ADAS

ADVANCED DRIVER ASSISTANCE SYSTEM

Calibration Best Practices

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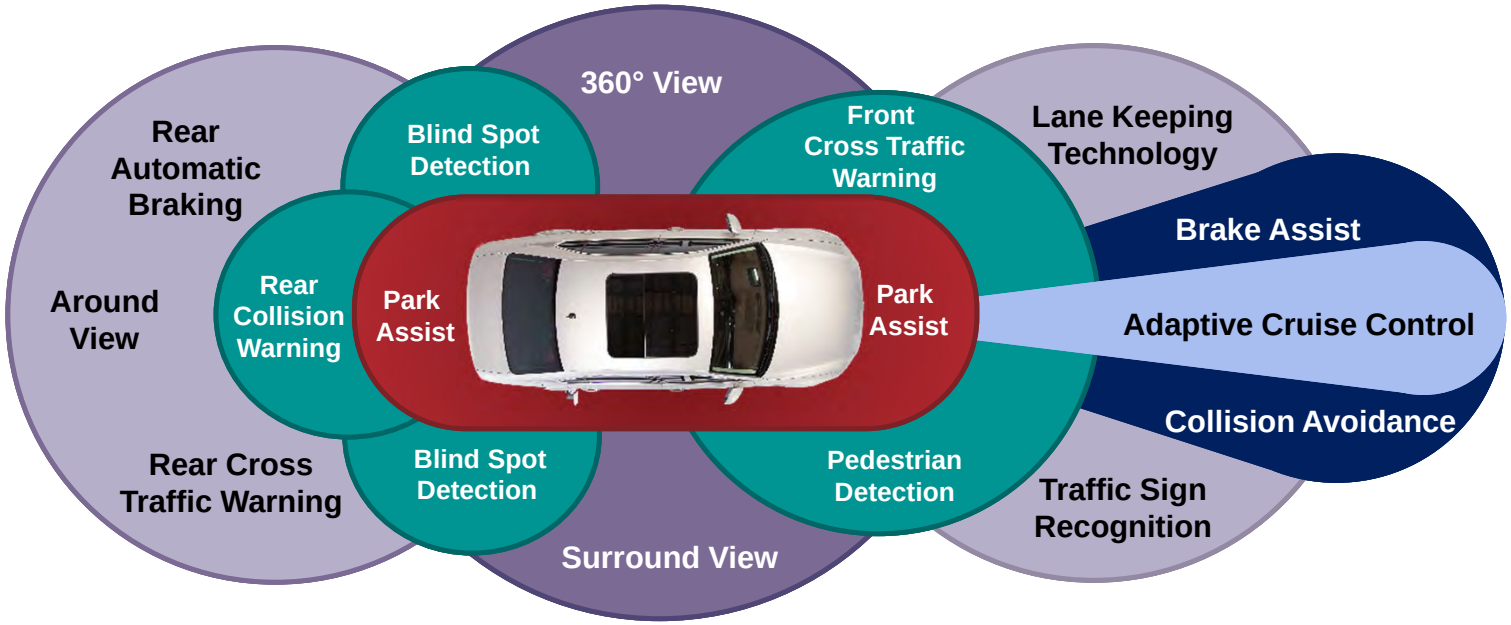
What is ADAS?

ADVANCED DRIVER ASSISTANCE SYSTEM

- Advanced Driver Assistance Systems, or ADAS, is a group of assist functions designed to improve driver safety and reduce the severity and number of traffic accidents.



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SAE 5 Levels of Driving Automation

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Driver Required | **Automated Driving**

0	1	2	3	4	5
No Automation	Driver Assistance	Partial Automation	Conditional Automation	High Automation	Full Automation

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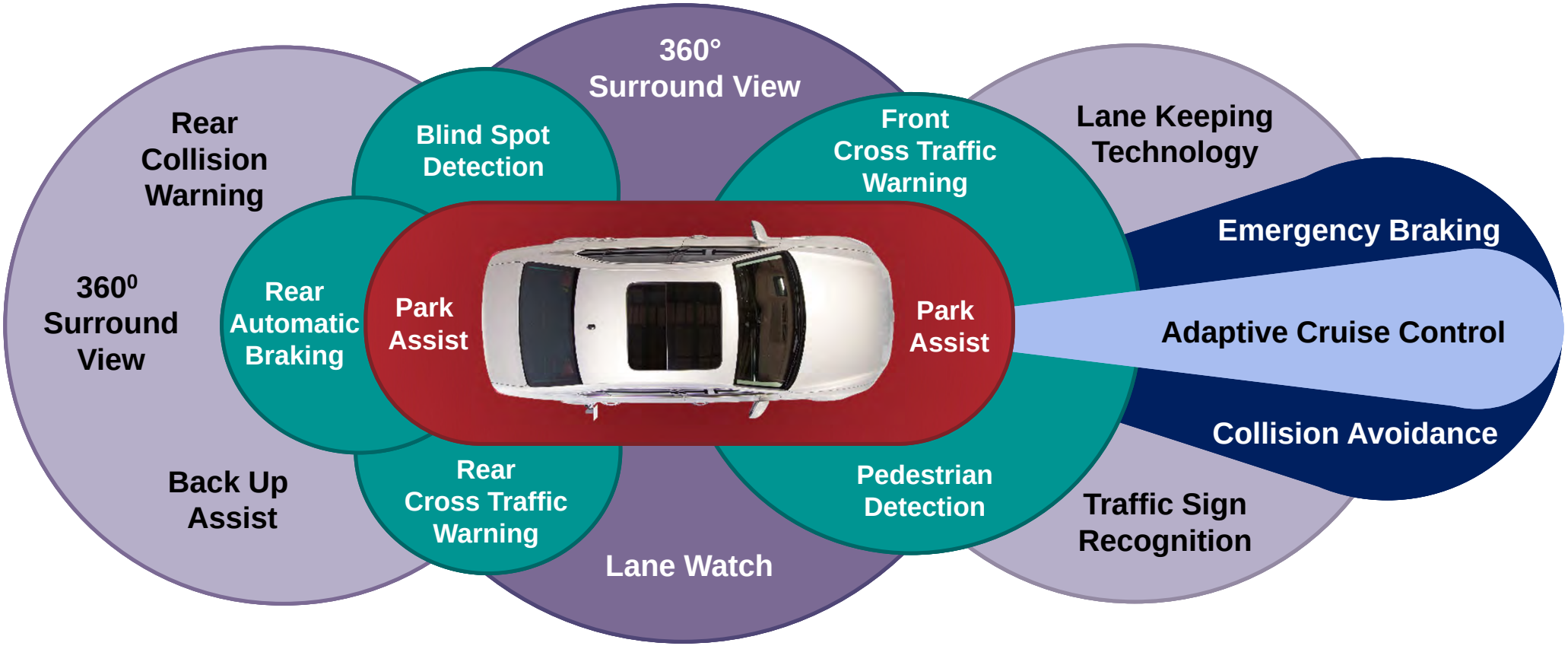
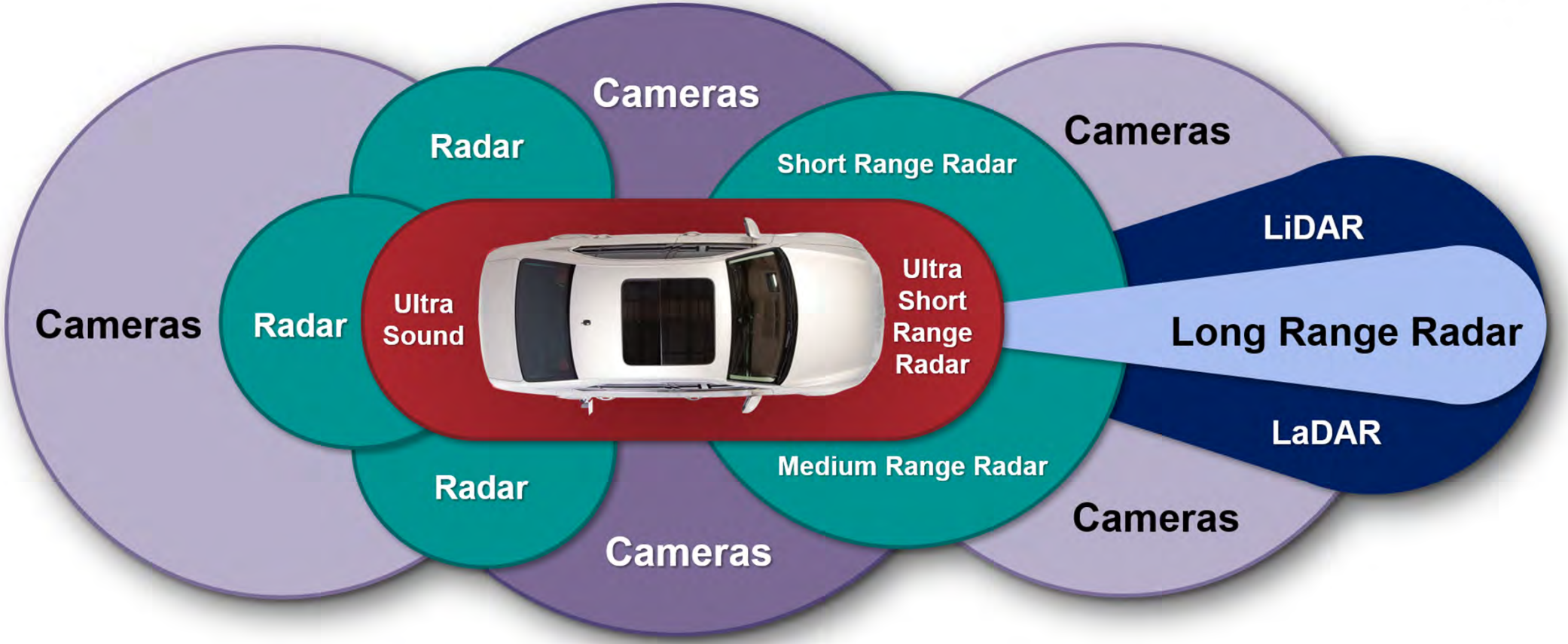
ADAS Technologies

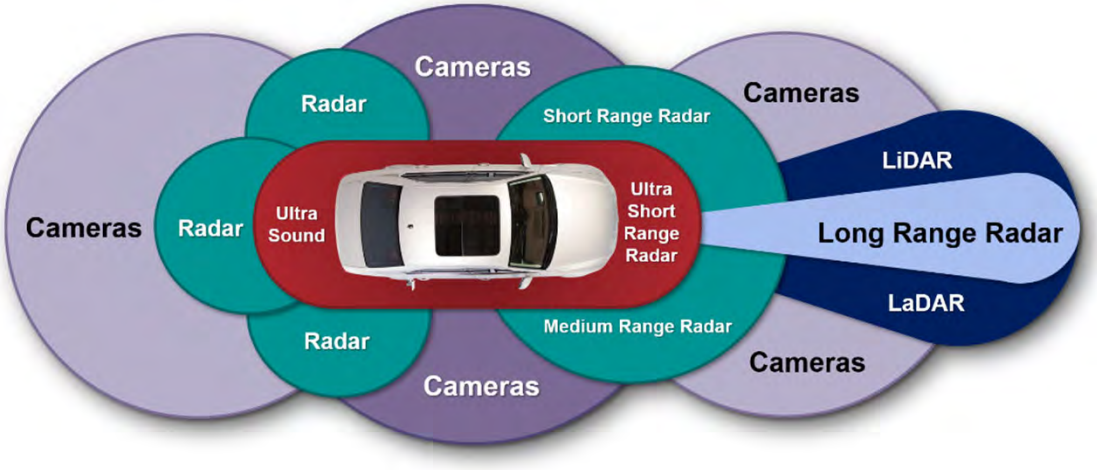


ADAS System Sensors



ADAS System Sensors

- **Imaging Cameras**
- **RADAR**
  - Radio Detection and Ranging
    - Ultra Short Range **USRR**
    - Short Range **SRR**
    - Medium Range **MRR**
    - Long Range **LRR**
- **LiDAR**
  - Light Detecting and Ranging
  - Laser Detecting and Ranging
  - Laser Radar
- **Ultrasonic**
- **Electromagnetic**
- **Thermal**
- **Infrared**



