PRIMEALUX

DURABLE AFFORDABLE GREEN

PRIMEALUX

EQUIVALENT WIND LOAD TEST

APRIL 16, 2024

CONTENT INDEX

PRIMEALUX

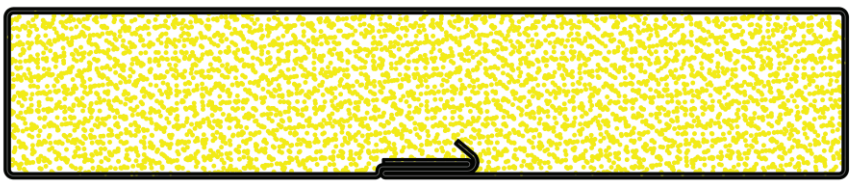
INOVATIVE ALUMINUM SYSTEMS

PRIMEALUX is a premium architectural systems manufacturer that combines elegant design, high quality, and value.

PRIMEALUX Products are made from Innovative Aluminum Slats made of coated Aluminum coils with PU foam core providing superior flatness and strength while maintaining lightweight, in addition to extruded parts for structural elements.

A. Aluminum FENCE:

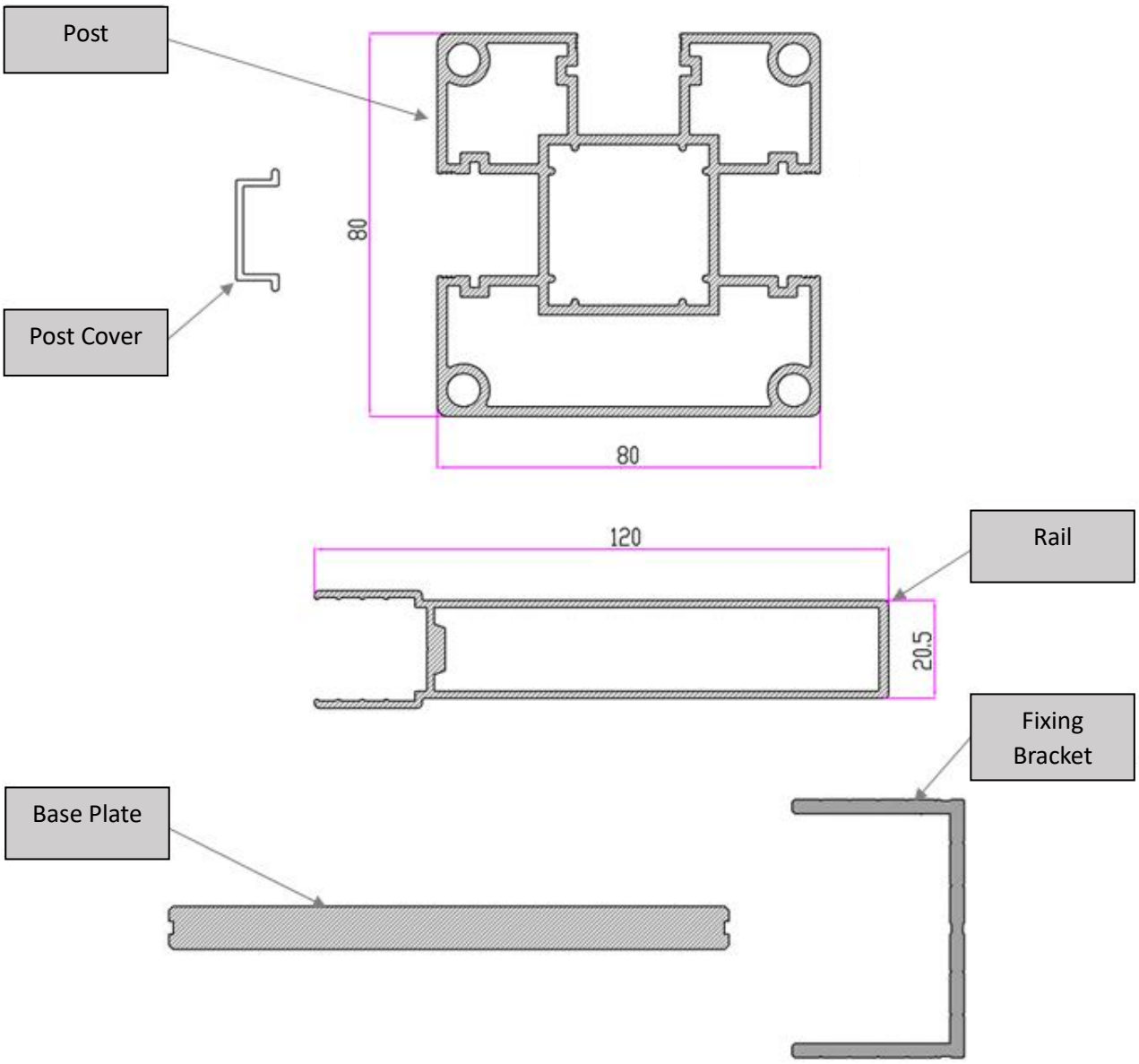
ALUMINUM FENCE panels consist of Aluminum light slats and structure of Extruded Aluminum Profiles.



