

RCC frames with ferrocement and fiber reinforced concrete infill panels under reverse cyclic loading

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Abstract. An experimental investigation was carried out to study the strength and behavior of reinforced cement concrete (RCC) frames with ferrocement and fiber reinforced concrete infill panel. Seven numbers of 1/4th scaled down model of one bay-three storey frames were tested under reverse cyclic loading. Ferrocement infilled frames and fiber reinforced concrete infilled frames with varying volume fraction of reinforcement in infill panels viz; 0.20%, 0.30%, and 0.40% were tested and compared with the bare frame. The experimental results indicate that the strength, stiffness and energy dissipation capacity of infilled frames were considerably improved when compared with the bare frame. In the case of infilled frames with equal volume fraction of reinforcement in infill panels, the strength and stiffness of frames with fiber reinforced concrete infill panels were slightly higher than those with ferrocement infill panels. Increase in volume fraction of reinforcement in the infill panels exhibited only marginal improvement in the strength and behavior of the infilled frames.

Keywords: ferrocement; fiber reinforced concrete; infill panel; reinforced concrete frame; cyclic loading

1. Introduction

Reinforced cement concrete (RCC) framed structures are usually infilled with masonry, which serve as either interior or exterior partitions. However, due to the complex behavior of the frame-infill interaction, masonry infills are commonly considered as non-structural elements. Ignoring the effect of infills may lead to inaccurate prediction in the strength and stiffness of the structure. On the other hand, if the infills are properly connected to the frame, the resulting system becomes stiffer and attracts higher lateral loads. These high loads will be rapidly transferred to the frame after the infill is partially or fully damaged. Hence, considering the lateral stability of the frame, an accurate assessment of the contribution of infills to the strength and stiffness of the frame system is essential for a safe design.

The behavior of masonry infilled RC frames were studied by a large number of researchers (Kahn and Hanson 1979, Mehrabi *et al.* 1996, Colangelo 2005, Misir *et al.* 2012, Zovkic 2013). The test results indicated that the presence of infills significantly enhanced the strength and

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- Kesner, K. and Billington, S.L. (2005), "Investigation of infill panels made from engineered cementitious composites for seismic strengthening and retrofit", *J. Struct. Eng.*, **131**(11), 1712-1720.
- Li, B.X., Wang, Z., Mosalam, K.M. and Xie, H.P. (2008), "Wenchuan earthquake field reconnaissance on reinforced concrete framed buildings with and without masonry infill panel walls", *Proceedings of the 14th World Conference on Earthquake Engineering*, Beijing, China.
- Mehrabi, A.B., Shing, P.B., Schuller, M.P. and Noland, J.L. (1996), "Experimental evaluation of masonry-infilled RC frames", *J. Struct. Eng.*, **122**(3), 228-237.
- Misir, I.S., Ozcelik, O., Girgin, S.C. and Kahraman, S. (2012), "Experimental work on seismic behavior of various types of masonry infilled RC frames", *Struct. Eng. Mech.*, **44**(6), 763-774.
- Sezen, H., Whittaker, A.S., Elwood, K.J. and Mosalam, K.M. (2003), "Performance of reinforced concrete buildings during the August 17, 1999 Kocaeli, Turkey earthquake, and seismic design and construction practise in Turkey", *Eng. Struct.*, **25**(1), 103-114.
- Sonuvar, M., Ozcebe, G. and Ersoy, U. (2004), "Rehabilitation of reinforced concrete frames with reinforced concrete infill panels", *ACI Struct. J.*, **101**(4), 494-500.
- Susoy, M. (2004), "Seismic strengthening of masonry infilled reinforced concrete frames with precast concrete panels", M.S. Dissertation, Middle East Technical University, Ankara, Turkey.
- Swamy, R.N. (1984), *New Reinforced Concretes*, Surrey University Press, London, U.K.
- Turk, A.M., Ersoy, U. and Ozcebe, G. (2006), "Effect of introducing RC infill panel on seismic performance of damaged RC frames", *Struct. Eng. Mech.*, **23**(5), 469-486.
- Zovkic, J., Sigmund, V. and Guljas, I. (2013), "Cyclic testing of a single bay reinforced concrete frames with various types of masonry infill panel", *Earthq. Eng. Struct. Dyn.*, **42**(8), 1131-1149.