

# Exterior Panels Damage Analysis

**Self-study Narrations**



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# *Module 1 - Front Body Inspection*

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## Learning Objectives

Exterior body panels are made of various types of materials. The type of material a part is made of, how it is attached, extent of damage, and vehicle maker recommendations must all be considered when determining whether a damaged part should be repaired or replaced. Electrical and electronic systems located on the front of the vehicle must also be inspected for damage and proper operation.

This module begins with some basic damage analysis practices that will help ensure a complete and accurate damage report. The module will continue with information on exterior trim and moldings. Replacement considerations and possible repair options for parts of the front body will also be discussed.

The learning objectives for this module include: identifying parts of the front bumper assembly and determining repair and replacement options, determining repair and replacement options for the hood, identifying front lighting systems and determining repair and replacement options.

## Types Of Steel

Parts of the vehicle body are made from a wide variety of materials. However, steel remains the primary material for parts of the vehicle structure and exterior body panels.

As vehicle emission standards and safety ratings increase, more parts are being made with advanced high-strength steel (AHSS). Although most applications of AHSS are used for parts of the unitized structure, some exterior body panels are also made of AHSS. AHSS is stronger than mild steel, and includes high-strength steels (HSS) and ultra-high-strength steels (UHSS). These types of steels are made thinner than mild steel, which reduces vehicle weight.

This may limit the repair options because the materials, when damaged, or when attempting to straighten, become brittle. These materials are also sensitive to heat, which may weaken the part if applied.

The fender, outer door panels, and liftgate on the 2011 Ford Edge are made of dent-resistant HSS. The hood and outer door panels on the 2010 Toyota Highlander are made of HSS.

## Damage Analysis Process

A thorough and accurate damage analysis process for exterior body panels must be established to ensure a complete and safe repair. This will help reduce supplements, which may also affect the timeliness of the repair. Writing a thorough and accurate

damage report requires a good understanding and knowledge of repair and replacement options for parts of the vehicle exterior.

Make note of any suspected structural damage. This will indicate that further inspection is required before beginning repairs and help ensure there are no delays in the repair process. During the damage analysis process, develop a repair plan based on the identified damage. The earlier that damage is identified, the more accurate the repair plan.

### **Damage Analysis Precautions**

Always disable the supplemental restraints system (SRS) when working on or near parts of the SRS. This is commonly done by removing and isolating the negative battery cable. A wait time is typically required for the system to completely discharge stored energy. Refer to vehicle-specific service information to determine how to disable the SRS.

It may be necessary to clean up broken glass from the vehicle interior before beginning the inspection process. Protective gloves should be worn when inspecting areas where there are sharp edges.

It is also important to prevent further damage to the vehicle. Do not try to force open or close closure panels that are not working properly. It is also important to avoid unnecessary force when removing parts during inspection. Store removed parts where they will not be damaged or lost.

### **Inspection Considerations**

Considerations that will help ensure an accurate damage report for exterior panels may start by determining the direction and severity of impact. This may be easily identified by visual damage. Consult the customer about the details of the collision. The damage analysis process may be affected by information about the collision, such as if the vehicle left the road and the approximate speed of the vehicle at the time of the collision.

Ensure there is adequate lighting available. It may be a good practice to carry a flashlight for inspecting under the hood or body of the vehicle for damage. Also, consider having the vehicle washed before conducting the inspection to help ensure all damage is visible. In some cases, however, it is not recommended to wash the vehicle before the insurance appraiser can verify certain details about the claim. For example, a deer hit may require an insurance appraiser to inspect the vehicle for signs of a deer collision before the vehicle is washed.

A logical process would be to start from the point of impact and continue the inspection by following signs of damage away from the point of impact. Primary damage is damage

located at the point of impact. This may include inspecting from the front, for a front impact, and working backward, or starting from the back of the vehicle and working forward for a rear impact. Walk around the entire vehicle and inspect for damage. This is one more measure to help ensure all damage is identified. This would include looking for any secondary damage that occurred during the collision.

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Download the [Exterior Panels Damage Analysis Checklist](#) handout in PDF format. This can be referenced throughout the course and used in the field during a damage analysis process.

### **Activity: Exterior Panels Damage Analysis Checklist**

A checklist will help ensure a thorough inspection. The Exterior Panels Damage Analysis Checklist begins with some general considerations and an illustration to mark areas of damage. The checklist continues with a comprehensive list of inspection items. Identify all damaged parts, which side of the vehicle they are located on, and the type of material in the blank fields.

### **Identifying Non-Drivable Vehicles**

An example of a non-drivable vehicle is a vehicle that is structurally damaged and is literally not drivable. However, a vehicle may also be considered not drivable if there are

potential safety concerns. An example of a non-drivable vehicle is one with deployed restraint systems, such as airbags or seat belt pre-tensioners. A vehicle with damaged or inoperative lighting, such as a damaged brake lamp, may also be considered non-drivable.

Even if a vehicle was driven in, it is imperative that any safety concerns be communicated to the customer and recommend that the vehicle not be driven until it is repaired. A non-drivable vehicle may require temporary repairs to address safety concerns, to avoid inconveniencing the customer. For example, it may be necessary to repair or replace non-functioning lighting systems before the vehicle can be safely driven.

### **Repair Vs. Replace Considerations**

Damaged exterior panels will either require repair or replacement. Considerations regarding repair or replacement of damaged exterior panels include the type of material. Common materials that exterior panels are made of include steel, aluminum, plastic, and composites, such as fiber-reinforced composites. The outer liftgate panel on the 2011 Lincoln MKT is made of aluminum and is attached to an inner magnesium panel with hem flanges. The liftgate is replaced as an assembly. Identifying the material that a part is made of may determine which repair method is used or if the part will require replacement.

Repair or replacement may require removal of adjacent parts, even though they are not damaged. It is also important to consider how replacement parts are supplied. Some parts are only available as part of an assembly.

The extent and location of damage must be considered when making repair versus replacement decisions. Damage to contour lines and edges may not be able to be returned to the proper state and shape.

Vehicle maker recommendations are yet another consideration when determining repair or replacement of a damaged part. Minor damage to mild steel exterior panels is often repairable, however, vehicle maker service information should be referenced to determine repair limitations.

### **Straightening Considerations**

Repairing damaged exterior panels often involves straightening. Considerations regarding straightening of exterior panels include vehicle maker recommendations and the type of material. This includes whether straightening is allowed, or whether heat may be applied during straightening. Links to various vehicle maker service information websites are available at [www.i-car.com](http://www.i-car.com). AHSS and aluminum panels are more prone to cracking than parts made from mild steel. Determining whether or not welding may be used to repair cracked exterior panels may depend on vehicle maker recommendations.

Even though a part may not be considered structural, durability of the repair may be a concern if a kink is straightened in an area subject to daily stress, such as road vibrations. After time, the repair area may fail. An example is an exterior panel located near suspension mounting points, such as a quarter panel.

Some parts are designed to collapse in a specific manner. Straightening or welding a bend or kink in a collapse zone may affect the safety of passengers in a subsequent collision.