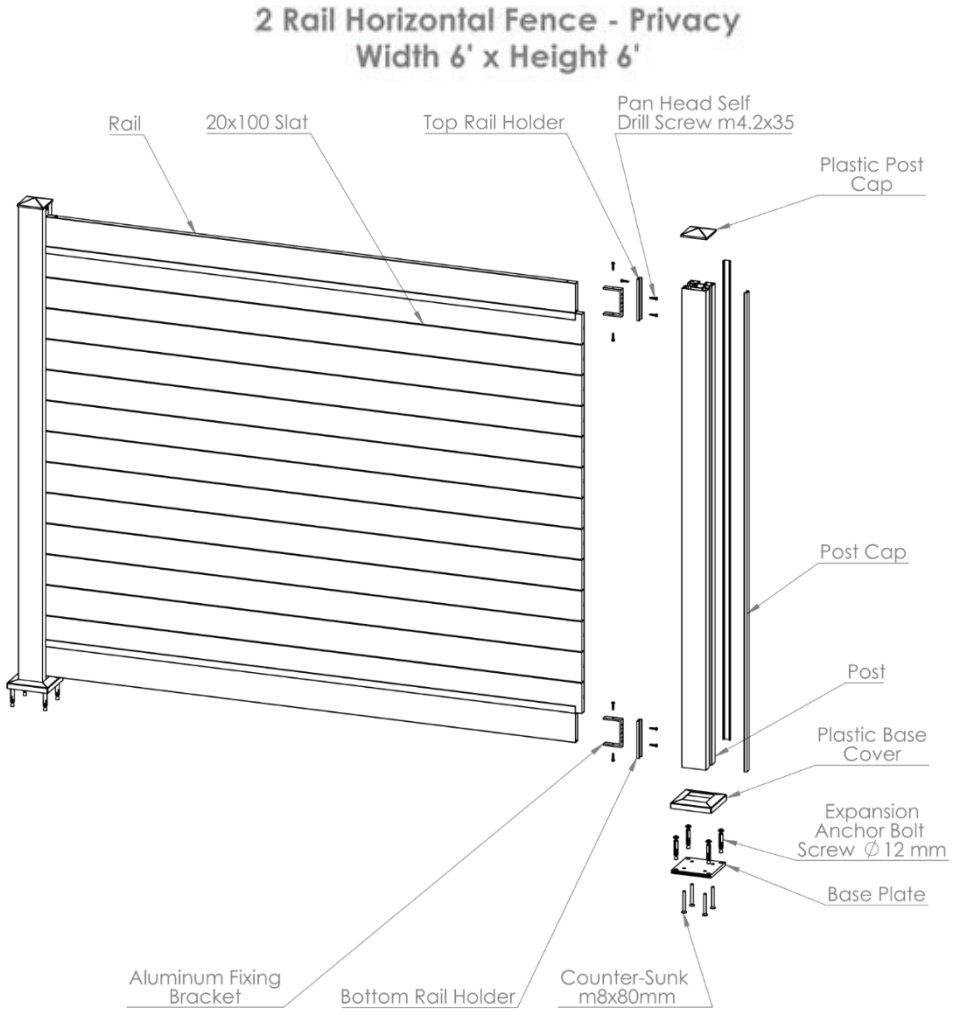
Aluminum light slat 20 x 100 (mm)

B. Extruded Aluminum Profiles (TDS):

Aluminum Fence, Structure's items (Aluminum Extrusion Profile 6063-T6).



C. ALUMINUM FENCE (6'x6') PRIVACY SYSTEM:



D. Equivalent Wind Load Test:

1. Abstract:

The Equivalent wind load test aim to realize maximum allowed wind velocity been acted on the Aluminum fence panel (6' x 6'), to find maximum allowed wind velocity.

2. Scope:

The equivalent wind load experiment specifies how the aluminum fence can resist the normal distributed normal load applied on the fence panel to know fence's posts and slats behaviors and reactions, then help to choose suitable fences' dimensions and systems according to the maximum allowed wind velocity.

- Aluminum fence panel has dimensions *(6' x 6')* and privacy fence system.
- Selected post section is *80 x 80 (mm)* with length *1890 (mm).*

3. Methodology:

a. Theoretically:

Applying normal distributed force on fence's panel *(6' x 6'),* find the maximum force that reach the fence to breakdown limit, then find the equivalent wind velocity resulted of applied load, depending on the forma:

$fn_{(n)} = 0.5\ \rho_{air(Kg/m^3)}\ A_{(m^2)}\ v^2_{(m/s)}$.

$\Rightarrow v_{(m/s)} = \sqrt{((fn) / (0.5\ \rho\ A))}$.

$\Rightarrow v_{(Km/hrs)} = 3.6 * \sqrt{((fn) / (0.5\ \rho_{air}\ A))}$.

↳ The maximum equivalent wind velocity.

b. Practically:

In temperature 20^{O}c, Aluminum fence lies horizontally on two holders on the posts and rise over the ground level about 1000 (mm) to allow free slats' deflection, whereas the spaces under the panel is empty, the loads were divided into 3 types of sand bags (4.0, 2.0 and 1.0

Kg), in normal distribution, and applied over three consecutive stages, and increased until panel breakdown.

loads been applied incrementally, the force has vertical direction, and the effective force just a weight force of the bags, loads applied on stages, the bags of 4.0 (Kg) weights added and distributed on the panel face, and the deflection recorded, steps repeated until the distributed weight force reach 350 (Kgf), then the bags 2.0 (Kg) weights added and distributed on the panel face, deflection recorded until the distributed weight force reach 450 (Kgf), then the bags 1.0 (Kg) added and distributed on the panel face, deflection been recorded until the distributed weight force reach 500 (Kgf).

