Waymo autonomously driven Hyundai IONIQ 5

Emergency Response Guide and Law Enforcement Interaction Protocol

This document includes material from the **Hyundai IONIQ 5 Emergency Response Guide**

WAYMO

Hyundai IONIQ 5

Contents

Waymo Fully Autonomous
Hyundai IONIQ 5

Introduction to Waymo's vehicle and service

Introduction

The Waymo fully autonomous Hyundai IONIQ 5 is based on the Hyundai IONIQ 5.

This document includes material from the Hyundai's "IONIQ5 Electric Emergency Response Guide" and supplemental information related to the Waymo Driver, Waymo's autonomous driving technology.

This guide is intended to be used by trained first responders and assumes a professional-level background in safely responding to emergencies, including those involving damaged vehicles.

Waymo has published and updated versions of Law Enforcement Interaction Protocols since 2019 in partnership with first responders and emergency services personnel in the communities we serve. We want to thank our partners in Phoenix, San Francisco, and Los Angeles metro areas, as well as California Highway Patrol and Arizona Department of Public Safety.

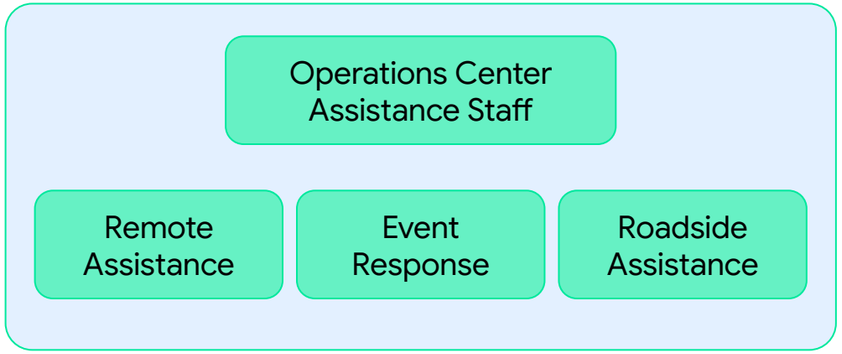
The information in these protocols is organized from more general orientation to more specific information about how to respond to specific scenarios and hazards.

Waymo updates these protocols to reflect material changes to the technology, ODD, regulatory guidance, and other factors.

Waymo Operations assists first responders

Waymo supports first responder interactions with Waymo vehicles in the field via operations teams available 24/7

- **Remote Assistance (remote location)***
  - Supports Waymo vehicles with tools to enhance vehicle performance.
  - Escalates first responder interactions to emergency response.
- **Event Response (remote location)***
  - Talk to first responders interacting with the vehicle.
  - Confirm the vehicle will remain stopped.
  - Instruct first responders on how to disengage the system, disconnect power, or take manual control of the vehicle.
- **Roadside Assistance (on-scene, direct interaction)**
  - Responds on-site to any vehicle at a scene.
  - Interacts with first responders and move the vehicle.



*This is part of the “indirect interactions” category in AVSC-I-01-2024.

Waymo toll-free hotline for first responders

Waymo has established a toll-free 24-hour telephone hotline dedicated to allowing police, fire departments, and other first responders to communicate directly with Waymo's professionally-trained specialists at any time during our vehicle testing and operation on public roads.

1-877-503-0840

We ask that emergency responders calling this hotline identify themselves and their agency, the numerical identifier of the vehicle in question, license plate, and any location information available.

See page 18 for how to contact Waymo assistance staff via the vehicle's two-way audio.

Quick Response (QR) Code for Waymo toll-free hotline

QR Codes allow police / fire departments, and other first responders to directly contact and communicate with Waymo's professionally-trained specialists using their own cell phones.

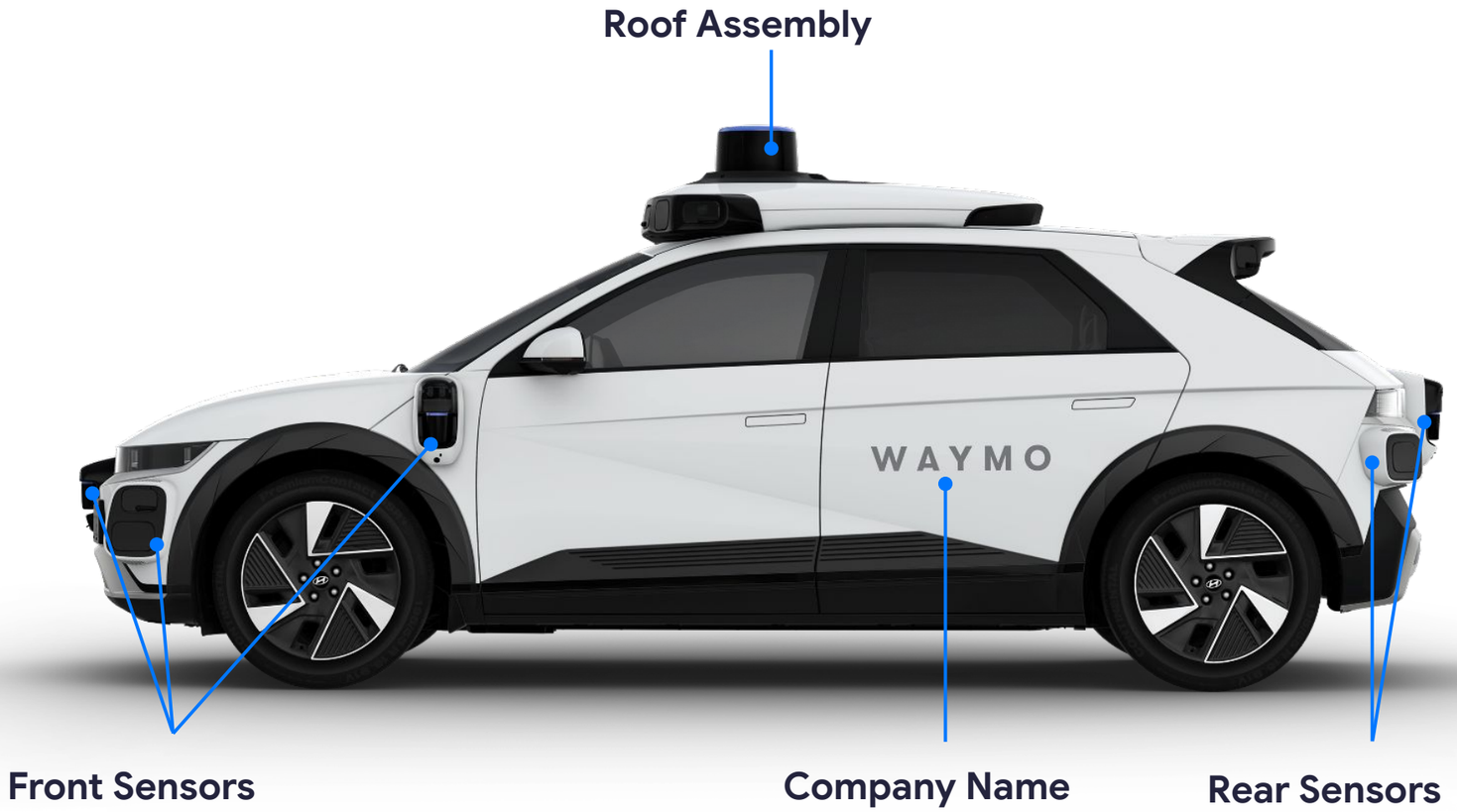
The QR code label is located on the driver and passenger side windows, next to the side view mirrors.

Identifying Waymo's fully autonomous vehicles

The Waymo autonomous Hyundai IONIQ 5 can be easily identified by the roof assembly and sensor housings.

Specific Waymo brand features include:

- Waymo blue colored band around the rooftop and other sensor housings.
- Light display on the rooftop sensor that may show a "W" logo, two-letter rider initials, or other icons (e.g. boarding, pedestrian crossing).
- Company name on the side of the vehicle.



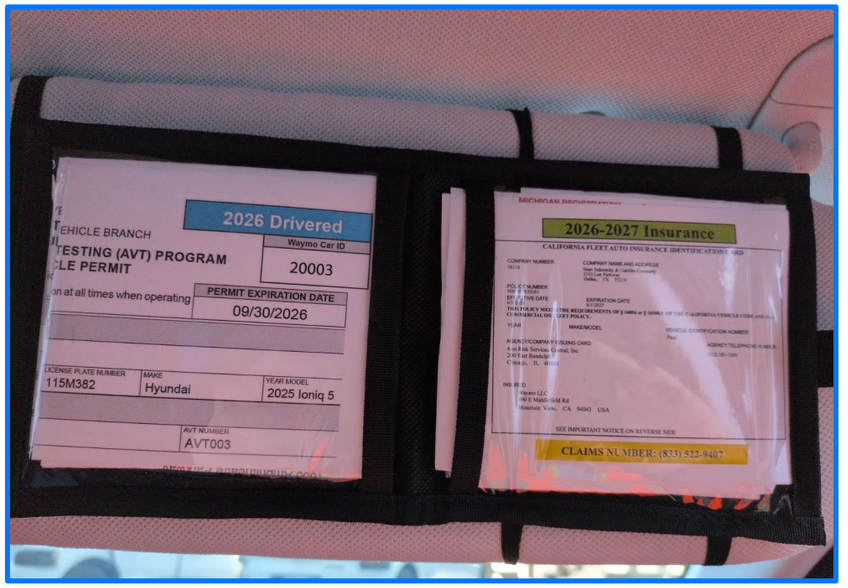
Identifying Waymo's fully autonomous vehicles

Each Waymo vehicle is identified by license plate, in addition to required identifiers in the jurisdiction (e.g. carrier identification symbol).