Paintless dent repair (PDR) is a technique used to fix minor dents on exterior panels without the need to refinish. This repair method is done using tools designed to access the backside of panels from various angles and work the dent outward to the original shape. A repair facility may be able to provide this type of repair, or it can be sublet to a specialized service.

If the vehicle maker does not provide repair procedures or recommendations, determining whether a part is repaired or replaced is a subjective business decision. The decision to repair or replace a part must be communicated and agreed upon by the repair facility, insurance company, and vehicle owner. The damaged panel must be straightened as close as possible to the original shape of the part. The use of body filler must not exceed the product maker recommendations.

### **Attachment Methods**

Attachment methods used for vehicle construction, replacement, and repair include squeeze-type resistance spot welding (STRSW), GMA (MIG) welding, adhesive bonding, and mechanical fasteners, such as bolts or rivets.

Spot welds are drilled out to remove the damaged part and are sometimes replaced with GMA (MIG) plug welds.

Adhesives may be used in conjunction with other attachment methods, such as welds or rivets. Heat is often used to remove bonded panels from the vehicle. During installation, the mating flanges on the vehicle and on the replacement part must be prepared according to the vehicle maker and product maker recommendations.

Steel and aluminum parts may be installed by welding. Plastic and composite parts are not weldable and may be attached to the vehicle with mechanical fasteners or adhesives. Duplicating the original attachment method may be recommended by the vehicle maker when replacing parts. The attachment method recommended by the vehicle maker may be a factor when determining whether a part is repaired versus replaced.

## **Refinish Considerations**

When inspecting exterior panels for damage, it is a good practice to consider which, if any, adjacent parts will require refinishing. Repaired and replaced exterior panels often require blending the refinish color into adjacent panels. For example, when replacing a damaged fender, the refinish may need to be blended into the lower A-pillar, front door, and hood. The intention is to prevent any minor color mismatch from being noticeable. Small damage located away from a panel edge may allow the color to be blended within the panel.

Clearcoat is not typically blended and should extend to the nearest panel edge. Blending clearcoat may void the paint maker's warranty.

## **Corrosion Protection**

Corrosion protection is applied at the factory and must be replaced following repair or replacement of damaged exterior panels. Corrosion-resistant coatings slow the corrosion process by sealing out moisture and air.

Corrosion-resistant coatings are applied to panel backsides. Coatings on panel backsides require replacement if damaged during the repair process, and may also be required following part replacement. Follow vehicle maker and product maker recommendations when applying corrosion-resistant coatings.

More information on the application of corrosion-resistant coatings can be found in the I-CAR live "Corrosion Protection (CPS01)" training course.

## **Emblems, Moldings, And Pinstriping**

Many parts of the vehicle exterior commonly have various types of trim and moldings attached. Trim and moldings attached to the vehicle exterior may include, but are not limited to emblems, pinstriping and other types of graphics, cladding, bodyside and belt-line moldings, weatherstripping, and appliqué.

## **Attachment Methods**

Common methods for attaching trim, moldings, and emblems include adhesive, two-sided tape, transfer adhesive, and mechanical fasteners, such as plastic clips. Fasteners are sometimes used in conjunction with other attachments, such as adhesive or tape, for proper alignment. Many plastic fasteners are difficult to remove without damaging.

The attachment method may be included with the replacement part. Plastic clips may be provided with replacement trim and moldings. Emblems may have preapplied adhesive attached.

## **Remove And Install (R&I)**

When exterior panels are repaired or replaced, undamaged trim and moldings are sometimes reused. Removal and installation of exterior trim and moldings may not be possible without damaging the trim, molding, or fasteners. A new part may be required if the original cannot be removed without damaging. For example, built-in fasteners that break during removal will require replacement of the entire trim or molding. A removed and installed trim or molding may require new fasteners for re-installation.

Removal and installation of exterior trim and moldings may not be feasible. It is sometimes more efficient to replace the part rather than cleaning the original part and applying the adhesive. For example, make or model lettering, such as nameplates, have several corners and crevices that may be difficult to clean. Retaping moldings may also be a difficult and time-consuming task.

## **Other Considerations**

Other considerations for replacement, or removal and installation (R&I), of trim and moldings include refinishing moldings. Trim and moldings ordered by color may require refinishing. Verify all clips and fasteners that do not come with the part are included on the damage report.

Removing adjacent parts for access is another consideration when replacing or R&I of trim and moldings. For example, belt-line moldings may require removal of the interior door trim and glass.

## **Pinstriping And Graphics**

Some vehicles have pinstriping or graphics applied to the exterior body panels. These may be applied by the vehicle maker, dealer, or aftermarket. Pinstriping and graphics may require replacement if damaged or if the panel is repaired or replaced.

Pinstriping or graphics may be painted on or applied as a decal.

The pinstripe on the entire side of the vehicle may require replacement if it is not possible to match the pinstripe on adjacent panels. For example, if the replacement pinstripe for one panel does not match the original application, it may be necessary to replace the entire pinstripe along that side of the vehicle. Pinstripe or graphic decals may only be available as a kit for one or both sides of the vehicle.

A customer consultation may help identify where to purchase replacement decals, or the business that did the custom refinish work.

## **Bumper Function**

Per the current Federal Motor Vehicle Safety Standard (FMVSS) Part 581, vehicle bumper assemblies are designed to withstand front and rear collisions at a minimum of 2.5 mph without damaging other parts of the vehicle. Following the crash test, the hood and deck lid must operate properly. There can be no broken headlamps, and no fuel, coolant, or exhaust leaks. Propulsion, suspension, steering, and braking systems must operate normally. Trucks, vans, and sport–utility vehicles (SUVs) are exempt from this requirement.

A height difference between vehicle bumpers may affect the inspection process. For example, bumpers on SUVs and pickup trucks are typically positioned higher than on cars. In this scenario, damage to the car will be higher than if the collision was between two cars. The Insurance Institute for Highway Safety is petitioning to revise the current version of FVMSS 581 to include trucks and SUVs to minimize or eliminate this issue.

## **Bumper Assembly Parts Overview**

The primary parts of the front bumper assembly include the bumper cover, energy absorber, and bumper reinforcement.

Other parts of the front bumper assembly may include air deflectors, that direct air through the grille opening, and closeout panels that divert airflow, reducing drag. Attachment brackets and fasteners secure the bumper assembly to the vehicle structure.

Honda provides a front impact kit for some models, which includes the front bumper cover, energy absorber, bumper reinforcement, headlamp assembly, fender, hood, seat belt pre-tensioner, front driver airbag, and restraints control module (RCM).

## **Bumper Cover**

The front bumper cover may also be called the bumper fascia, and is typically made of a semi-rigid plastic, such as polypropylene (PP), thermoplastic polyolefin (TPO), polyurethane (PUR), or a combination of materials. A code for the type of plastic can often be found on the back of the part.

The front bumper assembly may house the headlamps, fog lamps, and other parts.

## **Bumper Cover Inspection**

When inspecting bumper covers, look for damage to other parts that may be hidden behind the bumper cover. Damaged bumper covers may return to the original shape immediately following the impact. For this reason, it is important to consider parts located behind the bumper cover that may be damaged, such as the energy absorber and bumper reinforcement. Never assume that a hidden part is damaged or undamaged.

