# FLOOR VIBRATIONS: GIRDER EFFECTIVE MOMENT OF INERTIA AND COST STUDY

by

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(ABSTRACT)

Studies on the effective moment of inertia of girders that support concrete slabs using joist seats as the horizontal shear connections, and a cost efficiency analysis comparing composite and non-composite floor systems that meet vibrations design standards, were conducted.

The first study was undertaken because over-prediction of girder effective moment of inertia was the suspected cause of several recent vibration problems in floors supported by widely spaced LH-series joists. Eight purpose-built floors of the type in question were subjected to experimental tests of girder effective moment of inertia and girder frequency. Frequencies were tested for two live loading cases. Three separate test configurations were made with each floor by changing the seat-to-girder connections between bolted, welded, and reinforced. In the study, 1) the accuracy of the current design practice is assessed, 2) a new relationship was proposed, and 3) suggestions for finite element modeling are made.

In recent years, composite construction has been used to improve cost efficiency by reducing structural weight and in some cases by reducing story height. However, vibration problems are a design consideration in composite floors because lighter floors tend to be more lively. It is not clear if cost savings can be made with composite construction if vibrations are considered in the design. To compare the cost of composite and non-composite floors that satisfy AISC/CISC Design Guide criterion for walking excitation, four typical size bays were analyzed using commercial design software that finds the least expensive member configuration for a given bay size. All acceptable bay configurations of member sizes and spacing were evaluated for least non-composite and composite costs, then these results were compared. The findings show that composite construction can be more economical when initial dead load deflections do not control the design.

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