# Automotive
# Laminated Side Windows
# Emerging Technology

ENHANCED PROTECTIVE GLASS
Automotive Association

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# Emerging Technologies

- Automotive Laminated Windows continues to grow:
  - Changing the automotive glass systems
  - Windshields continue to improve.
  - Laminated side windows.
- Auto Glass Emerging Technology
  - Variety of constructions offer different benefits to meet OEM designs and features needed.
- Auto Glass Systems Development
- Governmental Approvals and Testing

# Emerging Technologies

- Current Auto Glass Paradigm
  - Laminated glass has been used for windshields for 62 years - in 99+% of global vehicles
    - Still serving as an excellent protection device for occupants and reaction surface for frontal airbags.
  - Tempered glass side windows were established as the best available technology nearly 30 years ago.
- Emerging Technology
  - Laminated glass side windows becoming the best available technology today.
    - Safety, Security, Sound and Solar

# Current Auto Glass Issues

- Many issues remain with today's auto glass systems:
  - Side and back window occupant ejection deaths and injuries.
    - 8000 Deaths/year in the US.
  - Side and back window partial ejection injuries.
  - No reaction surface for side or roof airbags once the tempered glass has broken.
  - Laceration injuries from flying tempered glass.
    - >275,000 Injuries/year
  - Vehicle security is global issue - theft of vehicles and contents
    - $8.5 Billion cost in the U.S.

# Current Auto Glass Systems

- Laminated glass has been used for windshields for 62 years.
  - Windscreen performance continues to improve:
    - Durability of the plastics exceed OEM requirements.
      - Life of vehicle - 7-10 years
    - Solar performance
      - UV up to 99% absorption
      - IR up to 55% reflection
    - Safety performance continues to be excellent:
      - Occupant protection
      - Reaction surface for frontal airbags
        - » System design enhancements continue to improve complementary performance
  - Many new features can be included with specialty windshield laminates:
    - Head-up displays, antennas, defrosting, etc.

# *Changing Auto Glass Systems*

- **Laminated glass side windows will become the best available technology:**
  - Laminated glass side windows (glass/plastic) are now available in thickness of 4.0mm and greater in any shape to meet design parameters.
  - Variety of plastics and systems offer different performance levels depending on vehicle door frame and attachment design.
  - Laminate durability now meets the OEMs need for side windows.
  - Laminated glass side windows can provide multi-functional glazing.

# *Changing Auto Glass Systems*

- **Laminated glass side windows (glass/plastic) will become the best available technology for occupant safety.**
  - Laminated glass side windows will help automakers address the following key safety issues:
    - Occupant full or partial ejections.
    - Provide a reaction surface for side or roof airbags.
    - Vehicle security.
    - Reduce flying glass lacerations and airbag puncture potential.
  - Laminated glass side windows will allow automakers to improve fuel economy through:
    - Laminates are lighter than the tempered parts they replace.
    - Laminates can reduce the vehicle solar load, UV & IR, allowing for smaller A/C compressors.

# *Auto Glass*
# *Emerging Technology*

- **Multiple glass companies now have developed the following advances in side window glass laminate (glass/plastic) technology:**
  - Good optics of thin glass in bent pairs to produce visually acceptable laminates.
  - Good heat strengthening of the glass to meet door slam and durability requirements.
  - Lamination technology and capacity to produce OEM quality parts.
  - Maintains rigidity, scratch resistance and durability of the current glass technology.

# *Auto Glass Emerging Technology*

- **Multiple plastics suppliers have developed the following advances in side-window glass technology:**
  - Multiple systems from single-layer plastic interlayers for use with glass to complex multilayer constructions.
  - Flexible to rigid systems have been developed for performance in different door designs.
  - Specialty performance products ranging from:
    - IR reflectance.
    - Antenna systems.
    - Acoustic interlayers.

# Auto Glass Systems Development

- **Development teams including OEMs, glass companies and plastic interlayer suppliers have been established to:**
  - Understand and improve the performance of automotive side windows laminates to meet the OEMs need for vehicle design:
    - Security, safety, sound and solar performance.
  - Implement laminated side window technology in many vehicle platforms - 20+ programs worldwide
  - Implementations in Europe moving to standard and to smaller, non-luxury vehicles
  - North America and Asia Pacific entering the market
  - Laminated glass side window technology in use in over 1.0MM vehicles worldwide.

# Auto Glass Systems Development

- **Industry groups are beginning to broaden the approach to help systems integration.**
  - AORC - Automotive Occupant Restraints Council
  - SAE - Society of Automotive Engineers
    - Establishment of a security testing standard.
- **Governmental Approvals**
  - US - Z26 already has a laminated glass standard established for safety and durability requirements.
  - Europe - R43 already has a laminated glass standard established for safety and durability requirements.

# Auto Glass Systems Testing

- **U.S. Government established a testing program in 1991 for advanced glazing to potentially reduce 8000 annual ejection deaths:**
  - NHTSA has issued two status reports and continues testing of advanced glazing:
    - Findings to date are:
      - Reductions of ejection deaths between 500-1300/year.
      - Multiple glass/plastic systems show enhanced performance.
      - Could aid airbag performance.
      - Limited risks for other issues - HIC or laceration.
    - Additional Status Report is due shortly.
    - Continues testing in 2001 for laceration and airbag interaction.

# NHTSA Airbag and Advanced Glazing Testing

- NHTSA and Car Company testing is beginning to show advantages of utilizing both technologies together:
  - Laminated Glass side windows provides reaction surface for airbags
  - Laminated Glass reduces the potential for airbag punctures
    - Less flying glass and smaller particle size
    - Similar to windshield performance
  - Airbags can reduce ejection issues if they stay in optimum position.
  - Both technologies seem to work well together, improving performance of both.
  - Testing methods appear to work with either technology independently or together.

# Future Auto Glass Systems

- Auto glass laminates (glass/plastic) will expand it's role into more functional applications:
  - Side Windows
    - Safety - ejection reduction, laceration reduction and reaction surfaces for airbags.
    - Solar - IR and UV reduction.
    - Sound - noise attenuation.
    - Security - theft reduction.
  - Specialties - head-up displays, defrosting, antennas, styling, etc.