Visual damage to the bumper cover may indicate more severe damage behind the cover. Disassembly may be required to identify all damage.

Also inspect for scratches and deformation. Deformation may be difficult to see and typically requires looking at all areas of the bumper cover from various angles to properly identify.

The front bumper assembly should also be inspected for tears, cracks, and damaged mounting tabs or fasteners. This may be apparent if the bumper cover shows signs of misaligned gaps or obvious detachment.

### **Bumper Cover Repair Considerations**

Considerations for bumper cover repair may include reshaping deformed areas with heat or repairing cracks or tears with adhesive or plastic welding repair methods.

Repair options for repairing damaged mounting tabs may also be a consideration. Mounting tabs on a plastic cover may be more difficult to repair than a small tear in the center of the cover. For this reason, the number of damaged mounting tabs may reduce the feasibility of repair.

Repair options may depend on the location of damage. For example, damage located on contour lines, or formed areas, may not be repairable. The extent of damage to the bumper cover may make repair a less feasible option.

Repair options may be limited if the bumper cover has been previously repaired. For example, the finish buildup from previous repairs may require removal, which would make repair a less feasible option.

More information on repairing bumper covers and other parts made from plastic can be found in the I-CAR live “Plastic and Composite Repair (PLA03)” training course.

### **Bumper Cover Replacement Considerations**

Bumper covers are often supplied according to various options and equipment. These may include the trim package or model of the vehicle. Different packages may have additional molding or are a different style.

A replacement bumper cover may be determined by the vehicle equipment, such as fog lamps or parking sensors for a parking-assist system. Parking-assist sensors can sometimes be reused if undamaged.

Bumper cover replacement may also depend on whether the vehicle is equipped with headlamp washers or lower spoilers.

These are only a few examples. Other factors that may have to be considered when ordering bumper covers include an outside temperature sensor, the engine size, the color, the vehicle year, tow hooks, or a radar sensor.

The vehicle identification number (VIN) may not identify all options on the vehicle. This is why it is important to be able to identify the various options the vehicle is equipped with.

Repair options may be limited in locations where a sensor is present. For example, application of plastic repair adhesive on a front bumper cover may adversely affect the function of a sensor located behind the damaged area.

### **Bumper Energy Absorber**

Bumper energy absorbers are designed to absorb minor collision energy, thus reducing physical damage to the vehicle structure. Most energy absorbers absorb collision energy by crushing or collapsing.

Bumper energy absorbers may be made of a high-density foam, or may be in the form of molded plastic with a square cell structure. When inspecting energy absorbers in the form of molded plastic, inspect the cell structure for crushing or other deformation. Replace the bumper energy absorber if there are any signs of damage.

A few years ago, General Motors updated a previous bulletin (63-20-02) regarding the repair of damaged foam energy absorbers using hot-melt glue. The current bulletin (07-08-63-001) states, "Because the energy absorbers are relatively low in cost to replace, it is now more cost efficient to replace the energy absorbers whenever they are damaged."

### **Bumper Reinforcement**

The bumper reinforcement may be called the impact bar. It is designed to distribute collision energy and may affect timing of the SRS. The bumper reinforcement is typically made from very strong materials, such as UHSS or aluminum, and is located behind the energy absorber. The bumper reinforcement attaches to both front lower rail ends or crush boxes.

### **Crush Boxes**

Crush boxes may be separate parts that are attached with bolts, or are designed into the bumper reinforcement and replaced as an assembly. Crush boxes are designed to absorb

crash energy. The crush boxes are one of the first parts of the vehicle to collapse during a front impact collision, and may prevent structural damage to front lower rails if the collision was not too severe. Crush boxes may also be called crush caps or crashboxes. Crush boxes are designed to be sacrificial parts and should be replaced if damaged.

### **Bumper Reinforcement Inspection**

When inspecting bumper reinforcements, look for cracks or deformation. Inspect the attachment points for tears or deformation. Some bumper reinforcements are supplied with built-in crush boxes. Bumper reinforcements are typically replaced if damaged. Any cracking or tearing of the bumper reinforcement, as well as any damage that may affect the crash characteristics of the vehicle, will require replacement of the part.

### **Full-Frame Front Bumpers**

Full-frame front bumpers may be made with a steel facebar. These may be chrome-plated, or painted with the body color or an accent color. Full-frame front bumpers may have a plastic cover or trim pieces attached to them. The bumper of a full-frame vehicle may be attached to the frame with welded or bolted brackets. The vehicle maker may have repair and replacement recommendations and service parts for damaged bumper brackets.

### **Full-Frame Bumper Repair Vs. Replace**

Repair and replacement considerations for full-frame front bumper assemblies may include options for repairing the front bumper cover or fascia. Front bumper covers or fascias are typically made from the same type of materials as bumper covers on passenger cars. Repairs may include the use of adhesives or plastic welding. Full-frame front bumper removal or replacement may require replacing one-time use fasteners, and may have to be ordered separately.

There may be bolt-on replacement parts for bumper brackets that were originally welded to the frame. When replacing the original welded-on bumper brackets on the 2011 Chevrolet Tahoe, holes need to be drilled for bolting on the replacement parts.

Repair options are limited for chrome-plated bumpers. Chrome-plated bumpers are typically replaced, however, refurbished or re-chromed bumpers may be an option for replacement.

The bumper assemblies on full-frame vehicles may also affect the timing of the front airbags. For this reason, it is important that full-frame bumper brackets are replaced properly.

### **Grille Assembly**

The front grille assembly may attach to the front bumper assembly or hood. Besides the grille itself, parts of the grille assembly may include, but are not limited to, a cover, moldings, an emblem, and brackets and fasteners.

Parts of electronic systems, such as adaptive cruise control sensors or infrared cameras may be located on or behind the grille. These types of electronic devices may have the appearance of a small camera lens or electronic sensor with attached wires. A flashlight may be beneficial when looking for devices located behind the grille.

### **Grille Repair And Replace**

Parts of the grille may be available separately, or be part of an assembly. Plastic repair techniques are limited on these parts because it is difficult to make an invisible repair, such as matching the texture of the part. The feasibility of repair is also a determining factor. Mounting tab repair may be an option, depending on the type of plastic and extent of damage.

### **Front Lighting**

Examples of front exterior lighting include, but are not limited to headlamps, daytime running lamps, fog lamps, front signals, cornering lamps, and side marker lamps. Some of these lamps may be combined into one assembly.

### **Types Of Headlamps**

One of the various types of headlamps is sealed beam headlamps, which have separate bulbs for the low and high beams or one bulb, with two filaments, for the low and high beams. An example of sealed beam headlamps is on the Jeep Wrangler. This type of headlamp assembly must be completely sealed in order to light. Headlamps may be a composite type and have a replaceable halogen bulb.

High-intensity discharge (HID) headlamps may also be called xenon headlamps. HID headlamps use an electronic control unit or HID ballast unit that changes DC volts to AC volts.