Location of in-vehicle documents

Two physical copies of vehicle owner information, vehicle registration, and proof of insurance are stored inside each vehicle under the driver-side and passenger side sun visors.

Each of location contains the same sets of documents, and either set of documents can be accessed in the event law enforcement requires this information.



In a container affixed to both the front driver-side and passenger-side sun visors

Level of automation

The Waymo vehicle is capable of autonomous operation.

- It is capable of performing the entire dynamic driving task within its operational design domain.
- It is capable of performing a safe stop without human intervention.
- It is equipped with redundancies for critical systems, such as sensors, computing, steering and braking, and can automatically detect changes to the vehicle or the environment and determine an appropriate response to keep the vehicle, its passengers, and other road users safe.

Operational design domain

The Waymo vehicle is intended to operate in the following conditions:

- On roadways including freeways, highways, city streets, rural roads, and other roadways, including all speed limits.
- In parking lots.
- At all times of day and night.
- All rain, fog, and other weather conditions.

Conditions that limit autonomous operations include:

- Widespread snow or ice accumulation on the roadway.

Waymo vehicles can only be operated without a human driver in autonomous mode within specific geofenced areas, where they have been tested and validated to safely perform all the dynamic tasks of driving without human intervention.

- Testing and deployment territory will be expanded incrementally over time via our rigorous testing and validation process.
- Information relating to these areas is provided by Waymo directly to state and local authorities, prior to any fully autonomous operation without a human driver.

Response to police and other emergency vehicles

The Waymo vehicle uses its sensors to identify first responders, emergency vehicles, and temporary traffic control devices by detecting their appearance and features like sirens and emergency lights.

- The Waymo vehicle is designed to yield as appropriate to stationary or moving emergency vehicles, no matter which direction they are headed.
- The Waymo vehicle is designed to respond to customary first responders instructions.

If a Waymo autonomous vehicle detects that a police or emergency vehicle is behind it and flashing its lights, the Waymo vehicle is designed to pull over and stop when it finds a safe place to do so and, once stopped for a traffic stop, to remain stationary for the duration of the stop.

- Waymo assistance staff can unlock the doors and roll down the windows to enable communication with law enforcement, including, for example, confirming from law enforcement that a vehicle may continue autonomous operations after a traffic stop.
- Waymo's assistance staff has protocols for interacting with any vehicle passengers in the event of the vehicle being pulled over or involved in a collision, by providing information through in-vehicle speakers, on the in-vehicle displays, and communicating with passengers through in-vehicle telecommunications capabilities.
- Waymo roadside assistance will be dispatched when needed to provide on-scene support for passengers and/or first responders.

Collision response

The Waymo vehicle is capable of detecting that it was involved in a collision. In that event, the vehicle will brake until it comes to a full stop and immediately notify Waymo's assistance staff.

- Waymo's assistance staff will call 911 if the circumstances warrant (e.g., where there is a significant collision in which police may be needed because of injuries, vehicles blocking traffic, etc).
- Waymo roadside assistance will be dispatched when needed to provide on-scene support for passengers and/or first responders.
- The Waymo vehicle will react differently depending on the nature of the collision. In the event an airbag is deployed, the base vehicle's electric propulsion system will be disabled.

Waymo Fully Autonomous
Hyundai IONIQ 5

Approaching, disabling, and towing

Determining the Presence of Passengers

A Waymo autonomous vehicle may be operated with or without passengers. To determine whether or not there are passengers present in the vehicle, a first responder should follow these steps:

- Do a visual inspection of the passenger area of the vehicle.
- Call the toll-free hotline for emergency responders to speak with a Waymo representative.

1-877-503-0840

Ensuring the vehicle will not drive autonomously

The vehicle will not drive autonomously while any of the following are true:

- Any airbags are deployed
- Any door is open
- The vehicle is in Park **(page 20)**

Open a door of the vehicle to prevent the vehicle from autonomously driving or assist passengers with exiting:

- Break a window if doors are locked and immediate entry to vehicle or ventilation of passenger compartment is necessary.
- Call Waymo **(1-877-503-0840)** to unlock the doors remotely if there is time and there are no signs of battery heating, smoke, or fire.

Keep at least one door open until the base vehicle is turned off (page 21)

Vehicle hazard lights will be active while the vehicle is in stopped or parked condition:

- Parking Brake applied
- Pulled over
- Stopped for extended period of time

⚠ Vehicles can roll or move regardless of autonomous driving state. Always use standard precautions including wheel chocks.

Disabling autonomous driving mode

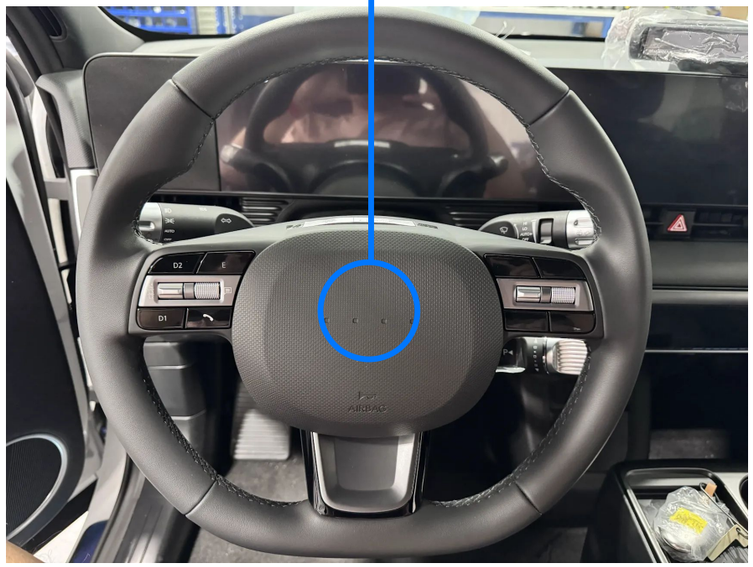
Emergency responders needing to disable autonomous driving mode should contact Waymo using one of the following methods:

- **Call: 1-877-503-0840**
- **Or: Activate in-vehicle call with assistance staff by pressing the horn on the steering wheel.**

Identify yourself and request that the Waymo assistance staff authorize the vehicle for manual mode. If calling the toll-free hotline, you will need to identify the vehicle by license plate and/or location.

Follow the Waymo assistance staff's instructions, including to provide identification verification information, if requested.

Push the horn to activate a call from assistance staff to the vehicle (if assistance staff have not already called in).

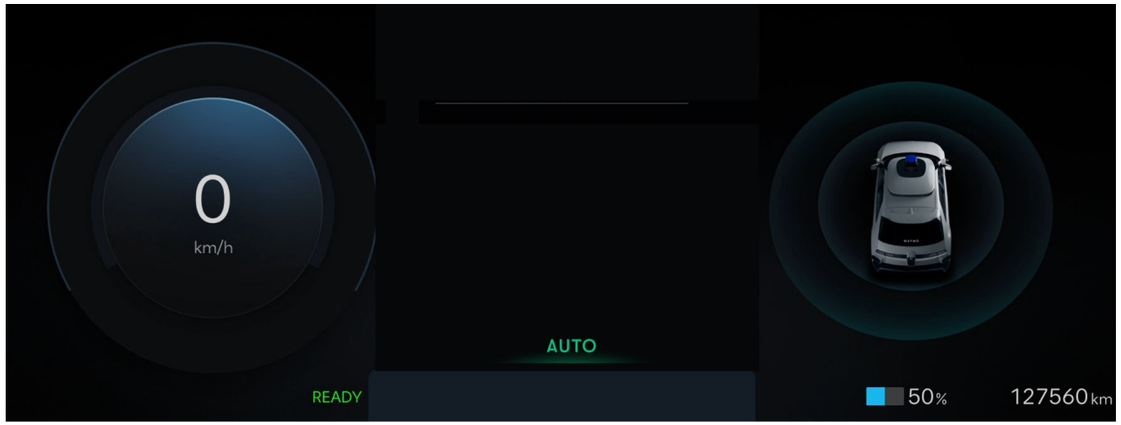


NOTE: Successful transition to manual mode can be confirmed by attempting to turn the vehicle on or off or change gears. If gears can be changed or the vehicle can be manually turned on or off, the vehicle is not in autonomous driving mode.

