Preface

Since its emergence in 1886, the automobile has progressed beyond the technology available in any other industry, even the airline industry—for example, a Boeing Dream Liner 787 only has 6.5 million lines of code, while modern vehicles contain nearly 20 times that. In fact, it is estimated that vehicles could contain 200–300 million lines of code by the year 2030. A large part of this development is because of the rapid evolution and growing availability of advanced driver assistance systems (ADAS) in vehicles. According to the Partnership for Analytical Research in Traffic Safety (PARTS), automatic emergency breaking (AEB) has reduced front-to-rear crashes by 52% from 2021–2023.

For this reason, ADAS training will provide technicians with an incredible opportunity for rapid advancement in the automotive industry. *Advanced Driver Assistance Systems (ADAS)* is geared toward current automotive technicians and students who have already undergone some basic vehicle system training. The content is designed to unpack the artificial intelligence, communication networks, and complex perception systems that are at the heart of ADAS features and provide additional knowledge on how fundamental vehicle systems and infrastructure have evolved and will continue to evolve to accommodate ADAS technology. To ensure that every learner has a basic understanding of the mathematical concepts used by ADAS technology, a chapter containing a review of math for automotive technicians is included. To provide further depth in learning knowledge, Deep Dive features focus on specific events or concepts in ADAS development and implementation.

Many chapters in *Advanced Driver Assistance Systems (ADAS)* focus on the practical knowledge needed to calibrate, diagnose, and repair ADAS-equipped vehicles. The chapters include safety recommendations; tools, equipment, and facility and environmental requirements; liability and documentation information; and step-by-step guidance on repairing, programming, encoding, diagnosing, and calibrating specific ADAS features. Pro Tip features provide opportunities to expand on information presented in the textbook as well as to provide advice that has helped automotive technicians apply the textbook concepts in a shop setting.

In addition, the learner will gain hands-on experience by completing the job sheets associated with the chapter content. Case Study features explore real situations encountered by repair technicians and expose learners to what they might encounter when working in a shop. Finally, end of chapter ASE-Type questions help the user prepare for the Advanced Driver Assistance Systems (ADAS) Specialist Test (L4) established by the National Institute for Automotive Service Excellence (ASE).

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About the Authors

Steve Zack has been a technician, technical engineer, and automotive technical instructor for most of his career. As an automotive technical instructor for Bosch, OTC, Mr. Zack taught technicians around the world how to use their electronic test equipment to diagnose difficult drivability and electrical and electronic issues using a hands-on approach. In 2017, Mr. Zack was the recipient of the ASE Training Managers Council (ATMC) National Excellence in Training Award. He held ASE Master and ASE L1 certifications and is a US EPA-certified Emission Master Instructor. He has been published many times, has been featured in multiple diagnostic videos, and holds numerous automotive patents. Mr. Zack recently retired from Bosch, OTC after 28 years. He spends his time with family discovering how things work, riding his Moto Guzzi motorcycle, and thinking about the next great patent.

Kurt Shadbolt has on information presented in 37 years of experience as a technician and educator in the automotive industry. As a technician, he specialized in electrical, drivability, and diagnostics. Mr. Shadbolt has instructed at the high school, technical, and community college levels, and he has provided instruction at BMW/MINI and Lucid Motors manufacturer training programs as well as at numerous train-the-trainer and webinar events. Mr. Shadbolt is an ASE Master Technician with C1, L1, L3, and L4 certifications and is a California Bureau of Automotive Repair-certified instructor, California licensed smog check inspector and repair technician, and Mobile Air Climate Systems Association (MACS)-certified instructor. He has extensive experience in curriculum development and has completed work for multiple manufacturers, the state of California, regional grant projects, and various levels of public education. Currently, Mr. Shadbolt is a faculty member in the automotive department at Chabot College in Hayward, California, focused on hybrid, EV, and ADAS.