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What the Camera Sees

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What the Camera Sees

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ADAS CALIBRATION MYTHS & MISCONCEPTIONS

Myths and Misconceptions

- *If there are no DTCs present I don't need to calibrate*

Myths and Misconceptions

- *If there are no warning lights or messages on the dash I do not need to calibrate*

Myths and Misconceptions

- *If I don't unplug the camera or radar sensor, I don't need to calibrate*

Myths and Misconceptions

- *The scan tool says the calibration completed, so it must be accurate*

ADAS Calibration Best Practices

ADVANCED DRIVER ASSISTANCE SYSTEM

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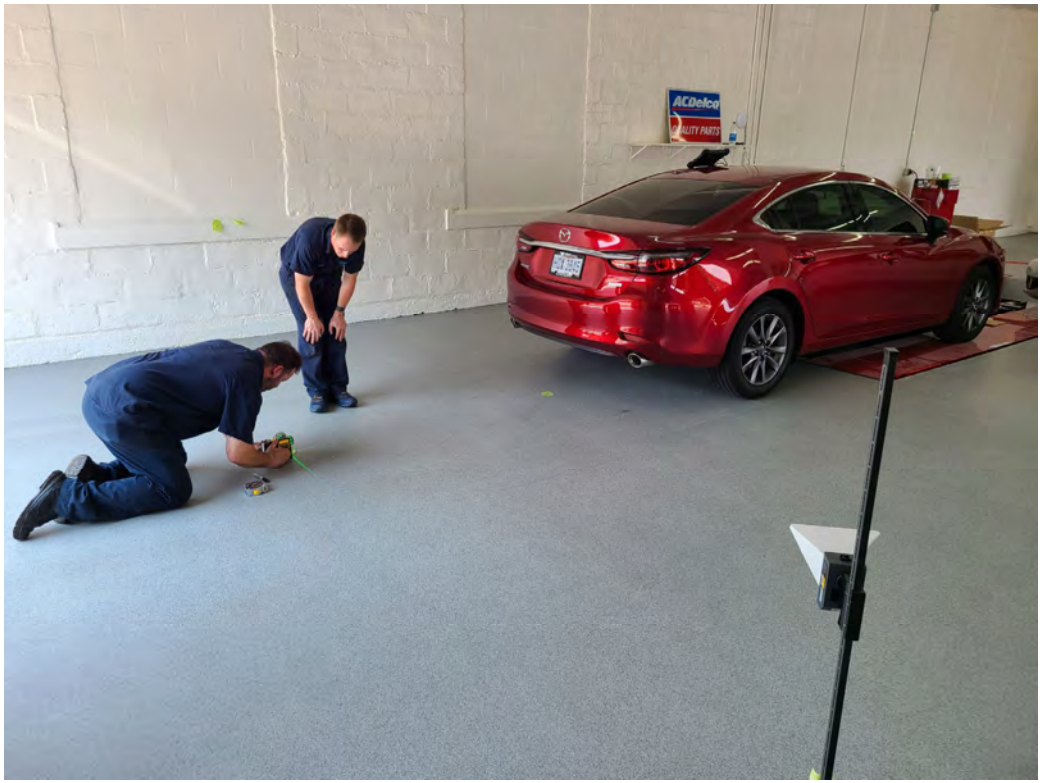
- Pre-calibration test drive
- Calibration skill set
- Calibration environment
- Vehicle pre-conditioning
- Calibration documentation



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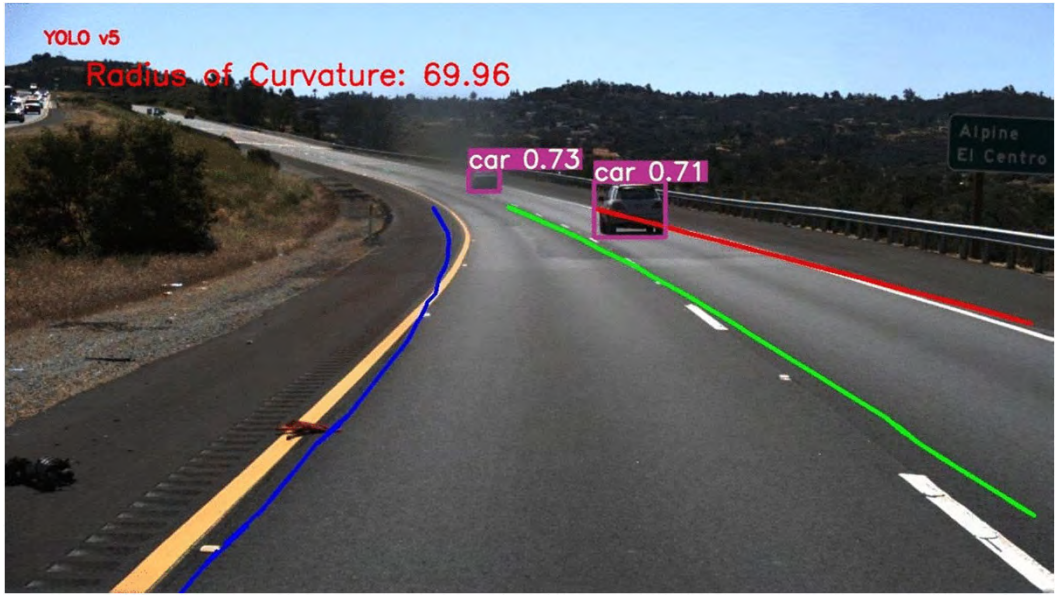
Pre-Calibration Test Drive

- Not all ADAS systems operate the same way
- Sets a baseline for comparison
- Exposes issues which may affect calibration



Segment 1:

Demonstration of pedestrian autobrake tests

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Insurance Institute for
Highway Safety

ADAS Calibration Skill Set

ADVANCED DRIVER ASSISTANCE SYSTEM

- A calibration technician **MUST** be able to:
  - Read, understand and follow detailed instructions without skipping steps
  - Make precision measurements with a metric tape measure
  - Utilize a plumb-bob and string line
  - Create a true 90° right triangle
  - Make clear markings on the ground
  - Utilize a spirit level
  - Utilize a laser level
  - Make precision adjustments

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ADAS Calibration Environment

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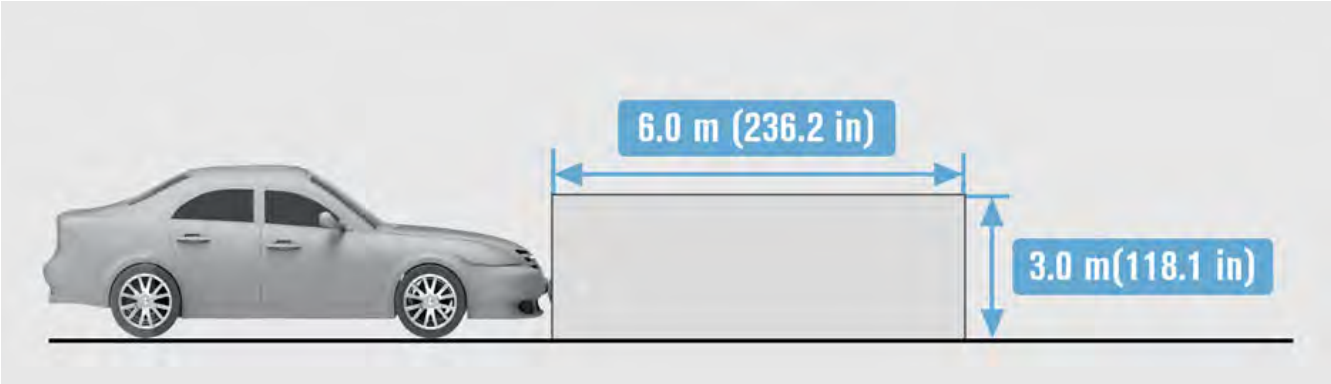
- Flat, level floor
- Bright, even, controlled lighting
- No windows or stray lighting behind or to the sides of targets
- No clutter behind targets in view of camera
- No objects of metallic mass within the specified distance of radar sensors



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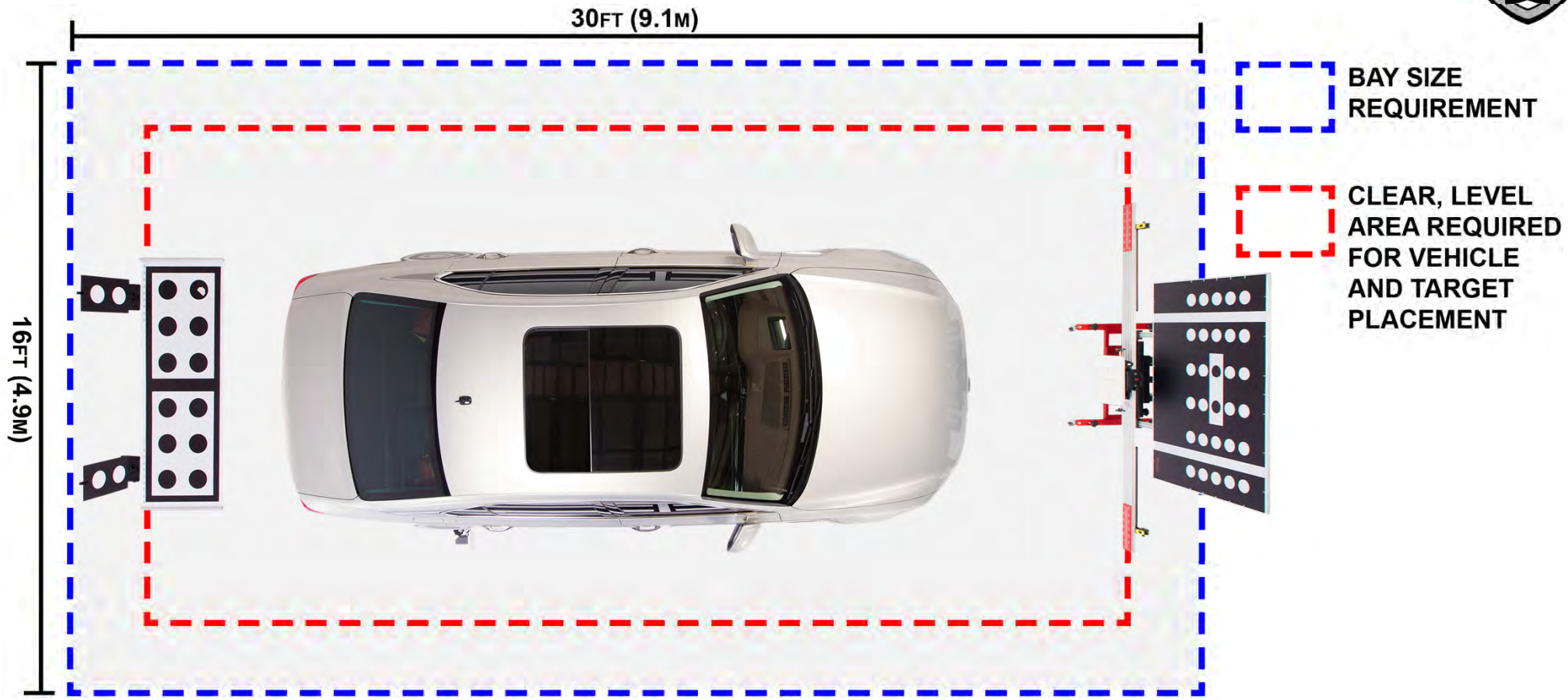
ADAS Bay Space Requirements

