AEM SIMULATION OF SEISMIC RETROFITTING METHODS OF UNREINFORCED MASONRY RAILWAY STRUCTURES

(鉄道における無筋の組積構造物の耐震補強方法についての AEM による数値シミュレーション)

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ABSTRACT

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According to previous surveys on railway structures in the metropolitan area of Japan, it has been reported that there are some old unreinforced masonry structures made of bricks or stones or plain concrete while are in service. In order to enhance the performance of unreinforced masonry piers in very limited spaces under severe seismic actions, many kinds of strengthening techniques have been planned by JR EAST company in Japan such as vertical-prestressed steel, grid-steel plate and Concrete Filled Tubes (CFT) methods. The basic concept of the methods is to prevent the large horizontal sliding and residual displacement at the mortar joints between bricklayers which may cause catastrophic failure of structures or difficulty of early resuming railway service after the earthquake. In this study, an attempt is made to apply the Applied Element Method (AEM) which is highly developed for simulating the experimental results in the case of Grid-steel plate retrofitting method. Two separated low strength concrete column was retrofitted by gird-steel plate method. A Polyvinyl Chloride (PVC) sheet was inserted between the joint of two column blocks to expect the reduction of the sliding friction when horizontal displacement was applied to the specimen. The Grid-steel plates were arranged on the two side surfaces of the column and joined with the penetrating reinforced bars. The investigated cases include the alteration of the dimensions, the thickness and the arrangements of the steel plates in the vertical direction to assess the sensitivity of the related influencing factors on the performance of the testing specimens. The grid-steel plate retrofitting method showed good contribution to mitigate the sliding behavior of the retrofitted column at the joint and caused rocking behavior at the base. The numerical monotonic and cyclic analysis results showed that the crack occurrences, crack propagation, load-displacement relation and failure pattern of the experimental specimens are quite comparable and highly validated. In addition, some possible techniques for the next stage of the research is also demonstrated.
CONTENTS
ACKNOWLEDGEMENT ................................................................................................. i
ABSTRACT ..................................................................................................................... ii
TABLES ........................................................................................................................... v
FIGURES ........................................................................................................................ vi
CHAPTER 1 ..................................................................................................................... 1
INTRODUCTION ............................................................................................................ 1
1.1 Background ............................................................................................................. 1
1.2 Objectives and scope .............................................................................................. 2
1.3 Brief outline of the study ........................................................................................ 2
1.3 Methodology and verification process in the study ................................................ 3
1.4 Justification of the research .................................................................................... 3
1.5 Organization of the Thesis ...................................................................................... 4
CHAPTER 2 ..................................................................................................................... 5
LITERATURE REVIEW ................................................................................................. 5
2.1 Previous studies on the seismic failure mode of unreinforced masonry railway
structures ....................................................................................................................... 5
2.2 Previous studies on seismic retrofitting methods of unreinforced masonry railway
structures ....................................................................................................................... 6
2.3 Previous studies on seismic retrofitting methods of unreinforced stone masonry
bridge piers ................................................................................................................... 7
2.4 Numerical simulation of masonry .......................................................................... 8
2.5 Conclusion .............................................................................................................. 9
CHAPTER 3 ................................................................................................................... 10
CONCEPT OF THE RETROFITTING METHOD ....................................................... 10
3.1 Working condition of the existing unreinforced masonry railway bridges .......... 10
3.2 Basic concept of the retrofitting methods ............................................................. 10
3.3 Main seismic retrofitting methods ........................................................................ 11
  3.3.1 The Grid-steel plate retrofitting method ........................................................ 11
  3.3.2 The Vertical-prestressed steel retrofitting method ........................................ 12
CHAPTER 4 ................................................................................................................... 13
AEM SIMULATION AND METHOD OF VERIFICATION ...................................... 13
4.1 Applied Element Method (AEM) ......................................................................... 13
4.2 AEM and FEM in comparison.............................................................................. 13
4.3 Software used for the Analysis following AEM .................................................. 14
4.4 AEM material models in the study ....................................................................... 14
  4.4.1 Concrete model .............................................................................................. 14
  4.4.2 Reinforcing bars model ................................................................................. 15
  4.4.3 Bearing material model ................................................................................. 16
  4.4.4 Elastic material model ................................................................................... 16
4.5 Justification of using AEM as a numerical analysis method for the research ..... 17
4.6. Basic assumptions in AEM simulation ............................................................ 18
CHAPTER 5 ................................................................................................................... 19
AEM ANALYSIS OF GRID-STEEL PLATE RETROFITTING METHOD FOR
MASONRY PIERS OF RAILWAY BRIDGES ............................................................ 19
5.1 Experimental program .......................................................................................... 19
  5.1.1 General........................................................................................................... 19
TABLES

Table 5.1 Details of steel plates, steel anchors, sheath tubes and steel bars ........................................... 20
Table 5.2 Details of columns and PVC sheet .......................................................................................... 20
Table 5.3 Characteristics of concrete .................................................................................................... 22
Table 5.4 Characteristics of steel ........................................................................................................... 22
Table 5.5 Material properties of concrete and steel in ELS models ....................................................... 27
Table 5.6 Properties of bearing material in ELS models ....................................................................... 27
Table 5.7 Properties of interface material in ELS models ..................................................................... 27
Table 5.8 Properties of elastic material in ELS models ......................................................................... 27
Table 5.9 Interface material assignment .............................................................................................. 28
Table 5.10 Material properties of concrete and steel in ELS models ..................................................... 31
Table 5.11 Properties of bearing material in ELS models ....................................................................... 31
Table 5.12 Properties of interface material in ELS models .................................................................... 31
Table 5.13 Properties of elastic material in ELS models ....................................................................... 31
Table 5.14 Interface material assignment ............................................................................................ 32
Table 5.15 Material properties of concrete and steel in ELS models ..................................................... 34
Table 5.16 Properties of bearing material in ELS models ....................................................................... 34
Table 5.17 Properties of interface material in ELS models .................................................................... 34
Table 5.18 Properties of elastic material in ELS models ....................................................................... 34
Table 5.19 Interface material assignment ............................................................................................ 35
Table 5.20 Prestressed force used in the test .......................................................................................... 38
Table 6.1 Prestressed force used in the test ........................................................................................... 38
Table 6.2 Characteristics of concrete .................................................................................................... 39
Table 6.3 Characteristics of steel ........................................................................................................... 39
Table 6.4 Material properties of concrete and steel in ELS models ....................................................... 47
Table 6.5 Properties of interface material in ELS models ..................................................................... 47
Table 6.6 Properties of elastic material in ELS models ......................................................................... 47
Table 6.7 Interface material assignment .............................................................................................. 48
Fig. 6.5 Experimental results Case 3 ..............................................................................................46
Fig. 6.6 Summation of experimental results ..................................................................................46
Fig. 6.7 Components in ELS model ...............................................................................................48
Fig. 6.8 The corresponding square section of steel bar in AEM model ........................................49
Fig. 6.9 Spring controller setting in ELS .......................................................................................49
Fig. 6.10 Internal force in the PC steel bar ....................................................................................50
Fig. 6.11 Construct scenario option in ELS ....................................................................................50
Fig. 6.12 Loading scenario in ELS .................................................................................................51
Fig. 6.13 Applying prestressed force using construct scenario in ELS .........................................51
Fig. 6.14 Monotonic analysis of Case 2 .........................................................................................52
Fig. 6.15 Failure mode of the ELS model Case 2 ..........................................................................52