Comparative Impact Testing Summary

In response to a rise in retail crime, forced entry events and mass casualty incidents on campuses, several retrofit solutions for glazing have been created and improved – some dating back decades and some newer technologies. To evaluate performance across technology types, standardized testing methods such as the following are often utilized:

- ASTM F3561 – Simulated Active Shooter Attack and Forced Entry Resistance
- UL 972 – Burglary Resisting Glazing Material
- ASTM F1233 – Standard Test Method for Security Glazing Materials and Systems

OBJECTIVE

The purpose of this testing summary is to evaluate resistance to forced entry without compromising ballistic glass integrity under increasing entry force. The main strengths and weaknesses of each standard test method are outlined below:

STANDARD	STRENGTH	WEAKNESS
ASTM F3561	Impact portion proceeds from low impact through high impact.	Full standard requires glass weaking, often accomplished through ballistic penetration.
UL 972	Standardized levels of force to achieve performance benchmarks.	Very few impacts tested and only two levels of performance.
ASTM F1233	Increasing levels of forced entry types and tools.	Variability in 'human-based' non-standardized levels of force.

To eliminate 'human-based' variations and ensure a standardized evaluation, the impact portion of ASTM F3561 was performed on test samples. Since the level of force increases with subsequent impacts, each sample is recorded with a 'cumulative' total force (in foot-pounds, ft-lbs.) Therefore, samples with relatively low impact resistance can be compared alongside samples with higher impact resistance in increasing entry force.

PROCEDURE

Samples of the same polyethylene terephthalate (PET) base film of varying thicknesses were applied to 6mm (1/4") clear tempered glass and tested using the ASTM F3561 impactor to generate prescribed impact forces of 50, 100, 150, 200, 250, 300, 350, and 400 ft-lbs.

The cumulative ft-lbs force in Figure 1 is a result of the sum of the force from each impact *prior to failure* and each PET base film thickness was compared to the most common security film on the market, 8mil clear PET. Therefore, both the thickness and the resulting cumulative ft-lbs force for 8mil clear PET are 100%. For example, a 21mil film would be 21/8=263% thicker than the 8mil baseline where it's performance in cumulative ft-lbs, tested at 2,800, was 350% of baseline. This approach allows all films to be compared relative to the same baseline.

RESULTS

Results of the Comparative Impact Testing Summary are shown in Figure 1, from which at least two (2) conclusions can be drawn:

1. Increasing film thickness to a point (in this case around 14-15 mil thickness) actually has a sublinear improvement. That is, the increasing thickness doesn't provide the expected improvement.

2. Increasing thickness beyond that point provides a superlinear improvement. That is, increasing thickness provides results beyond the expected linear improvement.

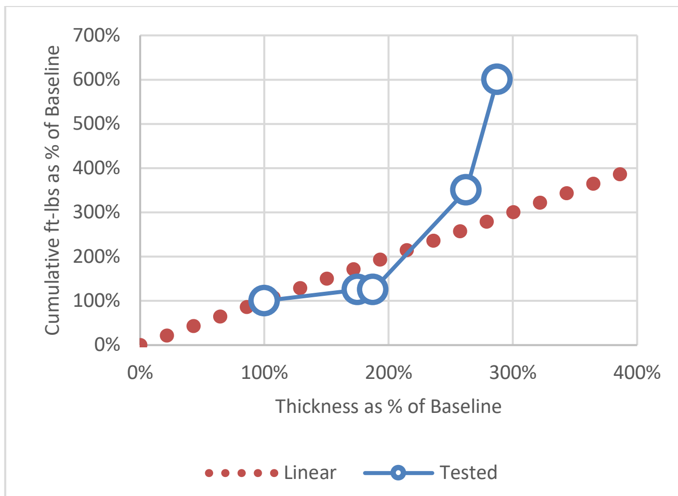

Figure 1 - Tested Cumulative ft-lbs.

CONCLUSIONS

When utilizing the ASTM F3561 impact portion to generate increasing levels of entry force in a standardized manner and adding the impact forces in a cumulative manner, there is a superlinear improvement in some of the industries thickest PET-based security films.

With the thickest PET-based window film on the market, Invisicade Crisis Shield 650 demonstrates the highest available performance, offering unmatched resistance to forced entry under increasing force conditions.

INVISICADE

12810A Century Drive
Stafford, TX 77477 866-847-2371
www.invisicade.com