Evaluation of Resilience in Displacement Restrain Brace with initial story stiffness and Buckling Restrained Brace

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Abstract

Setting prestress disc springs at the end of the PC steel bar of DRB (Displacement Restrain PC steel bar Brace) can provide "initial story stiffness" to the brace before the story displacement reaches the "initial story displacement". This system with disc springs is called DRBS. We evaluated its resilience using time history response analysis under a large-scale earthquake by 10 story-mass system model. In addition, we were shown that the result of summarizing the results of story deformation angles, residual deformations, floor response accelerations, and floor response velocities. Then, the influence in non-structural elements was described as horizontal displacement by the relationship between floor response accelerations and floor response velocities.

Keywords: displacement restrain PC steel bar brace; disc spring; mass system model; time history response analysis; story deformation angle; residual deformation; floor response acceleration; floor response velocity; non-structural element; horizontal displacement

1 Introduction

Japan is an earthquake-prone country. And Japanese building structures are designed using response control analysis with braces systems. The DRB (Displacement Restrain PC steel bar Brace) is one of these bracing systems. The DRB is based on the conventional brace using the PC steel bar and has a predefined stat gap at the end of the bar brace. When the relative story displacement reaches that state which we call "initial story displacement", the bracing system functions to control the displacement [1]. Moreover, setting prestress disc springs at the end of the PC steel bar of DRB can provide "initial story stiffness" to the brace before the story displacement reaches the "initial story displacement". This bracing system is called DRBS. After the story displacement reaches the "initial story displacement", both the DRB and DRBS fully demonstrate the stiffness of the PC steel bar brace [2].

This paper reports the resilience of structures which braced with DRB or DRBS and BRB (Buckling Restrained Brace). Previous research has already shown that the story deformation angles of the building using the DRBS are less than those of the DRB [3]. It means that the "initial story stiffness" reduced structural damage and improved resilience performance compared to using DRB. On the other hand, one of the issues is the lack of consideration for non-structural elements. This is because the structural target performance is

https://doi.org/10.2749/manchester.2024.0896