# An Evaluation of the Prediction of Flat Slab Deflections

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## Summary

The deflection calculation of slender, lightly reinforced, concrete members is investigated. It is observed that the different available calculation methods produce different deflection results. The reasons for the irregular results are investigated. The various deflection prediction methods include empirical hand calculation methods as presented in SABS 0100-1, the Eurocode2, and the ACI 318. Comparisons are also made with the finite element method using a commercial software package. It is shown that deflection calculations do not consider construction and post construction conditions, often resulting in non durable and non sustainable structures.

**Keywords:** deflections, calculation method, flat slab, reinforced concrete, slender members.

## 1. Introduction

The serviceability limit state often governs the design of slender reinforced concrete members. A reinforced concrete flat slab structure is thin relative to the span length, and thus prone to serviceability problems.

Design methods from [1], [2] and [3] are considered in this investigation. As a comparison, deflections are also calculated using the finite element method with standard linear elastic methods as available in most design offices.

In order to evaluate the accuracy of the methods for the prediction of actual flat slab behaviour, the results from the different methods are compared to data recorded by others on experimental flat slab specimens. Comparisons are also made to two case studies where excessive deflections were observed. It is shown that available design tools do not always provide the necessary support to determine serviceability behavior of structures.

## 2. Empirical Hand Calculation Approach

The equation in design standards for the calculation of the deflection of a single span beam, using the moment-curvature theorems [4], is based on the following equation :

$$\Delta = KL^2 \frac{M_a}{EI_e} = KL^2 \frac{1}{r} \quad (1)$$

The variables include K, the deflection coefficient dependent on the shape of the bending moment diagram of the member, L the span length of the member, $M_a$ the applied serviceability moments, E the modulus of elasticity of concrete and $I_e$, the effective moment of inertia for the section. The principle variable in the expression is the value of the effective moment of inertia, $I_e$. The effective moment of inertia, $I_e$ provides an estimate of the extent of cracking of a member.

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