ADVANCED DRIVER ASSISTANCE SYSTEM



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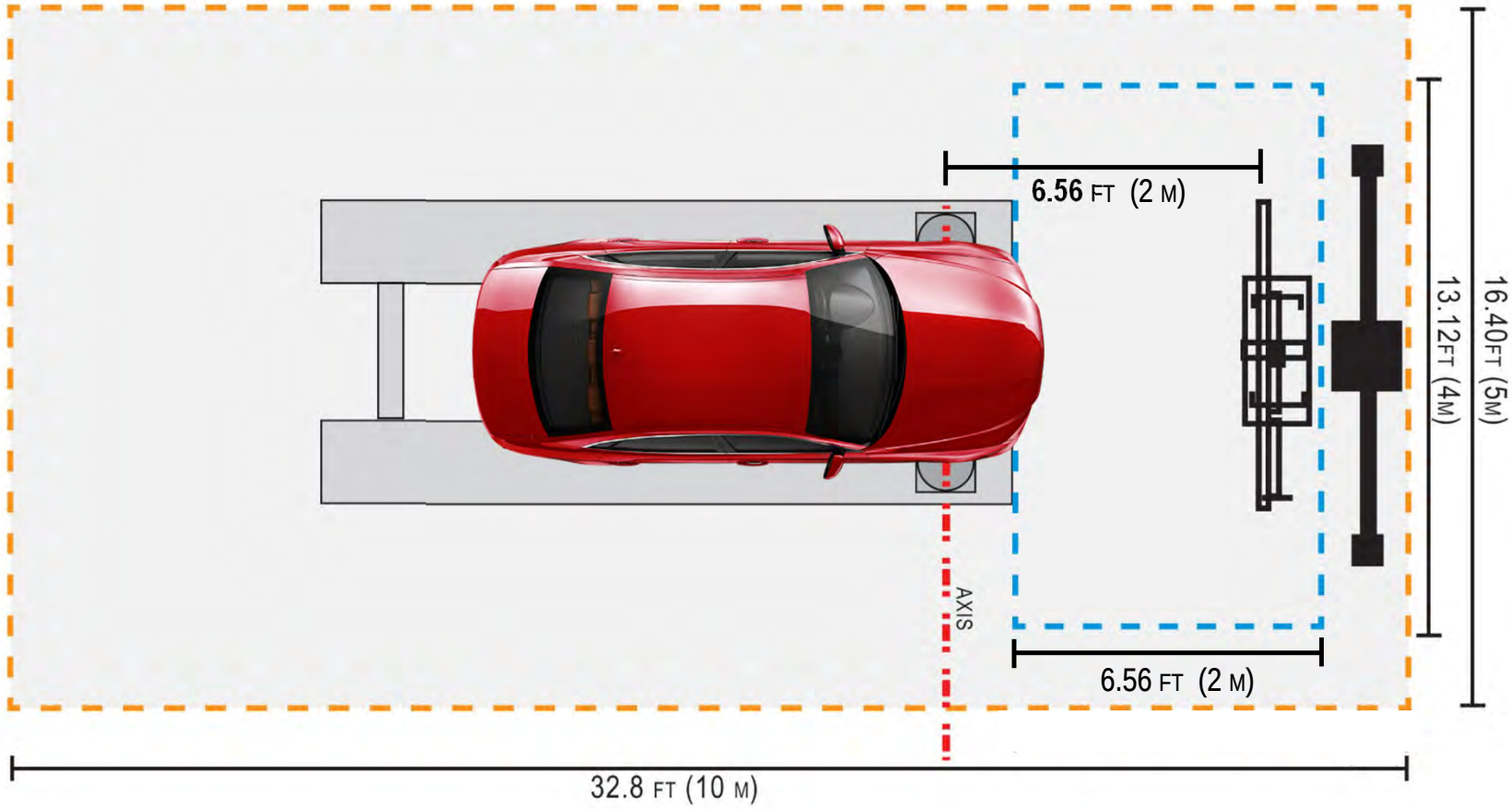
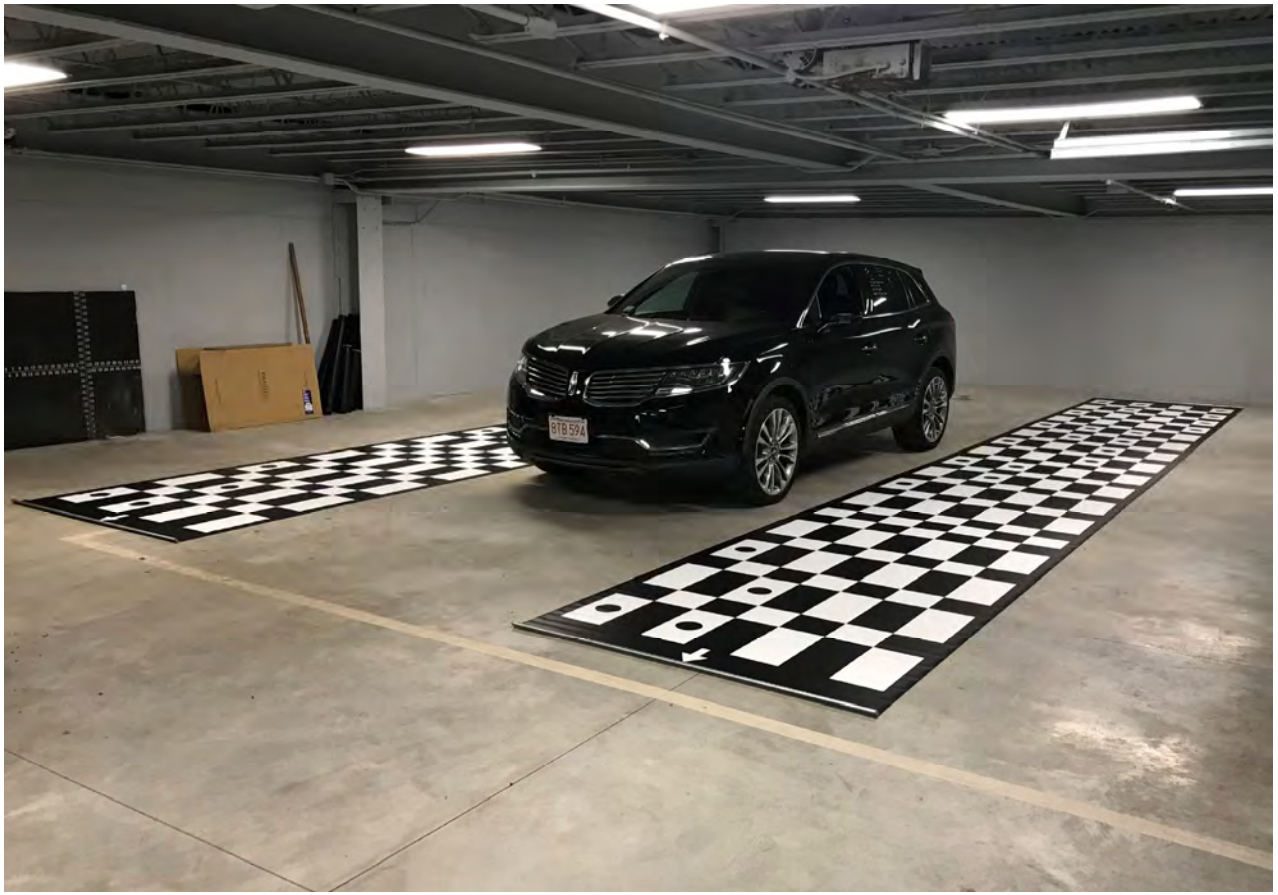
Bay Space Requirements



ADAS ADVANCED DRIVER ASSISTANCE SYSTEM Ford AVM Calibration



- Around View AVM calibration may require 25’ X 40’ or more

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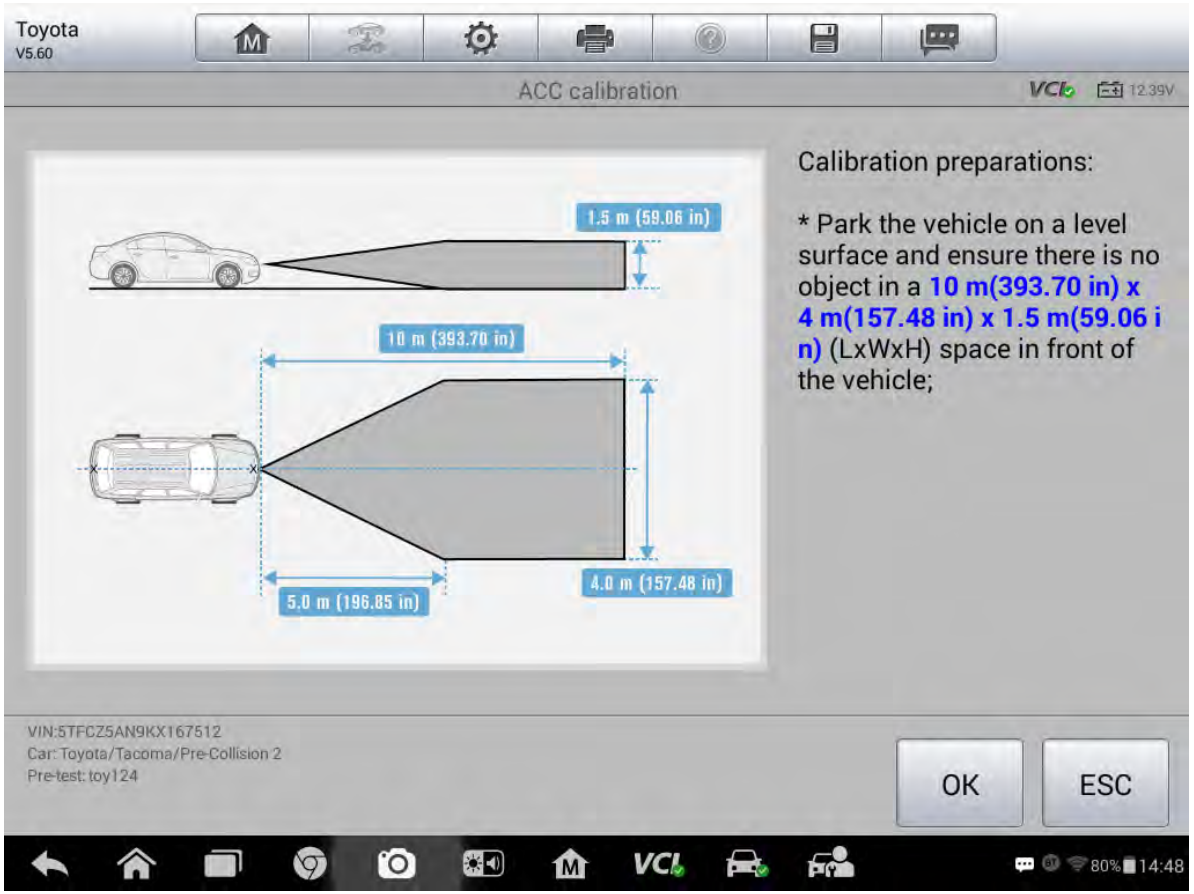
ADAS Radar Calibration

