RESEARCH & INNOVATION

BLIND STRENGTH: Wind Testing

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Testing Preamble

When wind hits a blind, it creates forces on the blind like those from a heavy weight.

To test the strength of a Ziptrak® Outdoor Blind against wind, we performed both physical and theoretical tests to the Ziptrak® Outdoor Blind system and to our Ziptrak® Side Spline.

This report details the testing methods, results, and fixing recommendations for Ziptrak® Outdoor Blinds.

Testing the Complete Blind System

To test the strength of Ziptrak® Outdoor Blinds in windy conditions, we used a 2.5 metre x 2.5 metre blind. We tested it both theoretically and physically in the Ziptrak® Engineering Lab, using the recommended Ziptrak® fixings for windy areas.

To test the force on a blind from strong winds, we applied a static load of 755kg, equating to a wind speed of more than 160 km/hr.

Using Ziptrak® fixings for windy areas, our tests showed that a Ziptrak® Outdoor Blind can handle wind speeds over 160 km/hr and still properly function afterwards.

Testing the Ziptrak® Side Spline

To test the force required to pull the spline out of the tracks, we tested using a horizontal pull-test. We achieved the result equivalent to 1,200kg for one side of a 2.5-metre-high blind.

This is more than four times the force exerted on the tracks during wind speeds of 160 km/hr for a 2.5m high x 2.5m wide blind, and twice as much for a 2.5m high x 5.5m wide blind.

The tests showed that the standard Ziptrak® Side Spline, when installed correctly, stays in the track even under extreme side forces.

Note:

In real world situations, wind acts like a shock force against the blind skin and blind structure, buffeting, fluctuating in intensity and force exerted onto the blind.

Laboratory or Wind Tunnel testing, while providing insight into general blind strength and wind resistance, cannot provide an exact representation as to exactly how a blind will perform in a storm or severe weather, nor the effects that constant wind and buffeting will have on the blind system and moreover the structure the blind is installed into.

Installation Structure

Outdoor blinds can be installed into a variety of structures, each with differing resistance to high winds and severe weather. Wooden structures in particular may expand and contract seasonally, and subsurface soil movement can alter the size of openings and place additional stress on the fixings used to attach the Ziptrak® Blind system to the structure.

Ziptrak® Fixings

The fixings used during installation are essential for ensuring the overall strength and durability of the blind system. Ziptrak® installation procedures recommend specific fixings for attaching the system to the base structure and for securing the Ziptrak® Track and Channel to each other, based on the size of the blind and the anticipated wind levels for the installation location.

Engineered to Work Perfectly Together.

Ziptrak® Blind Components and Their Effect on Overall Blind System Performance

The Ziptrak® Outdoor Track Guided Blind system uses a controlled system of Ziptrak®-approved parts. Our components, along with our Ziptrak®-recommended installation procedures, ensure top performance and unmatched durability.

Using only Ziptrak®-engineered parts in every Ziptrak® Outdoor Blind ensure the blind performs as designed and continues to do so for many years. Longevity and performance are critical to Ziptrak®.

The Effect of Blind Size and Fabric on Wind Resistance Results.

The size of the blind, and the fabric used, affect wind performance. Small blinds handle high winds better than large blinds.

The material of the blind skin, and the airflow across it, also affect wind resistance. PVC and blockout-style fabrics offer the highest barrier to wind, as these materials act like a solid surface, preventing air from passing through. In contrast, open mesh styles, such as 95% mesh, allow some wind to pass through the fabric, reducing the pressure exerted on the blind material and increasing their potential wind resistance.

The Tests

Multiple theoretical and physical tests were conducted to determine the results presented in this document.

Scientific Theoretical Calculations

Different blind sizes were studied using theoretical calculations based on Bernoulli's Principle and advanced Ziptrak® software simulations. The objective was to understand the behaviour of blinds under varying wind speeds. The study identified that the majority of the force is transmitted to the side tracks, rather than the top tube and bottom bar, and is concentrated in the centre portion of the side tracks.

The maximum force transferred to the tracks was recorded for each blind size and compared to the force required to pull the spline out of the track.

Theoretical Test Findings

It was found that for an average-sized Ziptrak® blind (2.5 meters high by 2.5 meters wide), the force required to pull the spline out of the track is more than three times the force experienced at wind speeds of 160 km/hr.

Due to the additional surface area size, larger blinds are more affected by wind than smaller blinds.

Simulations and calculations helped us understand the stress that different wind speeds exert on our components. For example, a 2.5 metre high by 5.5 metre wide blind subjected to 110 km/hr wind speeds experiences similar forces to that of a 2.5 metre high by 2.5 metre wide blind subjected to 160 km/hr wind speeds. In both cases, the wind generates a force equivalent to a static load of 755 kg.

