

## **“Shell in Danger: Los Manantiales-Xochimilco after the Earthquake of September 19th, 2017”**

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### **Abstract**

The earthquake that shook Mexico on September 19th, 2017 had devastating effects in the lake area of Xochimilco, south of Mexico City, where one of Felix Candela's masterpieces stands: Los Manantiales restaurant (1958), a reinforced concrete shell 2 inches thick that forms an "eight-petal flower", derived from a peculiar geometry generated by the intersection of four hyperbolic paraboloids that rotate on an axis, creating a groin vault of eight segments. The shell opens a clearing of more than 30 meters and covers an area greater than 900 square meters without intermediate supports. This original structure, the best example of "free edge shells", extended Candela's worldwide fame through the image of the weightless concrete flower reflected in the placid waters of Xochimilco.

The earthquake seriously affected the structure; a deformation was observed in one of its "petals", a cause of alarm because the geometry of the hyperbolic paraboloids a fundamental condition for the proper structural functioning of this type of structures, where their resistance is determined by their form.

When analyzing the condition of the structure after the earthquake, it was evident that the affectations were not only caused by telluric movement, but also by the progressive sinking of the land, generating differential subsidence in its foundations and causing the main deteriorations in the shell.

This paper presents the analysis of the damages Los Manantiales has suffered in recent years and which became evident after the September earthquake, basis of an analysis of the original project, its geometry and the construction process.