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EXPERIMENTAL AND THEORETICAL STUDY OF THE REINFORCED CONCRETE FLAT SLABS WITH THE CENTRAL SUPPORT LOSS

Abstract. The paper experimentally and theoretically considers the issues of assessing the robustness of reinforced concrete structural systems with flat slabs in an accidental design situation.

The methodology of experimental studies for two scale models of a flat slab fragment in the case of removal of the central support under static (sample FS-1) and dynamic (sample FS-2) loading are presented. Based on the data obtained, the analysis of the main mechanisms of resistance of flat slabs to progressive collapse was carried out.

The article presents a theoretical approach to a direct quantitative assessment of robustness, which is based on the provisions of the energy balance of a damaged structural system in an accidental design situation. The proposed solutions make it possible to determine the non-linear quasi-static "load-displacement" reaction and the ultimate dynamic resistance for reinforced concrete structural systems with flat slabs in the case of removal of the vertical key element.

Keywords: flat slab, robustness, resistance mechanism, membrane action, dynamic resistance, energy balance method.

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ЭКСПЕРИМЕНТАЛЬНЫЕ И ТЕОРЕТИЧЕСКИЕ ИССЛЕДОВАНИЯ ЖЕЛЕЗОБЕТОННЫХ ПЛОСКИХ ПЕРЕКРЫТИЙ ПРИ УДАЛЕНИИ ЦЕНТРАЛЬНОЙ ОПОРЫ

Аннотация. В работе экспериментально и теоретически рассмотрены вопросы оценки живучести железобетонных конструктивных систем с плоскими дисками перекрытий в особой расчетной ситуации.

Представлена методика проведения экспериментальных исследований для двух масштабных моделей фрагмента плоского перекрытия в случае удаления центральной опоры при статическом (образец FS-1) и динамическом (образец FS-2) нагружениях. На основании полученных данных выполнен анализ основных механизмов сопротивления плоских дисков перекрытия прогрессирующему обрушению.

В статье представлен теоретический подход прямой количественной оценки живучести, который основан на положениях энергетического баланса поврежденной конструктивной системы в особой расчетной ситуации. Предложенные решения позволяют определить нелинейную квазистатическую реакцию «нагрузка-перемещение» и величину предельного динамического сопротивления для железобетонных конструктивных систем с плоскими дисками перекрытий в случае удаления вертикального ключевого элемента.

Ключевые слова: плоское перекрытие, живучесть, механизм сопротивления, мембранный эффект, динамическое сопротивление, поврежденная система, энергетический баланс.

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