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# **STRUCTURAL ANALYSIS REPORT**

**OF ALUMINIUM PROFILE FOR GLASS RAILING  
AL0006 ECO**

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# 1 Project description

The subject of the report is a lightweight aluminium profile which is used to attach the glass railing to the supporting structures. The report assumes the use of the railing in the buildings of A, B, C1, C2, C3, C4 and D category.

## 1.1 Received documents

- Order No. 20OVOP0100000505 from October 2020
- 3D model of an aluminium profile
- 3D model of a glass railing assembly
- Drawing of the detail of placing the glass in the profile and anchoring the profile in the concrete structure

# 2 Used materials

Aluminium:

AL0006 profile: EN-AW 6063, T6

Glass:

PVB foil 2x8 mm + 1.52 mm Heat-treated glass

# 3 Load

## 3.1 Fixed load

The railing height is 1.0 m above the floor level. The placement in the profile is 0.1 m. The weight of the glass plate 2x8 mm + PVB 1.52 mm, height 1.0 m.

$$g_k = 0.40 \text{ kN/m'}$$

## 3.2 Working load

Horizontal for categories A, B C1,

$$q_k = 0.5 \text{ kN/m'}$$

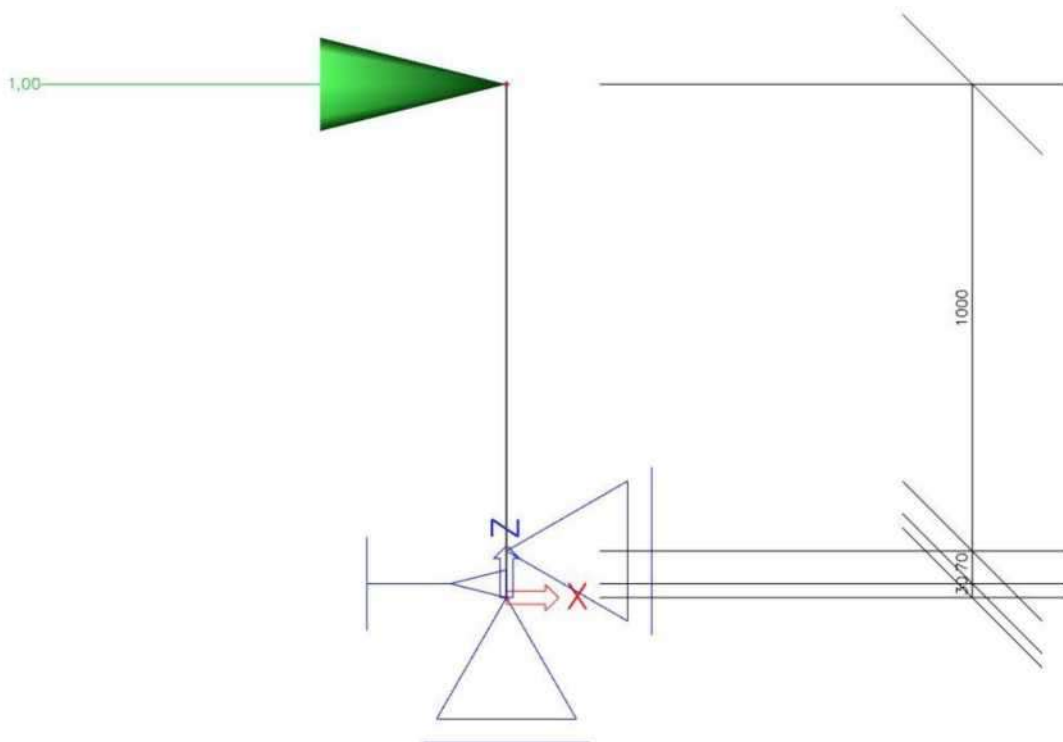
Horizontal for categories C2, C3, C4

$$q_k = 1.0 \text{ kN/m'}$$

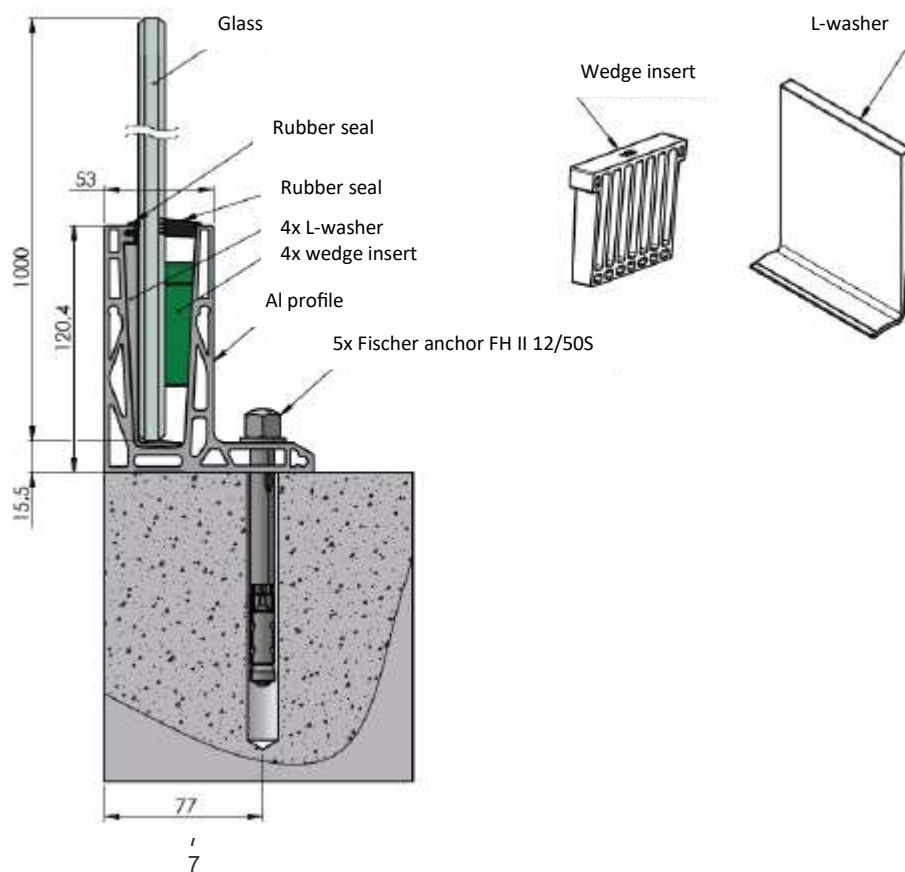
## 3.3 Wind load

The maximum permissible wind load is specified in Chapter 6.

## 4 Structural scheme



## Loaded assembly



## 5 Stress distribution

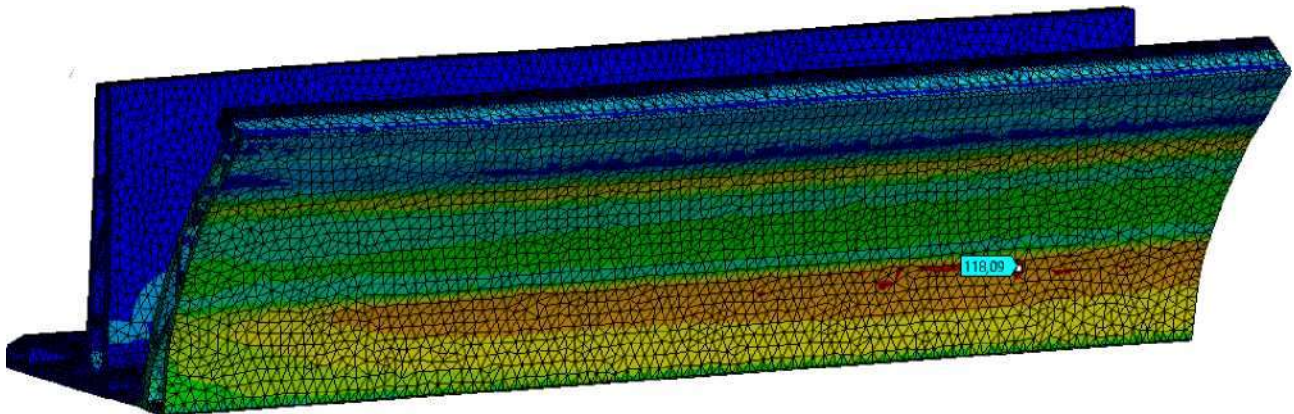
Symmetry was used in modelling and **only a half of the assembly was modelled!**

