



Structural analysis of fasteners used for an outdoor switchboard at Port of Gladstone

Dara Switchboards

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Introduction

A structural analysis was carried out to investigate the factor of safety of bolts that used to fix the switchboard to the plinth under maximum wind loads generated in Port of Gladstone.

Material properties

Material properties of bolts were extracted from the manufactures as shown in Table 1. Table 1: Material properties

Material	UTS (MPa)
HSS	700

Finite element analysis

Results from the CFD analysis showed that the wind pressure on the switchboard can reach up to 4000 Pa in an event of 237.6 km/h (66 m/s) maximum wind gust speed. Therefore, 4000 Pa pressure was applied on the switchboard to investigate the bolt strength while assuming that the plinth to concrete was fully fixed.

Results

The maximum displacement observed was 42.4 mm and Maximum stresses (von-Mises) generated on the switchboard and bolts were 312.2 MPa and 305.39 MPa respectively.

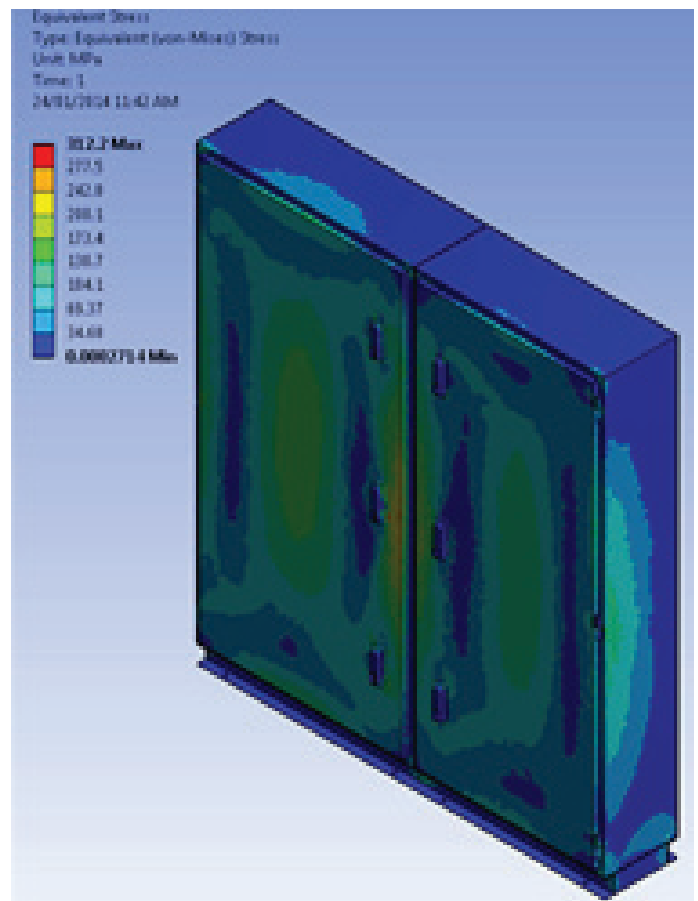


Figure 1: Stresses generated on the switchboard

Conclusion

The switchboard and its fixtures (bolts) can withstand the maximum potential wind load generating in Port of Gladstone. Switchboard with a minimum safety factor of 1.85 and bolts with a minimum safety factor of 2.29.

Definition	
Type	Joint Probe
Boundary Condition	Fixed - Ground To Plinth
Orientation Method	Joint Reference System
Suppressed	No
Options	
Result Type	Total Force
Result Selection	All
Display Time	End Time
Results	
<input type="checkbox"/> X Axis	11021 N
<input type="checkbox"/> Y Axis	1060.5 N
<input type="checkbox"/> Z Axis	-13676 N
<input type="checkbox"/> Total	17662 N

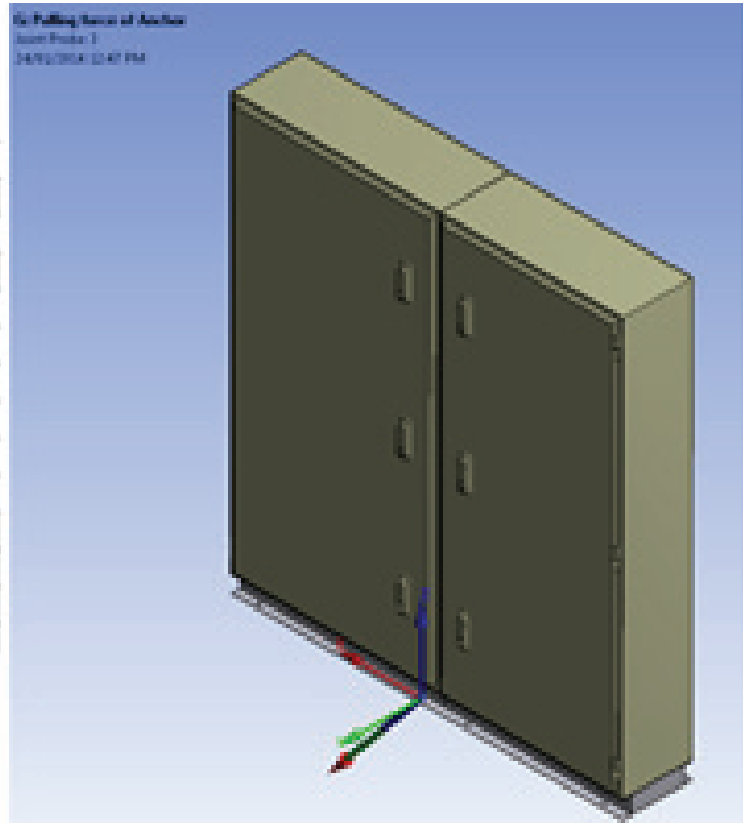


Figure 2: Maximum pulling force of an anchor

Recommendations for anchoring

The maximum pulling force generated for anchors was 17.66 kN. Therefore it is recommended to have a anchor that is rated to at least 30-35 kN to have a safety factor around 2. Therefore we recommend to use HILTI chemical anchoring (HIT-HY 200 + HIT-V (8.8) M12) or similar product with specified rated pulling force.

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