Projector-type headlamps create a focused beam of light and are typically used for the low-beam headlamps. The 2011 Lincoln MKS is an example of a vehicle equipped with projector-type headlamps.

Headlamps may use light-emitting diode (LED) bulbs. LED bulbs cannot be replaced separately. Damaged LED headlamps will require replacement as a complete assembly. The 2011 Toyota Prius, 2011 Lexus LS 600h, and the 2011 Cadillac Escalade Platinum are a few examples of vehicles that may be equipped with LED headlamps.

High amounts of voltage are used to light HID headlamps, so serious injury may occur from incidental contact. Do not touch the ballast or any nearby parts unless the power has been disabled on the vehicle. Disabling the power is typically done by disconnecting and isolating the negative battery cable and waiting a specific time for the power to discharge.

Refer to vehicle-specific service information for proper procedures when working around HID headlamps.

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### **Adaptive Front Lighting Systems**

Adaptive front lighting systems may include self-leveling headlamps that adjust vertically to prevent glare into oncoming traffic. The self-leveling headlamps on the 2010 Lexus IS 350 automatically adjust the headlamp reflectors to reflect the light upward or downward. Swiveling headlamps swivel horizontally when the steering wheel is turned. The 2011 Lincoln MKS is equipped with this type of adaptive headlamp system.

Adaptive front lighting systems use electric motors to adjust the angle of the lights, and may have an electronic control unit that may be located near, or is part of, the headlamp assembly. There may be a lit malfunction indicator lamp (MIL) on the instrument panel to indicate a problem with the system.

### **Front Lamp Assembly Inspection**

When inspecting front lamp assemblies, verify proper operation. Also, check for looseness, which may indicate damage. It may be important to check both headlamps because collision energy could have transferred to the non-impact side of the vehicle and damaged the other headlamp. This may be more of a concern in cold temperatures, as parts become more brittle when cold.

Disassembly may be required to access headlamp assembly mounting areas. The mounting points may be damaged even if there are no visual indications of damage on the exterior. There are repair kits available for the headlamp mounting tabs on the 2011 Lexus IS 350. Also, check adjacent parts, such as brackets or the headlamp mounting panel, for damage. Damage to the backside of the lamp assembly may affect reflective material and be a safety concern for oncoming drivers. In addition, check the headlamp assembly wiring and connectors for damage.

### **Headlamp Assembly Considerations**

Removing minor scratches on a headlamp lens may be a repair option. Abrasive methods, such as buffing, may degrade the ultraviolet (UV) coating on the lens, therefore a chemical product may be used as an alternative. Due to lens clarity degradation from UV rays, a repaired or replaced headlamp may not match the other headlamp. Restoration

products may be a consideration for the original headlamp to match the repaired or new one.

How replacement parts are serviced is another consideration. A cracked lens may only be available as a lens and housing assembly or as an entire front lamp assembly. Parts of lamp assemblies may include the lamp housing, bulbs, sockets, wiring harness, and connectors.

The headlamp assembly should be replaced if the housing is cracked. This is because cracks in the lamp assembly housing may cause the bulb sockets to corrode. It may be necessary to remove the bumper cover to access the headlamp assembly.

Wiring repair may be an option. Some lamp assembly wiring is integrated with the engine compartment wiring harness and not available as a separate replacement part. In this case, it may be more feasible to repair damaged front lamp wiring if allowed by the vehicle maker.

### **Headlamp Aiming**

If there has been damage to the headlamp assembly, an aiming procedure may be required. Aiming headlamps may be required if lamps are replaced, or removed and the same part installed (R&I).

Aiming headlamps is done using special aiming equipment. Three prongs that are designed into some headlamp lens assemblies indicate it is compatible with some mechanical headlamp aiming equipment. Damaged aiming adjusters may require assembly before the headlamps can be aimed.

Verify proper operation of the adaptive front lighting systems. A damaged motor may cause an improper or non-functioning adaptive lighting system. A scan tool may be required to verify operation or identify diagnostic trouble codes (DTCs).

### **Wiring Inspection**

A non-operational or improperly functioning system, a lit MIL, or DTC may indicate wiring inspection is necessary. When inspecting wiring, identify electronic systems the vehicle is equipped with. Check the area of damage for pinched or torn wires in the wiring harness, damaged connectors, and bent or broken terminal pins. The area of damage is the most likely place for cut or pinched wires or damaged sensors. Some disassembly may be required to access damaged wiring.

### **Wiring Identification**

Electrical wiring may be color-coded. SRS wiring may be yellow or be attached to yellow connectors. Black wiring usually indicates a ground connection.

The wiring harness for high-intensity discharge (HID) lighting may have a tag on the wire, indicating that the wires carry high voltage. Hybrid electric and pure electric vehicles may have orange casing to identify the high voltage wires. A blue-colored casing may indicate intermediate voltage. General Motors specifies a range of 30–60 volts DC and 15–30 volts AC for intermediate voltage. Blue-colored casing is used for the electronic power steering system on the 2011 Chevrolet Tahoe.

### **Wiring Repair Options**

A wiring harness may be repairable using specific procedures and materials from the vehicle maker. This type of repair requires using proper splicing methods. Refer to vehicle-specific service information for wire splicing procedures. Specific splicing kits or repair materials, such as heat-shrink tubes, are often required. Heat-shrink tubes will prevent moisture from entering the splice location. Merely soldering the wire ends together and wrapping them with electrical tape is not an acceptable repair method.

There may be an option for replacing damaged connector terminals. General Motors provides pre-made terminal leads, which are wires with pre-attached leads. The terminated leads are available for various wire gauges and do not require crimping, other than for attaching the splice sleeves.

Wiring repairs may NOT be an option if it is part of the SRS. Toyota, for example, does NOT allow restraint system wiring repairs. Some vehicle makers allow repairs to restraint system wiring following specified procedures. Examples of vehicle makers that have procedures for repairing restraint system wiring harnesses include Chrysler, Ford, and General Motors.

### **Hood**

The hood is the front top closure panel that covers the engine compartment. Although some hoods have front-mounted hinges, where the hood opens from the back, most have rear-mounted hinges.

The hood may be made of several different materials, including steel, aluminum, plastic, or carbon fiber. Hoods have safety features built in, such as collapse zones, latches, and safety stops. Typically, the safety stop is built into the hood hinge. Collapse zones and safety stops minimize the potential for the hood to intrude into the passenger compartment during a front-end collision.

### **Hood Crush Zones**

Hoods typically have crush zones in the underside panels that cause them to fold during a collision, preventing hood intrusion into the passenger compartment. Another repair or replace consideration is whether or not the crush zones can be repaired without affecting

the integrity or durability of the part. Crush zones must initiate folding during a frontal impact. The hood must retain the proper shape for the life of the repair.

### **Hood Inspection**

Hoods should also be inspected for misalignment with the adjacent body panels and cowl. Also inspect for proper alignment of the latch and striker. Inspect the hood for proper operation of the main and secondary latch mechanisms. When inspecting the hinges, check for the proper alignment of the safety stops. These reduce the likelihood of the hood entering the passenger compartment from a frontal impact.