Scott Brown is a professional automotive service technician and an independent automotive service and repair facility owner with more than 40 years of professional experience. He is the owner of Connie and Dick's Service Center, Inc., an automotive service and repair shop and ADAS service training center. Dedicated to industry relations across the service industry, Mr. Brown is the former Industry Relations Manager and President of the International Automotive Technicians Network (iATN). He is also the founder of Diagnostic Network, an online community platform for automotive service industry professionals. Mr. Brown is currently an ASE Master Automotive Technician who holds L1, L3, and L4 certifications and is on the Board of Directors for the National Automotive Service Task Force (NASTF), Automotive Service Councils of California (ASC-CA), and Automotive Management Institute (AMI). He is also a technical instructor with a strong focus on vehicle electronics; vehicle network communications; engine performance; automotive service information systems; and ADAS service, diagnostics, and repair.

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Reviewers

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New to This Edition

The second edition of *Advanced Driver Assistance Systems (ADAS)* has been updated to strengthen the student's understanding of ADAS, testing, and calibration. In this edition, you will find new and updated art. The second edition contains new or updated information on data communication systems, 48v electrical systems, zonal architecture, automatic windshield wipers, 77 GHz radar sensors, service modes, and the proposed fourth traffic light to accommodate the increase in autonomous vehicles on the road. In addition, new Deep Dive and Pro Tip features have been added in key areas to help build on the content each chapter covers.

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The authors and publisher would like to thank the following companies, organizations, and individuals for their contribution of resource material, images, or other support in the development of *Advanced Driver Assistance Systems (ADAS)*.

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ASE Connections

Advanced Driver Assistance Systems (ADAS) is correlated, where applicable, to the Advanced Driver Assistance Systems (ADAS) Specialist Test (L4) established by the National Institute for Automotive Service Excellence (ASE). These standards were developed with input from industry experts to ensure they reflect the skills students and technicians must master to succeed in the automobile service and repair industry.

ASE certification is becoming the benchmark for automobile repair technicians. It is recommended that you seek ASE certification once you have sufficient knowledge and meet the work experience requirements. Visit the ASE website for more information on ASE certification.

The ASE Education Foundation has established a training program accreditation process designed to improve the quality of training offered at both secondary and postsecondary levels. This foundation grants accreditation to programs that comply with their evaluation procedure, meet established standards, and adhere to the policies set forth by the organization. To learn more about the accreditation process, visit the ASE Education Foundation website.

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Features of the Textbook

The instructional design of this textbook includes student-focused learning tools to help you succeed. This visual guide highlights these features.

Chapter Opening Materials

Each chapter opener contains a list of learning outcomes and a list of technical terms. **Learning Outcomes** clearly identify the knowledge and skills to be gained when the chapter is completed. These outcomes are labeled and correlated to related assessment elements to facilitate reporting and remediation. **Technical Terms** list the key words to be learned in the chapter. An **Introduction** provides an overview and preview of the chapter content.

Additional Features

Additional features are used throughout the body of each chapter to further learning and knowledge. **Deep Dives** explore a topic related to ADAS by providing additional information or suggested sources outside the textbook for more in-depth learning. **Pro Tips** provide advice and guidance that is especially applicable for on-the-job situations. **Case Studies** showcase real-life situations that professional automotive technicians have encountered when calibrating, diagnosing, or repairing ADAS-equipped vehicles.



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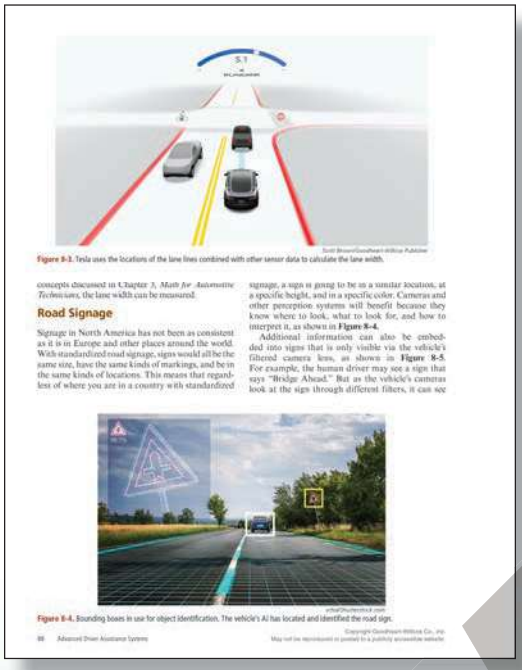