ADVANCED DRIVER ASSISTANCE SYSTEM



- Some radar calibrations can require 10 meters or more in front of the vehicle

ADAS Checking for Level

ADVANCED DRIVER ASSISTANCE SYSTEM

- Measure the height of the horizontal laser beam
  - In this case it is 5” (127 mm)

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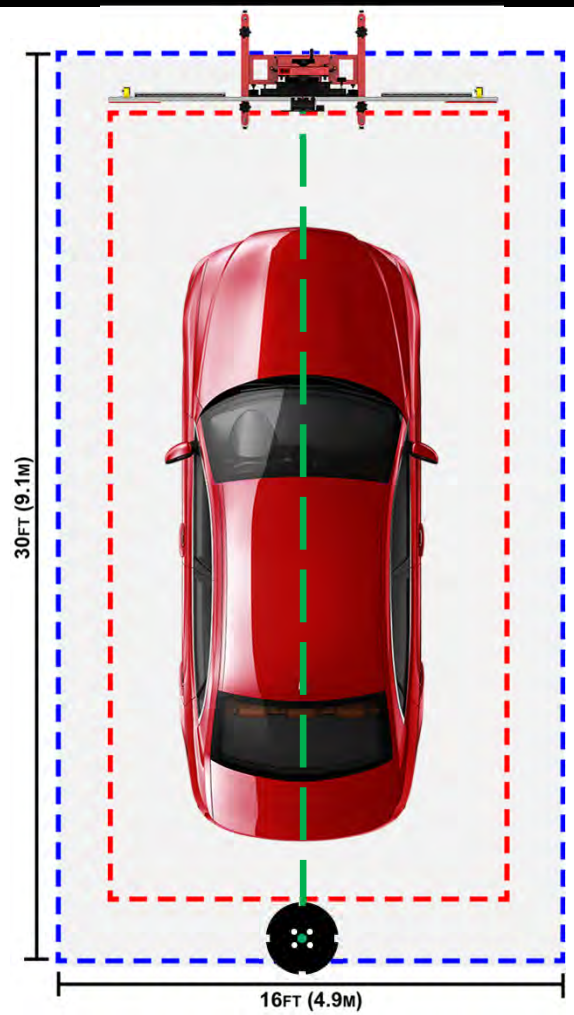
Checking for Level



- Measure the height of the laser beam
  - In this case it is 5”
- Place the laser level behind the vehicle
- Measure the height of the beam at the calibration frame

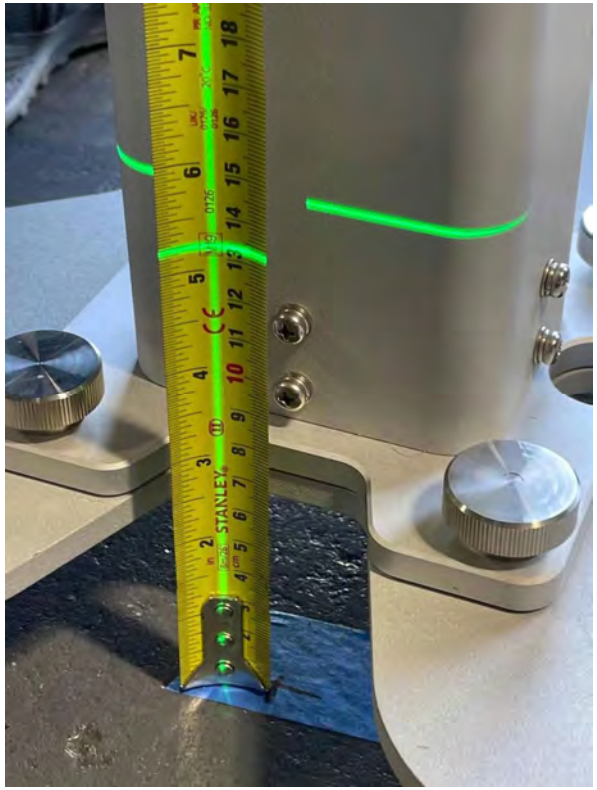
ADAS Checking for Level

ADVANCED DRIVER ASSISTANCE SYSTEM

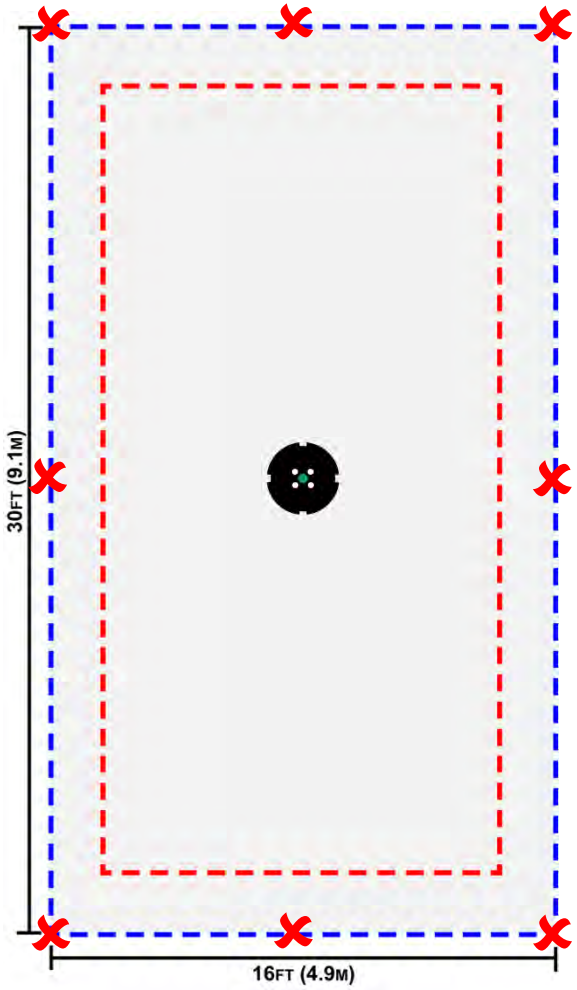
Rear of Vehicle

5.25 inches (133 mm)

At calibration Frame



Checking for Level



- Place the laser level in the center of an empty bay
- Measure at multiple points around the bay
- Determines level in all directions
- Half tolerance on measurements

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Solution to Unlevel Floors

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Not an Ideal Environment

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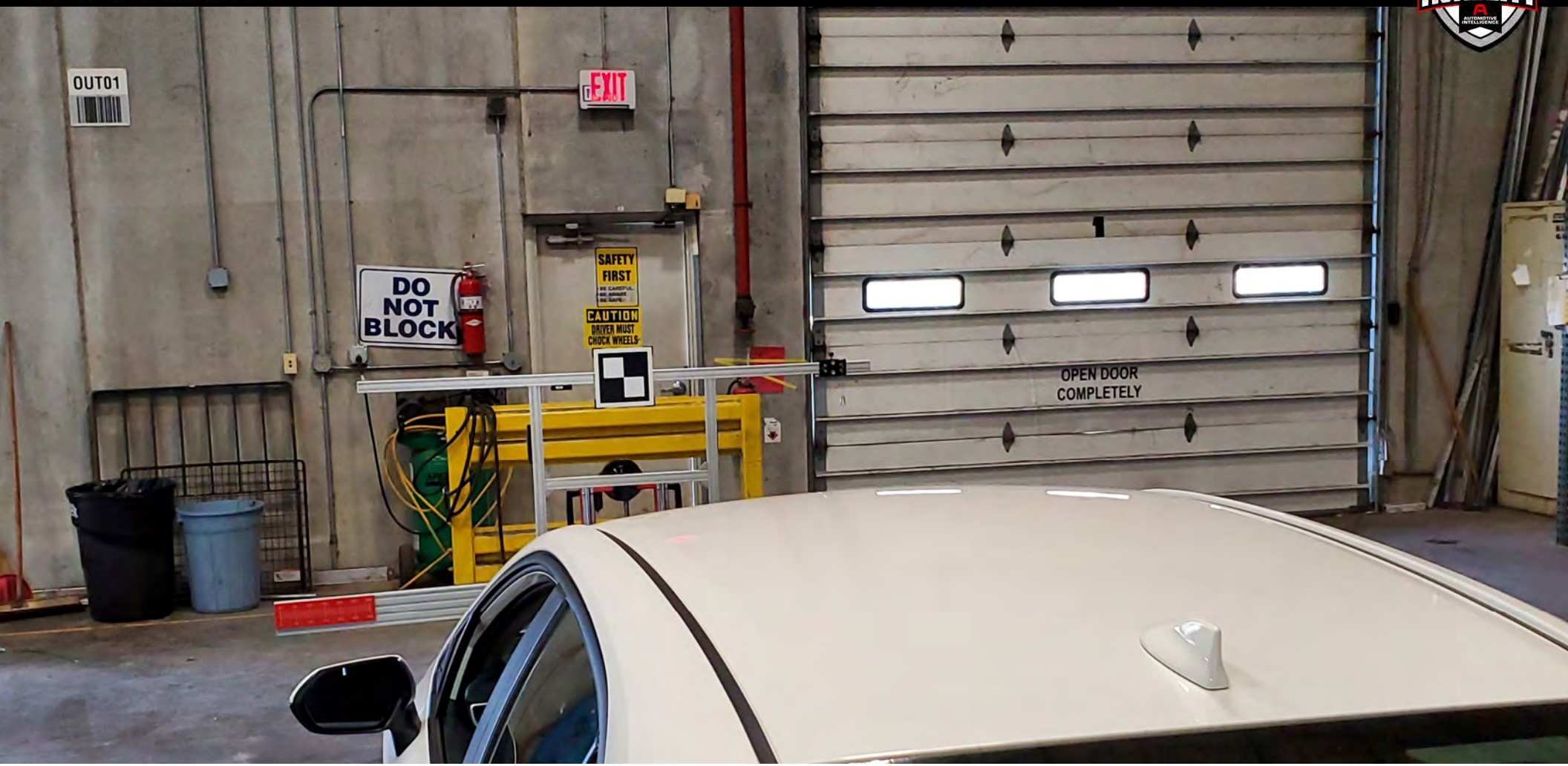