Indications of previous repairs may include excessive film thickness or the use of body filler. Excessive film thickness of the finish could potentially lead to the removal of the existing finish before refinishing.

### **Hood Repair Considerations**

Repair considerations for hoods include the extent and location of damage. Damage to panel contours may be difficult to straighten. Access to the backside of the damage may be required to apply corrosion protection. Repairs to composite hoods may be limited due to no access to the panel backside to make a two-sided repair.

The type of substrate is another consideration when determining repair options for a damaged hood. The hood may be made of mild or high-strength steel, aluminum, or composite. High-strength steel and aluminum may be more difficult to straighten compared to mild steel. Considerations for a repair that can be done on a mild steel part with a large crease may not be feasible on an aluminum part with similar damage. This is due to aluminum having less memory than mild steel and is not easily returned to the proper shape following collision damage. Some vehicle makers, such as Audi and Jaguar, have recommendations against welding cracks on aluminum hoods. The hood on the 2011 Chevrolet Corvette ZR1 is made of carbon fiber. Repair options for exposed weave carbon fiber hoods are limited to minor surface imperfections.

More information on repair vs. replacement considerations for damaged aluminum hoods can be found in the October 1, 2007 issue of the Advantage Online.

### **Hood Replacement Considerations**

When replacing a damaged hood, be sure all damaged parts are replaced. The hood is typically supplied separately from the attached parts. Parts of the hood that may be damaged and may require replacement include the hood hinges, latch mechanisms, support rod, hood cushions, molding, and trim. The hood insulator may be reinstalled if it is undamaged. Replace all fasteners that were damaged during the collision or removal. Ensure all labels that were attached to the hood are replaced.

Application of chip-resistant coating may be required on the leading edge of the hood. Service information for the 2010 Honda CR-V specifies applying two-part primer-surfacer on the leading edge of the hood.

Seam sealer may be required. Some replacement hoods do not have seam sealer applied by the factory. Hood replacement requires making adjustments to ensure the hood is properly aligned.

**Module Summary**

Module 1 discussed basic damage analysis practices to help ensure a complete and accurate damage report. The module continued with information on exterior trim and moldings. Replacement considerations and possible repair options for parts of the front body were discussed. Information on electrical and electronic parts located on the front body were also discussed.

Topics discussed in this module included: the front bumper assembly, the hood, front lighting systems.

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# *Module 2 - Side Body Inspection*



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## Learning Objectives

A side-impact collision may damage fenders, quarter panels, doors, and movable glass. Knowing how to identify damage is important to write a complete and accurate damage report. Knowing how parts may be supplied is also important for making proper replace decisions.

Module 2 will discuss replacement considerations and repair options for various panels and parts located on the side of the vehicle. The module will continue with identifying the various parts of door assemblies and how to inspect them for damage and proper information. Various types and parts of movable glass, including sunroofs, will also be discussed.

The learning objectives for this module include: identifying damage to side body panels and determining repair and replacement options, identifying door damage and determining repair and replacement options, identifying replacement considerations for door intrusion beams, identifying types of movable glass damage and determining repair and replacement options.

## Fenders

The fender is the outer panel located above the front wheels and is commonly bolted to the vehicle structure. Fenders may be made of steel, aluminum, or composite material. The 2009 Acura RL has aluminum fenders.

## Fender Inspection

When inspecting fenders for damage, look for visible damage. Check the gaps between adjacent panels for misalignment. Check the mounting locations. The top mounting locations for the fender on the 2011 Toyota Camry are designed to collapse in the event of a pedestrian impact. The mounting brackets can be repaired if the damage is not too severe. The bracket may be available as a separate part. For example, on the 2011 Toyota Camry, the bracket is serviced as a separate part on Japan-made vehicles. On U.S.-made vehicles, the brackets can only be serviced as part of the radiator side support.

## Fenders Repair Vs. Replace

Repair or replacement considerations for fenders may include the extent of damage and also the type of material. Different materials may require specific repair techniques. For example, the fenders on the Chevrolet Corvette Z06 and ZR1 are made from carbon fiber. A two-sided repair can be done on these carbon fiber fenders, as long as the damage does not extend to the edge of the part.

Adjacent part removal is another repair or replacement consideration. Examples of parts that may require R&I when replacing a fender include the bumper cover, front header

panel, or rocker panel molding. There is an upper fender bolt on the 2011 Volkswagen Touareg that may require removal of the windshield to access. Expandable foam may require removal to access an inner fender bolt on the 2010 Ford F-150. The foam should be replaced with a comparable flexible foam.

### **Fender Liners And Splash Shields**

Damaged fender liners and splash shields are typically replaced. Plastic repairs to damaged fender liners are typically not feasible because it is not a refinished part and it is difficult to match the texture of the repair area to the rest of the part. However, tab repair may be an option. Fender liners and splash shields should be inspected for damaged clips and mounting holes.

### **Other Fender Attachments**

Other parts attached to the fender that may require replacement or removal include emblems, nameplates, moldings, and reflectors. There may be mechanical attachments and electrical grounds, mainly on trucks and SUVs. There also may be foam. On the 2010 Ford Taurus, the flexible foam should be replaced following replacement or R&I of the fender.

### **Door Construction**

Parts of the door include the door shell. This may also be called the door frame. A replacement door shell often includes the door intrusion beam and may include the outer door panel. The outer door panel may also be called the door skin. An outer door panel is often serviced as a separate part, but may only be serviced with a door assembly. The outer door panels on the 2009 Volkswagen Touareg and Audi A5 are only available with the door shell assembly.

All doors have intrusion beams. Door intrusion beams are positioned against the backside of the outer door panel and run across the door. These are designed to reduce the chance of the door collapsing into the passenger compartment during a side impact. Door intrusion beams are commonly made of UHSS. Damaged intrusion beams should not be straightened and are typically only serviced with the door shell.

Doors may be constructed with a frame around the glass or they may be frameless.

### **Door Inspection**

When inspecting doors for damage, check visible damage to the outer door panel and door shell. Check for proper alignment, such as checking the edges of the door for uneven gaps to adjacent panels. This may be an indication of indirect or hidden damage. A side impact may cause the entire door to distort. The door shell may be distorted outward at the top edge, bottom edge or both. Extensive damage of the door shell typically requires replacement.

Check for proper operation by opening and closing the doors. Improperly functioning doors may be an indication of hidden damage to the door or adjacent panels. Also, ensure that the window regulator, lock, and power accessories are operating properly. Finally, check for damaged weatherstripping. Weatherstripping may be attached with adhesive and not be removable without damaging it.

### **Door Hinges And Latch Mechanisms**

When inspecting door hinges and latch mechanisms, check for visible damage, such as distortion or a cracked weld bead. Check for proper operation, such as verifying that the door swings smoothly on the hinges. Pay attention to any odd movement when the latch engages or disengages from the striker. Also, check hinges and latches for uneven panel gaps, which may indicate bent door hinges or damage to the structure.

