In January 2011, DuPont Glass Lamination Solutions conducted a comprehensive technical testing program to characterize the impact strength and post-break performance of glass balustrades (railings) made with commonly specified types of safety glass.

TEST METHODS AND MATERIALS

2011 GLASS RAILING SYSTEM
POST-BREAK PERFORMANCE TESTING
“Swing Bag” Impact Tests Were Conducted on A Wide Range of Safety Glass Types Used in Glass Railings

Beginning in January 2011, DuPont Glass Lamination Solutions conducted a comprehensive technical testing program to characterize the breakage characteristics and post-break behavior of glass balustrades (railings) made with commonly specified types of safety glass.

An industry recognized “swing bag” test was conducted under controlled lab conditions, based on the protocol outlined in ANSI Standard Z97.1-2004. This protocol considers the impact loading created by a 100-lb (45.4 kg) shot bag, dropped from various heights. Because the intent of the test was to EXCEED the force needed to break the glass, a shot bag height of 5 ft was chosen for most of the tests, resulting in an impact in excess of 500 ft-lbs (69 kg-m).

Dozens of 42-in. x 48-in. (107-cm x 122-cm) panels were tested for deflection strength and breakage behavior in line-supported and 3-side-supported configurations. The cantilevered panels were mounted and dry-glazed in the channel of an R.B. Wagner PanelGrip™ railing system. For the swing bag portion of the test, care was taken to impact each glass panel at exactly the same location, in the middle of the panel at a consistent height above the floor.

The swing bag testing protocol involves controlled acceleration (by gravity) of a 100-lb (45.4-kg) shot bag, resulting in repeatable delivery of a chosen impact force on glass panels intended for applications such as railings, requiring barrier performance.
A Variety of “Safety Glass” Types are Used in Balustrades

Safety glass panels tested in the railing system were typical for U.S. railing applications, and included:

**Non-Laminated Glass Panels:**
- ½-in. (12.7-mm) Fully Tempered (FT) monolithic glass
- ½-in. (12.7-mm) FT monolithic glass with 0.008-in. (0.2-mm) applied PET film

**Laminated Glass Panels:**
- ¼-in. FT | 0.060-in. PVB | ¼-in. FT
  (6.35-mm. FT | 1.52-mm PVB | 6.35-mm FT)
- ¼-in. FT | 0.035-in. SentryGlas® | ¼-in. FT
  (6.35-mm. FT | 0.89-mm SentryGlas® | 6.35-mm FT)
- 3/16-in. FT | 0.060-in. SentryGlas® | 3/16-in. FT
  (4.76-mm. FT | 1.52-mm SentryGlas® | 4.76-mm FT)

Conventional and high-speed video cameras recorded the swing bag impacts, as well as the resulting post-break behavior of the panels, from multiple viewing angles.

Conclusions for Cantilevered Glass Balustrades

1. Standard impact testing simulates potential human loading
2. Tempered glass provides no residual barrier on impact breakage
3. Applied PET film does not retain glass in place on breakage
4. PVB laminates remain attached to the railing system after impact breakage ... but
5. PVB laminates display no residual barrier after glass breakage
6. Laminates made with SentryGlas® ionoplast interlayer display residual barrier after glass breakage
7. Laminates made with 35-mil (0.89-mm) SentryGlas® demonstrate considerable post-glass breakage integrity
8. Laminates made with 60-mil (1.52-mm) SentryGlas® allow reduction in glass thickness while retaining good barrier performance.

What does “safety glass” mean in a balustrade or railing system?

Tempered glass (see right) is often used in railings, but retains no barrier properties after breakage.

DuPont tested tempered glass, applied-films, and laminated glass panels to compare and record post-break performance.
DuPont has assembled “moment-of-impact” technical video footage into several educational clips that can be viewed online at safetyglass.dupont.com.