Identifying autonomous mode

The instrument panel indicates when the vehicle is operating in Autonomous mode or in Manual mode.

The vehicle is operating in Autonomous mode when the word Auto is displayed in green on the instrument panel (see below).

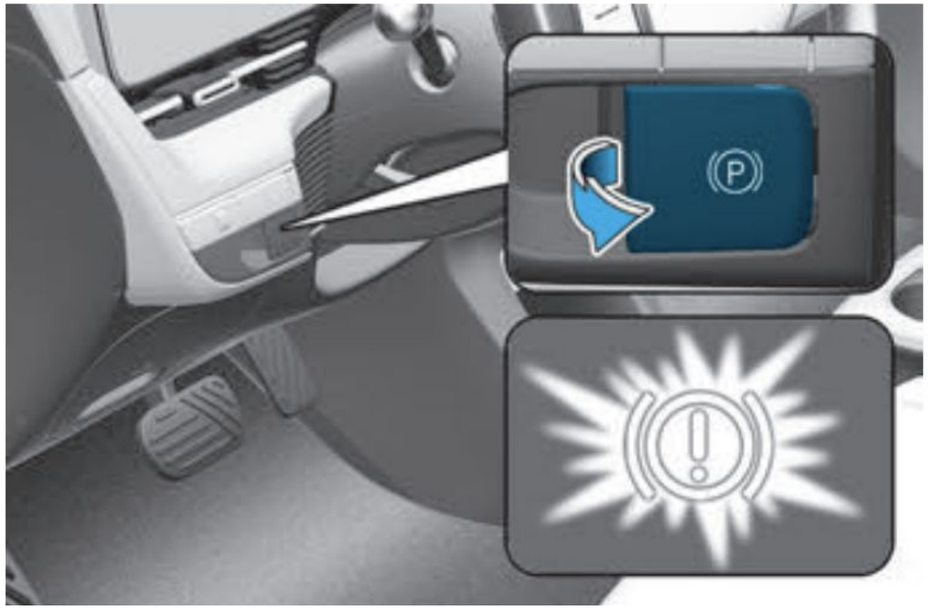


The vehicle is operating in Manual mode when the word Manual is displayed in gray on the instrument panel (see below).

Parking brake operation

- To apply EPB (Electronic Parking Brake):
  - Depress and hold the brake pedal.
  - Pull up the EPB switch.
- Make sure the Parking Brake warning light comes on.
- The Parking Brake cannot be manually controlled while the vehicle is in autonomous driving mode.
  See page 18 to disable autonomous driving mode.

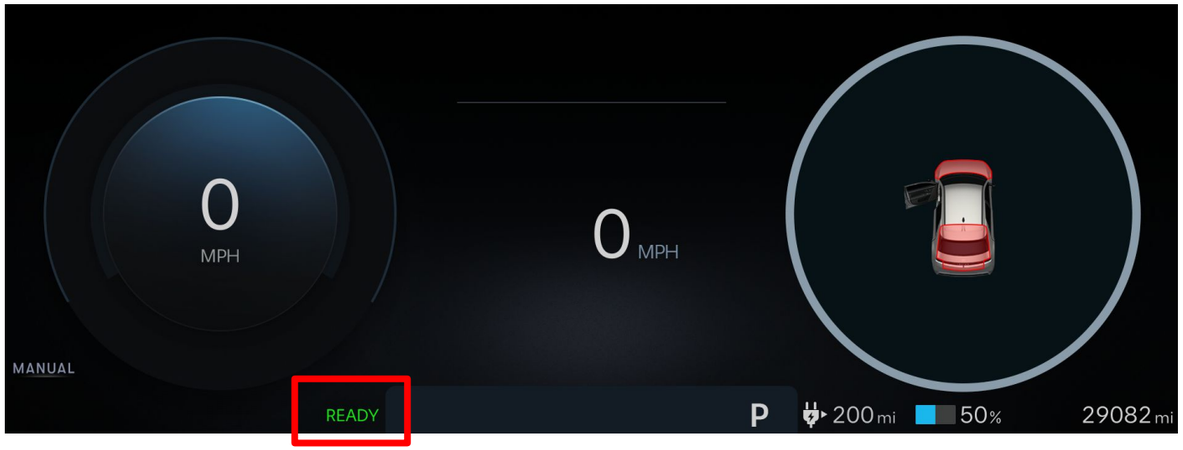
The Electronic Shift Control and Parking Brake cannot be manually controlled while the vehicle is in autonomous driving mode. See page 18 to disable autonomous driving mode.



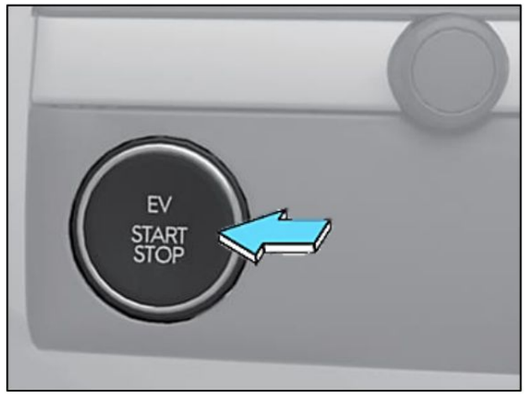
NOTE: Base vehicle 12V power must be functional to shift in or out of Park.

Turning the vehicle off

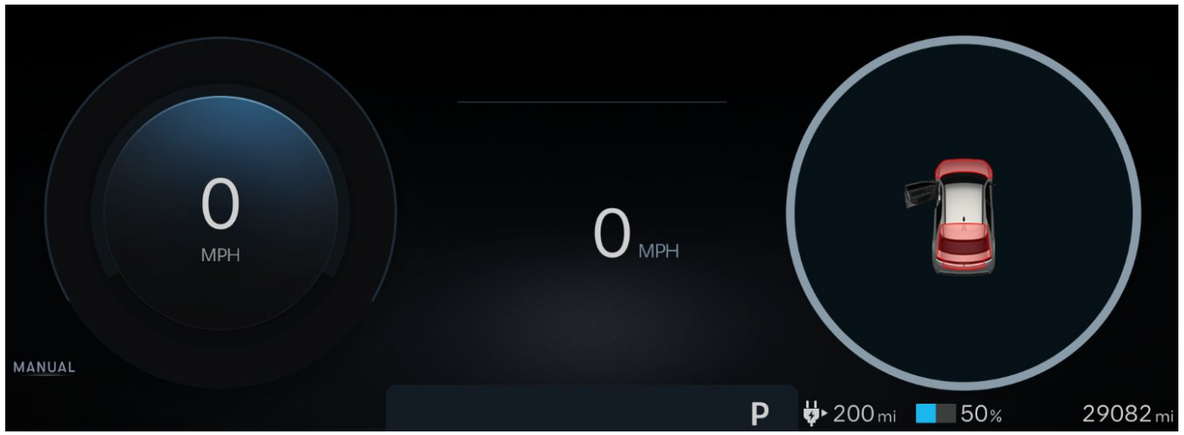
- The instrument panel indicates when the vehicle is running or when it is off.
- Confirm the status of the READY light on the instrument panel. If the light is illuminated, the vehicle is ON.
  - If the READY light is NOT illuminated, the vehicle is off. Do not push the “POWER” START/STOP button because the vehicle may start (go into READY mode).
  - To turn OFF the system, position the shift lever in Park and press the POWER button.



Press park (P) position



“POWER” START/STOP Button

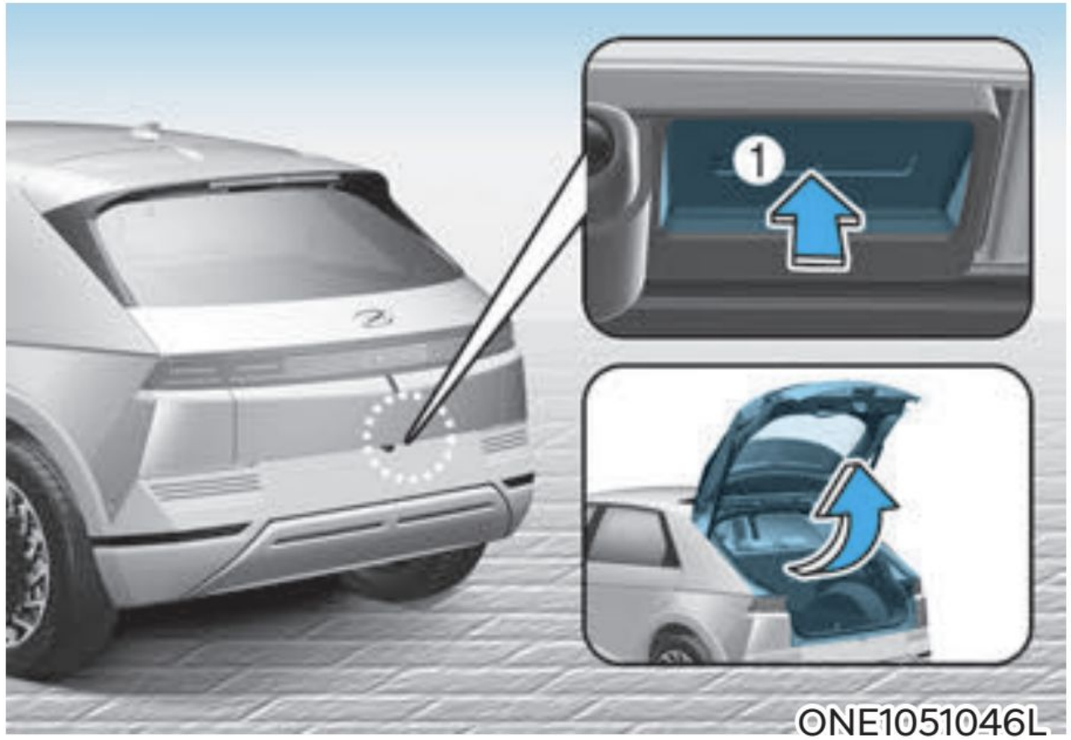


Opening the rear trunk

The rear trunk is locked during normal operation.