Door hinges may be welded or bolted to the door shell and the A- and B-pillars. It may be recommended to replace welded-on hinges with bolt-on replacement parts. This may require drilling holes for the bolts.

### **Outer Door Panel Repair**

Repair options for the outer door panel may include straightening, depending on the extent and location of damage. Minor dents may be repaired with PDR, however, this may require removing the glass to prevent breaking it.

Repair options may depend on the type of material. Outer door panels may be made from carbon fiber or sheet-molded compound (SMC). Currently, adhesive products used for repairing SMC are used to repair carbon fiber. Minor surface imperfections may be repaired.

### **Outer Door Panel Replacement**

Considerations for outer door panel replacement include part availability. Replacing the outer door panel is not an option if it is only supplied with the door shell. Attachment methods must also be considered, including GMA (MIG) welds, STRSW, adhesive, rivets, or a combination. Outer door panel replacement may require combining welding and bonding. This should not be confused with the process of weld bonding, which uses adhesive and spot welds in the same joint. Adhesives may be used along the outside flanges while welds are used in the pinchweld of the window opening or a sectioning joint. An example of this is on the 2010 GMC Sierra.

Outer door panel replacement may include sectioning on or near the door belt line or window frame. Sectioning is a repair made by cutting and removing a portion of a panel and replacing it with an undamaged portion, as opposed to replacing the complete part at factory seams. There is a procedure for sectioning the outer door panel on the 2011 Toyota Tundra. The sectioning joints are located on the front and rear frame areas.

Application of materials is also a consideration for outer door panel replacement, including applying anti-corrosion compound to the lower hem flange seam area, seam sealer that was removed during the repair process, and noise, vibration, and harshness (NVH) foam, or foam pads that were removed during the repair process.

### **Damaged Door Intrusion Beams**

There may be one or more intrusion beams attached to the door shell. Damaged door intrusion beams should not be straightened and must be replaced. Door intrusion beams are usually made of UHSS. Straightening damaged UHSS can cause the metal to be brittle and may not react as designed in a subsequent collision. Door intrusion beams are typically only supplied with a replacement door shell. However, Audi provides a bolt-on replacement door intrusion beam for some vehicles, such as the 2009 A4 Quattro Cabriolet.

Door intrusion beams may be attached to brackets. Damaged parts that attach to the door intrusion beam should not be straightened. For example, Toyota states in their service information that damaged door intrusion beam brackets require replacement.

### **Handles, Locks, And Lock Cylinders**

Inspect door handles, locks, and lock cylinders for proper operation, first of all. Also, check them for loose or improper mounting. There may be a keypad that is damaged. Some doors have an electronic keypad that can be used to unlock the door. A customer consultation may be necessary to determine if the keypad is working properly.

Lock cylinders or attaching lock parts cannot be repaired. Replacement lock cylinders must be re-keyed to match the other lock cylinders on the vehicle. R&I of door handles, locks, and lock cylinders may be difficult without damaging. Handle and lock trim, such as garnishing for door handles and the lock, may be ordered according to color or the trim package, but may still require refinishing to achieve the proper color match.

### **Door Mirror Inspection**

Besides visual damage, inspect exterior mirrors for loose or improper mounting. Also, check for secondary damage to the door shell or adjacent parts. Mirrors may include mechanical or electronic systems. Verify proper operation of the adjustment control. This may be a pivot-action control, or an electronic system using motors to adjust the mirror. There may be heating elements, which should also be checked for proper operation. Turn signals are sometimes shown in the mirrors. These may be displayed with a series of LEDs. If the vehicle is equipped with blind-spot detection systems, there may be indicator lamps in the mirrors. This may require a test drive to determine proper operation. Finally, there may be courtesy lighting, usually under the door mirrors, which should be verified for proper operation.

### **Door Mirror Replacement Considerations**

Considerations for door mirror replacement may include R&I of the interior door trim panel for access. Door mirror assemblies may vary on the same year, make, and model vehicle. It is important to identify the trim package and vehicle options to ensure the mirror is replaced properly. Considerations may include identifying the part or trim color, determining the type of adjustment controls, if the mirror is heated, and whether the mirror contains any advanced system, such as a blind-spot detection indicator. A power folding mirror may be included with a towing package. This may also have to be identified when replacing a door mirror assembly.

There may be separate replacement parts available, such as the glass, motor or actuator, and turn signal.

### **Door Assembly Replacement**

Considerations for replacing a door assembly include transferring the original inner mechanical and electronic parts and interior trim panel to the replacement part. On some vehicles, these parts are contained in a door cassette, which can be transferred in one piece.

If replacing with an entire recycled door assembly, all the inner electrical and mechanical parts and interior trim panel may have to be transferred from the original door assembly if the interior trim color and accessories do not match. This may require removing parts from both the original door assembly and from the recycled door assembly. The original parts would then be installed in the recycled door assembly.

### **Other Door Considerations**

Other considerations regarding repair or replacement of the door may include inspecting the side impact sensor for damage. It may be recommended to replace any side impact sensor located near collision damage. Side impact sensors for the 2010 Chevrolet Cobalt are located in the doors. General Motors service information specifies to replace any SRS sensor located near collision damage, regardless of deployment. The SRS may have to be disabled before inspection. The door may contain a side airbag. Disabling is commonly done by disconnecting the vehicle battery and waiting a few minutes before beginning repairs. Check the vehicle information for the specific disabling procedure. A deployed door side airbag may have to be replaced. This may require replacing the interior door trim panel.

When replacing a door, labels may have to be replaced that were attached to the original part. There may be labels attached to the replacement part that should not be removed. There may be undamaged stationary glass that could be removed and reinstalled, such as on a sliding side door on a minivan. After the door is replaced, there may be adjustments to properly align the door.

## **Movable Glass**

Movable glass may include door glass, quarter glass, and sunroofs. Movable glass may be tempered or laminated. Movable glass is typically tempered, which shatters upon impact. Repair options for tempered glass are usually limited to minor surface scratches. Minor cracks in laminated door glass may be repairable if the damage is contained to the outer laminate. The front driver side door glass on the 2011 Ford Taurus is laminated.

## **Glass Inspection**

Inspect movable glass for cracks, deep pits, a chipped edge, and scratches. Damage that can be felt with your fingernail is typically not repairable. There may be damage to the interior side caused by mass inertia. There may also be water leaks, or signs of an improper previous installation.

Disassembly may be required to completely inspect movable glass. This is especially true if the door glass was lowered, or open, during the collision. If the glass is broken, cover the area to prevent moisture from damaging the vehicle interior.

## **Movable Glass Considerations**

Considerations for damaged movable glass include replacing the glass with the correct window tint. Placing a white sheet of paper behind the glass on the undamaged side may identify the level or color of tint. Coding information, or markings, located on the bottom of the glass may also indicate the type of tint. Aftermarket tint may be identified by a seam line near the top portion of the glass.

Any broken glass should be cleaned up to ensure occupant safety and proper operation of mechanical parts. Pieces of glass may fall into heater vents. Vents should be vacuumed out to reduce the chance of small pieces of glass injuring the occupants when the vent blower is turned on. Turning the blower motor on HIGH with the selector in the A / C or VENT position while vacuuming should clear the vents of any glass fragments. Pieces of glass may also fall into areas that can restrict the movement of mechanical parts. Examples include the glass run channels, seat tracks, and seat belt retractors. Glass between the door intrusion beam and the outer door panel also needs to be removed.