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Not an Ideal Environment

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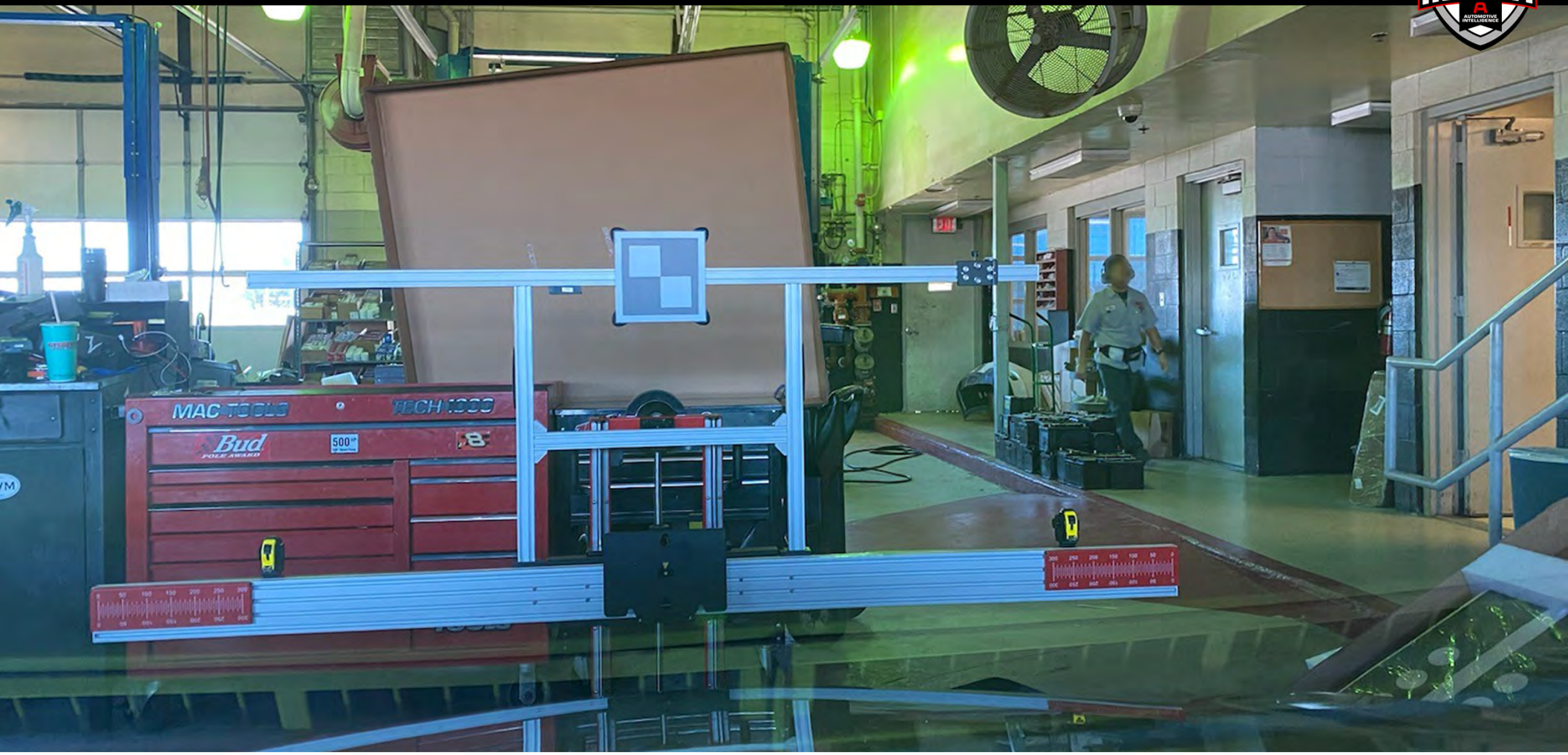
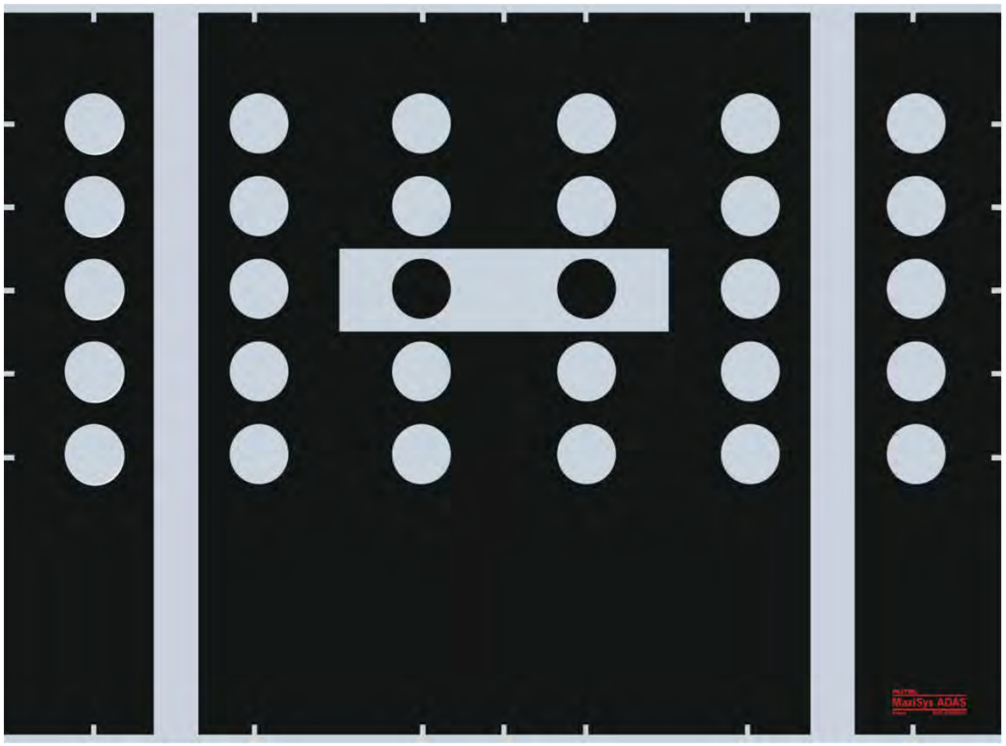
AUTOMOTIVE INTELLIGENCE



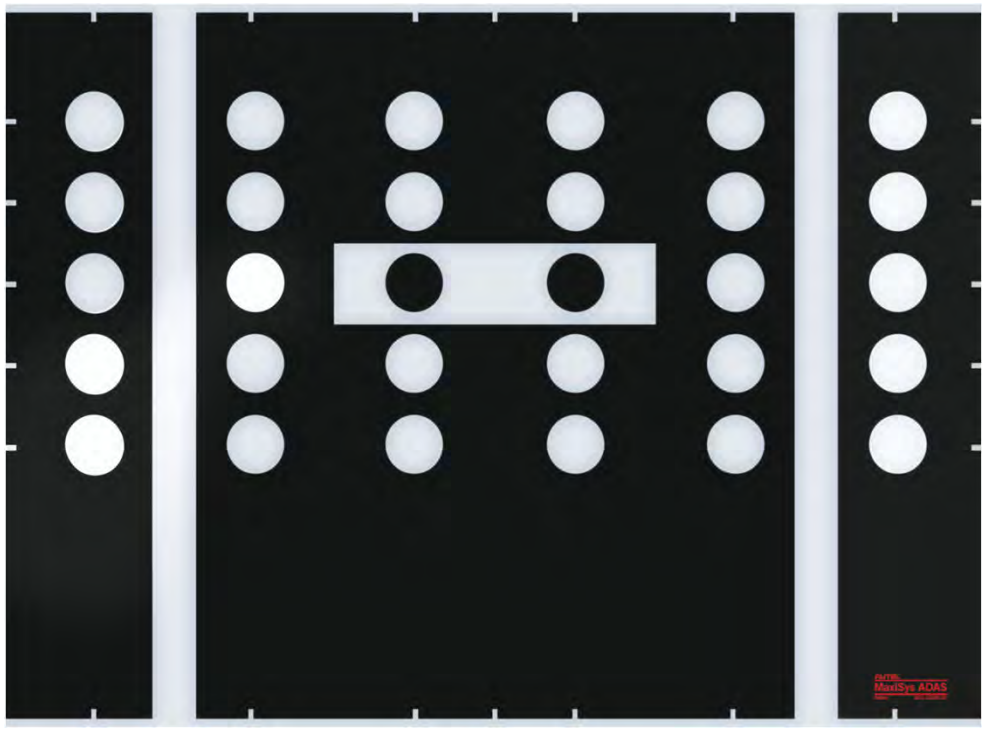
ADAS Lighting Issues

ADVANCED DRIVER ASSISTANCE SYSTEM

PASS



FAIL



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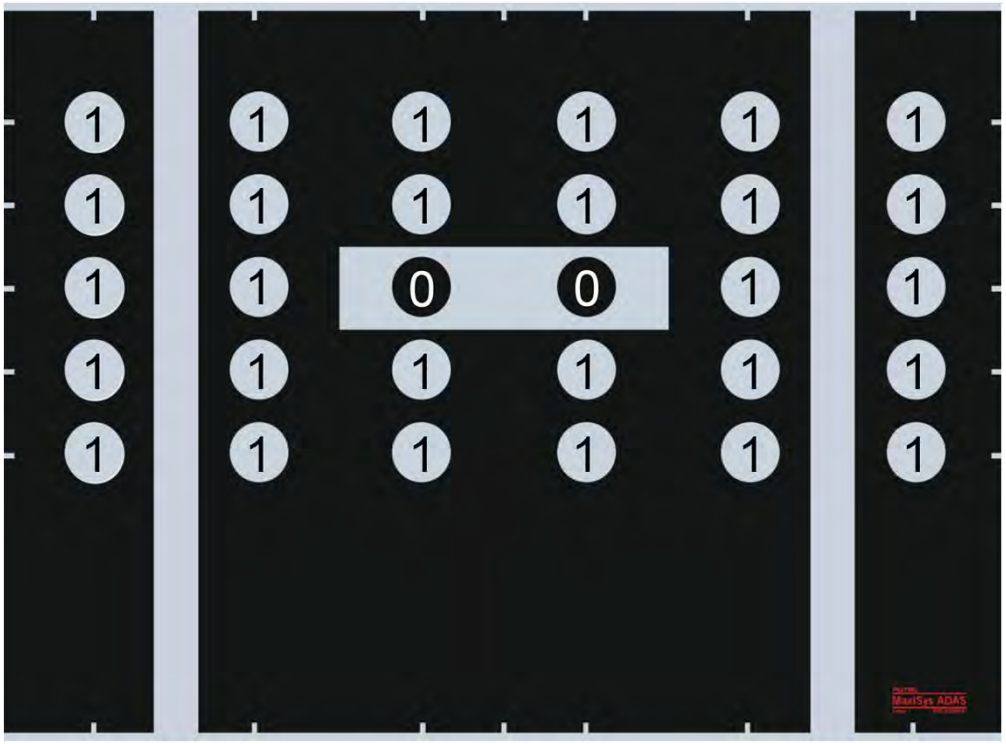
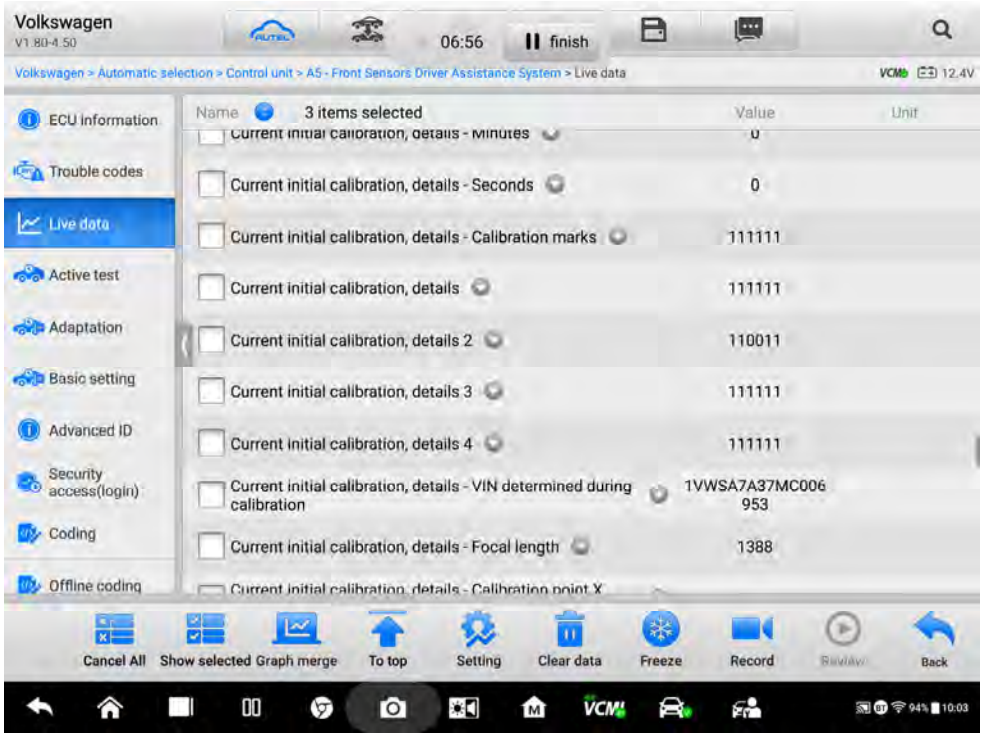
ADAS Proper Lighting