Physical Testing and Improvement Cycle

The University of Adelaide tested our Ziptrak® Outdoor Blind System in 2018, and while the results were impressive, we used the findings to enhance the design and wind performance of our current system. A new track and spline were introduced in 2019, and a new bottom bar and guide were released in late 2023, which further enhanced our wind test results. Additionally, we updated our fixing instructions for blinds over 4 metres wide or in windy areas were released in 2024.

The system was re-tested after each development using the testing technique established by the University of Adelaide to verify that the design intent was achieved.

In our latest round of testing, a 2.5 metre x 2.5 metre blind was installed using all new componentry and Ziptrak® Fixing Recommendations for Windy Areas. The blind was subjected to an impressive load of 876 kg, equivalent to the force generated by a 172 km/hr wind speed, and the Ziptrak® system successfully withstood this load without failure. After unloading, the system was inspected, and while the blind remained operational, some minor permanent damage was evident in the skin (stretching) and in the tracks and channels (stress was observed at the fixing points).

The static load test gave high-tension force to the skin which transferred to a pulling-in (or inward bending) of the track and channel, where minor deformation to the channel fixings occurred. The Bottom Bar also showed inward bending, however after testing it sprung back to its original shape.

In a separate study, the strength of the Ziptrak® Side Spline and Track were tested for their ability to resist tensile loading[1], specifically in the scenario where spline is pulled from the track.

The physical test performed for this study was with a 500mm section of Small (65mm) Ziptrak® Side Spline within a standard Ziptrak® Track. The results showed that the Ziptrak® Side Spline and Track can withstand more than 480 kg/metre of static force in the horizontal direction. This result was compared with the software-simulated outcomes described in the previous section.

Note: These results are extrapolated into kms/hr for the various blind sizes within Tables 1 & 2 on Page 6.

Wind Load Force Representation

Figure 1 demonstrates the load force the blind undergoes during a 755kg static load test. A 755kg static load is equivalent to the pressure from wind speeds of 160 km/hr. Note the red sections where the greatest load occurs.

The results achieved were consistent with both theoretical and physical tests.

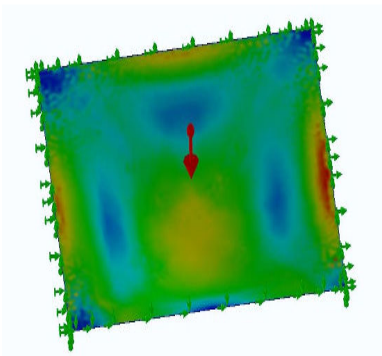

Figure 1. Simulation results for a 2.5m by 2.5m blind under a 755kg load.

Results Summary

- Ziptrak® Spline requires a force greater than 480 kg/metre to be pulled out of the tracks.
- Using the Ziptrak® Fixing Recommendations for Windy Areas or blinds more than 4 metres wide, resulted in an approximate 30% increase in wind resistance performance, when compared to the Ziptrak® Fixing Recommendations for blinds under 4 metres wide and in non-windy areas.

[1] Tensile loading is the application of force to a material that causes it to stretch or elongate.

Ziptrak® Research & Innovation

Blind Strength – Wind Testing

Standard Fixing Procedure

Width

Height

Metres	1	1.5	2	2.5	3	3.5	3.9
1							
1.5							
2							
2.5							
3							
3.5							

More than 80 km/hr

More than 70 km/hr

More than 65 km/hr

Table 1 – Using the Ziptrak® fixing recommendations **for blinds less than four metres wide and <u>not</u> in windy areas.**

Windy Areas Fixing Procedure

Width

Height

Metres	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
1											
1.5											
2											
2.5											
3											
3.5											

More than 160 km/hr

More than 140 km/hr

More than 130 km/hr

More than 110 km/hr

Less than 90 km/hr

Table 2 – Using the Ziptrak® fixing recommendations for **blinds more than four metres wide or in windy areas.**

Conclusions

The Ziptrak® Outdoor Track Guided Blind System effectively transfers wind loading to the side channels and tracks.

Tests confirmed that the standard Ziptrak® Side Spline, when installed correctly and subjected to the loads used in these tests, will not pull out of the Ziptrak® Track due to side forces acting upon it.

Maximum wind resistance performance can be achieved with minor adjustments to the fixing instructions for the Ziptrak® side channels.

It is important to use common sense, as each installation is unique and local wind conditions must be considered.

Ziptrak® Blinds are designed to work as a complete system, engineered to withstand significant wind force and ensure long-lasting performance.

Whilst outdoor blind systems are not solid walls, consumers can trust that Ziptrak® Outdoor Blinds are capable of withstanding significant winds.