

# SUPPORTING CONDITION IS AN IMPORTANT FACTOR IN THE BEHAVIOUR OF THE FAÇADE SYSTEM

**ABSTRACT:** - The Main task of this paper is to present the behaviour of the glass with various types of fixing methods, mainly discuss the stress & displacement variation of the glass under the loading with following fixing methods: Four side, two side & Point Fixing. Failure of the glass or required thickness of the glass mainly depending on the fixing methods. Mainly glass is fixed with supporting member by using either Structural Sealant (Four side & two side fixing) or Spider (Point Fixing). Mainly this Study is to analyse the stress & displacements pattern of the glass under different type of loading (Uniform Pressure, Line Loading & Point Loading) with above categorized support condition. In addition, Point Fixing Curtain wall (Glass) is required additional design concern to avoid the glass breakage at the contact surface of the Glass & spider.

**KEY WORDS:** - Point Fixing, Structural Sealant, Spider & Curtain Wall

## 1. INTRODUCTION

Façade Engineering is the major role in the Construction Industry. It is known as the Curtain wall systems. Generally four sides of the glass panels fix to the Alum Framing using Structural Sealant (Figure - 1). In the Alum Framing, Vertical member is called as Mullion & Horizontal member is called as Transom. In addition, Two side fixing glass (frameless glass) is used at Shop front & Vision area of the building to avoid the reduction of the vision area as shown below in the Figure - 2.

Nowadays, Point Fixing Curtain wall also, another major part in the Façade industry, Normally Spider is used to fix the Glass panel to main frame. This type of Curtain wall not required any additional frame to hold the glass panel as shown in Figure -3

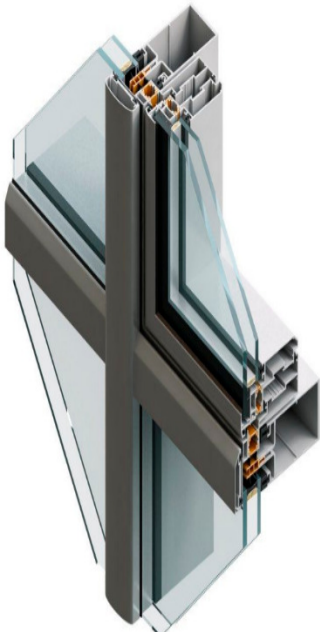


Figure 1 - Four side Fix  
Curtain Wall



Figure 2 - Two side Fix  
Curtain Wall



Figure 3 - Point Fix  
Curtain Wall

## 2. ANALYSIS & RESULTS

In this study, Glass panel model was analysed under different types of Fixing method with various load cases. Consideration of fixing method for the Glass Panel as follows:-

- ❖ Four side fixing method
- ❖ Two side fixing method
- ❖ Point fixing method

So, similar dimension of the glass panel was modelled with above mentioned fixing method & different types of loading condition (Uniform Pressure, Line Load & Point Load). Using software modelling, glass panel was analysed & Stress and displacement variation of the glass panel was compared as attached below. Major scope of this study is to identify the fixing & loading method which is create the more chances to failure of the glass.

- Glass panel was analysed under uniform Pressure with above fixing cases. Stress and deflection variation of the glass as follows.

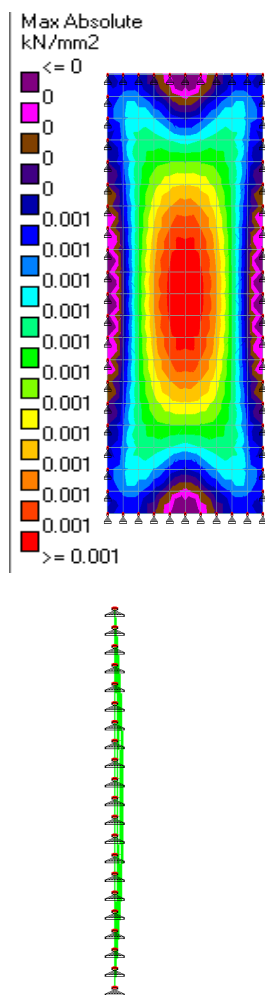


Figure 4 – Stress & Deflection variation of the glass under uniform pressure with four side fixing.

