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Behavior of ultra-high performance fiber reinforced concrete columns under blast loading

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1 BEHAVIOR OF ULTRA-HIGH PERFORMANCE FIBER REINFORCED

2 CONCRETE COLUMNS UNDER BLAST LOADING

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6 ABSTRACT

7 This paper presents the results of a study examining the blast load performance of ultra-high
8 performance fiber reinforced concrete (UHPFRC) columns. As part of the experimental
9 program nine full-scale columns constructed with compact reinforced composite (CRC), a
10 proprietary UHPFRC, were tested under simulated blast loading and exposed to varying blast
11 pressure–impulse combinations using a shock-tube. Parameters considered in this study
12 include concrete type, fiber content, fiber properties, transverse reinforcement spacing and
13 longitudinal reinforcement ratio. The results demonstrate that the use of UHPFRC
14 significantly improves the blast performance of reinforced concrete columns by reducing
15 maximum and residual displacements, enhancing damage tolerance, and eliminating
16 secondary blast fragments. The results also indicate that fiber content, fiber properties,
17 seismic detailing and longitudinal reinforcement ratio are important factors that can affect the
18 blast load behavior and failure mode of UHPFRC columns. The analytical investigation
19 examines the suitability of using single-degree-of-freedom (SDOF) analysis to predict the
20 blast response of the UHPFRC columns tested in the research program.

22 **Keywords:** UHPFRC, CRC, Columns, Blast, Shock-tube, Seismic detailing

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