TMC Recommended Practice

RP 548 VMRS Various

TECHNICIAN TRAINING FOR ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS)

PREFACE

The following Recommended Practice is subject to the Disclaimer at the front of TMC's *Recommended Maintenance Practices Manual*. Users are urged to read the Disclaimer before considering adoption of any portion of this Recommended Practice.

PURPOSE AND SCOPE

This Recommended Practice (RP) offers guidelines for establishing training procedures for diesel technicians (and other equipment repair personnel including alignment shop technicians, tire technicians, etc.) who service commercial vehicles equipped with Advanced Driver Assistance Systems (ADAS).

For more information on ADAS terminology and nomenclature, see TMC RP 547, *Guidelines For Advanced Driver Assistance System (ADAS) Nomenclature*.

INTRODUCTION

ADAS technologies are subject to many of the same types of repair and maintenance issues that affect all vehicle systems. ADAS technologies, which include Bendix Wingman, Daimler Assurance, Volvo Active Driver Assist (VADA),and ZF OnGuard (or Wabco OnGuard) themselves experience similar maintenance-related issues.

This RP provides a general overview to establishing a technician training program for ADAS. For system specific information, always consult the appropriate original equipment manufacturer (OEM) or ADAS manufacturer's guidelines. It is also critical to follow your company and OEM warranty processes when filing ADAS warranty claims.

GENERAL SYSTEM INFORMATION

ADAS maintenance requires a holistic or "whole truck" repair approach. All ADAS repairs must be made based on a properly functioning antilock braking system (ABS). Keep in mind that even small things can change the operation or calibration of ADAS. Anything that can change the sensor location, cab ride height, sensor function/performance/adjustments can affect ADAS. Without a solid working knowledge of ADAS on a vehicle so equipped, technicians will struggle with diagnostic procedures if ADAS malfunctions.

For the purpose of this RP, it is important for technicians to have received prior ADAS-related training in the following areas:

- Preventive maintenance inspection (PMI) on ADAS -equipped vehicles.
- Accessing ADAS service/repair information.
- Warranty coverage.
- System part identification.
- Part location.
- System function.
- Diagnostic system testing.

Figure 1 depicts the "whole truck" approach to ADAS. As noted previously, if the vehicle ABS isn't working properly, then the stability control systems will not be able to be repaired properly, which affects the collision safety systems, etc.

GENERAL REPAIRS

In order to properly train technicians on ADAS, this RP will cover three critical areas for training:

- Preventive Maintenance,
- Driver Complaint, and
- Post Accident/Collision Considerations.

For the purpose of this RP, there is an underlying assumption that you have worked with your OEM or system manufacturer to properly perform any inspections and required in-service procedures when bringing the truck to your fleet. TMC recommends that for all repairs a pre-diagnostic scan is completed as well as research in the ADAS product(s) in the fleet. There are several scanning options.