Figure 8-3. Tesla uses the locations of the lane lines combined with other sensor data to calculate the lane width.

concepts discussed in Chapter 3, *Math for Automotive Technicians*, the lane width can be measured.

Road Signage

Signage in North America has not been as consistent as it is in Europe and other places around the world. With standardized road signage, signs would all be the same size, have the same kinds of markings, and be in the same kinds of locations. This means that regardless of where you are in a country with standardized signage, a sign is going to be in a similar location, at a specific height, and in a specific color. Cameras and other perception systems will benefit because they know where to look, what to look for, and how to interpret it, as shown in **Figure 8-4**.

Additional information can also be embedded into signs that is only visible via the vehicle's filtered camera lens, as shown in **Figure 8-5**. For example, the human driver may see a sign that says "Bridge Ahead." But as the vehicle's cameras look at the sign through different filters, it can see

Figure 8-4. Bounding boxes in use for object identification. The vehicle's AI has located and identified the road sign.

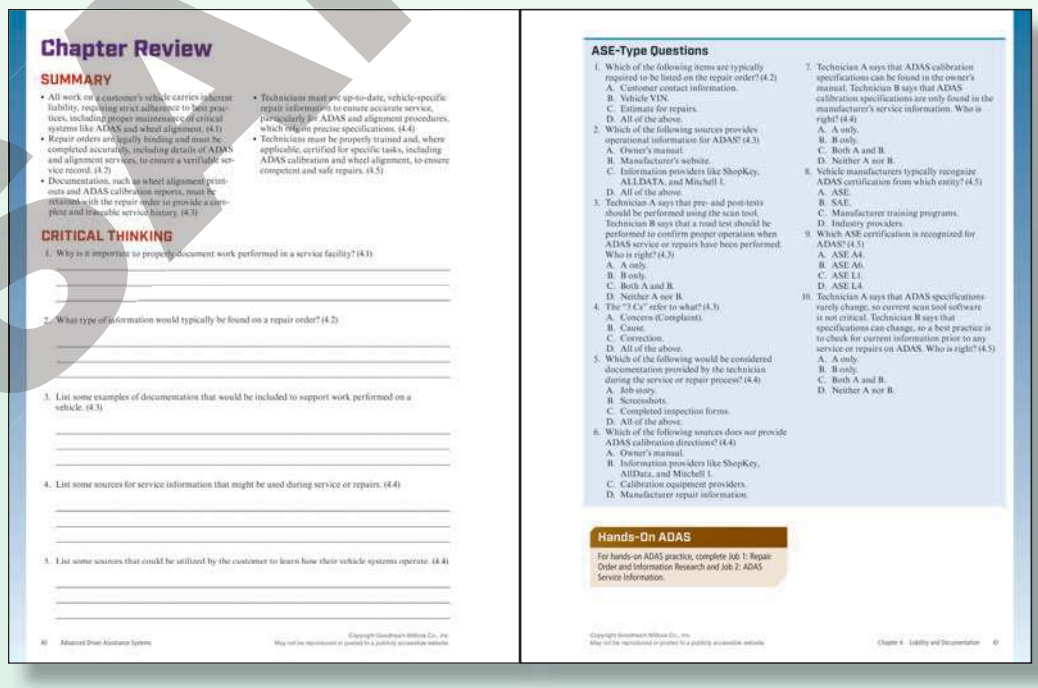
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Illustrations

Illustrations have been designed to clearly and simply communicate the specific topic and show the latest equipment.