ADVANCED DRIVER ASSISTANCE SYSTEM





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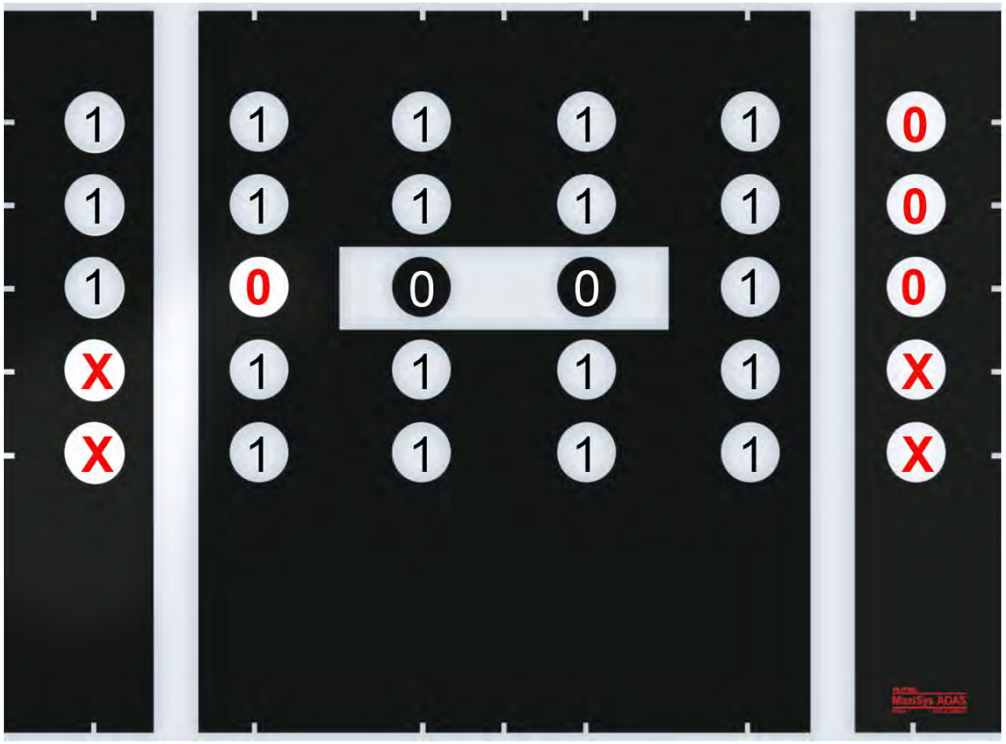
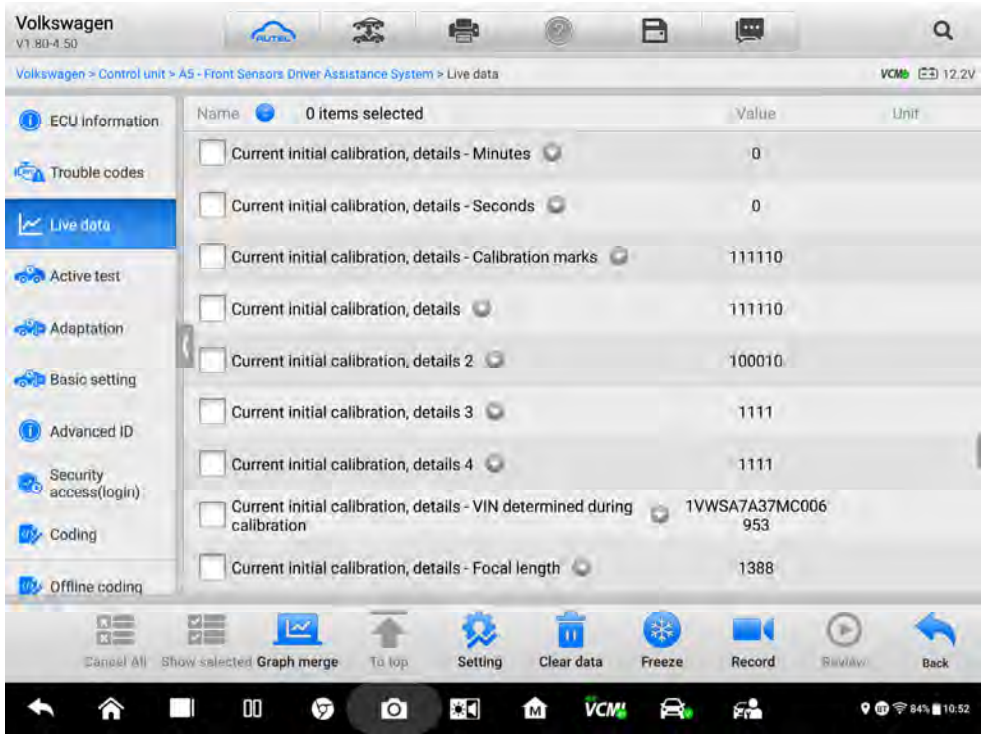
ADAS Improper Lighting

ADVANCED DRIVER ASSISTANCE SYSTEM





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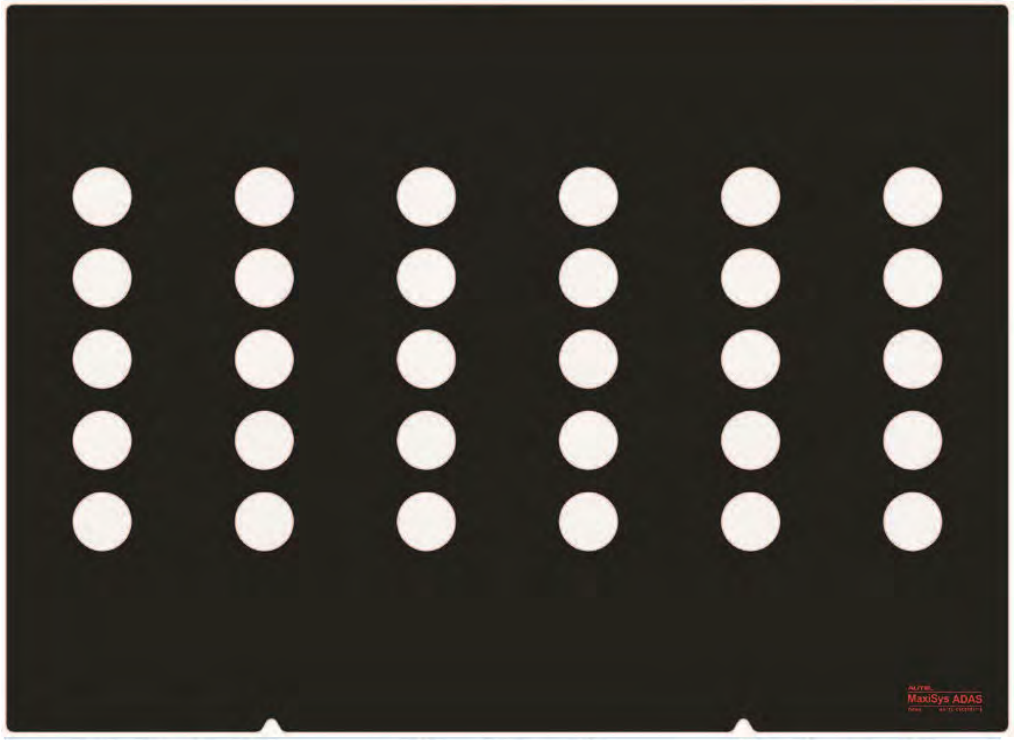
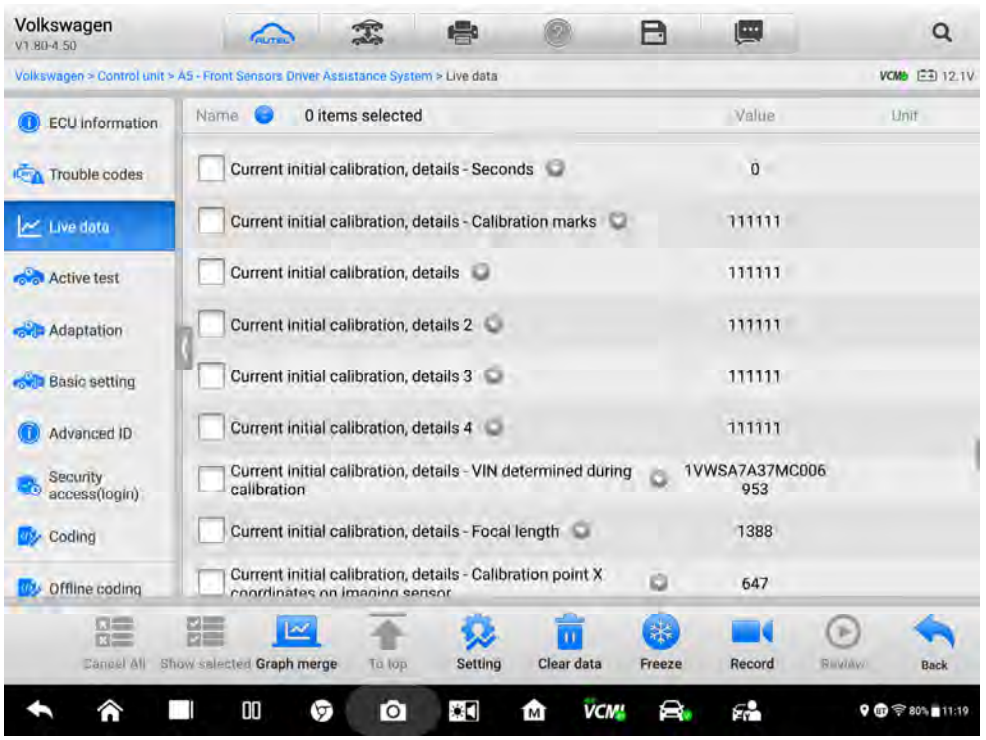
ADAS Substitute Alfa Romeo Target