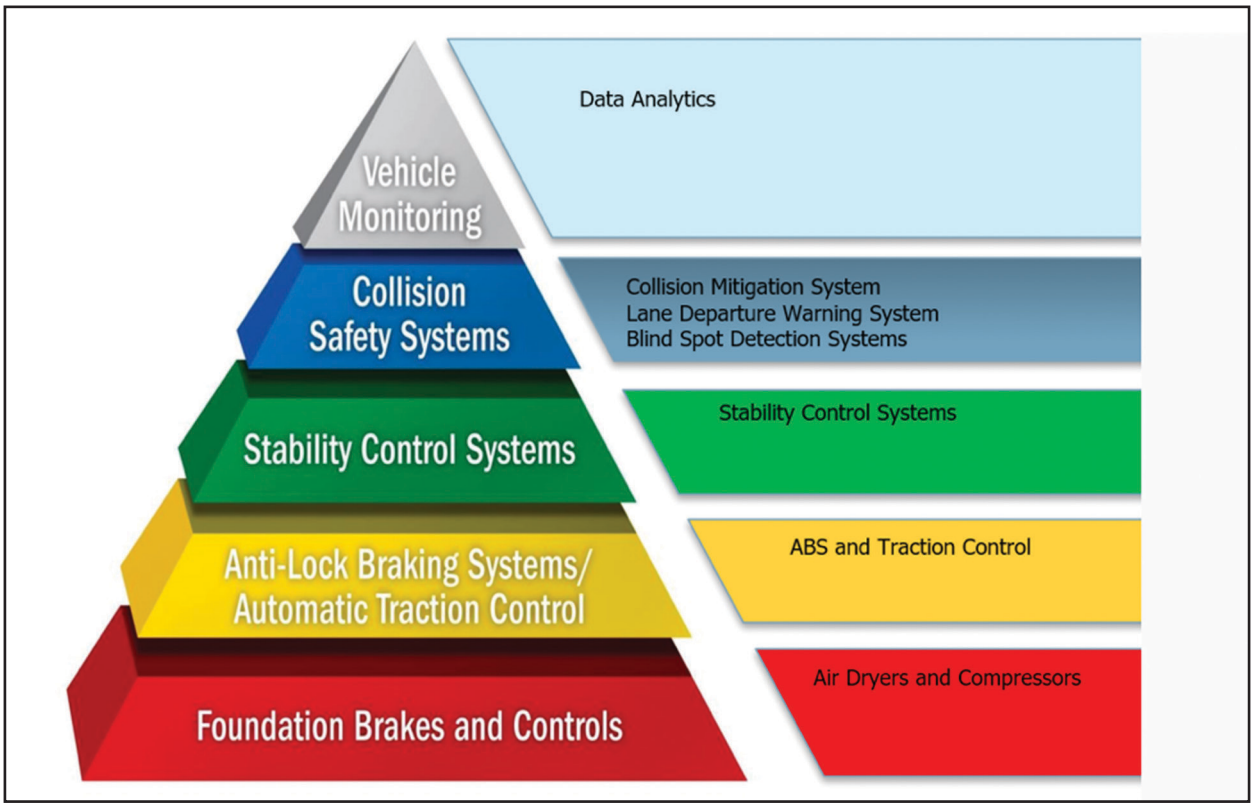

Figure 1: The Whole Truck Approach

Scanning Options

For many ADAS repair issues, proper scanning tools are critical. The following scanning options are available:

a. ***In-House Scanning and Diagnostics—*** In this option, the maintainer purchases or leases a suite of OEM and aftermarket software, tooling, and interface devices. The technician is trained or hired to specialize in ADAS.

b. ***In-House Remote Scanning and Diagnostics—*** In this option, the maintainer utilizes a provider that accesses the vehicle remotely over the internet and performs scans, diagnostics and calibrations in collaboration with an in-house technician familiar with ADAS.

c. ***Outsource to Mobile Diagnostic Specialty Service—*** In this option, the maintainer seeks out a qualified and trained mobile ADAS repair provider and schedules accordingly in when service is needed.

d. ***Outsource to Dealer—*** In this option, the maintainer is not capable of, or is limited in, ADAS repair/maintenance because of a proprietary or uncommon system for which only a dealer has access.

Pre-Diagnostic Repair Research

Maintainers should access authorized OEM repair information to understand specifically what is involved in inspecting, repairing and verifying ADAS function. Research will also help determine what tooling, OEM brackets, levels, plumb bobs, targets, software, and road-testing conditions will be necessary to complete repairs. Sources, in order of authority and current status, follow:

- OEM manufacturer workshop manual directly from OEM website with most recently updated information.
- Secondary-tier ADAS manufacturer workshop manual or technical data sheet with most recently updated information.
- OEM scanning software repair information and supplementary data.
- Aftermarket secondary data from information providers and aftermarket scanning software providers. Take care when using this information because it can be out of date and no longer current with OEM recommendations.

Pre-Repair Diagnostic Scan

Before all ADAS repairs, a pre-repair diagnostic

scan is recommended to set the vehicle's baseline. Perform this scan on level ground, apply parking brakes and place chocks under tires to keep the vehicle from moving. Disconnect any aftermarket global position system (GPS), electronic logging device (ELD) or other telematics device that may interfere with direct access to the OEM SAE J1939 dataport. These add-on systems can cause issues with accessing some truck systems and can cause false trouble codes to report.

Using a screen-recording video-capture software is recommended to document the scanning process for future reference. Most ADAS require that the TMC RP 1210 Adapter be connected to the computer containing the scanning software via a USB cable even if the adapter is Bluetooth or wireless capable.

