Separate lists have been developed for damageability, repairability, and serviceability to assist the designer and the engineer in establishing appropriate priorities. Thus, it is recognized that there may be instances where an improvement in damageability may reduce repairability. It is felt, however, that the lists will generally permit independent consideration.

Within the context of recognized design tradeoffs, it is suggested that a basic objective should be that the cost of repairing a vehicle should be at the lowest level in areas where collision involvement frequency is the highest, i.e., around the exterior perimeter of the vehicle.

2. Damageability Issues

2.1 Component Vulnerability

Collision involvement frequency of front end, left and right corners is 60%; the rear end is 30% and 5% each for the sides. (See Ref. 1.)

Can an expensive component be moved to a less vulnerable location?

If a component cannot be moved, can it be made more easily repairable or cheaper to replace?

2.2 Resistance to Damage

When involved in a low speed impact, does the component resist minor damage without being completely destroyed?

2.3 Transfer of Damage

Can a design be modified to allow a component to absorb low speed impact energy?

Are components collapsing too readily and allowing the load path to reach more expensive components?

2.4 Damageability Improvement—Examples

Bumper systems meet a 5 mph no damage standard, including corners.

Prevention of front fender intrusion into windshield.

Hood is designed to limit transmittal of damage to the windshield.

Upper rail reinforcement should provide protection to mechanical components by extending from the cowl/firewall forward to the radiator core support.

Plastic grille is separate from headlamp bezel and is designed to limit damage to headlamp and radiator.

Adequate clearance is provided between hood lock support and radiator.

Radiator has floating mounts to absorb minor impact damage.

Cooling fans designed to reduce damage to the radiator core under minor impact.

Air conditioning receiver/dryer is located in a minimum vulnerability area.

Expensive electronic components are located in a protected area or else in a minimum vulnerability area.

Rack and pinion is mounted in a protected location.

Adequate clearance is provided for front drive shafts and other underhood mechanical components.

Fuel tank is protected against puncture by framerails, suspension components, etc.

3. Repairability Issues

3.1 Ease of Repair

Are welded components or assemblies readily accessible for straightening or removal?

Can components or assemblies be repaired without removal from the vehicle?

Is the component material economically repairable?

Can service parts be located using alignment holes, dimples, or cutouts on mating flanges for ease of reassembly?

Is there information provided which describes special welding, assembly sequence or corrosion protection procedures?

3.2 Damage During Repair

Can components be repaired without causing further damage to adjacent components?

3.3 Cost of Repair

Is the repair cost associated with a design inordinately more expensive than similar competitive designs?

1. Does it take more time?
2. Do the parts cost more?

3.4 Repairability Improvement—Examples

An approved sectioning procedure exists for the following components:

Front and rear rails, forward or rearward of suspension mounting

Rear floor pan at or rearward of suspension mounting

Rocker panel (full and partial)

Windshield and lock pillars

Hood, decklid, fenders, and doors are bolted on for ease in replacement and have adequate adjustability (±6 mm) minimum.

Upper engine compartment, rear body, and underbody component alignment reference marks are provided.

Mating component flanges have matching cutouts for alignment.

Openings in inner body structure are provided to allow access for straightening door outer and quarter panels.

Panel joints are designed so that the higher frequency replacement panels are easily accessible.

Front apron extension overlaps strut tower and upper rail reinforcement.

Front and rear rail extensions overlap respective inboard portions.

Front side member overlaps front floor reinforcement.

Lower back panel overlaps the outer quarter panel and the rear floor pan.

Rocker panel has increased resistance to deformation during straightening of front or rear rails.

All major plastic components have molded in material identification codes for bonding and welding.

4. Serviceability Issues

4.1 Component Accessibility

If a major component has to be removed, do other parts have to be removed before the component is accessible?

4.2 Part Availability

Are assemblies or large parts located in vulnerable areas serviced in sub-assemblies or partial panels?

4.3 Part Cost

Are serviced parts, partial panels, and sub-assemblies competitively priced?

4.4 Serviceability Improvement—Examples

Partial component panels are serviced separately from assembly:

Radiator core support side baffles
Front apron panel extension
Front and rear rail (extensions)
Rear floor pan extension
Door outer panel door skin
Rocker panel
Quarter panel

If uniside panels are used, parts should be serviced in the following sections:

Windshield Pillar
Lock Pillar
Rocker Panel

Radiator core support is also serviced in a one-piece sub-assembly.

Air conditioning plumbing does not have to be disconnected to service radiator baffle.

Front spindles have camber and caster adjustment, ±2° minimum.

Rear lower control arms have adjustable toe-in.

Instrument panel is serviced in sections.

Instrument panel components and switches are readily accessible by removing finish panels.

A service wire is imbedded in the moulding of fixed glass for ease of removal.

5. References

1. Tech-Cor Collision Data Report, June 1982.

STATIONARY GLASS REPLACEMENT—SAE J1556 DEC85

SAE Recommended Practice

Report of the Maintenance Division, approved December, 1985.

1. Purpose—The intent of this SAE Recommended Practice is to provide guidance to automobile repair shops and personnel in the replacement of stationary glass when damaged in collisions.

2. Introduction—As the design of today's automobile changes, new technology is being developed which has a direct influence on maintaining the safety and structural integrity of these vehicles. A factor now contribut-