## **Movable Glass Parts Inspection**

Inspect movable glass parts for proper operation through the whole range of movement. Inoperative power windows may have blown fuses, damaged wiring, or damaged motors. Loose or corroded grounds, connectors, or terminal pins may also be the cause of an inoperative power window.

Inspect for loose or missing parts, binding, or improper alignment. To prevent further damage, do not try to force the glass if it is binding. Shake the door and listen for clanking sounds, which may indicate loose interior parts or damage.

## Sunroof Inspection

The roof may be equipped with a glass panel called a sunroof or a movable panoramic roof. Panoramic roofs are wider than sunroofs and extend closer to the sides of the vehicle for more view or light. Sunroofs may be designed to fully open by sliding the glass backward or be hinged at the front to only partially open. Sunroofs or panoramic roofs should be inspected for proper operation through the whole range of movement. Again, be cautious of binding glass and do not force movement to prevent additional damage. Check for misaligned or damaged guide rails, damaged weatherstripping, and damaged or missing clips or other parts, such as switches, cables, or gears. Check for damage to the air deflector. Also, inspect for pinched drain tubes.

Plan to replace the glass if it is damaged. Determine if the mounting parts will be replaced or reused.

## Sunroof Assembly Considerations

Considerations for replacing sunroof or movable panoramic roof assemblies include determining what parts require replacement and which parts can be ordered separately. For example, only the glass may require replacement if it is damaged. If damage extends to parts of the frame, the frame assembly has to be replaced. Consider whether the parts are bolted or bonded. The glass may be bolted to the frame. The frame may be bolted and bonded to the roof. Consider what adjacent parts require removing. For example, the headliner may require removal or repositioning. It may be recommended to remove an adjacent panoramic roof when the sunroof assembly requires replacement. Vehicle maker procedures must be followed to ensure the sunroof is installed properly and to prevent damage to adjacent parts.

An initializing procedure may be required, either manually or with a scan tool.

## Heated Glass

Heated glass is common with backglass, but may also be found on movable glass, such as on movable liftgate glass. Heated glass typically has wires or grid lines printed onto the glass. The heating parts may be repairable. Repairs include reattaching loose terminals with conductive epoxy or solder. Grid lines may be repaired with a conductive paint.

## Convertible Top Parts

A convertible may have a retractable hardtop, or a fabric or vinyl outer cover. Hardtops have multiple exterior panels, which may be made of steel, aluminum, or a composite material. Inspect hardtops for scratches, deformation, or cracks. Inspect fabric or vinyl outer covers for rips, tears, or punctures.

There may be a front panel and roof bows that should also be inspected for damage.

A convertible top will have a lifting mechanism. Do not operate a convertible top with a bent frame to prevent causing further damage. Just like with any roof, there will be a headliner. A rear compartment contains the convertible top when it is down. Parts of the rear compartment include the housing, lid, seal, and moldings.

### **Convertible Top Considerations**

A consideration for a damaged hardtop includes determining if repair may be an option. This may depend on the material type. Straightening steel or aluminum hardtops may be a consideration depending on the extent and location of damage.

A consideration for a damaged fabric convertible top may include sewing the seams. Ripped or punctured covers away from the seam generally require replacement, as sewing the fabric may leave a visible mark. Service information for the Ford Mustang Convertible specifies that light scratches may be removed using isopropyl alcohol and 600-grit sandpaper or steel wool. Using power tools or excessive pressure may permanently damage the fabric. There may be damage to back windows, which may require replacement of the entire cover. There may also be damaged roof bows or other framing parts that require replacement.

### **Quarter Panels**

The quarter panel is the exterior panel located on the side of the rear portion of the vehicle. Originally, this part was considered about one quarter of the body assembly, with the front sheet metal added later in the manufacturing process. On a passenger car, the quarter panel is located behind and adjacent to the front or rear doors, depending on whether the vehicle is a coupe or sedan. On minivans and SUVs, this is the side body panel located between the rear or sliding door and the rear of the vehicle. The cab corners on pickup trucks may also be considered a type of quarter panel.

### **Quarter Panel Inspection**

Parts of the quarter panel that should be inspected include the wheelhouse, inner panel, fuel door, filler neck, and fuel label. Also, inspect the quarter glass, and inspect the seams for separation and excessive panel gaps.

### **Other Quarter Panel Inspection Items**

Inspecting quarter panel damage may also include removing the rear bumper cover, if hidden damage is suspected. Check air vents for damage. Verify the proper operation of advanced vehicle systems, such as blind spot detection sensors. Sensors for the blind spot detection system are attached to the quarter panels on the 2011 Ford Taurus.

### **Quarter Panel Considerations**

Repair and replacement considerations for quarter panels include that they are typically replaced by sectioning. Check with the vehicle maker's recommendations to determine

if sectioning is an option. A replacement quarter panel may only be serviced as part of a uniside. This will require cutting the quarter panel section from the assembly at the specified cut locations. It may be necessary to R&I undamaged glass during replacement.

Consider the extent and location of the damage. Straightening may not be an option if the damage is located on formed areas, such as contours or on the door opening. Similar repair and replacement procedures may apply to cab corners on pickup trucks.

### **Module Summary**

This module discussed how to identify damage to parts of the body side, and how those parts may be supplied. Other replacement considerations and repair options were also discussed. Module 2 identified various parts of door assemblies and how to inspect them for damage and proper operation. Various types of movable glass were also discussed.

Topics discussed in this module included: side body panels, doors, door intrusion beams, movable glass.

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***Module 3 - Rear  
Body And  
Aftermarket Parts  
Inspection***

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## Learning Objectives

Many parts of the rear body are similar to parts located on the front and sides of the vehicle. Examples include bumpers, closure panels, and lighting systems. However, the rear of a pickup truck consists of an entire box assembly.

This module will recap some of the replacement considerations and repair options for bumpers, closure panels, and lighting systems. The module will continue by identifying parts of a pickup truck box assembly, and how to inspect these for damage. The module will conclude with considerations for aftermarket parts.

The learning objectives for this module include: identifying rear closure panels and determining repair and replacement options, identifying parts of rear bumper assemblies and determining repair and replacement options, identifying parts of rear lighting systems and determining repair and replacement options, identifying parts of pickup truck box assemblies and determining repair and replacement options, identifying aftermarket parts and determining repair and replacement options.

## Rear Body Inspection

The same approach as inspecting front impact damage may also be applied to analyzing damage from a rear impact. There are similar parts on the rear of the vehicle as on the front of the vehicle, such as bumpers, lighting, and closure panels. A logical approach to inspecting vehicles involved in a rear impact is to start at the back and work toward the front of the vehicle.