Prior to scanning, software and interface devices should be fully updated with the most current software and firmware version to ensure the vehicle is being provided with the latest manufacturer updates.

After completing the pre-diagnostic scan, the technician may now select the proper workflow.

ADAS TRAINING WORKFLOWS

I. ADAS Training Workflow: Preventive Maintenance Inspection

This workflow covers general training for technicians performing ADAS PMI. These systems require proper PMI to provide their intended safety benefits.

NOTE: ADAS technologies vary so always be aware of the specific version/type in question. Always check the manufacturer's technical and warranty guidelines for detailed instructions and procedures.

The following workflow is meant as a general guide and is not specific to any single ADAS technology:

1. Connect the vehicle to diagnostic computer to check for stored, inactive or active fault codes, and check for any available software updates.
2. Check for any driver vehicle inspection reports (DVIRs) that would indicate a malfunctioning ADAS. Visually inspect all systems.
3. Inspect wiring, wire clips, wire insolation, and wire connectors for security, corrosion, and chafing.
4. Check for missing, broken or loose brackets.
5. Check camera lenses for obstructions and cleanliness. Verify cameras are mounted properly.
6. Turn ignition "on" and inspect for operational lamps indicating systems are powered on.
7. Check for any obstructions to the forward-looking radar if so equipped. Common examples include tape, license plates, bumper guards, etc.
8. Inspect for signs of tampering such as:
   a. High counts of inactive fault codes related to blocked sensors (e.g., camera, radar.)
   b. High counts of inactive fault codes related to switches on ADAS such as lane departure warning (LDW). If the switch is jammed with a foreign object to hold the switch in the applied position, it could log a switch fault code.
   c. High counts of inactive fault codes related to sensors and components that drivers may unplug such as cameras, displays, radars, and electronic stability control (ESC) sensors to disable ESC and collision mitigation.
9. Dash- or cab-mounted camera displays such as rearview displays, side mirror displays, blind spot displays, or birds eye view displays.
10. Inspect the surface of the display for cracks or scratches that will impair view.
11. Test each type of installed camera display to check for clarity and function, while adhering to your company's safety procedures.
12. Check the specific camera that provides the digital feed to the display for security, obstructions, lens scratches, etc.
13. If the installed ADAS has a test mode, use those instructions and abilities to test the full function of each system. This is especially important to systems that provide collision avoidance, autonomous braking or emergency braking. Note it is not safe to physically test all ADAS.
14. Check for installed ADAS that include computer-guided checks while connected to a diagnostic computer. When they exist, TMC recommends performing them as part of preventive maintenance.
15. A CDL-qualified driver should test drive the equipment, if those systems that can be tested safely. TMC recommends inspecting ADAS functions such as adaptive cruise, lane change assist, and blind spot assist.
16. Inspect ADAS and its sub-systems to ensure they react and function as intended.
17. After inspection, TMC recommends performing a post PM diagnostic scan to ensure any fault codes are cleared.

II. ADAS Training Workflow:
Driver Complaints

This workflow covers general training for technicians receiving a driver complaint that may be impacted by ADAS. These systems require proper diagnostics and maintenance to provide their intended safety benefits.

NOTE: ADAS technologies vary so always be aware of the specific version/type in question. Always check the manufacturer's technical and warranty guidelines for detailed instructions and procedures.

The following workflow is meant as a general guide and is not specific to any single ADAS technology:

1. ***Analyze the driver complaint.*** Gather details on the issue — verify the fault code, dashboard malfunction indicator lamp (MIL), ride complaint/performance, etc. If it is a performance-related issue, can you recreate it? Get as much detail from the driver as possible.

   NOTE: The goal is to try to recreate the issue. Gather information when the issue occurred such as date, time, vehicle speeds, type of road (e.g., highways, local roads, etc.), weather conditions, cruise control on/off, traffic patterns, pertinent geographical location, vehicle load (bobtail, heavy trailer, etc).