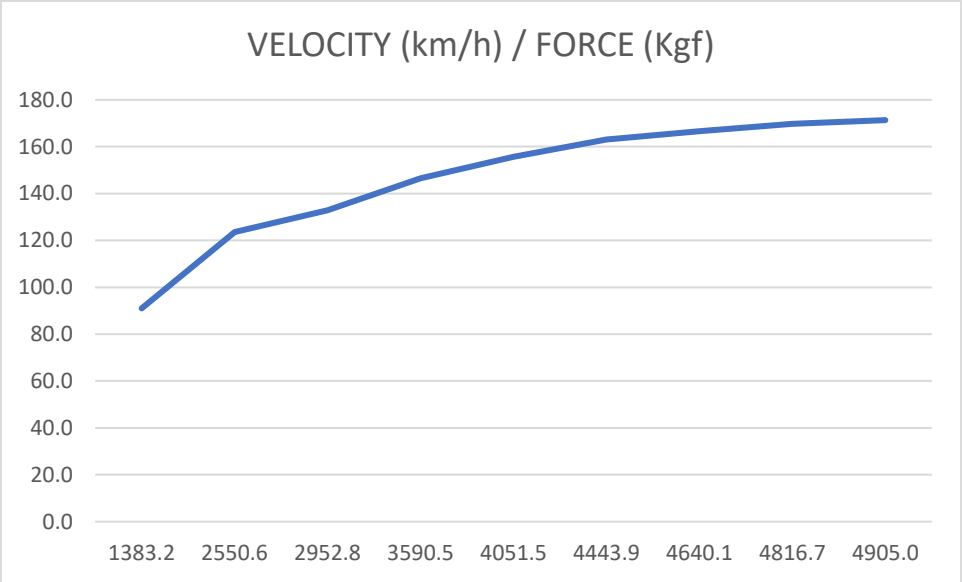
Each stage of applying the loads took waiting time about 15 (min) to ensure the approximated the closest force which the fence can withstand before collapsing, in addition the final record before the breakdown been ignored to ensure greater accuracy and safety.

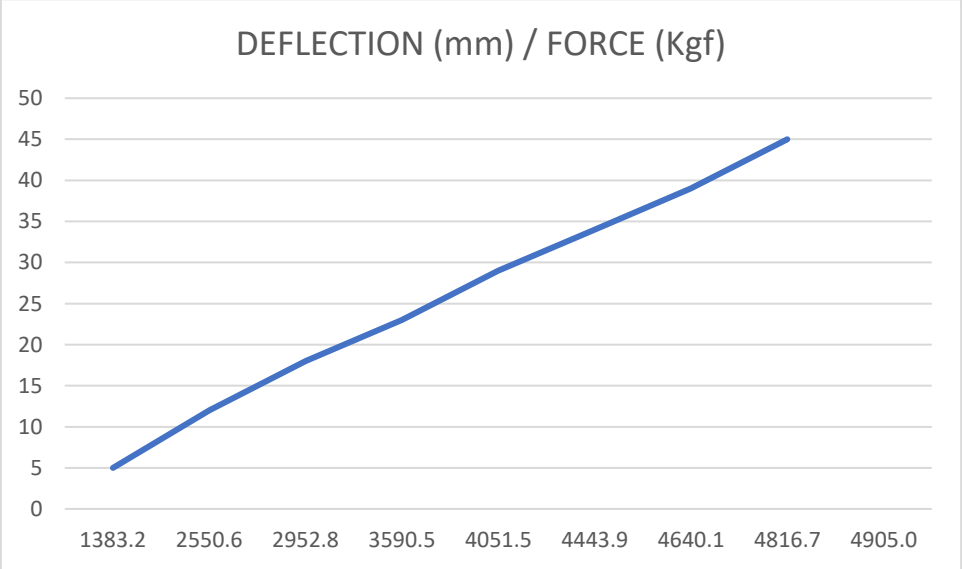
4. Calculatins and results:

The 6' x 6' Privacy Fence Panel has undergone wind load laboratory testing and demonstrated its strength by withstanding a force of 491 kilograms-force (Kgf).

This performance equates to a wind resistance of up to 169.8 (Km/h) indicating the panel's robustness and durability in severe weather conditions, aligning with our commitment to quality and safety.

Experiment #	Accumulative Applied Force (Kgf)	Equivalent Wind Velocity (Km/h)	Deflections (mm)
1	141	91.0	5
2	260	123.6	12
3	301	132.9	18
4	366	146.6	23
5	413	155.7	29
6	453	163.1	34
7	473	166.7	39
8	491	169.8	45
9	500	171.4	-





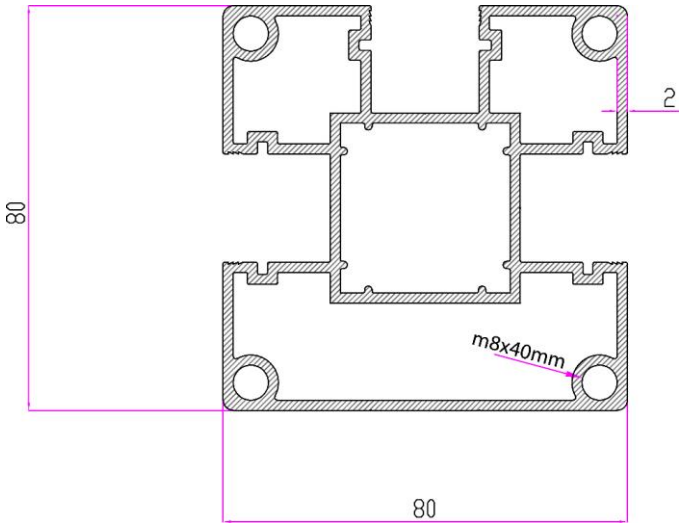
5. Aluminum post test:

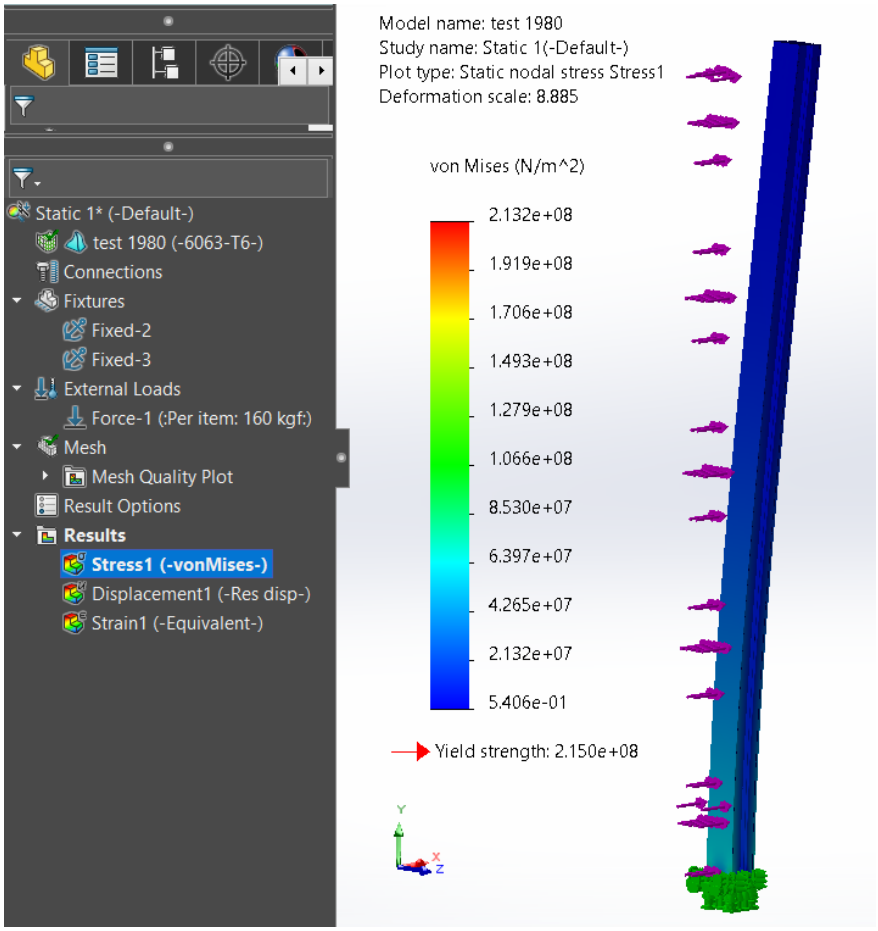
The fence's panel realize wind velocity 169 (Km/hr) with normal distributed load 491 (Kgf), to be sure the fence can resist the load, the fence's posts have to pass the maximum wind load applied on panel, so the one post has to pass load at least 500 (Kgf), because of the next fence panel acted to the same wind force, and so on.

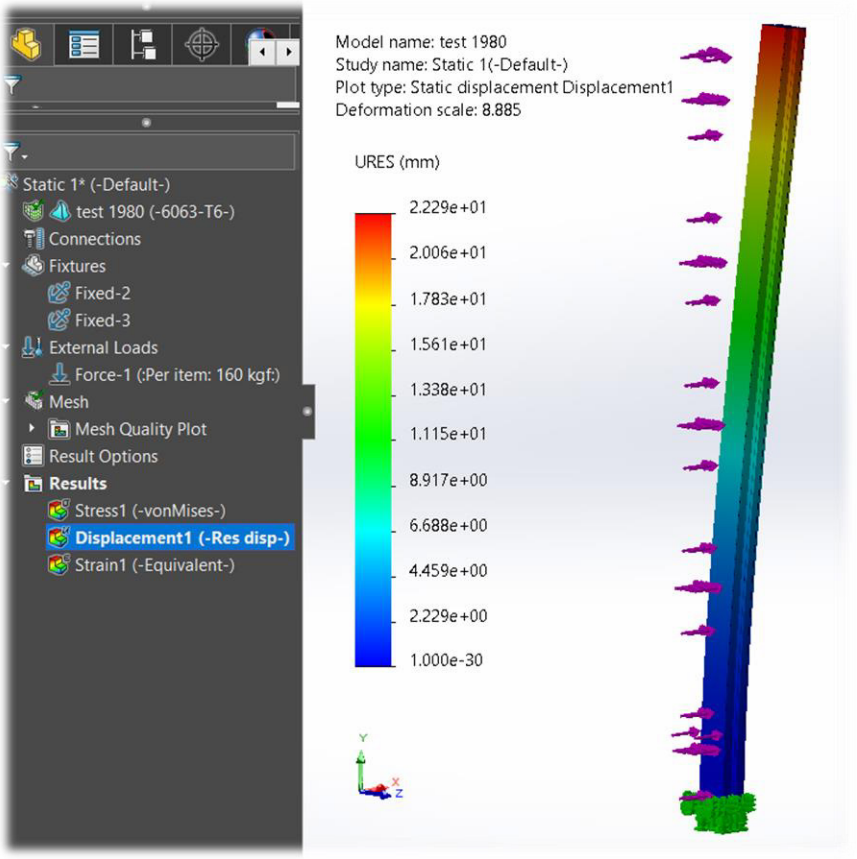
Therefore, the one of fence items (panel or post) that have the less force to reach breakdown will determine the maximum force load for the overall system or the maximum wind velocity that the system can resist it.

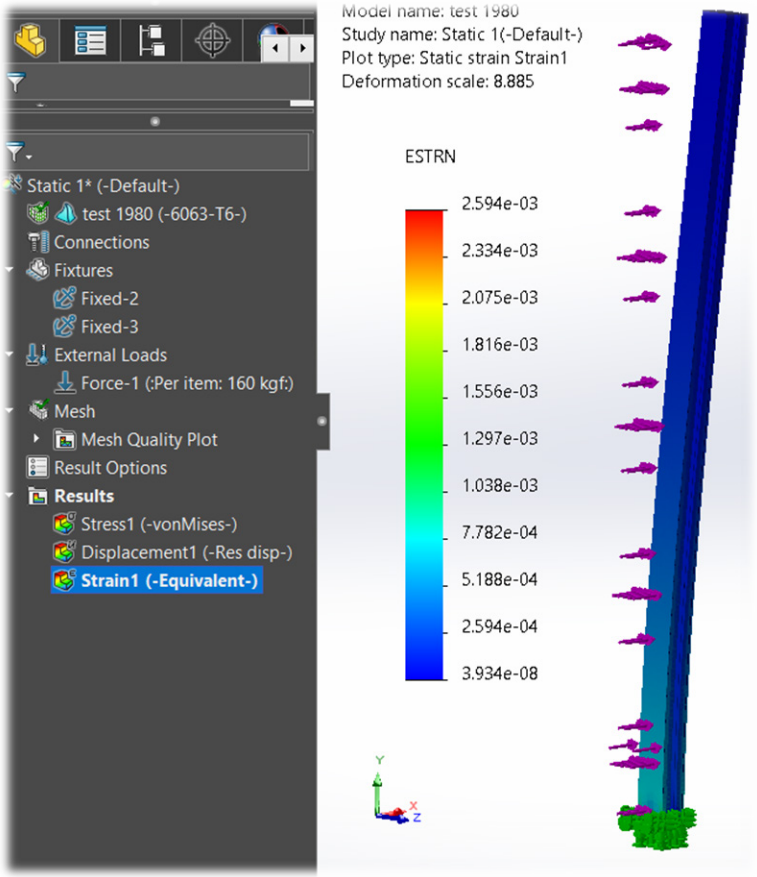
There are two methods to check the maximum allowed load on the aluminum post:

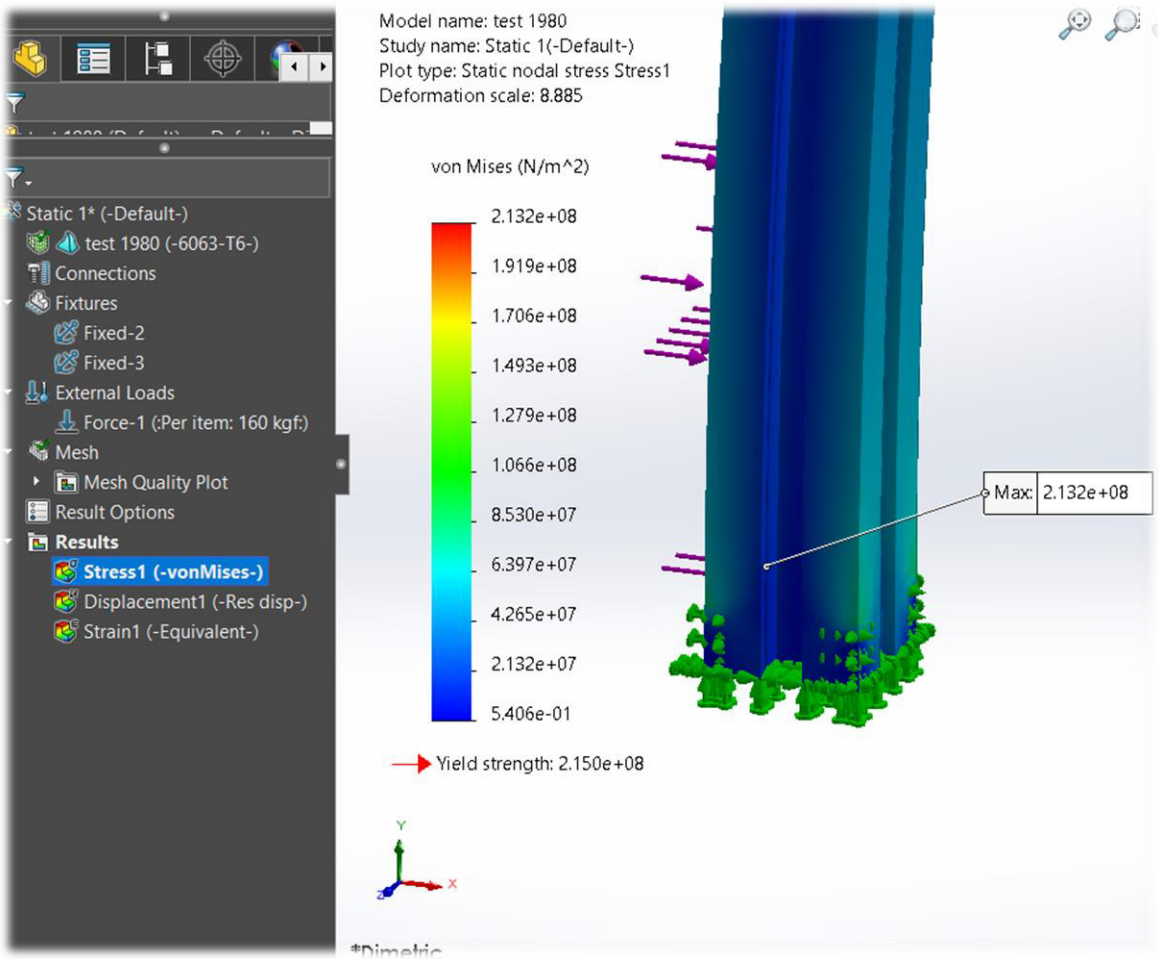
a. <u>On-Ground Post Non-destructive testing (NDT) using simulation software (SolidWorks):</u>
The aluminum post section is 80x80 (mm), thick 2 (mm) and length 1890 (mm), while the four counter sunk screws are m8 (mm) x 40 (mm) x 4 (Screws) and the screws entrance in the post is 30 (mm) because of base plate thick is 10 (mm), in addition the post fixed on the ground.






Static 1* (-Default-)
test 1980 (-6063-T6-)
Connections
Fixtures
Fixed-2
Fixed-3
External Loads
Force-1 (:Per item: 160 kgf:)
Mesh
Mesh Quality Plot
Result Options
Results
Stress1 (-vonMises-)
Displacement1 (-Res disp-)
Strain1 (-Equivalent-)
Model name: test 1980
Study name: Static 1(-Default-)
Plot type: Static displacement Displacement1
Deformation scale: 8.885
URES (mm)
2.229e+01
2.006e+01
1.783e+01
1.561e+01
1.338e+01
1.115e+01
8.917e+00
6.688e+00
4.459e+00
2.229e+00
1.000e-30