To access the trunk:

1. Disable autonomous driving mode (page 18).
2. Press the liftgate button (1) on the rear of the vehicle (see right).



NOTE: The rear liftgate latch is electrical.

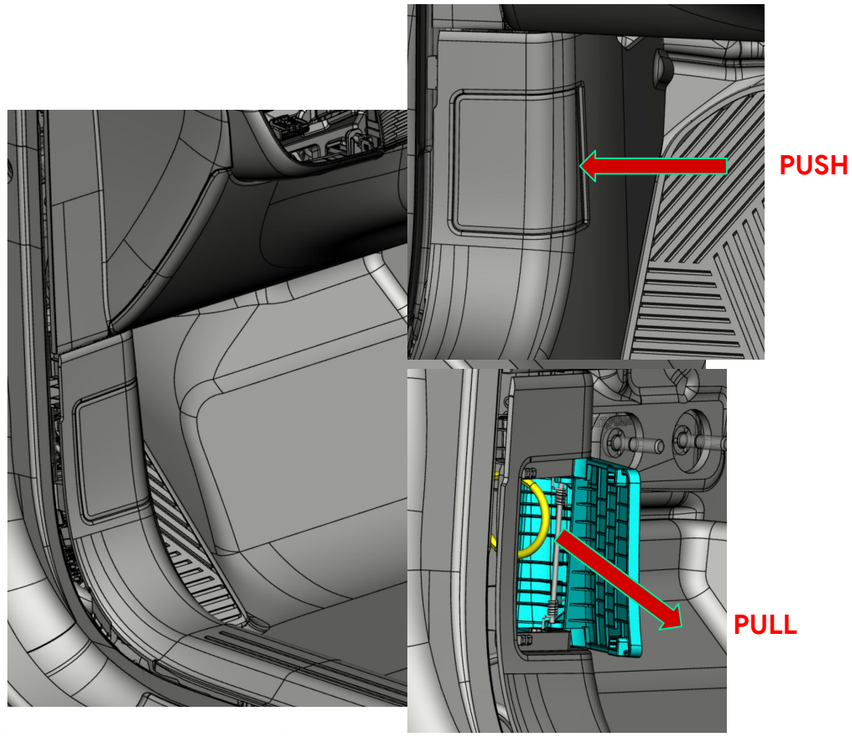
During Autonomous Operations:
The liftgate is electronically locked and disabled while the vehicle is in motion. It can only be operated manually by pressing the liftgate button (1) on the rear of the vehicle (see right) when the vehicle is stopped at designated passenger pick-up/drop-off (PUDO) locations, or when autonomous mode is disabled.

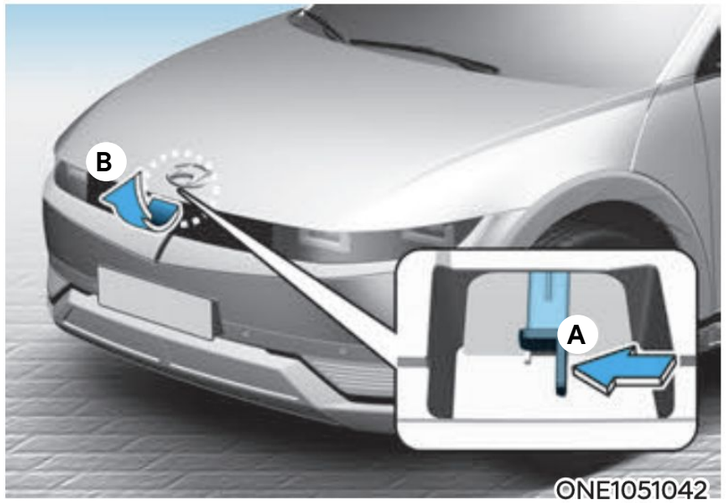
Loss of 12V Power:
If the base vehicle 12V power is removed, the electrical exterior button will not function. The trunk must be opened from the interior using the manual emergency release lever (accessible by folding the rear seats and sliding the lever inside the tailgate slot with a flat-head screwdriver).

Opening the front hood

To open the front hood:

1. Park the vehicle and set the parking brake.
2. Pull the release lever to unlatch the hood. The hood should pop open slightly.
3. Go to the front of the vehicle, raise the hood slightly, push the secondary latch inside of the hood center to the left (A) and lift the hood (B).

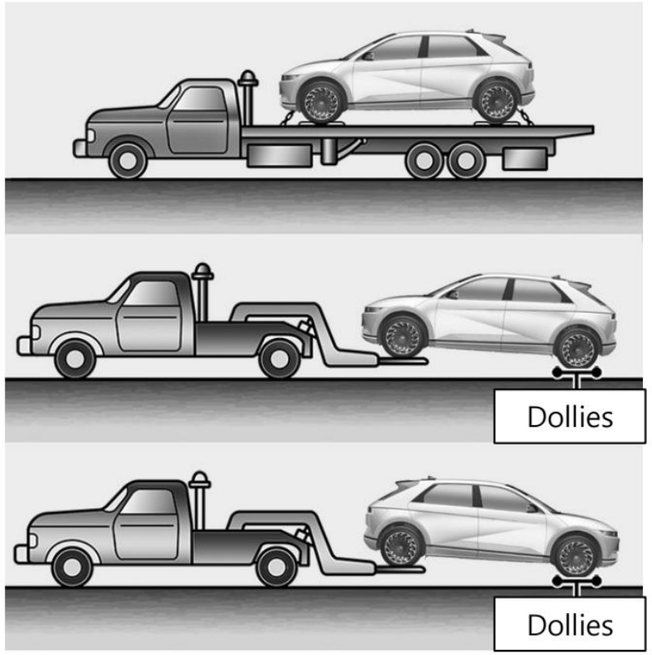


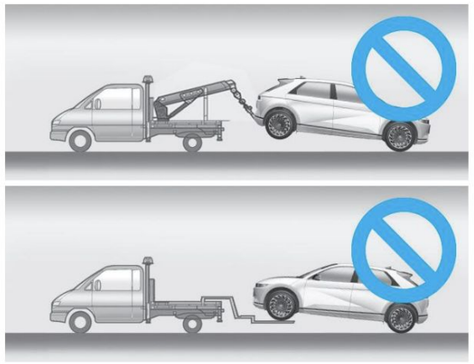


Towing the vehicle

The recommended method for recovery or transportation of the vehicle is on a flatbed truck or trailer designed for that purpose.

- In the event of an accident, the high voltage system must be disabled. The safety plug must be removed from the high voltage battery according to the method described in page 29.
- Towing the IONIQ 5 vehicle is not different from towing a conventional electric vehicle. Proper lifting and towing procedures are necessary to prevent damage to the vehicle. The use of wheel dollies or flatbed is recommended.





Do not tow with sling-type equipment.
Use wheel lift or flatbed equipment. Never tow the vehicle with the wheels on the ground (forward or backward), as this may cause a fire or damage to the motor.