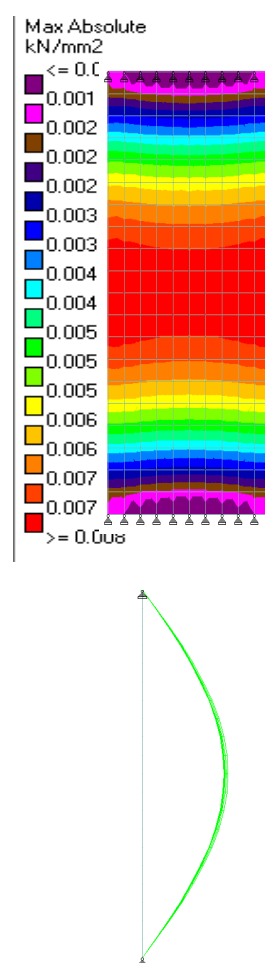


Figure 5 – Stress & Deflection variation of the glass under uniform pressure with two side fixing.

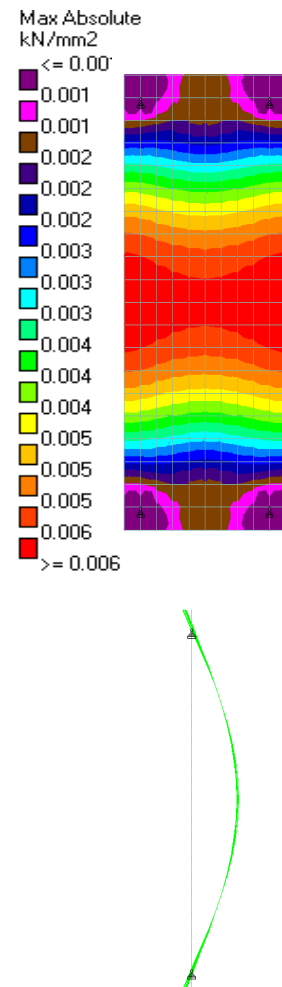


Figure 6 – Stress & Deflection variation of the glass under uniform pressure with point side fixing.

- Glass panel was analysed under Line Loading with above fixing cases. Stress & deflection variation of the glass as follows.

Line loading (UDL force) was applied at the mid of the Glass panel in horizontal direction as shown in the figure -7

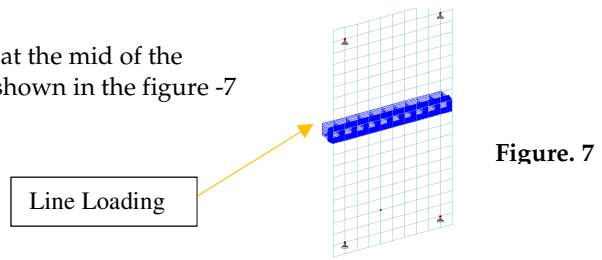


Figure. 7

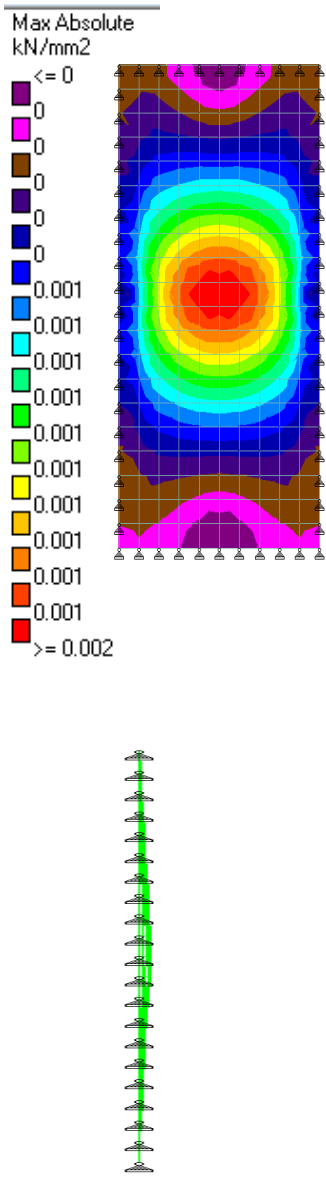


Figure 8 – Stress & Deflection variation of the glass under Line Loading with four side fixing.

