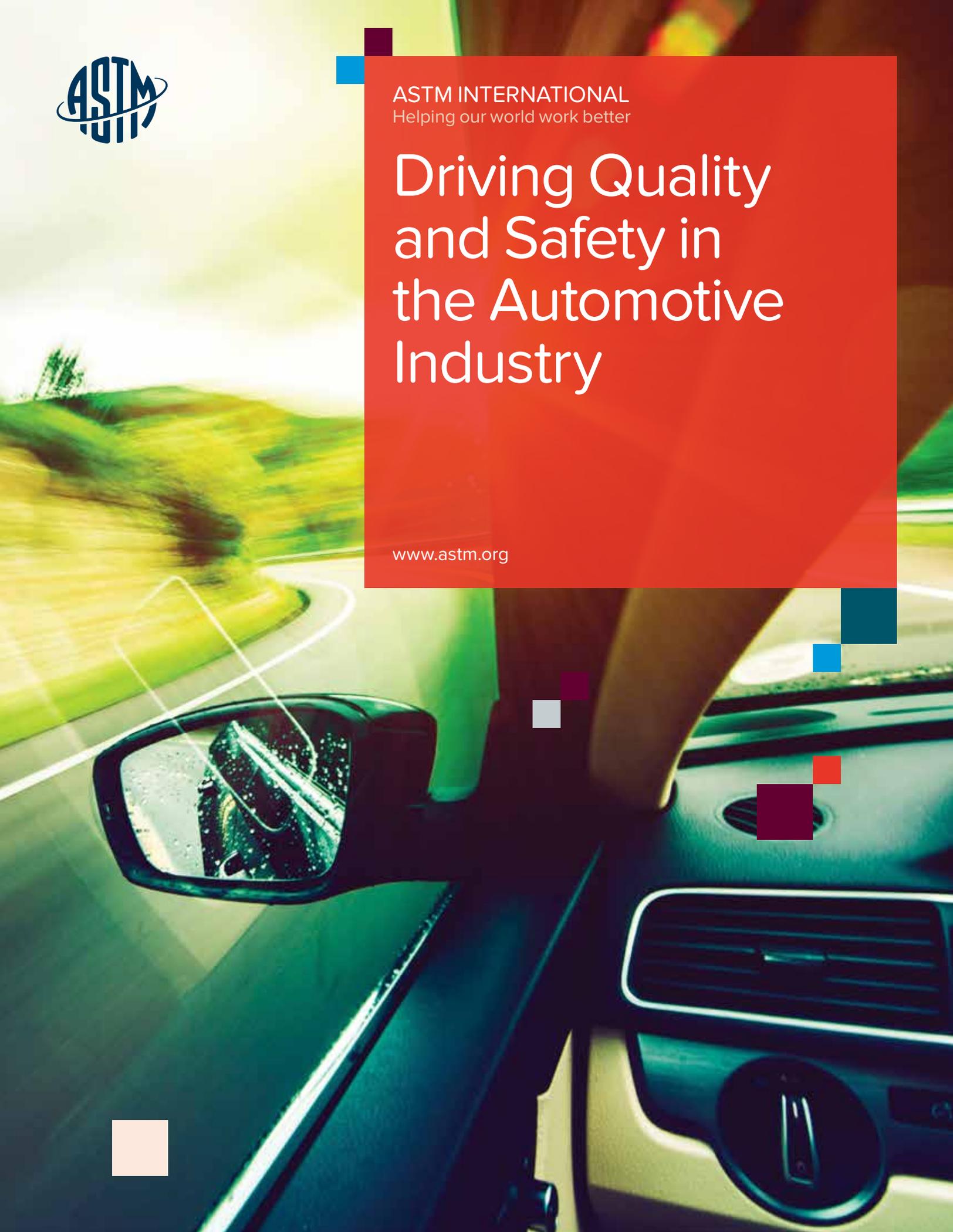


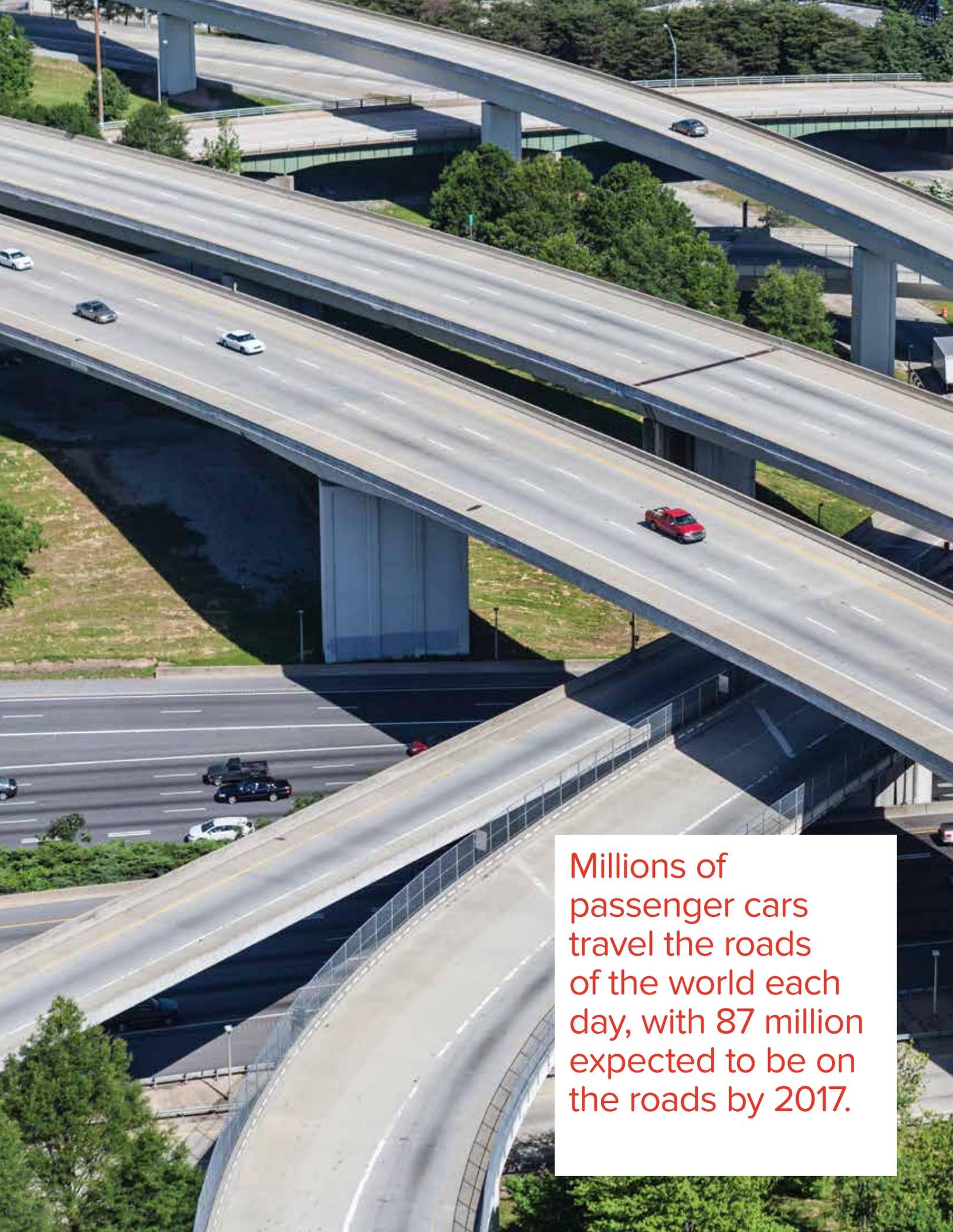


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# Driving Quality and Safety in the Automotive Industry

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Millions of passenger cars travel the roads of the world each day, with 87 million expected to be on the roads by 2017.

When the millions of passenger cars travel the roads of the world each day, ASTM International standards are helping to enhance the quality, safety and performance of the vehicles we drive. Throughout the industry supply chain, ASTM standards assist in the delivery of high quality, expertly tested parts and materials to automotive manufacturers. At local car dealerships, ASTM standards aid consumer confidence by helping to ensure that the vehicles they buy are durable. Out on the road where safety and reliability matter most, ASTM standards facilitate dependable vehicle performance.

#### **ASTM Standards: Facilitating Quality in the Automotive Supply Chain**

To supply the automotive sector, steel manufacturers often depend upon test methods developed by ASTM International's oldest committee, A01 on Steel, Stainless Steel and Related Alloys. With a membership of 1,300+ industry professionals, A01 has responsibility for just under 500 materials specifications and test methods.

To test the readiness and integrity of steel for the rigors of automotive production, manufacturers use such A01 standards as the test methods and definitions for mechanical testing of steel products (A370), which are particularly useful in determining the strength and ductility of steel. Another similarly useful standard is the specification for metallic coated carbon steel wire for mechanical springs (A764).