Accessing Vehicle Data

Waymo may provide data to law enforcement officials in response to proper legal process (e.g. search warrant, subpoena, etc.). Law enforcement officials should email their request and legal documents to:

waymolawenforcement@google.com

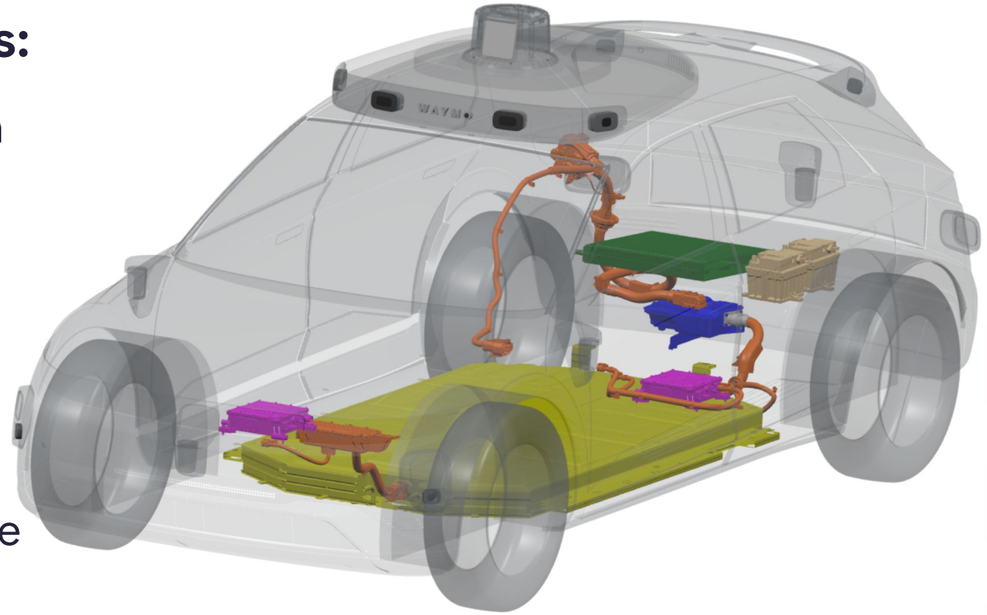
Waymo Fully Autonomous
Hyundai IONIQ 5

Vehicle systems safety considerations

Electrical system overview

The Hyundai IONIQ 5 electrical system includes:

- A high voltage (HV) **battery pack** in the vehicle bottom
- Two **electronic power inverters** provide HV power to two Drive Units - one in the front, one in the rear.
- There are **two independent low voltage (12V) Power Systems** with distribution throughout the car. Each independent bus has a:
    - DC/DC Converter: These connect to high voltage and outputs low voltage.
        - **One is under the hood, and the other is under the rear seat.**
    - 12V Battery:
        - **One per bus, both batteries are located in the rear trunk.**

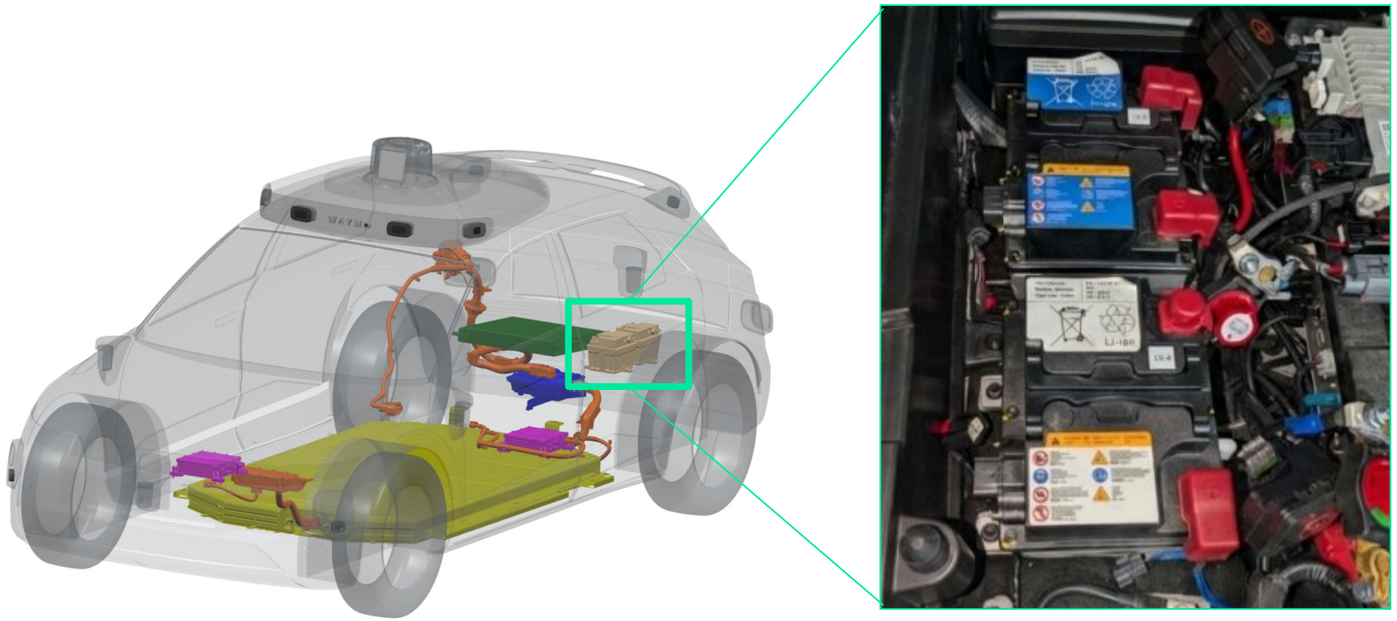


WAYMO

Disconnecting the 12V batteries

Disconnect the two 12V batteries cable located at the in the trunk, under the load floor.

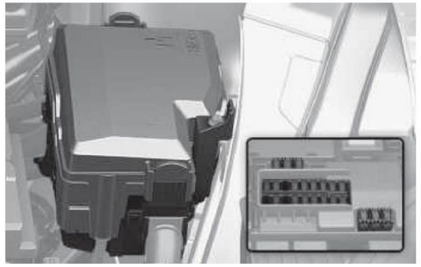
1. Open the trunk
2. Break the lock and lift the load floor
3. Disconnect the negatives terminal of the LV-2 12V battery (near rear bumper) by cutting the cable
4. Disconnect the negatives terminal of the LV-1 12V battery (near cabin) by cutting the cable



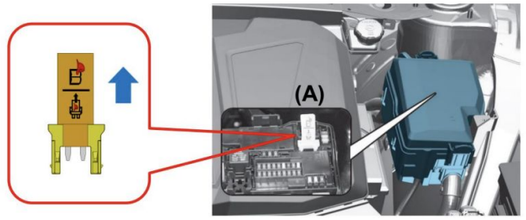
Disconnecting the HV battery

In case of emergency, disconnect the High-voltage Cut-off Switch(A) to isolate the high voltage of the battery.

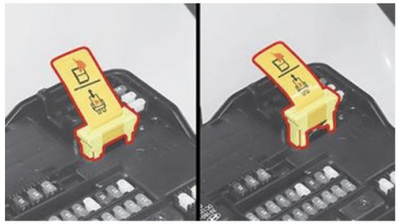
a. Remove the fuse box cover located at the motor compartment.



b. Disconnect the High voltage cut-off Switch(A)