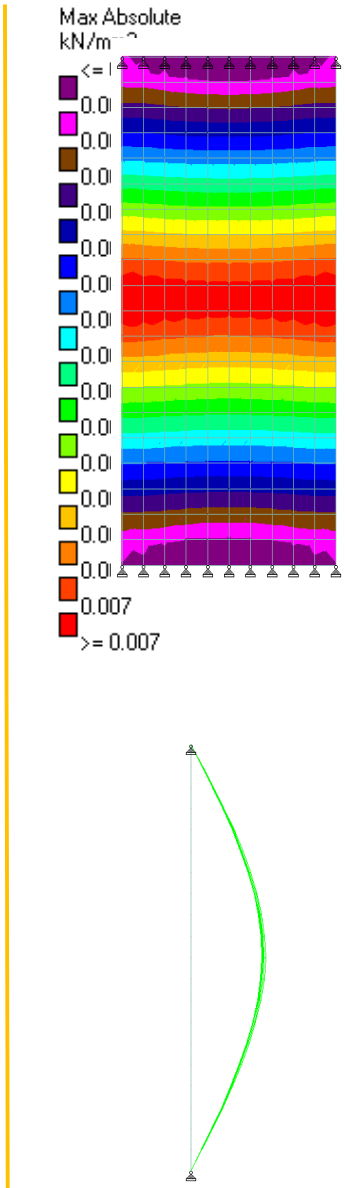


Figure 9 – Stress & Deflection variation of the glass under Line Loading with two side fixing.

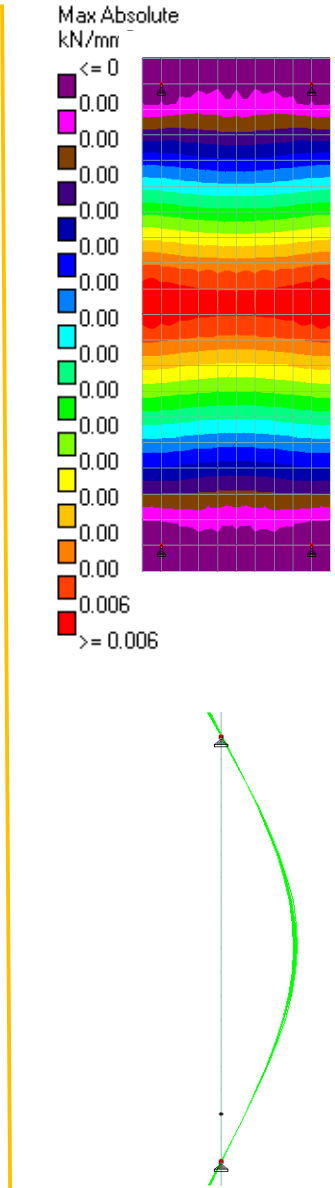


Figure 10 – Stress & Deflection variation of the glass under Line Loading with Point fixing.

- Glass panel was analysed under Point loading with above fixing cases. Stress & Deflection variation of the glass as follows.

Point Loading was applied at the mid-point of the glass panel.  
As shown in the Figure - 11

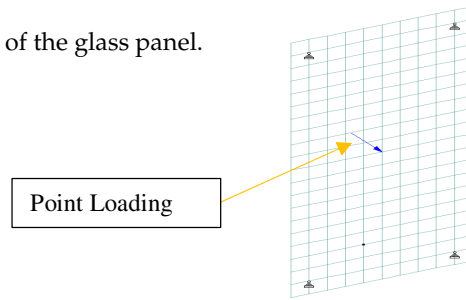


Figure -11

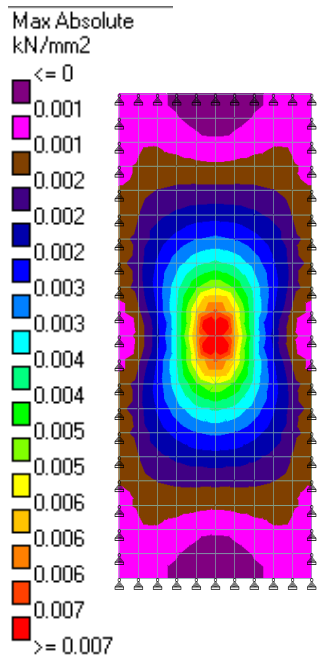


Figure 12 – Stress & Deflection variation of the glass under Point Loading with four side fixing.

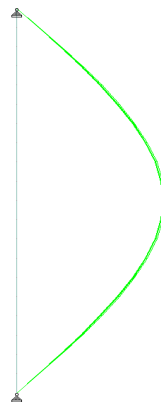
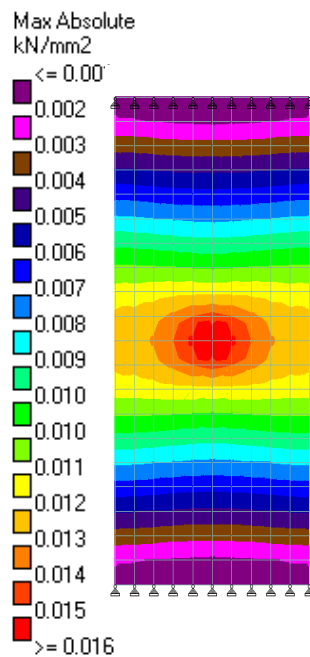


Figure 13 – Stress & Deflection variation of the glass under Point Loading with two side fixing.