End-of-Chapter Content

End-of-chapter material provides an opportunity for review and application of concepts. A concise **Summary** provides an additional review tool and reinforces key learning objectives. This helps you focus on important concepts presented in the text. **Critical Thinking** questions develop higher-order thinking and problem solving. **ASE-Type Questions** enable you to demonstrate knowledge, identification, and comprehension of chapter material in the style of the questions in the Advanced Driver Assistance Systems (ADAS) Specialist Test (L4) established by the National Institute for Automotive Service Excellence (ASE). **Hands-On ADAS** points the student to the associated **job sheets** for hands-on practice opportunities.



Chapter Review

SUMMARY

- All work on a customer's vehicle carries inherent liability, requiring strict adherence to best practices, including proper maintenance of critical systems like ADAS and wheel alignment. (4.1)
- Repair orders are legally binding and must be completed accurately, including details of ADAS and alignment services, to ensure a verifiable service record. (4.2)
- Documentation, such as wheel alignment printouts and ADAS calibration reports, must be retained with the repair order to provide a complete and traceable service history. (4.3)
- Technicians must use up-to-date, vehicle-specific repair information to ensure accurate service, particularly for ADAS and alignment procedures, which rely on precise specifications. (4.4)
- Technicians must be properly trained and, where applicable, certified for specific tasks, including ADAS calibration and wheel alignment, to ensure competent and safe repairs. (4.5)

CRITICAL THINKING

1. Why is it important to properly document work performed in a service facility? (4.1)
2. What type of information would typically be found on a repair order? (4.2)
3. List some examples of documentation that would be included to support work performed on a vehicle. (4.3)
4. List some sources for service information that might be used during service or repairs. (4.4)
5. List some sources that could be utilized by the customer to learn how their vehicle systems operate. (4.4)

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ASE-Type Questions

1. Which of the following items are typically required to be listed on the repair order? (4.2)
   A. Customer contact information.
   B. Vehicle VIN.
   C. Estimate for repairs.
   D. All of the above.
2. Which of the following sources provides operational information for ADAS? (4.3)
   A. Owner's manual.
   B. Manufacturer's website.
   C. Information providers like ShopKey, ALLDATA, and Mitchell 1.
   D. All of the above.
3. Technician A says that pre- and post-tests should be performed using the scan tool. Technician B says that a road test should be performed to confirm proper operation when ADAS service or repairs have been performed. Who is right? (4.3)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
4. The "3 Cs" refer to what? (4.3)
   A. Concern (Complaint).
   B. Cause.
   C. Correction.
   D. All of the above.
5. Which of the following would be considered documentation provided by the technician during the service or repair process? (4.4)
   A. Job story.
   B. Screenshots.
   C. Completed inspection forms.
   D. All of the above.
6. Which of the following sources does *not* provide ADAS calibration directions? (4.4)
   A. Owner's manual.
   B. Information providers like ShopKey, AllData, and Mitchell 1.
   C. Calibration equipment providers.
   D. Manufacturer repair information.
7. Technician A says that ADAS calibration specifications can be found in the owner's manual. Technician B says that ADAS calibration specifications are only found in the manufacturer's service information. Who is right? (4.4)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
8. Vehicle manufacturers typically recognize ADAS certification from which entity? (4.5)
   A. ASE.
   B. SAE.
   C. Manufacturer training programs.
   D. Industry providers.
9. Which ASE certification is recognized for ADAS? (4.5)
   A. ASE A4.
   B. ASE A6.
   C. ASE L1.
   D. ASE L4.
10. Technician A says that ADAS specifications rarely change, so current scan tool software is not critical. Technician B says that specifications can change, so a best practice is to check for current information prior to any service or repairs on ADAS. Who is right? (4.5)
    A. A only.
    B. B only.
    C. Both A and B.
    D. Neither A nor B.

Hands-On ADAS

For hands-on ADAS practice, complete Job 1: Repair Order and Information Research and Job 2: ADAS Service Information.

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