ADVANCED DRIVER ASSISTANCE SYSTEM





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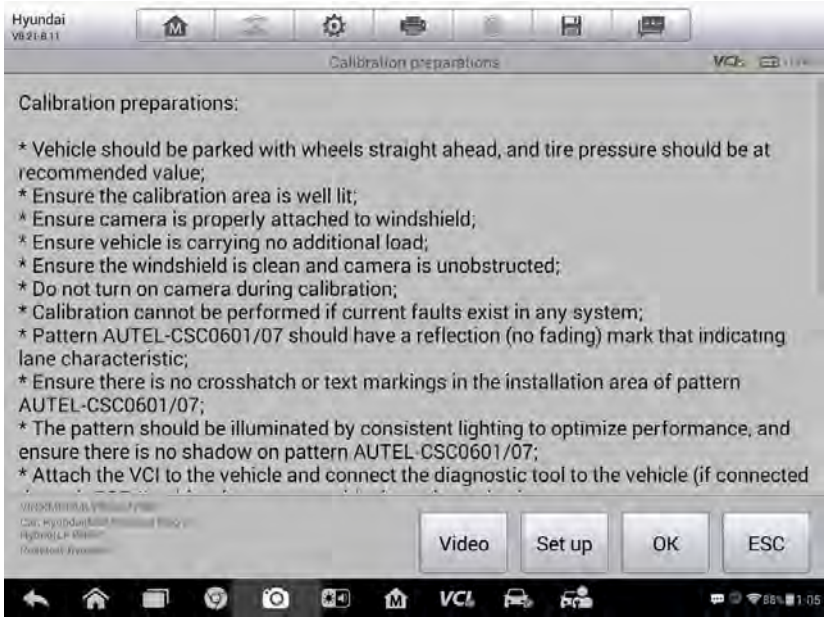
ADAS Vehicle Preconditioning

ADVANCED DRIVER ASSISTANCE SYSTEM

- All fluids to recommended levels
- Gas tank full
- Tire pressure adjust to placard value
- Windshield clean
- Dashboard clear
- No load in vehicle
- All lights off and all doors closed
- Connect a battery power supply
- Front wheels steering straight ahead
- Rear wheels steering straight ahead



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ADAS Camera Field of View

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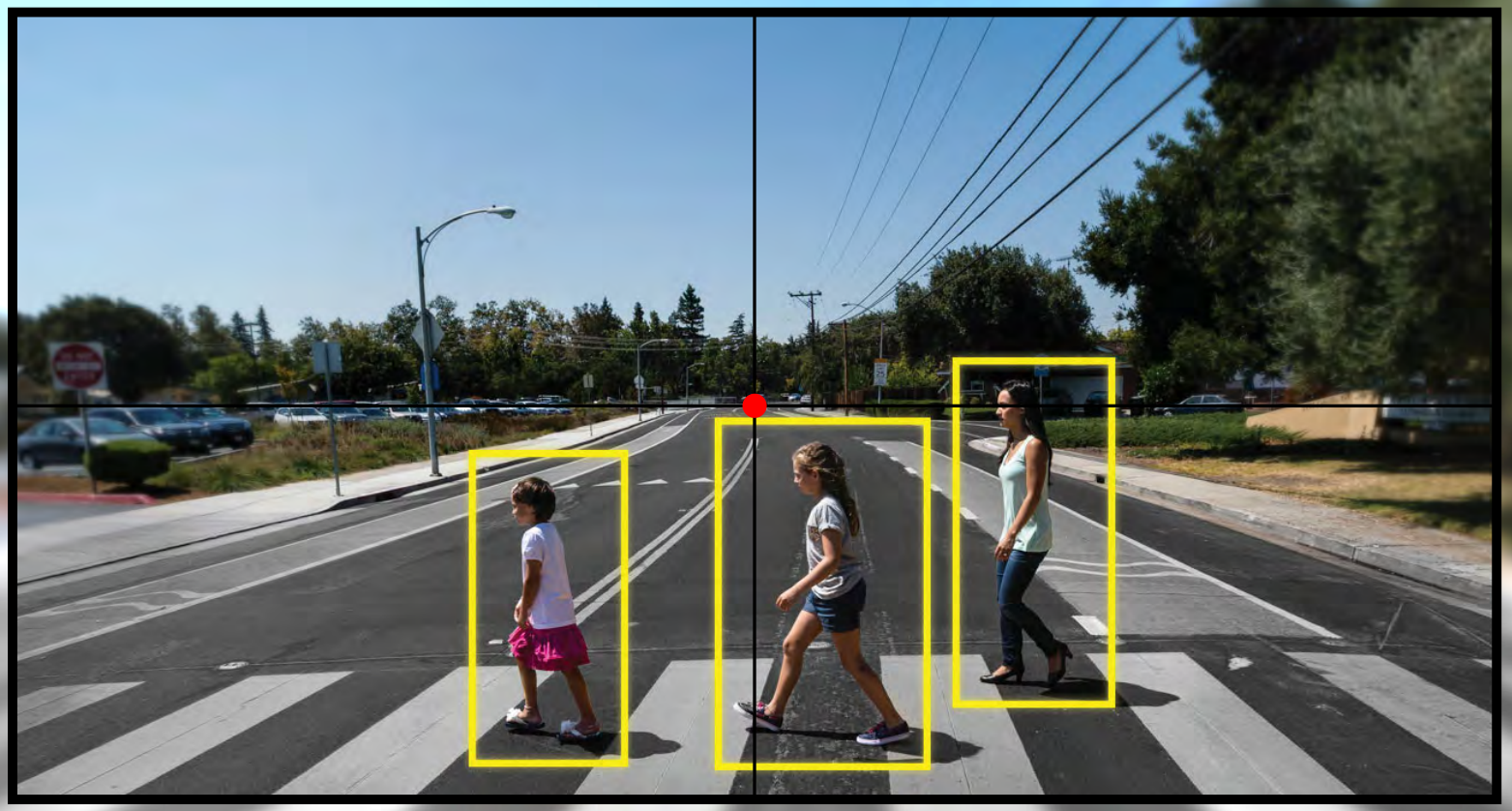
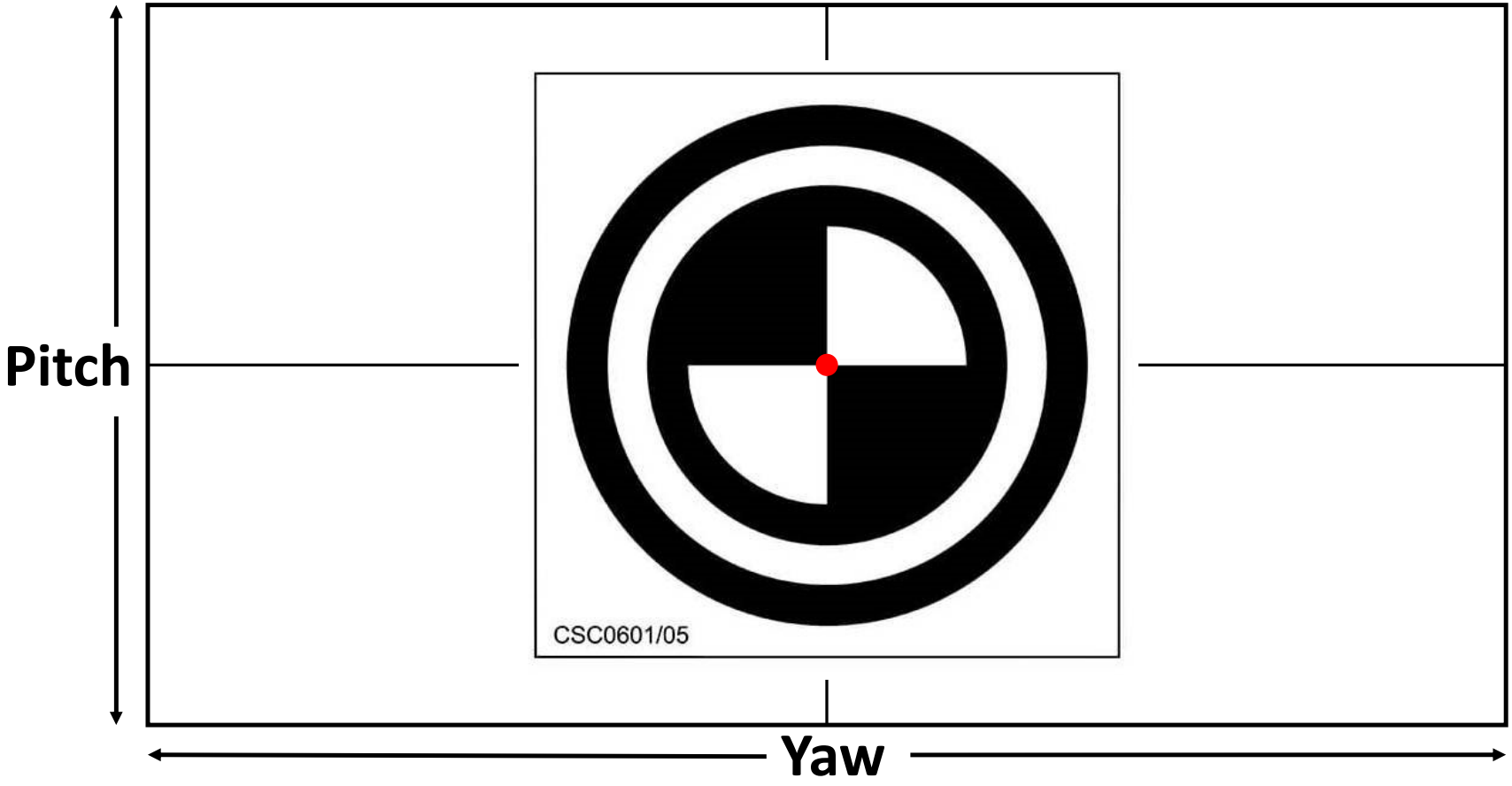


ADAS Zero Point Calibration

ADVANCED DRIVER ASSISTANCE SYSTEM



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ADAS Vehicle Preconditioning

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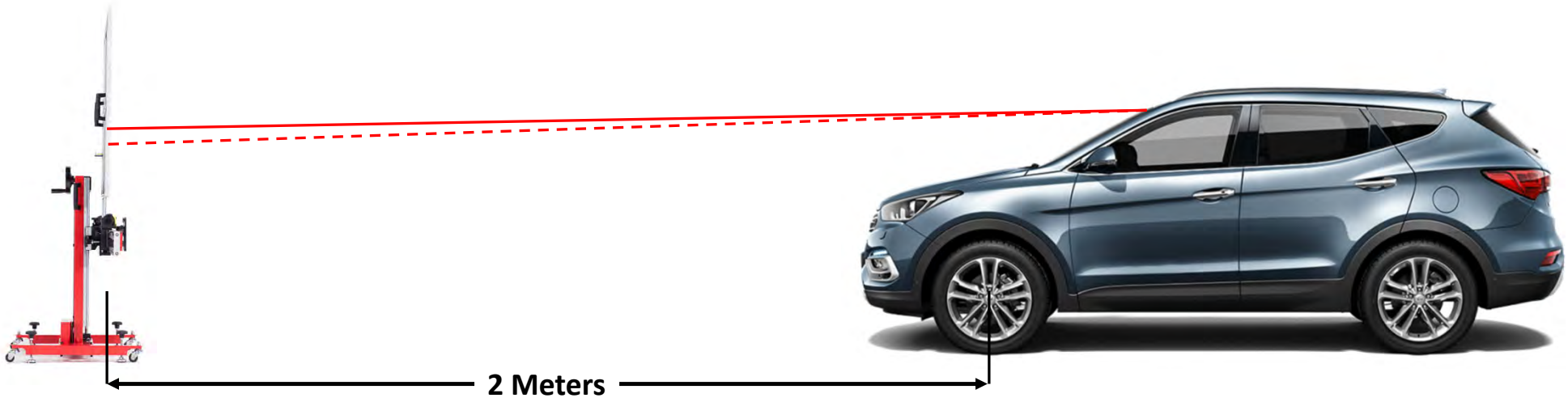
1° of deviation = 1.3” @ 2 Meters