#### **Committee E28: The Leader in Mechanical Testing Standards**

Automotive material suppliers also rely on standards of ASTM International Committee E28 on Mechanical Testing to meet quality control demands. Across its several subcommittees, E28 maintains almost 60 standards that address ductility and formability, indentation hardness, impact and residual stress — all critical requirements for automotive materials.

One widely referenced E28 standard contains the test methods for tension testing of metallic materials (E8/E8M). During automotive manufacturing, flat-rolled metals are shaped into finished car designs. Tension tests provide a valuable reference for

suppliers to measure the strength and ductility of materials under uniaxial tensile stresses, information used in material comparison, alloy development, quality control and design.

Another key automotive material consideration is springback, which occurs when a metal or alloy is cold-worked; on release of the forming force, the material tends to partially return to its original shape because of elastic recovery properties. To respond to marketplace needs, Committee E28 released the test method for evaluating springback of sheet metal using the Demeri split ring test (E2492). Developed with input from automotive industry stakeholders, E2492 provides a test to evaluate metal springback behavior through simulating a stretch-draw forming process.

#### **B09: Advancing Innovation**

Vital to automotive parts production is powder metallurgy, a process to convert fine metal powders into solid products. Powder metallurgy minimizes the machining operations typically required for cast or forged parts, lowering costs and manufacturing cycle time for creating high performance, high precision automotive parts. Through recycling and high materials utilization, powder metallurgy also reduces waste and energy consumption in manufacturing. Automotive powder metallurgy applications extend throughout the engine, transmission, brakes, steering, suspension and exhaust systems as well as to such hardware as seats, locks and windshield wipers.

ASTM International advances automotive powder metallurgy technology through Committee B09 on



#### Paint Standards

The luster and durability of an automotive paint finish is supported by ASTM standards.

Metal Powders and Metal Powder Products, and standards for automotive-related applications can be found in Subcommittee B09.05 on Structural Parts. Included are the specification for materials for ferrous powder metallurgy (PM) structural parts (B783) and the specification for powder forged (PF) ferrous materials (B848), which specify PM materials for applications such as automotive parts.

Standards such as ASTM B438 and ASTM B439, under the jurisdiction of Subcommittee B09.04 on Bearings, relate to bronze-base and iron-base powder metallurgy bearings (oil impregnated), respectively. These self-lubricated bearings are essential for automotive parts, hand tools and home appliances. The ASTM test method for cleanliness of powder metallurgy bearings and structural parts (B970) covers the surface cleanliness of such parts. Surface cleanliness is vital for parts that are used in transmissions, engines and steering applications.

Another useful standard is the test for effective case depth of ferrous powder metallurgy (PM) parts using microindentation hardness measurements (B934). This standard is used to check the effective case depth of surface hardened PM parts.

#### F16 Fastener Standards and Safety

Fasteners — nuts, bolts, screws, retainers, spring clips and washers — play an important role in car equipment safety. Typically made from plastic or steel, fasteners must have a high shock and vibration resistance and most important, must be strong enough to withstand the impact of accidents.

To test the quality, strength and durability of the fasteners they supply to the automotive market, manufacturers rely on the more than 75 standards developed by ASTM International Committee F16 on Fasteners.

Subcommittee F16.02 on Steel Bolts, Nuts, Rivets and Washers has an extensive array of standards, including many that are widely referenced by fastener manufacturers. Notable among these is a specification for carbon steel bolts and studs, 60,000 psi tensile strength (A307), which covers the chemical and mechanical requirements of three grades of carbon steel bolts and studs in sizes ranging from 1/4 to 4 inches. Also utilized by automotive suppliers is the specification for structural bolts, steel, heat treated, 120/105 ksi minimum tensile strength (A325), which covers the requirements for heavy hex structural bolts intended for use in structural connections.

#### ASTM Paint Standards

One important factor that impacts vehicle service life is a car's finish and its ability to withstand corrosion or other degradation. Thanks to many standards from ASTM International Committee D01 on Paint and Related Coatings, Materials and Applications, consumers can trust that the luster and durability of their car's finish can stand the test of time. Formed in 1902, D01 today has a diverse membership of 625+ global stakeholders and a portfolio of more than 650 standards. Among its technical subcommittees, one of the most prominent ones addressing automotive sector standards requirements is D01.27 on Accelerated Testing.

D01.27 provides standards to evaluate film performance of applied paint and finishes subjected to accelerated deterioration in normal and abnormal service environments. Improvements in automotive coating performance and durability can be attributed in part to the group's accelerated test procedures. One popular D01.27 standard for automotive applications is the practice for xenon-arc exposures of paint and related coatings (D6695), which simulates the effects of sunlight, moisture and heat on paints. A popular weathering and corrosion test procedure is the practice for cyclic salt fog/UV exposure of painted metal (D5894), which blends cyclic corrosion testing with the evaluation of ultraviolet exposure of paints on metal.