Maximum permissible stress:  $f_0 = 160 \text{ MPa}$ ;  $Y_M = 1.1$ ;

$f_{0,d} = f_0 / Y_M = 160 / 1.1 = 145.5 \text{ MPa}$

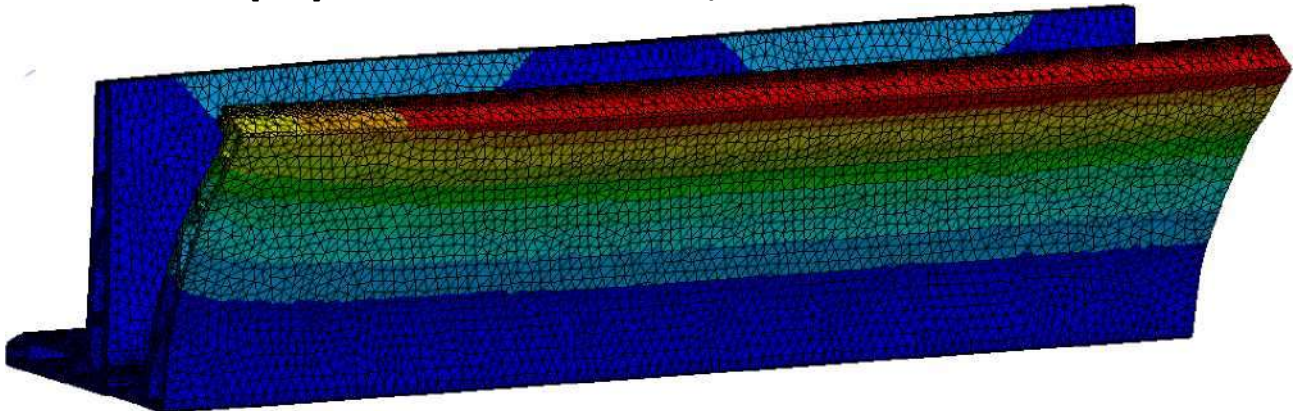
**Equivalent (von-Mises) stress [MPa]**

**Profile**

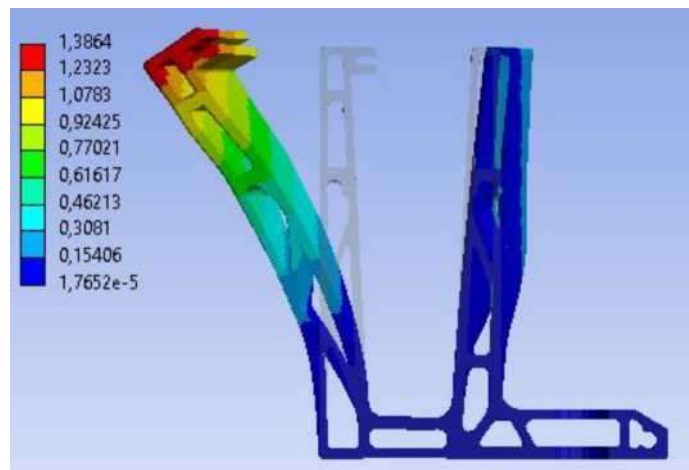


The maximum stress on the profile is 118.1 Mpa.

**Total deformation [mm] at characteristic load of 1 kN/m**



The maximum deformation of the profile is 1.4 mm.



## 6 Conclusion

The resulting stress under the horizontal working load  $q_k = 1 \text{ kN/m}$  is  $\sigma_d \approx 118.1 \text{ MPa}$ .  
 $\sigma_d \leq f_{0,d} = 118.1 \leq 145.5 \text{ MPa} \Rightarrow \text{THE PROFILE IS COMPLYING}$ . The assessed profile safely transfers the applied load considered in the calculation to other supporting structures.