Static 1* (-Default-)
test 1980 (-6063-T6-)
Connections
Fixtures
Fixed-2
Fixed-3
External Loads
Force-1 (:Per item: 160 kgf:)
Mesh
Mesh Quality Plot
Result Options
Results
Stress1 (-vonMises-)
Displacement1 (-Res disp-)
Strain1 (-Equivalent-)
Study name: Static 1(-Default-)
Plot type: Static strain Strain1
Deformation scale: 8.885
ESTRN
2.594e-03
2.334e-03
2.075e-03
1.816e-03
1.556e-03
1.297e-03
1.038e-03
7.782e-04
5.188e-04
2.594e-04
3.934e-08



According the results of the test above the overall system can resist the wind velocity as the following calculation:

$$v\,(Km/hrs) = 3.6 * \sqrt{((fn) / (0.5\ \rho_{air}\ A))}.$$

$$\downarrow v\,(Km/hrs) = 150\ (Km/hr)$$

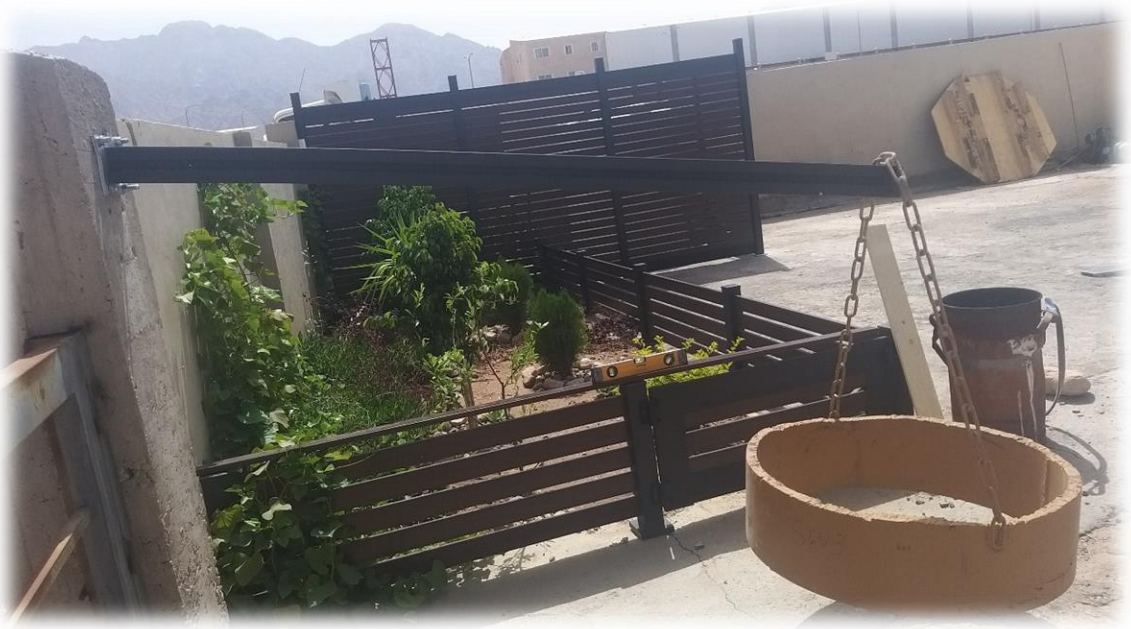
b. <u>On-Ground Post Destructive testing (DT):</u>

The post fixed horizontally and perpendicularly to the wall, and act normal distributed force, the post has to resist force 500 (Kgf), by applying the load force the results were as following:

Apply load at the end of the post, and maximum load at the end point 1.89 (m) was 157 (Kgf), or 314 (Kgf) focus load at the middle point of the post, or equivalent normal distributed equal to: 166 (Kgf/m)

$v_{(Km/hrs)} = 3.6 * \sqrt{((fn) / (0.5\ \rho_{air}\ A))}.$

$\downarrow v_{(Km/hrs)} = 153\ (Km/hr)$

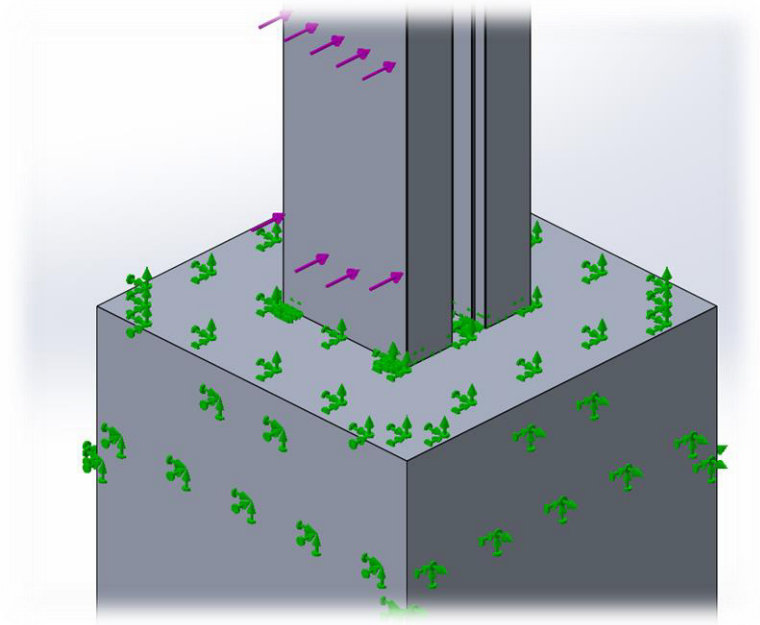


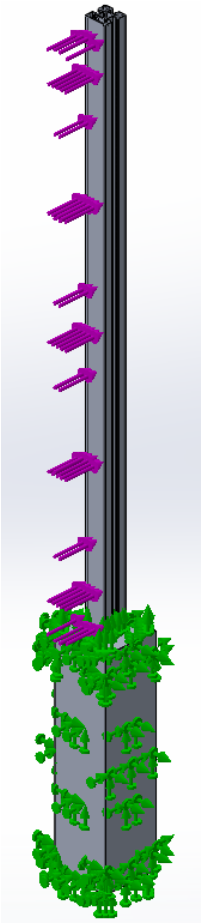
c. <u>Under-Ground Post Non-destructive testing (NDT) using simulation software (SolidWorks):</u>