## Rear Bumpers

Considerations for damaged rear bumpers are similar to front bumpers, which include inspecting the rear bumper cover for damage. Replacement considerations may depend on the vehicle trim package or if the vehicle is equipped with a parking-assist system or rear camera. Plastic or foam energy absorbers also require replacement, however some vehicles use mechanical energy absorbers for the rear bumpers. The rear impact bar on the 2011 Cadillac STS attaches to two mechanical energy absorbers. These should be inspected for leaks, bends, correct length, and proper operation.

As is the case for the front bumper, a damaged rear bumper reinforcement must be replaced.

## Rear Bumper Electronic Parts

The rear bumper may have electronic parts that require inspection. Examples include parking-assist sensors. A parking sensor malfunction indicator lamp may turn on to indicate damage to parts of the system. The system may also be activated to determine if the system is operating properly. Damaged sensors are typically replaced, but one sensor can often be replaced independently. Replacement sensors typically require refinishing

to match the vehicle. Some vehicle makers do not recommend refinishing sensors with minor finish damage because excessive paint thickness may adversely affect the operation of the parking-assist system. Refer to vehicle-specific service information for repair or replacement recommendations for parking sensors. Some vehicle makers require drilling holes in the bumper cover for parking-assist sensors. For example, there is a tool specified for drilling parking-assist sensor holes on the replacement rear bumper cover for the 2011 Volkswagen Touareg.

There may be a rear camera located on or above the rear bumper. Another location for a backup camera is above the backglass.

### **Rear Lamp Inspection**

Inspect rear lamp assemblies for broken or burned-out bulbs, and damaged or corroded bulb sockets. Some lamp assemblies use multiple LEDs for illuminating rear lamps. Individual LEDs cannot be replaced if damaged. This is because they are typically mounted directly to a circuit board. The lamp assembly will have to be replaced.

Inspect for cut, pinched, or corroded wires. Electrical wires for lamp assemblies may be repairable. Also, inspect for damaged, loose, or corroded grounds or connectors. It may be necessary to partially disassemble the lamp assembly to determine the condition of the connectors and other electrical parts. Also, inspect for damaged or corroded switches, and blown fuses.

### **Rear Closure Panel**

The rear closure panel may be a deck lid or liftgate. A deck lid may also be called a luggage lid. When inspecting the rear closure panel, verify proper alignment. Check for panel gaps between the rear closure panel and the bumper and quarter panels. Check the hinges and latch mechanism for distortion and proper operation. Verify the operation of rear lamps. It may be necessary to inspect support rods for proper operation or distortion. Also, check parts of mechanical or electronic systems for damage and verify proper operation. For example, there may be a mechanical glass wiper for liftgate glass. A rear camera may be attached to the liftgate.

### **Rear Closure Panel Considerations**

Considerations for damaged rear closure panels may include the extent and location of damage. Repair options for rear closure panels may depend on access to the backside. Material type is another consideration for repair options. Rear closure panels may be made of aluminum or HSS, which may be difficult to straighten. The inner and outer deck lid panels on the 2009 Acura RL are made of aluminum, and are attached to each other with self-piercing rivets. Repair may not be an option. Replacement may include a deck lid or liftgate shell. Undamaged glass could be removed and reinstalled. Also, with a damaged rear closure panel, adjustments will need to be made to properly align the panel.

Other considerations may include damage to a rear-mounted spare tire and spare tire carrier. Lock cylinders or attaching lock parts cannot be repaired. Replacement lock cylinders must be re-keyed to match the other lock cylinders on the vehicle.

### **Box Assembly Parts**

Common parts of a pickup truck box assembly include the front panel, inner and outer side panels, bed floor, tailgate, and crossmembers.

### **Box Assembly Inspection**

When inspecting a pickup box assembly, check the alignment between the front panel of the box assembly and the back panel of the cab. Inconsistent gaps on both sides of the vehicle may indicate structural damage. Inspect the front panel for damage. Collision forces from a side impact may transfer to the front pickup box panel. Inspect for mass inertia damage caused by objects in the box assembly at the time of the collision. This includes inspecting the inner panels, bed floor, and tailgate.

Inspect crossmembers for damage. Inspect body mounting hardware for damage. When inspecting body mounting hardware, inspect the bolts that attach the frame to the vehicle body for worn threads and bends. Check the cushions that absorb energy between the frame and body for wear and cracking. The retainers that keep cushions in place should be inspected for bends and corrosion. Cage nuts in the body should be checked for distortion, damaged spot welds, and damaged threads. Some brackets and crossmembers may not be serviced as separate parts. Some riveted parts may be reinstalled with bolts.

### **Box Assembly Considerations**

Considerations for repair or replacement of a box assembly may include identifying the type of material to determine repair methods. The box sides on the Ford Explorer Sport Trac are made from SMC. Ford service information provides a procedure for SMC repair. The bed on the Honda Ridgeline is made from SMC. Damage to the bed may be repairable if there is access to both sides. The Honda service information also specifies that damage located within 50 mm (2") of the six main attachment bolts should not be repaired.

The entire box assembly may have to be lifted or removed for repairs or replacement. When inspecting the box assembly, make note of the size of the bed to ensure the correct parts are ordered. Know how parts are supplied. For example, outer pickup box side body panels may be available as separate replacement parts or only as assemblies. Determine the attachment method specified by the vehicle maker.

### **Bedliner Considerations**

A damaged pickup truck may have a bedliner installed. A bedliner may be a plastic drop-in type or a spray-on type that is applied directly to the painted or bare metal bed floor.

The bedliner may be OEM or aftermarket. It may require repair. It may be necessary to repair a spray-on bedliner that was damaged during the collision or removed during the repair process. Information on repairing spray-on bedliners can be found in the I-CAR online “Spray-On Bedliners (BED01)” training course.

### **Other Considerations**

Other considerations for pickup truck box assemblies may include inspecting the rear bumper. Full-frame rear bumpers are commonly made of steel and may be painted or chrome-plated. There are limited repair options for chrome-plated parts. If there is a tonneau cover, that should be inspected for damage. Covers may be OEM or aftermarket, soft or hardtop.

Inspect the tailgate for visible damage and proper operation. This includes inspecting the inner and outer panel seams. The tailgate may be equipped with a backup camera. Also, inspect the spare tire hoist.

### **Accessories**

Some vehicles are customized with accessories. Accessories may be supplied by the vehicle maker or aftermarket. Examples of vehicle accessories include a grille guard, running boards, colored display lighting, tow hooks, and a snow plow.

### **Damaged Accessory Considerations**

Determining whether accessories are OEM or aftermarket may include checking for branding by the manufacturer. The customer could be consulted. This may also determine where replacement parts can be obtained.

Considerations for OEM or aftermarket accessories may include the owner’s insurance policy or company guidelines regarding damage to accessories. Consider the repair options. There may be kits available for repairing grille guards, for example.

### **Module Summary**

This module discussed various parts of the rear body that are similar to parts located on the front and sides of the vehicle. Considerations for inspection, replacement, and repair were also discussed. The module continued with information on pickup truck box assemblies and aftermarket parts.

Topics discussed in this module included: the rear closure panel, the rear bumper assembly, rear lighting systems, a pickup truck box assembly, aftermarket parts.