Extreme weather conditions are the focus of another widely referenced D01.27 standard, the practice for salt-accelerated outdoor cosmetic corrosion testing of organic coatings on automotive sheet steel (D6675). D6675 helps to evaluate the corrosion resistance of organic coatings on metal products exposed to highly salty environments such as areas subjected to deicing salts or coastal areas.

### Reducing the Health Risks of VOCs

A critical issue in the automobile industry is identifying and quantifying volatile organic compounds (VOCs) in newly manufactured automobiles. Indoor air contamination is caused by VOC emissions from paints, fabrics, upholstery, carpets and adhesives as well as from exhaust fumes. The toxicity of many of these components creates potential health risks.

In the United States, regulations limiting VOC emissions from paints and coatings rely on ASTM measurement standards for total volatile content, exempt solvent content and paint or coating density. One such method determines the VOC weight percent of individual VOCs in air-dry coatings (D6886). The U.S. Environmental Protection Agency references D01 standards in regulations as acceptable tests methods for regulatory compliance. These include test methods for density of liquid coatings, inks and related products (D1475) and for volatile content of coatings (D2369).

### G03 Helps Build Durable Autos

Complementing D01 activities in serving automotive standards needs are those of ASTM International Committee G03 on Weathering and Durability. G03 publishes more than 30 standards, many of which provide utility for automotive manufacturers and suppliers in measuring the performance of automotive paint and coatings, and interior dashboard materials, in varying weathering exposures. Many D01 material standards reference G03 weathering standards for guidance on specimen conditioning and preparation as well as for specifying laboratory accelerated test apparatus and natural outdoor exposure protocols.

Key G03 performance standards include a practice for exposing nonmetallic materials in accelerated test devices that use laboratory light sources (G151); a practice for operating open flame carbon arc light apparatus for exposure of nonmetallic materials (G152); and a practice for operating fluorescent light apparatus for UV exposure of nonmetallic materials (G154). All of these standards help measure the effects of sunlight (either direct or through window glass), moisture such as rain or dew, and heat on automotive components.

### Road Safety and Performance with the Help of ASTM Airbag Standards

Airbags play a vital part in protecting people from injury as a result of automobile accidents. Companies involved in the manufacturing of airbags can better ensure their products' performance, thanks to ASTM standards focused on the design, quality and performance of inflatable restraints.

Standards from Subcommittee D13.20 on Inflatable Restraints are cited in automotive material specifications used by manufacturers worldwide.

Newest among these is the test method for determining pressure decay of inflatable restraint cushions (D7559/D7559M), a cost-effective screening test to judge the ability of a rollover side curtain airbag to maintain needed pressure over time. Side curtain airbags are usually mounted in the roof of a vehicle and burst through the headliner to cover the side window area in the event of a side impact or rollover accident. Other notable D13.20 standards provide guidelines to assess inflatable restraint fabric quality. These include the practices for visual inspection and grading of fabrics used for inflatable restraints (D5426) and the practice for determining physical properties of fabrics, yarns and sewing thread used in inflatable restraints (D5446).

### F09: Expert Source for Tire Standards

For over 40 years, ASTM Committee F09 on Tires has been the preeminent source for tire safety standards widely accepted worldwide. Committee F09's members include a broad cross section of industry and public stakeholders who work together to create critical tire performance test methods. F09 has a long history of delivering the relevant, high quality standards that guide tire-related regulatory requirements set forth by the U.S. National Highway Traffic Safety Administration.

A recent significant F09 focus has been the testing and measurement of tire aging because of increased tire wear life and resulting additional industry and regulatory interest in the subject. The U.S. Congress formalized this need when it passed the Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act, which calls for an upgrade of tire safety standards, including an aged durability test for light vehicle tires.

## Committee D13 on Textiles has taken the lead in developing test methods and practices for such airbag requirements as:

- air permeability on deployment,
- seam strength,
- fabric stability during stress,
- ability to hold inflation pressure, and
- durability.



Subcommittee F09.30 on Laboratory (Non-Vehicular) Testing responded with a practice for accelerated laboratory aging of radial passenger car and light truck tires through load range E for the laboratory generation of belt separation (F2838). A standard has also been completed that describes a laboratory method to generate belt edge separation in tires undergoing accelerated aging according to F2838 (F3015).