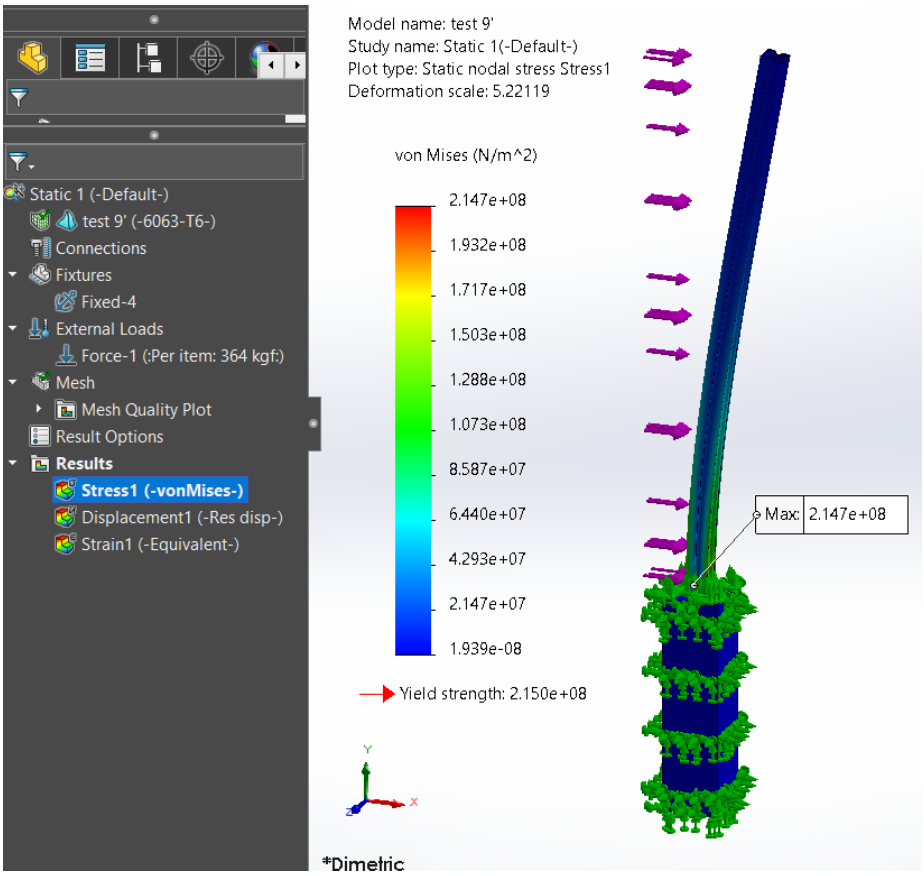
In this test, Aluminum Post plant in concrete base by 3 (ft), the maximum normal distributed force was 364 (Kgf), so the equivalent wind velocity will be:

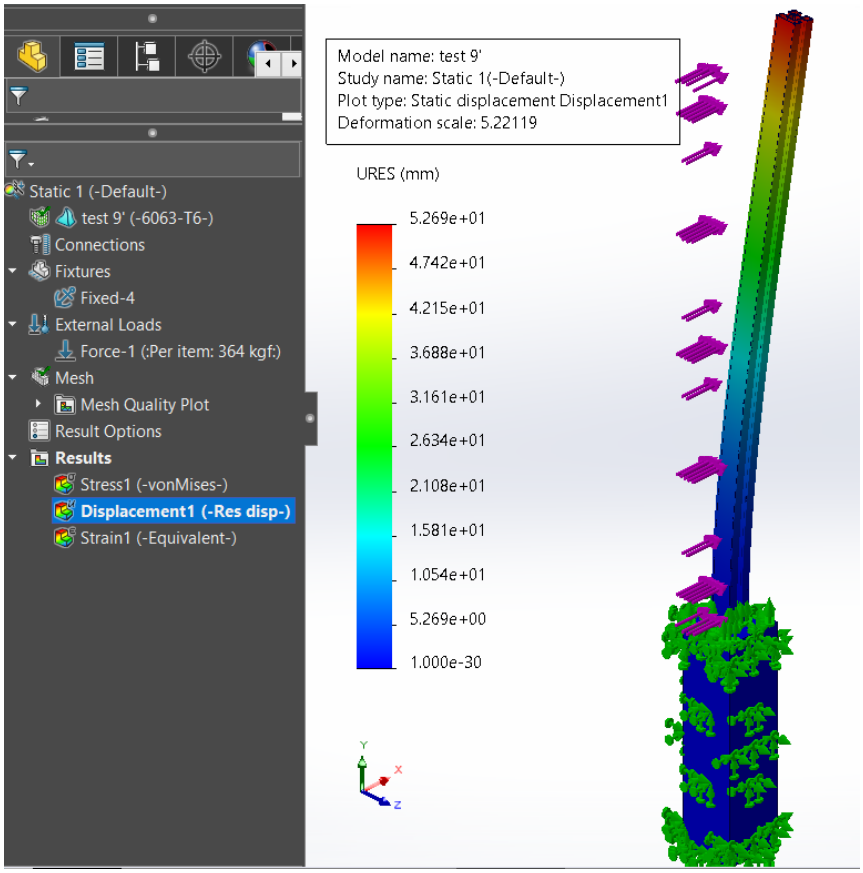
$$v\,(Km/hrs) = 3.6 * \sqrt{((fn) / (0.5\ \rho_{air}\ A))}.$$

