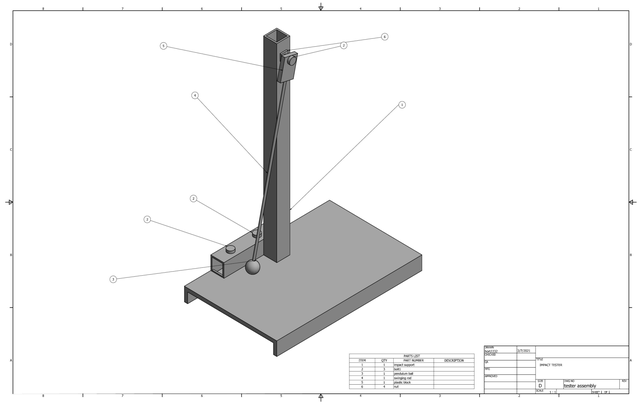
Testing Cell Phone Screen Protectors

Jubilee Horton, Scott Newbolds

PROJECT OVERVIEW

For this project, three different kinds of cell phone screen protectors underwent various tests. Two kinds were best-sellers on Amazon (Ailun and Trianium), and one was a budget brand which wasn't highly rated (Dollar Tree). Each type was also of different thickness, so that aspect was a factor. Tests were performed on each of them including a Mohs hardness test, an impact test, and a drop test. All protectors failed at the same hardness level, so it can be concluded that they are all similar hardness. Next, they underwent drop tests, and it was found that the thinnest screen protector, a highly rated one, was the hardest to break. Finally, they underwent impact tests, and it was found that the thickest screen protector, a highly rated one, required the most kinetic energy to fail. The thickest screen protector was highly rated and while it performed the best in the impact test, it behaved very similarly to the other well-rated screen protector which performed best in the drop test, and the low-rated screen protector performed the poorest.



TEST METHODS

The screen protectors underwent a hardness test using a Mohs hardness test kit which uses picks of increasing hardness and are applied to the screens until failure. They also underwent impact tests using the impact tester which was built for the project (Fig. 1 and Fig. 2) and the pendulum was released from rest at increasing heights until the screens failed and the potential energy for failure was calculated. The screen protectors then underwent drop tests, released from rest, from increasing heights until they failed. For each test, the screen protectors were applied to a piece of wood and sheet metal simulating a phone. Table 1 shows the different brands of screen protectors and their thicknesses, measured with a caliper.

Table 1

Brand	Thickness (mm)
Ailun	0.53
Trianium	0.51
Dollar Tree	0.45

Fig. 1 & Fig. 2: Impact Tester

RESULTS

All screen protectors performed similarly in the hardness test, reaching an 8 on the Mohs hardness scale. The thickest screen protector (Ailun) was the most difficult screen protector to break in the impact test and the second hardest to break in the drop test. The other highly rated brand (Trianium) performed the best in the drop test and the second best in the impact test. The easiest screen protector to break was the thinnest, poorly rated budget brand. Table 2 shows the average height the screen protectors broke at in the drop tests, the average energy it broke at in the impact tests, and the results from the hardness test.

Table 2

	Avg. Height for Failure (m)	Avg. Energy for Failure (Joules)	Hardness on Mohs Hardness Scale
Ailun	1.72	0.886	8
Trianium	2.61	0.846	8
Dollar Tree	1.64	0.647	8

CONCLUSIONS AND CONTINUOUS IMPROVEMENT

Since screen protectors are widely used for protection and are commonly broken by being dropped, the factors of safety for each brand were found comparing how high they are held by the average person (1.07 m) to how high they fail at. Results are shown in Table 3.

Table 3

Brand	Avg. Factor of Safety
Ailun	1.61
Triainium	2.45
Dollar Tree	1.53

Some parts of this project were not identical to actual situations. For example, the prototype cell phone that the screen protectors were stuck to was lighter than an actual cell phone by about 16% so if a real cell phone were used, results would likely be lower. Results could differ if this were to be repeated since failure was determined qualitatively and was somewhat arbitrary. For example, some screens had a single crack (Fig. 3), while some were significantly cracked (Fig. 4) but failure was assumed to be any crack on the surface.

Fig. 3: Screen After Drop Test

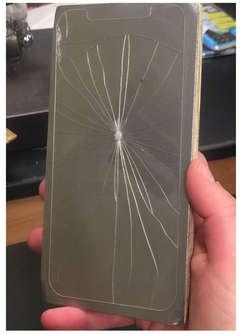


Fig. 4: Screen After Impact Test