The total deflexion of the profile of the railing is 1.4 mm.

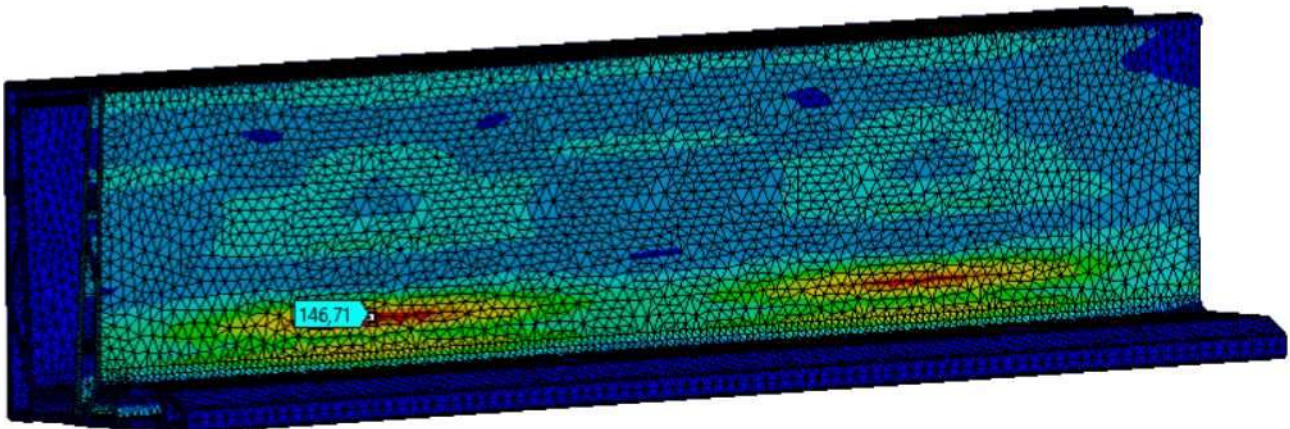
### 6.1 Maximum design wind load

#### 6.1.1 Suction

The maximum permissible design wind load is  $0.4 \text{ kN/m}^2$ . In the structural calculation, the wind load is calculated so that the direction of the load is the same as the direction of the horizontal force caused by the working load on the upper edge of the railing (wind suction). At the given load values, the maximum design carrying capacity of the aluminium profile will not be exceeded.

#### 6.1.2 Pressure

The maximum permissible design wind load is  $3.1 \text{ kN/m}^2$ . At the given load values, the maximum design carrying capacity of the aluminium profile will not be exceeded.



The resulting stress under the horizontal design wind load  $q_d = 3.2 \text{ kN/m}^2$  is  $\sigma_d \approx 146.7 \text{ MPa}$ .  
 $\sigma_d \leq f_{0,d} = 146.7 > 145.5 \text{ MPa}$ ; **The maximum permissible wind load is  $q_d = 3.1 \text{ kN/m}^2$**

THE PROFILE AL 0006 ECO EN-AW 6063, T6 VERIFIED BY THE NUMERICAL CALCULATION DEMONSTRATES THE CARRYING CAPACITY HIGHER THAN THE DETERMINED HORIZONTAL WORKING LOAD OF RAILINGS ACCORDING TO STN 74 3305. TO VERIFY THE NUMERICAL MODEL AND BEFORE PUTTING THE PROFILE ON THE MARKET IT IS NECESSARY TO PERFORM AN EXPERIMENTAL ANALYSIS OF SAID PROFILE. THE PRESENTED RESULTS ARE INFORMATIVE ONLY. THE ANCHORS HAVE NOT BEEN ASSESSED. THE CHOICE OF AN ANCHOR AND ITS USE MUST BE APPROVED BY THE ANCHOR MANUFACTURER.

## **7 Standards and used software**

- [1] STN EN 1990 - Basis of structural design
- [2] STN EN 1999 - Design of aluminium structures
- [3] STN 74 3305 - Guard railings
- [4] STN EN 1993 - Design of steel structures

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