Before After

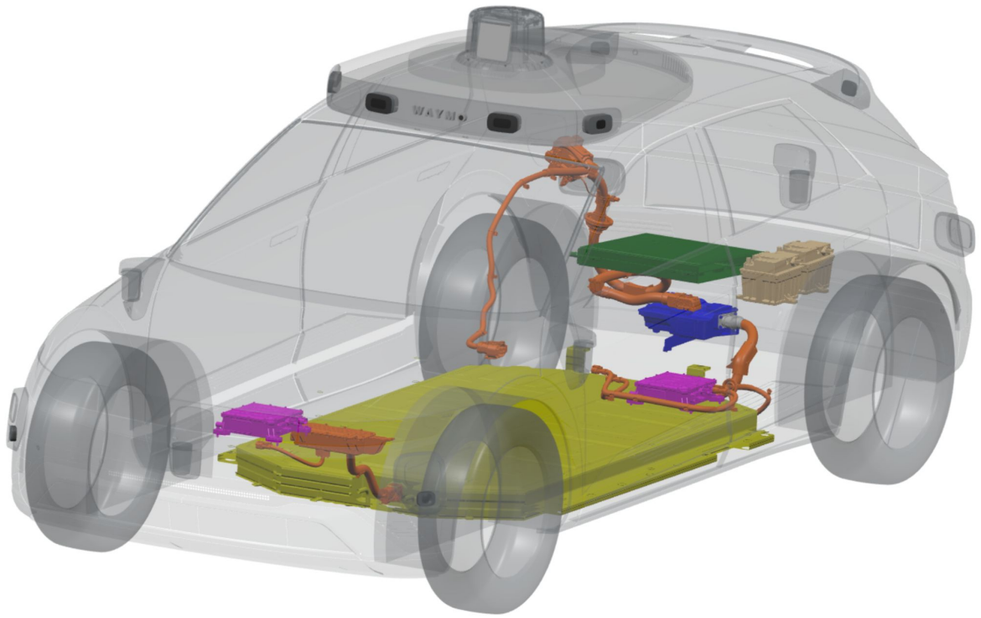


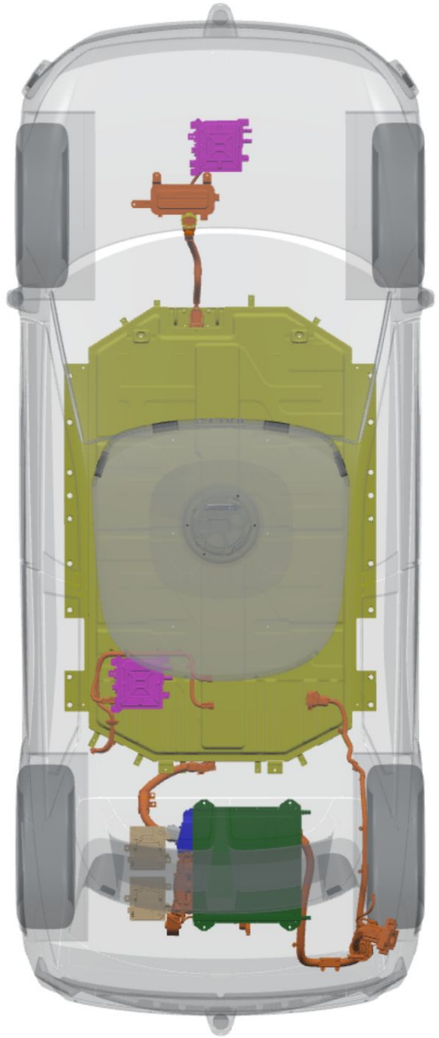
⚠WARNING **Electrocution Risk!**

- Before engaging in emergency response procedures, ensure the vehicle is disabled and wait for more than 5 minutes to allow the capacitor in the high voltage system to discharge to avoid electrocution.
- Exposed cables or wires may be visible inside or outside the vehicle. To prevent injury or death due to electrical shock, never touch the wires or cables before disabling the system, to prevent injury or death due to electrical shock.

Failure to follow any of these instructions may result in serious injury or death by electrocution.

Vehicle systems overview





- 12V battery
- DC:DC converter
- Electric Power Inverter
- High voltage cables
- High voltage battery
- Added computer

Prevent vehicle roll away

Accidental vehicle movement can endanger first responders or civilians. If the IONIQ 5 is damaged in a crash, it may appear to be shut off because there is no engine sound. However, if the "READY" mode light is illuminated on the instrument panel, the vehicle can still move silently.

First responders should approach the vehicle from the side, staying away from the front and rear to avoid potential paths of movement. Immobilize the vehicle in the following manner:

Put the vehicle in P (Park) position by pressing the ‘P’ button on the rotary shifter

Engage Parking Brake

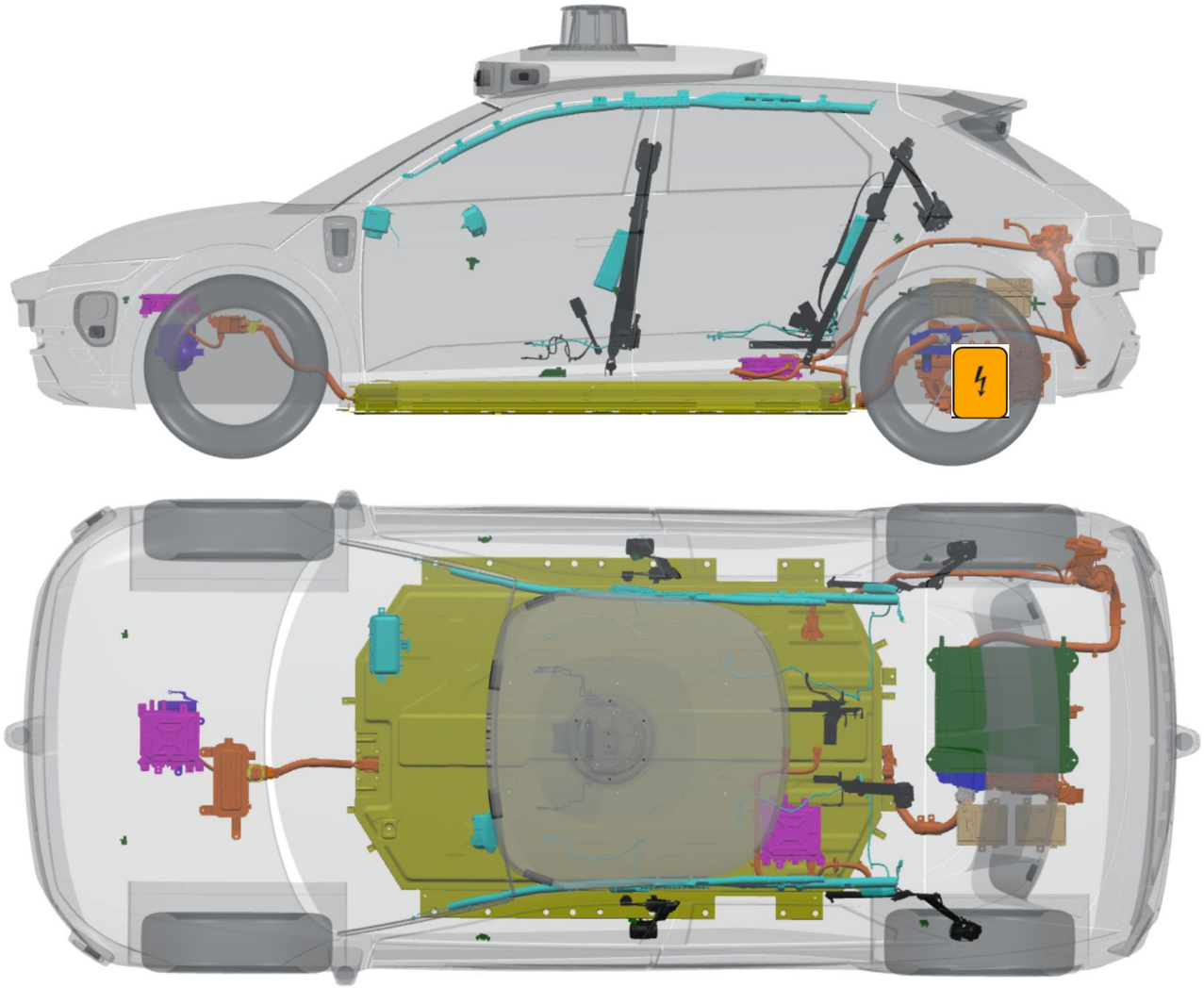
Chock the wheels

Use standard stabilization (lift) points, as shown beside. Always be sure to connect to a structural member of the vehicle and avoid placing cribbing under high voltage cables, and other areas not normally considered acceptable.

WAYMO

Access to the occupants

When dealing with an emergency situation, check the components below. When the first responders cut the vehicle, they should always pay special attention to the airbag system, orange colored high voltage cables and other high voltage components.

