depending on the magnitude and direction of impact, the frame might experience damage while the body does not. Frame deformation can be broken down into five categories:

1. **Side-way damage.** Collision impacts that occur from the side often cause side-way damage or a side-bending frame damage condition (Figure 17-8). Side-way usually occurs in the front or rear of the vehicle. Generally, it is possible to spot side-way by noting whether there are buckles on the inside of one rail and buckles on the outside of the opposite side rail (Figure 17-9).

   Side-way can be recognized by abnormalities, such as a gap at the door on the long side (Figure 17-10) and wrinkles on the short side. Look for impact damage obvious from the side, such as the hood and deck lid do not fit into the proper opening.

![Side-way diagram](image)

**FIGURE 17-8** Study various kinds of side-way damage: (A) side-way at the front of the frame caused by a front-end collision, (B) rear side-way, and (C) double side-way on the frame’s outer section.

2. **Sag damage.** Sag damage is a condition in which one area, often the cowl area, is lower than normal (Figure 17-11). The structure has a swayback appearance. Sag damage generally is caused by a direct impact from the front or from the rear (Figure 17-12) can occur on one side of the vehicle or on both sides.

   Sag can usually be detected visually by a gap between the fender and the door that is narrow at the

![Sag diagram](image)

**FIGURE 17-11** (A) Note the sag condition on the left front frame section and (B) rear-end sag.

![Buckles diagram](image)

**FIGURE 17-12** (A) This side rail sag resulted from a front-end collision; (B) this side rail sag resulted from a rear-end collision.
Mash damage. Mash damage is present when any section or frame member of the car is shorter than factory specifications (Figure 17-13). Mash is usually limited to the areas forward of the cowl and rearward of the rear window. Doors might fit well and appear to be undisturbed. Wrinkles and severe distortion will be found in fenders, the hood, and possibly frame rails or horns. The frame will rise upward at the top of the wheel arch causing the spring housing to collapse (Figure 17-14). With mash damage, there is very little vertical displacement of the bumper. The damage results from direct front or rear collisions.

Diamond damage. Diamond damage is a condition where one side of the car has been moved to the rear or front causing the frame and/or body to be out of square (Figure 17-15). The resulting shape is a figure similar to a parallelogram and is caused by a hard impact on a corner or off-center from the front or rear. Diamond damage affects the entire frame, not just the side rails. Visual indications are hood and trunk lid misalignment. Buckles can appear in the quarter panel near the rear wheelhousing or at the roof-to-quarter panel joint. Wrinkles and buckles often will appear in the passenger compartment and/or trunk floor. There is usually some mash and sag combined with the diamond.

Twist damage. Twist damage (Figure 17-16) is a condition where one corner of the car is higher than normal; the opposite corner might be lower than normal. Twist can happen when a car hits a curb or median strip at high speed. It is also common in rear corner impacts and rollovers.

A careful inspection reveals no apparent damage to the sheet metal. However, the real damage is hidden underneath. One corner of the car has been driven upward by the impact. Most likely, the adjacent corner is twisted downward. If one corner of the car is sagging close to the ground as though a spring is weak, the car should be checked for twist.

Diamond damage (Figure 17-17) usually occurs when the vehicle is struck off-center. However, a frame will rarely experience deformation involving the whole frame. The most frequent order of occurrence of damage is:

1. Side-sway
2. Sag
3. Mash
4. Diamond
5. Twist