PENGARUH LUAS DAN TATA LETAK PERFORASI TERHADAP KAPASITAS GESER *STEEL PLATE SHEAR WALL*

DISERTASI

Oleh:

NIDIASARI
NIM. 2130922010

Promotor:

Prof. Dr. Eng. Ir. Rendy Thamrin, S.T., M.T.
Ir. Sabril Haris HG, , S.T., M.T., Ph.D.
Dr. Ruddy Kurniawan, S.T., M.T.

PROGRAM STUDI DOKTOR TEKNIK SIPIL
DEPARTEMEN TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS ANDALAS
2024

ABSTRACT

The Perforated-Steel Plate Shear Wall in ANSI/AISC 341-16 requires the plate to have a regular hole pattern, with aligned holes and uniform diameter. It also specifies a minimum number of holes. It can be challenging if the perforations do not meet these requirements. Experimental tests were conducted on sixteen perforated steel plates modeled as a single panel and designed to behave as a 900 x 900 mm shear wall to understand this. Two types of perforation layouts were tested, straight and staggered layouts, with variation in perforation percentage between 10.25% and 49.59%. The perforations used were circular in shape and designed using two conditions, including variation in the number of perforations with a uniform diameter of 65 mm and variation in perforation diameter at the same perforation percentage review. In addition, two plate thicknesses of 1 mm. and 2 mm. were used to determine their effect on the performance of the steel plate shear wall. The load was applied cyclically with displacement control. The loading protocol starts from 0.25% to a maximum drift of 11% or is stopped when the specimen has failed. Loading at the same drift is repeated twice, called cycles A and B. The test results showed that increasing percentage of perforations decreased the shear capacity of each test specimen. The staggered perforation layout resulted in the highest shear capacity compared to the straight hole layout, while the 2 mm thick plate showed twice the shear capacity compared to the 1 mm plate. Plate thickness also affected stiffness, where plates with a low percentage of perforations had higher stiffness, and specimens with staggered perforation layouts showed higher initial stiffness than others. A significant decrease in stiffness occurred up to a drift ratio of 1.5%, after which the decrease in stiffness slowed down. The ductility of the 1 mm thickness plate is higher than that of the 2 mm thickness plate. The low perforation and thicker plates exhibit higher stiffness, limiting the inelastic displacement. The accumulated dissipation energy for specimens loaded to a drift ratio of 6% shows similar results between specimens with the same percentage of perforations, but there is a difference in dissipation energy of up to 20% in plates with a thickness of 2 mm. The tearing pattern in the plates with staggered perforation layout follows a diagonal direction, while that in the plates with straight perforations follows a pattern parallel to the plate edge. These findings indicate that the perforation configuration significantly affects the plate's stress distribution and failure pattern. Finally, it is found that the analytical predictions are greater than the empirical results; hence, the theoretical predictions are not conservative. Therefore, a reduction value of $(1 - 0.7D/\alpha S_{diag})$ *is proposed for perforated shear wall plates, where* $\alpha = 0.45$ *for straight configuration and 0.7 for staggered perforations.*

Keywords: Perforated-Steel Plate Shear Wall, percentage of perforations, experimental tests, cyclic load