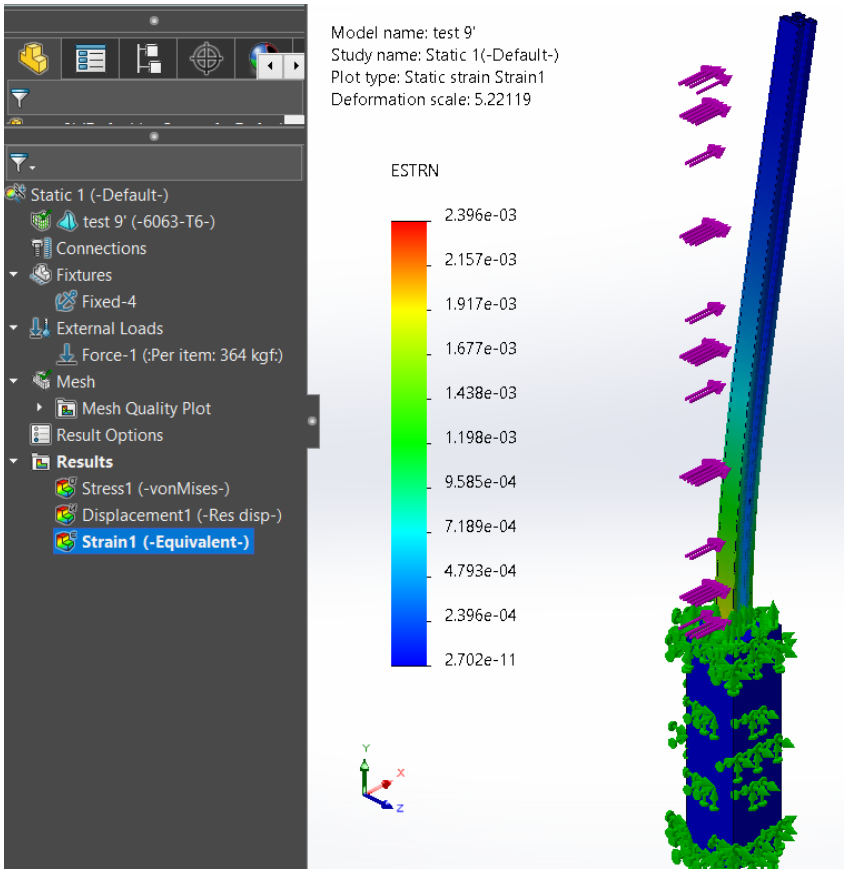
$$\downarrow v\,(Km/hrs) = 227\ (Km/hr)$$






Static 1 (-Default-)
test 9' (-6063-T6-)
Connections
Fixtures
Fixed-4
External Loads
Force-1 (:Per item: 364 kgf:)
Mesh
Mesh Quality Plot
Result Options
Results
Stress1 (-vonMises-)
Displacement1 (-Res disp-)
Strain1 (-Equivalent-)
Model name: test 9'
Study name: Static 1(-Default-)
Plot type: Static nodal stress Stress1
Deformation scale: 5.22119
von Mises (N/m^2)
2.147e+08
1.932e+08
1.717e+08
1.503e+08
1.288e+08
1.073e+08
8.587e+07
6.440e+07
4.293e+07
2.147e+07
1.939e-08
Yield strength: 2.150e+08
Max: 2.147e+08
*Dimetric


Static 1 (-Default-)
test 9' (-6063-T6-)
Connections
Fixtures
Fixed-4
External Loads
Force-1 (:Per item: 364 kgf:)
Mesh
Mesh Quality Plot
Result Options
Results
Stress1 (-vonMises-)
Displacement1 (-Res disp-)
Strain1 (-Equivalent-)
Model name: test 9'
Study name: Static 1(-Default-)
Plot type: Static displacement Displacement1
Deformation scale: 5.22119
URES (mm)
5.269e+01
4.742e+01
4.215e+01
3.688e+01
3.161e+01
2.634e+01
2.108e+01
1.581e+01
1.054e+01
5.269e+00
1.000e-30


Static 1 (-Default-)
test 9' (-6063-T6-)
Connections
Fixtures
Fixed-4
External Loads
Force-1 (:Per item: 364 kgf:)
Mesh
Mesh Quality Plot
Result Options
Results
Stress1 (-vonMises-)
Displacement1 (-Res disp-)
Strain1 (-Equivalent-)
Model name: test 9'
Study name: Static 1(-Default-)
Plot type: Static strain Strain1
Deformation scale: 5.22119
ESTRN
2.396e-03
2.157e-03
1.917e-03
1.677e-03
1.438e-03
1.198e-03
9.585e-04
7.189e-04
4.793e-04
2.396e-04
2.702e-11

d. Under-Ground Post Destructive test (DT):

The 9 (ft) post fixed horizontally and perpendicularly to the wall, and lies in sandwich plates on vertical post which realize the equivalent concrete base reaction, the post supported from one side and free the side with a length 1.89 (m), the results were as following:

By applying load at the end of the post, and maximum load at the end point 1.89 (m) was 340 (Kgf), or 680 (Kgf) focus load at the middle point of the post, or equivalent normal distributed equal to: 359 (Kgf/m).

$$v\,(Km/hrs) = 3.6 * \sqrt{((fn) / (0.5\ \rho_{air}\ A))}.$$

$$\downarrow v\,(Km/hrs) = 226\ (Km/hr).$$

6. Conclusion:

in the system that the post On-ground:
The panel of the aluminum fence privacy system can resist load resulted of wind velocity 169.8 (Km/hr), and the post for the same system can resist load resulted of wind velocity 149 (Km/hr).

Whereas, in the system that the post Under-ground:
The panel of the aluminum fence privacy system can resist load resulted of wind velocity 169.8 (Km/hr), and the post for the same system can resist load resulted of wind velocity 218 (Km/hr).

#	Simulation study	Case Study	Test Methodology	Available equivalent Wind Velocity (Km/hr)
1	Aluminum fence panel	6’ x 6’ Privacy system	Destructive test (DT)	169
2	Aluminum post 1890 mm	On-Ground	Non-destructive testing (NDT)	150
3			Destructive test (DT)	153
4	9’ Aluminum post 860 mm (Fixing Terminal) 1890 mm Free	Under-Ground	Non-destructive testing (NDT)	227
5			Destructive test (DT)	226