2. ***Identify the system.*** What systems are installed on the truck? How are they supposed to work? What are the OEM or ADAS manufacturer recommendations? What is suspected?
3. ***Follow proper diagnostic, and efficient repair processes including*:**
   a. Tools / resources needed to repair
   b. Troubleshooting for intermittent code
   c. Diagnostics. Diagnostics often comes down to electrical faults in one or more of four key areas: power, ignition, ground and controlled area network (CAN) for radar.
   d. System code history, and other historical repairs.
   e. Active faults. Scan the entire truck and then assess where you need to go. Download and save reports to share with suppliers for diagnostic support.

4. ***Follow established troubleshooting steps for the identified system.*** Contact the appropriate supplier for more in-depth support.

II. ADAS Training Workflow:
Post-Crash/Collision Repairs

This workflow covers technician training for ADAS when the vehicle has been involved in a crash, or had collision/body work completed. These systems require proper post-crash/collision maintenance to provide their intended safety benefits.

NOTE: ADAS technologies vary so always be aware of the specific version/type in question. Always check the manufacturer's technical and warranty guidelines for detailed instructions and procedures.

The following workflow is meant as a general guide and is not specific to any single ADAS technology:

1. ***Driver/Authorized Vehicle Representative Interview.*** Obtain pre-approval of the work to be completed from the vehicle's authorized representative including accessing the vehicle's electronic control units (ECUs), vehicle data, authorization of dynamic on-road calibrations and safety system verifications that may need to be completed. Discuss and document conversation with the driver or the vehicle's authorized representative about:
   a. Have any customizations or previous repairs been done to the truck? Tire size changes, ride height changes, windshield replacement, previous collision repairs, paint work, frame correction, axle changes, body modifications or changes, thrust angle alignment changes, aftermarket hood changes, aftermarket bumper changes, aftermarket brush guard changes?
   b. Has there been any malfunction indicator lamp warnings such as ABS, aftertreatment, transmission, ADAS, engine, etc?
   c. Have any ADAS or other safety features been temporarily or permanently disabled on purpose?
   d. Have drivers been complaining about the ADAS, such as false positives, aggressive braking, too many unjustified automatic braking interventions, annoying lane maintaining warnings, unwanted steering into the next lane, unwanted steering towards off ramps, side object detection isn't predictably warning properly, etc.?

2. ***Conduct a Visual Inspection.*** After completing the initial interview, inspect the vehicle

for physical damage that may affect ADAS or other systems that can cause ADAS to be degraded or disabled. Visual inspection is necessary after a crash/collision because if a sensor is damaged, it may not show up on the diagnostic report and you won't know it's not working properly. Visual inspection is also necessary because the vehicle may have had a loss of electrical power for some time or may not have been able to be driven from the accident site.

a. Visually look for sensors and warning stickers around the vehicle. Understand that a visual inspection will not always help you locate all safety systems and sensors but will provide an idea of the sophistication of the system for future probing with diagnostic software.
b. Make a checklist of safety features available using the OEM build sheet, visual verification and diagnostic scan ECU information. This checklist will aid in post-repair safety system operation verification prior to returning vehicle to the driver.

Examples of sensors to look for include:

- ***Steering Angle Sensor***—Typically located along the steering column under the knee bolster or dash panel.
- ***Forward-looking Radar—***Located on the front of the vehicle and usually mounted to front frame crossmember.
- ***Forward-looking Multipurpose Camera—*** Located on the front of the vehicle and usually mounted to inner windshield glass.
- ***Lidar***—Not common or widely used at the time this RP was developed, but is usually located high up on the truck near roof cap.
- ***Electronic Stability Control (ESC)/ Roll Stability Control (RSC)/ Yaw Rate Sensor/ Lateral Accelerometer***—Usually mounted under the rear of the cab to a frame crossmember or frame rail.
- ***Electronic Steering Gear***—A traditional steering gear with an electronic component to aid in steering and lane maintaining.
- ***Side-object Detection Sensor***—Usually located near a lower side skirt fairing, projecting through the fairing or mounted behind (out of visual range unless the panel is opened). Many vehicles so equipped will have a warning light and buzzer located on the A-pillar trim panel inside the cab.
- ***Rear-view Mirror Cameras***—Some are mounted to the side mirrors, some are mounted to the doors, some are on the rear of the cab to aid in fifth wheel connection, some are on rear of vehicle.
- ***Rear-object Detection Sensor***—Usually mounted in the rear of vehicle.