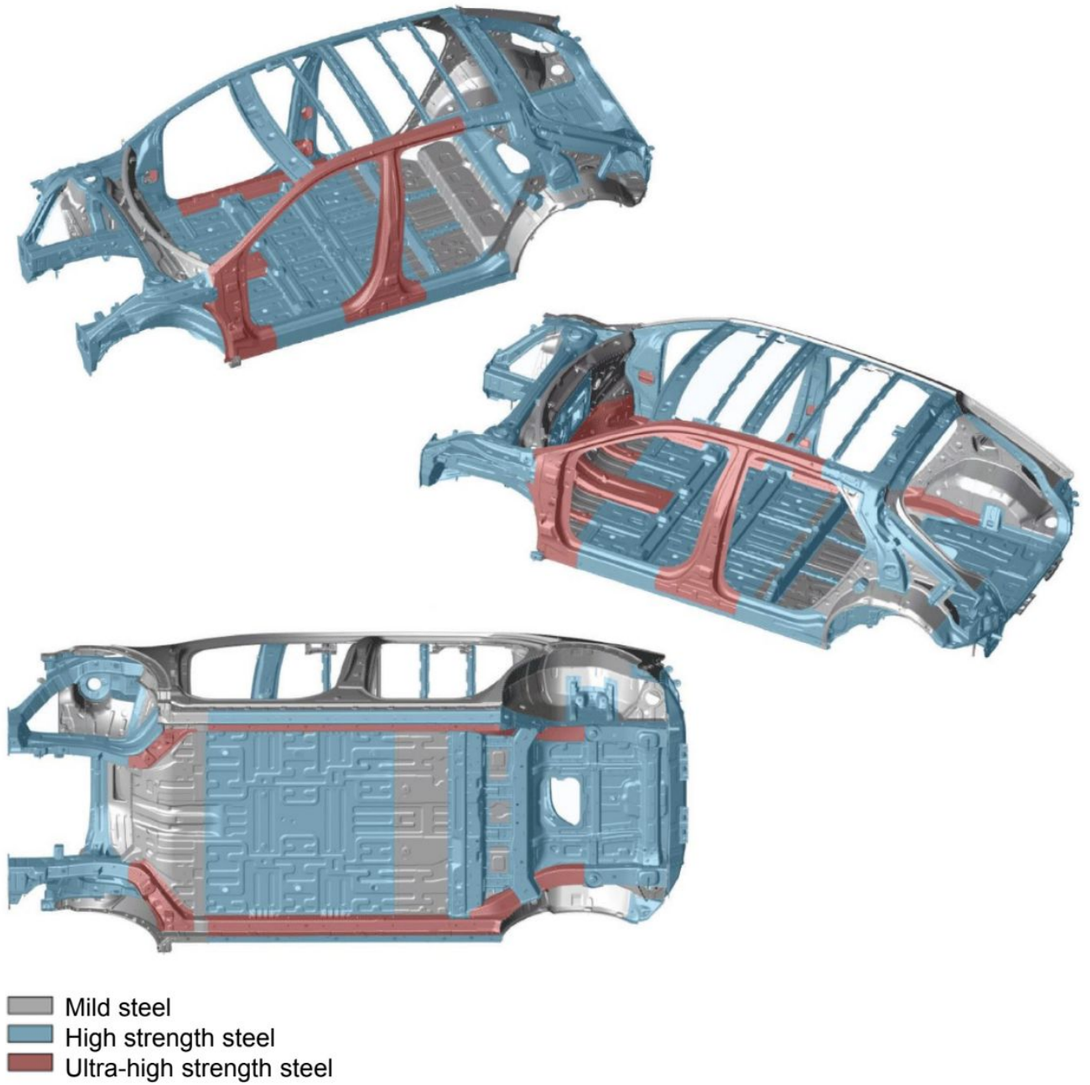


High voltage cables	12V battery	AC Compressor
High voltage battery	Restraints	Airbags
Added computer	DC:DC converter	Motor Drive Unit

WAYMO

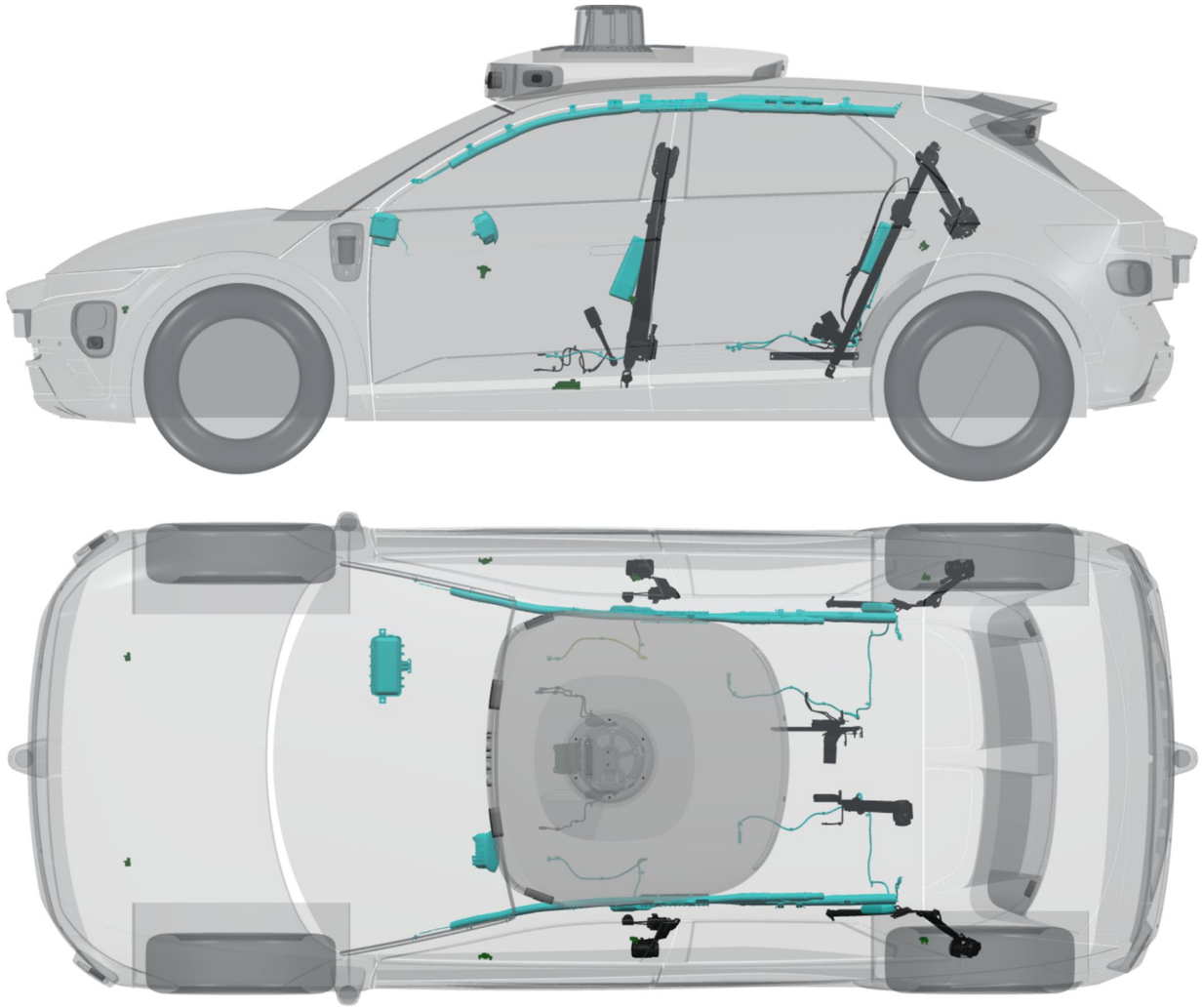
Location of ultra-high strength steel

High strength steel is used in the areas colored in blue and ultra-high strength steel is used in the red colored areas. Depending on the tools used, ultra high strength steel can be challenging or impossible to cut. If necessary, use a workaround technique.



