveyed are:
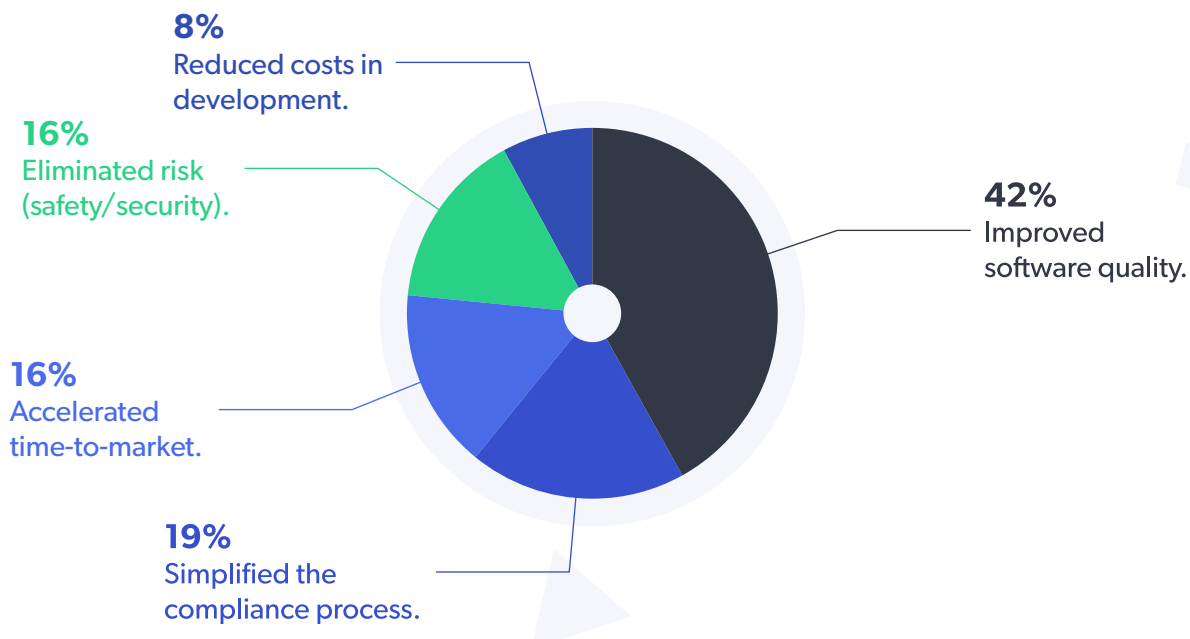
- Static code analysis (66%).
- Project management (61%).
- Version control (59%).
- Application lifecycle management (46%).

Perforce offers development tools in each of these key areas:

- Helix QAC is a top static code analyzer for automotive software developers with compliance regulations.
- Hansoft is an Agile project management tool best-suited for infotainment developers.
- Helix Core is the best version control tool for large global teams with complex development needs.
- Helix ALM is an application lifecycle management tool that helps teams document that requirements have been fulfilled, tests have been run, and bugs have been resolved.

A majority (42%) of those we surveyed said that using these tools improved quality. Some remarked the biggest benefit was simplifying the compliance process (19%). A faster time to market and reduced risk were also cited by 16% each. And, 8% said the biggest benefit was reduced cost.

HOW HAVE THESE TOOLS HELPED THE MOST?

8%
Reduced costs in development.

16%
Eliminated risk (safety/security).

16%
Accelerated time-to-market.

19%
Simplified the compliance process.

42%
Improved software quality.

Why Static Code Analysis Is The Top Tool For Automotive Software Developers

A static code analysis tool ensures safe, secure, and reliable software, which is essential for automotive development. Choosing the right static code analysis tool is important. (See why Socionext chose Helix QAC.)

Helix QAC is a C/C++ static code analyzer widely used in the automotive industry. It helps teams fulfill ISO 26262 requirements, enforce coding standards (especially MISRA/AUTOSAR), and improve software quality.

HOW HELIX QAC WORKS [DEMO]

Have comments or suggestions for next year's report? Share with us by emailing info@perforce.com

About the Survey

We surveyed over 400 professionals working in automotive software development in May 2019. Participants represent a range of experience. However, a majority are veterans of the automotive industry who have seen a dramatic change over the past decade. Those who participated in the survey work primarily for Tier 1 suppliers and OEMs, with some participation from Tier 2 and Tier 3 suppliers. Their teams produce a range of automotive products, ranging from ECU/ECM to driver assistance systems to chassis/safety systems.