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EXTENDED ABSTRACTS

Performance of Pipe Dampers in Pipe and Center under Cyclic Load in Energy Dissipation

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Tube dampers, Concentric tube dampers, Tube-in-tube dampers deformation, Energy dissipation, Analysis, Damper analysis.

1. Introduction

In the 1970, Popov et al. Developed plans to make plastic joints in frames with eccentric bracing to increase energy dissipation (Roeder and Egor, 1978), and since the late 1980s, the use of steel dampers has been common in countries such as Japan and Indonesia. Has been. Different types of steel dampers have been used since then, for example ADAS, X-shaped and honeycomb dampers are some of the steel dampers that are still under development and research studies have been done on them (Askariani et al. 2020).

2. Practical test

The test specimen is similar to the specimen tested by Siojan and Sang (2003). In the study sample, two symmetrical pipes were connected by welding connection to one-beam flanges with IPE270 cross section and two UNP300 studs which were connected to the supports. Fig. 2 shows the sample preparation process. We perform this test with a ten-ton jack from the highest point of IPE27 load at a speed of 0.04mm/s in the sample (Fig. 1).

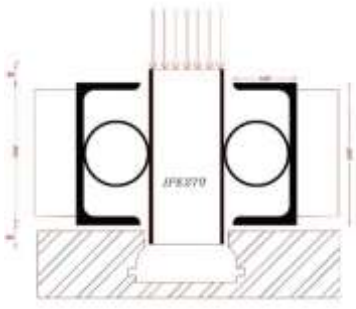

Fig. 1. Details of the sample tested

We apply this test with a ten-ton jack from the highest point of IPE27 load at a speed of 0.04mm/s in the sample. Table 1 shows the standard UNP300 and IPE270 sections used in the sample. Also, the specifications of the pipes used in the measured sample are given in Table 2. Also, the loading is applied cyclically (back and forth) to the sample in three stages (In the first stage, 30% of the final load of Mr. Singh's sample, in the second stage, 60% of the loads, and in the third stage, 90% of the final load).

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3. Numerical analysis of sample performance

The slope of the displacement force curve (hysteresis) shows the stiffness of the specimens. Finally, by comparing these two dampers, it can be said that the stiffness of a concentric tube damper has increased compared to the tube damper in the tube. Also, the performance of concentric tube dampers has been significantly increased compared to simple tube dampers. The maximum amount of force in the maximum displacement used in this sample increases by 4.36 times compared to a simple tube damper in the pressure and stress range, and the symmetry in the displacement force curve of this sample expresses the stability of the sample performance for cyclic loads (Fig. 2).

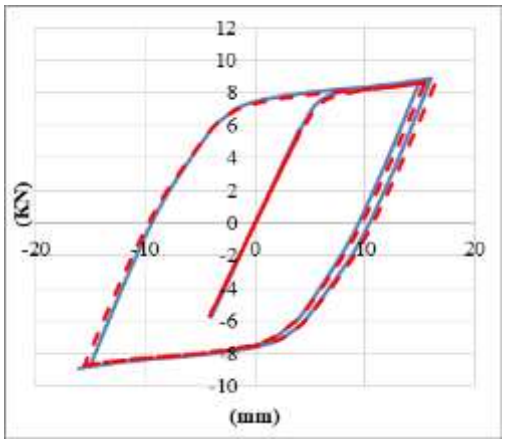

Fig. 2. Cycle behavior of the tested sample and cycle behavior simulated by the finite element method

4. Conclusions

In this research, the performance of pipe dampers in the pipe and the center under cyclic loads and pipe dampers in terms of energy loss has been investigated. The results of laboratory research show that tube dampers have an acceptable ability to dissipate energy of cyclic loads and in addition kinematic hardening behavior was observed in the performance of tube dampers and due to the good agreement between the simulated sample and the laboratory sample was observed. This confirms the accuracy of the simulation method. Then, two types of concentric tube dampers and tube-in-tube dampers were presented. The results of finite element analysis showed that the concentric tube damper shows a more kinematic hardening behavior compared to the simple tube damper and the energy loss in this damper was 2796.86 kN/mm2 compared to the simple tube damper. Increased 3 times. Considering the stiffening behavior, the connection points of the inner and outer pipes are important against stress, and the connection of the two pipes should be designed in such a way that the connection of the two pipes is not lost in the load cycles. Energy loss in this study is based on the area of the hysteresis curve and on the other hand a decrease in stiffness in the behavior of the tube-in-tube damping cycles in relation to the concentric damping and nonlinear behavior of the concentric damping was observed in this sample. Also, regarding the pipe damper in the pipe, the amount of energy loss in this damper was reported to be 2636kN/mm2, which shows an increase of 3.21 times.

5. References

ABAQUS Analysis user's manual version 6.12. ABAQUS Inc. 2012.

Aghlaraa R, Tahir M, "A passive metallic damper with replaceable steel bar components for earthquake protection of structures", Engineering Structures, 2018, 159, 185-197.

Askariani SS, Sadegh Garivani S, "Introducing and numerical study of a new brace-type slit damper. Structures", 2020, 27, 702-717.