#### **Reliability in Severe Weather Driving**

Another important role of F09 standards is to measure tire performance in severe weather. The test methods for tire performance testing on snow and ice surfaces (F1572) and the test method for single wheel driving traction in a straight line on snow- and ice-covered surfaces (F1805) help assess tire performance on snow and ice. These tests are often done in conjunction with the specification for a P195/75R14 radial standard reference test tire (E1136), which is used as a reference for tire traction performance evaluations. Today, many tire manufacturers use a product graphic of a peaked mountain with a snowflake to signify that their product has passed these industry accepted traction performance tests for severe snow, ice and winter conditions.

#### **D02 Standards: Cleaner Gasoline, Better Automobile Performance**

With more than 2,300 members from over 70 countries, ASTM Committee D02 on Petroleum Products and Lubricants benefits from global expertise that has produced more than 800 standards accepted worldwide.

Virtually any product that requires fuels or operates on moving parts depends on standards developed by D02's technical subcommittees. Highlighting the D02 portfolio are standards that provide for safe, economical and environmentally sound fuels. These include the test method for motor octane number of spark-ignition engine fuel (D2700) and the specification for automotive spark-ignition engine fuel (D4814), both of which help ensure good gasoline performance.

As momentum continues to build for alternative fuels, Committee D02 has established a leadership position in standards for fuels such as ethanol and biodiesel. Ethanol is widely used in the United States as a gasoline extender and octane number enhancer; it also helps to reduce harmful emissions. Committee D02 has contributed standards that assist in the production of ethanol, including the specification for ethanol fuel blends for flexible-fuel automotive spark-ignition engines (D5798), the specification for denatured fuel ethanol for blending with gasolines for use as automotive spark-ignition engine fuel (D4806), and the practice for blending mid-level ethanol fuel blends for flexible-fuel vehicles with automotive spark-ignition engines (D7794). Biodiesel is an alternative fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. D02's flagship standards here are the specification for diesel fuel oils (D975), the specification for biodiesel fuel blend stock (B100) for middle distillate fuels (D6751) and the specification for diesel fuel oil, biodiesel blend — B6 to B20 (D7467). Committee D02 also provides standards that address the oil, and lubricants and greases, used in automotive engines. The performance of motor oil to cool engine parts, reduce friction and protect against wear and corrosion is supported by D02 standards such as the specification for performance of active API service category engine oils (D4485).

#### **Cooperation for Engine Coolants**

Standards from ASTM International Committee D15 on Engine Coolants and Related Fluids address a wide range of automotive-related issues including cavitation, corrosion and formulations of coolants for cars, light trucks and heavy duty engines. Formed in 1944, D15 now numbers more than 200 technical experts from close to 20 countries.

Recent D15 activities respond to consumer desire for lower automotive cooling system maintenance costs and different standardization areas. Since 2010, Committee D15 has issued several new standards focused on glycerin/glocol-based engine coolants, a relatively new type of coolant being used in the industry. D15 has also established new subcommittees that cover areas where standards are needed: D15.22 on Non-Aqueous Coolants; D15.25 on Diesel Exhaust Fluid; and D15.30 on Industrial Heat Transfer Fluids.

From the early stages of the supply chain, through to manufacturing and assembly operations, and onto the roads and highways throughout the world, ASTM standards are the building blocks of reliable, durable automobiles that are safe to drive.

#### **Committee F09 on Tires**

For over 40 years, ASTM Committee F09 on Tires has been the preeminent source for tire safety standards widely accepted worldwide.

# ASTM International technical committees highlighted in this piece include:

- A01 on Steel, Stainless Steel and Related Alloys
- B09 on Metal Powders and Metal Powder Products
- D01 on Paint and Related Coatings, Materials and Applications
- D02 on Petroleum Products, Liquid Fuels and Lubricants
- D13 on Textiles
- D15 on Engine Coolants and Related Fluids
- E28 on Mechanical Testing
- F09 on Tires
- F16 on Fasteners
- G03 on Weathering and Durability

## ASTM INTERNATIONAL

Helping our world work better

Over 12,000 ASTM standards operate globally. Defined and set by us, they improve the lives of millions every day.

Combined with our innovative business services, they enhance performance and help everyone have confidence in the things they buy and use – from the toy in a child's hand to the aircraft overhead.

Working across borders, disciplines and industries we harness the expertise of over 30,000 members to create consensus and improve performance in manufacturing and materials, products and processes, systems and services.

Understanding commercial needs and consumer priorities, we touch every part of everyday life: helping our world work better.

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