WAYMO

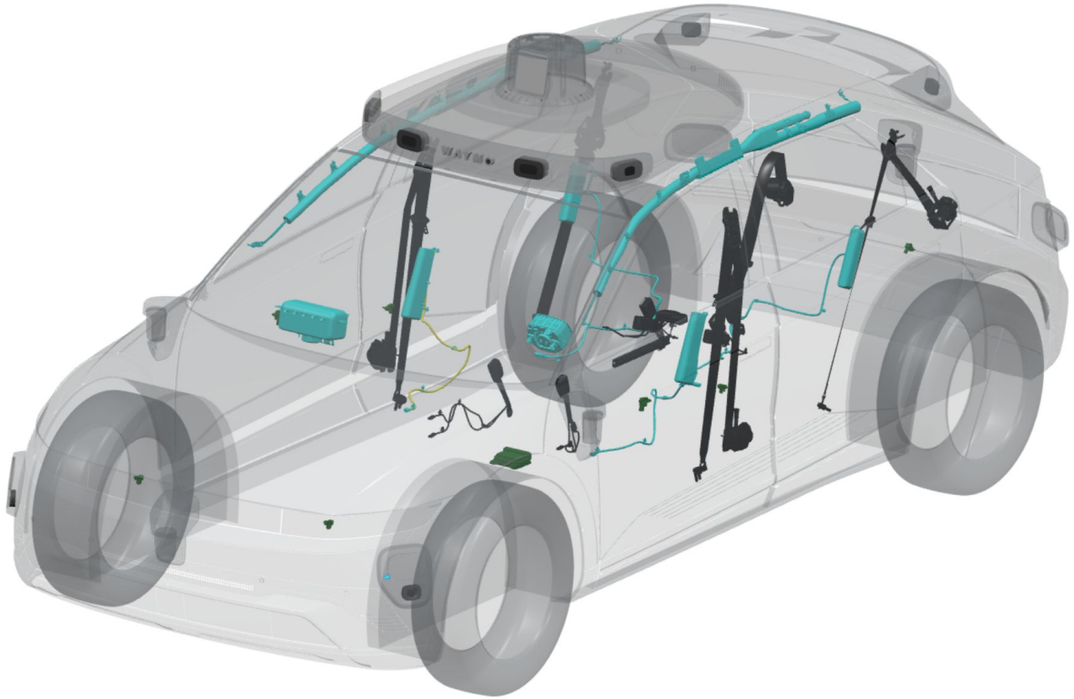
Passive restraint device considerations



Airbags

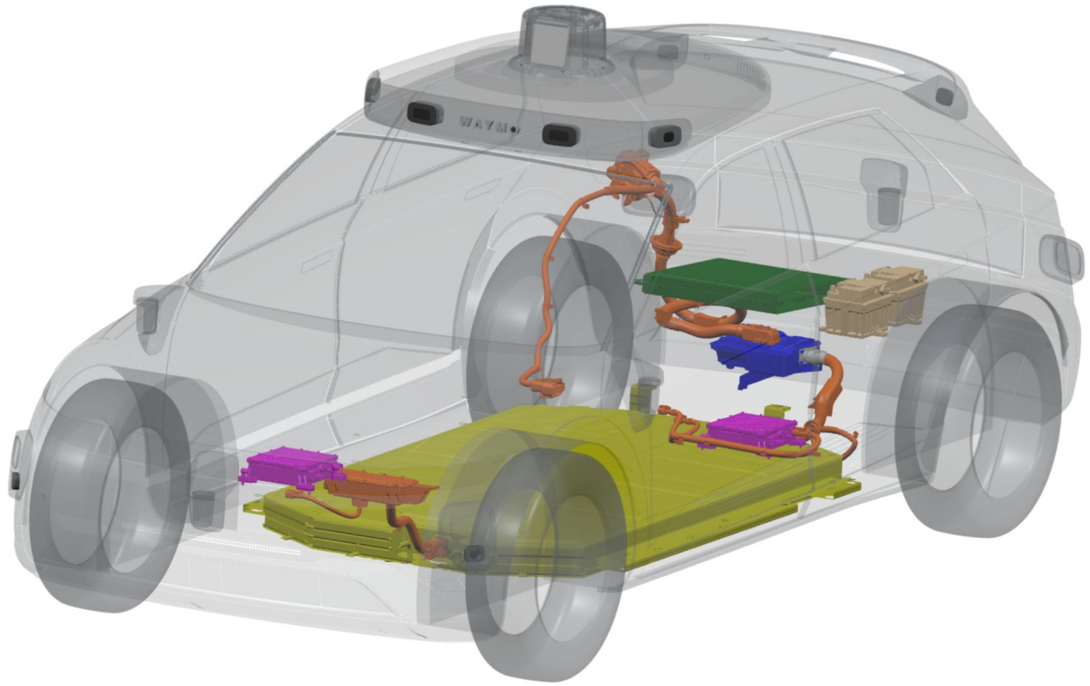
Restraint

Sensors



High-Voltage (HV) Battery

The HV lithium-ion battery supplies and stores electric energy, to the traction motor, and is located under the IONIQ5 chassis.



Motor	**Type**	**Permanent magnet synchronous motor**
	Max. Output (kW)	Long Range (2WD) : 168
	Max. Torque (Nm)	Long Range (2WD) : 350
High Voltage Battery	Rated Voltage (V)	697
	Energy (kWh)	84
	Quantity for Pack (cell / module)	384 cells / 32 modules

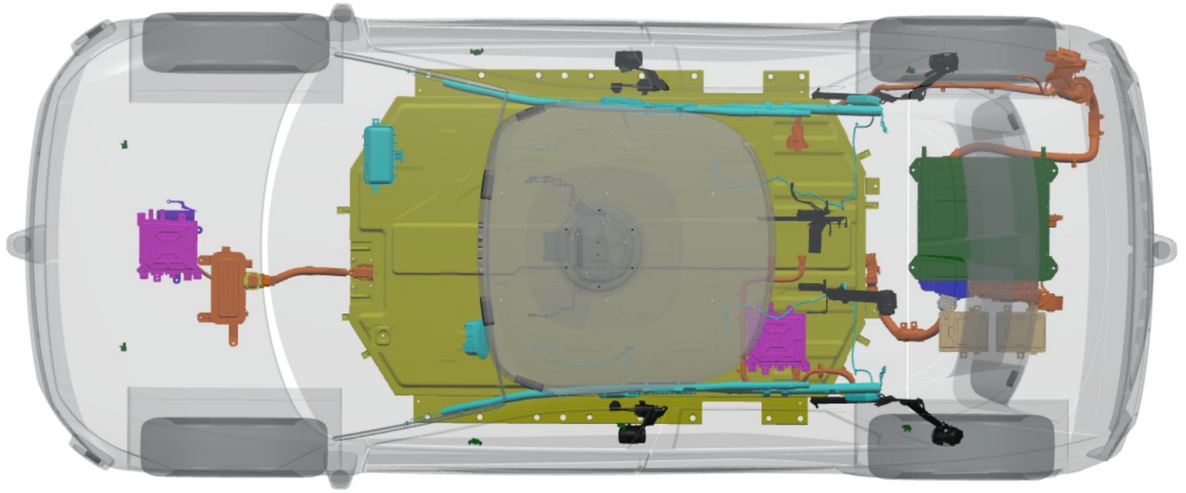
WAYMO

High voltage orange cabling

The HV lithium-ion battery supplies and stores electric energy to the traction motor, and is located under the IONIQ5 chassis.

The High Voltage cabling is orange, per Society of Automotive Engineers (SAE) standards. Cables run under the floor of the vehicle and connect the High Voltage Battery to the ICCU, Motor, A/C compressor and other High Voltage components located towards the front and rear of the vehicle.

The presence of orange cables under the hood, in the under-floor battery compartment, or HV cables under the car, identifies the vehicle as an electric vehicle.



Never cut or disconnect the high voltage orange cabling and connectors without first disabling the HV system.
Exposed cables or wires may be visible inside or outside the vehicle. Never touch the metal chassis wires, cables, connectors, or any electric components before disabling the system, and; or shorted to the vehicle chassis.
Failure to follow these instructions will lead to serious bodily injury or death by electrical shock.

WAYMO

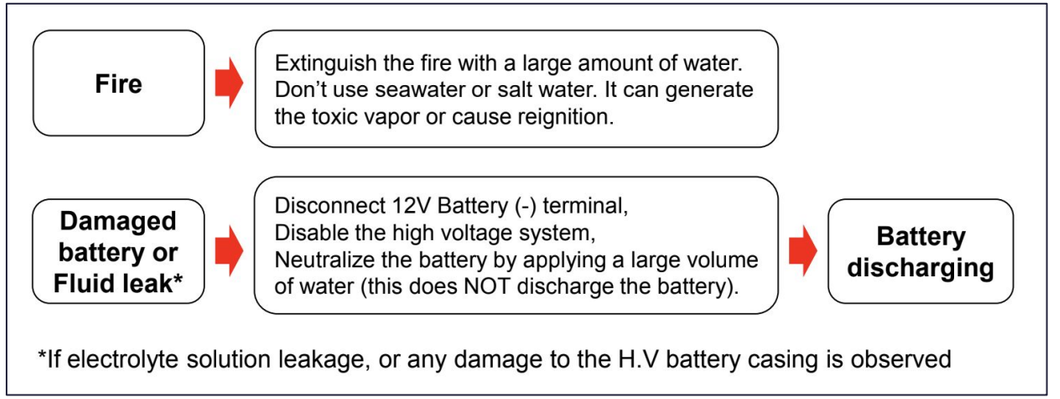
Additional information in case of a fire

Firefighting Operations

- Strict precautions must be taken while conducting firefighting operations due to following reasons:
  - Lithium-ion batteries contain electrolyte that can vent, ignite, and produce sparks when subjected to temperatures above 300°F.
  - Vehicle may burn rapidly with a flare-burning effect.
  - Even after the high-voltage battery fire appears to have been extinguished, renewed or delayed fire can occur.
    - Use a thermal imaging camera to ensure the high voltage battery is completely cooled before leaving the incident.
    - Always advise second responders that there is a risk of the battery re-igniting.
    - In a fire, submersion or a collision that has compromised the high voltage battery, always store it in an open area with no exposures within 50 feet.
  - A burning battery could release hydrogen fluoride, carbon monoxide, and carbon dioxide gasses. **Use NIOSH/MSHA approved full-face self-contained breathing apparatus (SCBA) with full protective gear.** Even if the high-voltage battery pack is not directly involved in a vehicle fire, approach the vehicle very carefully.

Extinguishers

- Small fires that do not involve the high voltage battery should be extinguished using an ABC fire extinguisher. (ex. Fire caused by wiring harnesses, electrical components, etc.)
- Do not attempt to extinguish fires that involve the high voltage battery with small amounts of water as this can result in electrocution. Fires that involve the high voltage battery should be extinguished using large amounts of water (min 2,650 gallons) to cool the high voltage battery. Firefighters should not hesitate to pour larger amounts of water on the vehicle in such scenarios. Make sure the battery is fully cooled to avoid fire re-ignition.



WAYMO

Additional information for fully or partially submerged vehicles

- Some emergency responses can involve a submerged vehicle.
- In the event of the vehicle is submerged or partially submerged, remove the vehicle from the water before attempting to disable the vehicle. Drain the water from the vehicle.
- Use one of the methods described in page 28-29 to disconnect the vehicle batteries.

If severe damage causes high voltage components to become exposed, responders should take appropriate precautions and wear appropriate insulated personal protective equipment.
Do not attempt to remove a safety plug while the vehicle is in water.
Failure to follow these instructions can lead to death or serious injury by electrocution.

Hazards

High voltage

There is HV DC in the battery and associated components. AC power may be present on the inverter and traction motor. Both should be considered hazardous.

HV cables are ORANGE in color.
Anything at the end of an orange cable should be treated as hazardous.

WARNING! DO NOT cut HV cables, battery case or associated components.

Suitable PPE shall be worn.

Fire

Fire in the battery is very unlikely; the battery is contained in a sealed metal enclosure underneath the vehicle. It will not normally be possible to get extinguishing media into the battery compartment.

If the vehicle is on fire, remove occupants from the vehicle, evacuate the area and call 911 to report an electric vehicle fire.

CAUTION! In the case of fire, HV fumes are likely to escape from the battery – keep a safe distance from vehicle.