SHORT-TERM BEHAVIORS AND DESIGN EQUATIONS OF MORTARLESS REINFORCED CONCRETE MASONRY WALLS

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Abstract

This paper presents the results of a study of the short-term behavior of mortarless reinforced concrete masonry wall subjected to two types of loading: concentrated axial load and transverse load. The specimens were made of standard hollow concrete masonry units, reinforcing steel bars, and grout. The variables studied were steel reinforcement ratio, height or span of the specimen, and grouting pattern. A total of 40 specimens were tested, including 24 specimens under concentrated axial load and 16 specimens under transverse load. The experimentally obtained results were correlated to the ACI 530-99 design equations for a reinforced mortar jointed wall and statistical analyses were performed. Finally, the design equations were adjusted based on the obtained results.

Keyword: Mortarless masonry, masonry wall, concrete masonry unit, concentrated load, transverse load

Introduction

Mortarless masonry or dry-stacked masonry differs from traditional masonry in that no mortar is used in the construction. Historical evidence at fort Porta Nigra, Tier, Germany, shows that this concept originated about 1,800 years ago (Marzahn, 1999). This Roman fortified gateway was constructed using sandstone blocks without any mortar. Recently, this concept has been used in many countries such as Germany and USA due to the developments in masonry unit production leading to well leveled units with small tolerances of size and shape. Typically, the units used in mortarless masonry are the same as those used in masonry with a thin mortar layer. Sometimes, they are in the form of interlocked masonry units to ensure the interlocking between them. The units can be both solid and hollow masonry units. Solid block units are popular in Europe, while hollow concrete block units, which are stacked and grouted with or without reinforcement afterward, are popular in USA (Marzahn, 2000). Construction with mortarless masonry is an attractive alternative to conventional masonry with mortar joints due to the construction efficiency and economy. It eliminates the use of mortar in head joint and bed joint, reducing the material and labor costs as well as cutting the mortar curing time. It also requires less skilled labor and the masonry units can be laid easier and quicker, offering labor cost and time savings. However, in the construction of mortarless masonry structural components such as wall, pilaster, and column, the first course has to be stacked carefully in grout or mortar because the absence of the mortar layer may affect the plumb and level of these structural components.

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