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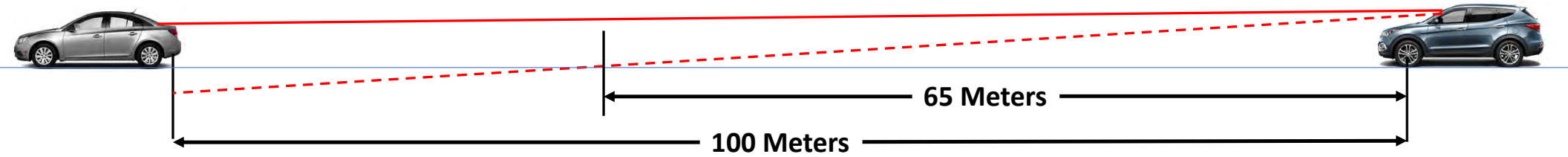
ADAS Vehicle Preconditioning

ADVANCED DRIVER ASSISTANCE SYSTEM

1° of deviation = 66” @ 100 Meters (328’)



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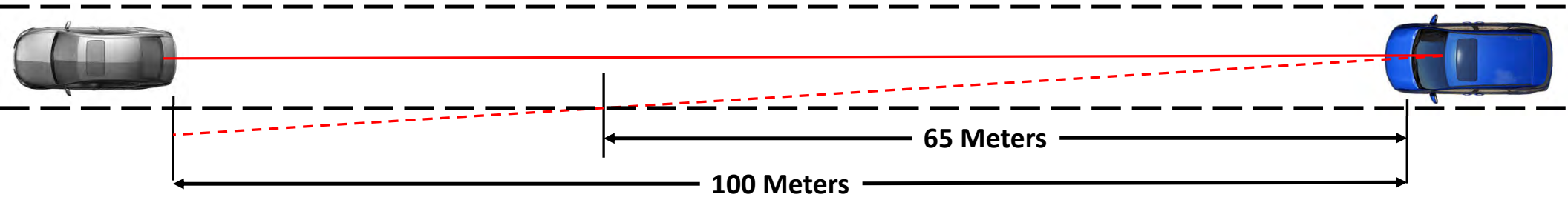
ADAS Vehicle Preconditioning

ADVANCED DRIVER ASSISTANCE SYSTEM

1° of yaw = 66” @ 100 Meters



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IIHS HLDI Advisory 43

IIHS HLDI Insurance Institute for Highway Safety Highway Loss Data Institute

ADVISORY

No. 43, October 24, 2018

Windshields – Aftermarket vs. OEM replacement and ADAS camera calibrations

Executive summary

Advanced driver assistance systems (ADAS) are proven to reduce crash frequency, but they also drive up repair costs when vehicle damage occurs. For most technologies, the reduction in claim frequency and associated costs outweighs the disbenefits of the pricier repairs. One of the most significant repair cost increases is associated with replacement windshields. Historically, replacing a windshield did not require any special consideration other than fit and clarity. Now that lidar and camera systems are becoming more common, replacing windshields requires additional consideration beyond aesthetics. No systematic evaluation has been completed to determine if ADAS equipment mounted behind the windshield is indeed affected when the glass is replaced. Most auto manufacturers recommend the use of original equipment manufacturer (OEM) replacement glass when ADAS is present, as well as post-repair calibration of the ADAS sensors. These two recommendations significantly increase repair costs.

This advisory outlines IIHS efforts to examine how original equipment windshields from various manufacturers, OEM replacement windshields, and aftermarket windshields affect ADAS operation and effectiveness on eight passenger vehicles. Initial evaluations of the constituent glass properties across the windshield types showed no distinct variation in clarity or refraction. Evaluations of automatic emergency braking (AEB) and lane departure warning (LDW) system operation showed negligible differences between the replacement glass types, except for the Honda Civic.

In the case of the Civic, multiple issues contributed to degraded ADAS performance. The most significant one was the aftermarket windshield's glued-on camera mount, which was skewed at an approximate 1° roll angle relative to the vehicle centerline. In addition, loose camera-mounting clips allowed the camera to rotate 1° relative to the vehicle's longitudinal axis. When the aftermarket windshield was initially installed with the camera centered, both lane departure warning and AEB exhibited degraded performance. In the case of AEB, warning times were closer to impact than originally tested, and for lane departure, the lane position was skewed to the right.

Of the models IIHS examined, no evidence exists that the glass itself causes any conflict with ADAS operations; however, the Civic results suggest that calibrations must be performed to ensure proper function. The camera-mounting problems in the Civic were not identifiable on casual inspection, and the misaligned camera did not trigger any system faults.

Ultimately, the situation would be improved if ADAS equipment were fitted with reliable self-diagnostics, which flag the operator when a sensor needs service. Such systems would free repair shops of the need for calibration, except in those rare cases as IIHS observed with the Civic.

Background

Two-thirds of all comprehensive claims are for glass, with about 14 percent of comprehensive dollars going toward glass claims. The dollar amount has been increasing as windshield replacement costs go up.

Aftermarket windshields are less costly than OEM glass, with some new windshields costing more than $1,000. Looking at the prices of a select group of vehicles (Table 1), the average savings when using aftermarket glass is $424.

Windshields sold and distributed by the original manufacturer and its dealer network are considered OEM, and they typically bear the OEM logo. Aftermarket windshields are sold by vendors outside of the dealer network (e.g. Safelite) but are often made by the same producers of OEM glass, these parts do not have the OEM logo.

iihs.org

- The Issue: OE vs. aftermarket windshields
  - Composition
  - Clarity
  - Color
  - Curvature
  - Camera bracket
  - Frit design

ADAS ADVANCED DRIVER ASSISTANCE SYSTEM FCW/AEB Test at 25 MPH

	Baseline	Camera Rotated 0.6° Degrees Right	Reaction Time Reduced
Time to Collision Warning	3.38 Sec (Avg)	2.78 Sec (Avg)	0.60 Sec (Avg)
Time to Collision Braking	1.47 Sec (Avg)	0.89 Sec (Avg)	0.58 Sec (Avg)
Target Impact Speed	0 MPH (Avg)	19.5 MPH (Avg)	

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ADAS Calibration and Wheel Alignment

ADVANCED DRIVER ASSISTANCE SYSTEM

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Myths and Misconceptions

- *If the camera or radar were calibrated before an alignment, they will still be calibrated after an alignment*

Wheel Alignment & ADAS

ADAS ADVANCED DRIVER ASSISTANCE SYSTEM

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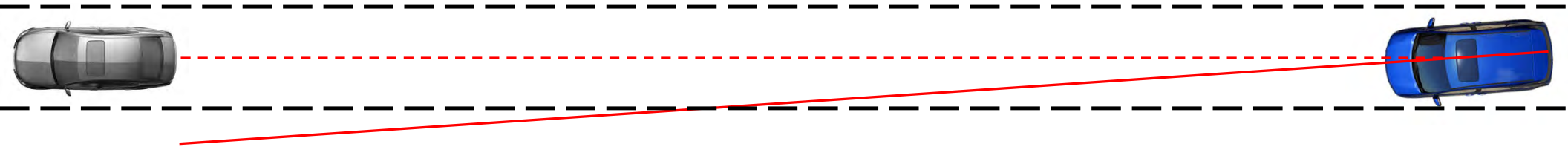
Vehicle Centerline = Where the vehicle is pointing

Thrust Angle = Where the vehicle is driving



- **When a vehicle is out of alignment, the thrust angle and vehicle centerline are different**
- **The vehicle is not pointing where it is driving**

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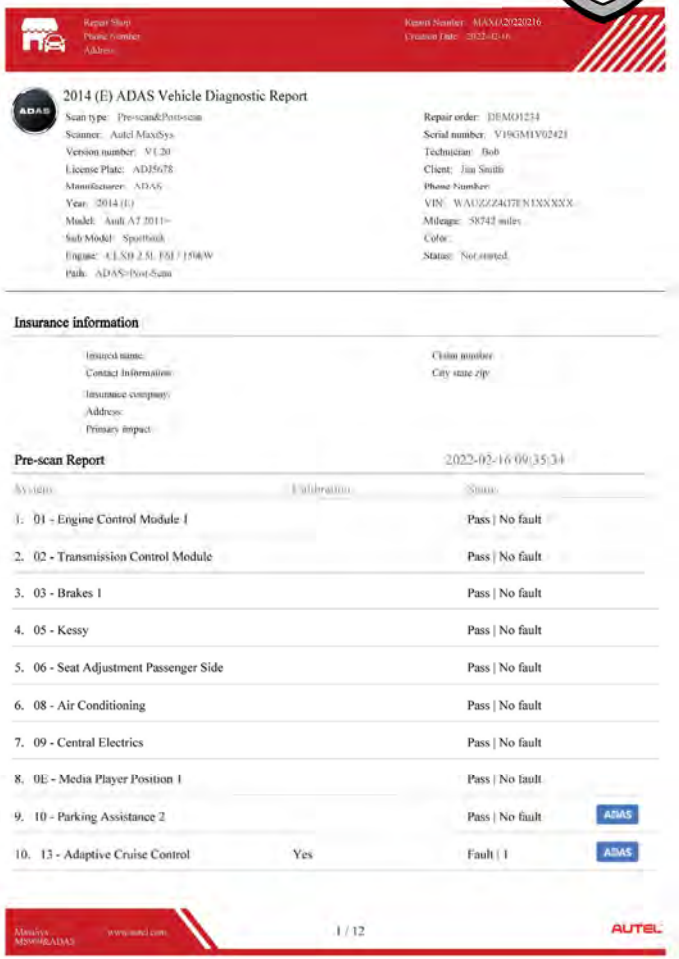
ADAS Calibration Documentation

ADVANCED DRIVER ASSISTANCE SYSTEM

- **Document everything**
  - Pre-scan report
  - Photograph pre-existing damage
  - Wheel alignment report
  - Steering angle sensor screen capture
  - Preconditioning instructions screen capture
  - Calibration completion screen capture
  - Calibration related data PIDs
  - Post-scan report
  - Photograph
    - Vehicle
    - License plate
    - Calibration set-up
  - Customer signature on report



2014 (E) ADAS Vehicle Diagnostic Report

Insurance information

Pre-scan Report 2022-02-16 09:35:34

1.	01 - Engine Control Module 1		Pass | No fault
2.	02 - Transmission Control Module		Pass | No fault
3.	03 - Brakes 1		Pass | No fault
4.	05 - Kessy		Pass | No fault
5.	06 - Seat Adjustment Passenger Side		Pass | No fault
6.	08 - Air Conditioning		Pass | No fault
7.	09 - Central Electrics		Pass | No fault
8.	0E - Media Player Position 1		Pass | No fault
9.	10 - Parking Assistance 2		Pass | No fault
10.	13 - Adaptive Cruise Control	Yes	Fault | 1

1 / 12

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Thank You