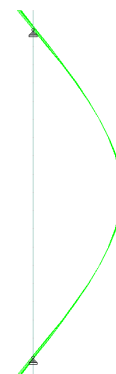
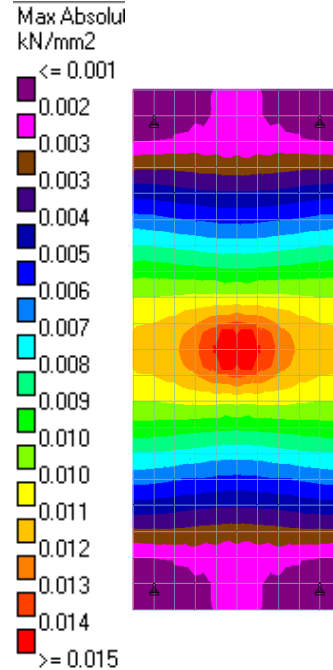


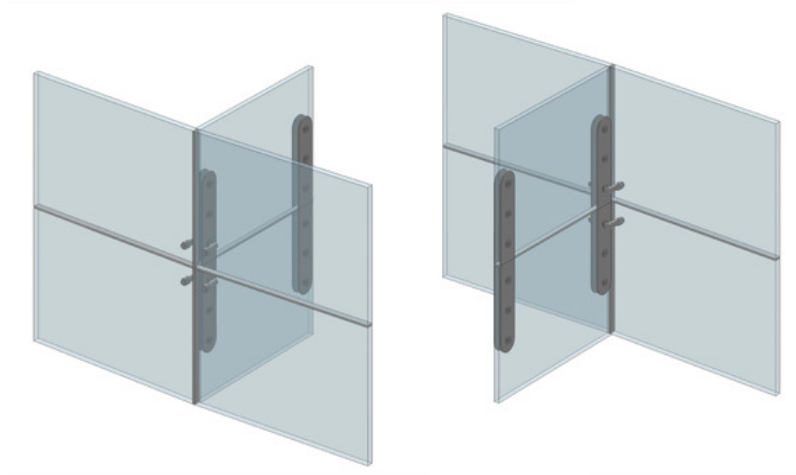
Figure 14 – Stress & Deflection variation of the glass under Point Loading with Point fixing.

Based on above study, two side Fixing & Point Fixing glass panel should be strengthened to withstand the high stress & deflection. So compare to four side fixing glass, two side & point fixing glass panel thickness should be high. According to the above analysis, Table 1 clearly show the comparison of the stress & deflection variation under different fixing method & loading cases.

**Table 1 - Stress & deflection variation under different fixing method & load cases**

Stress/ Deflection Variation of the Glass			
Fixing Method / Loading	Four Side Fixing	Two Side Fixing	Point Fixing
Uniform Pressure	Low	Very High	High
Line Loading	Low	Very High	High
Point Loading	Low	Very High	High

To avoid the failure of the two side fixing glass panel or to reduce the glass thickness, additionally glass panel is supported by glass fin behind the glass panel as shown in the Figure 15, it will act as an additional support to the glass, and this will reduce the deflection & stress of the glass panel.



**Figure 15 - Two side Fix Glass panel strengthened by Glass Fin**

As per this study, when we apply the sudden forces to the Glass panel with two side fixing or Point fixing has more chances to occur sudden breakage in the glass. So, façade engineering design is required additional safety concern on their design. Because when we apply the load to the glass, breakage will be occurred suddenly after the elastic deformation. Glass deformation is not like any other structural elements (steel or concrete), glass element doesn't show the plastic deformation behaviour.

### 3. CONCLUSIONS.

- In the design of the glass, two side & point fixing method is required additional design concern to avoid the failure of the glass.
- In order to reduce the failure of the frameless glass or thickness of the glass, glass panel is supported by glass fin behind the glass panel.
- Glass panel doesn't show the plastic deformation behaviour, like steel or concrete elements, sudden breakage will happen after the elastic deformation.
- Point Fixing Curtain wall is required additional design concern to avoid the glass breakage at the contact surface of the spider & glass.
- Stress & deflection values are very high to the two side & point fixing glass compare to four side fixing glass.

### 4. REFERENCES.

- AS 1288 (2006) 'Glass in Buildings – Selection and Installation', Australian Standard.



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