INTISARI

Struktur *slab on pile* di Indonesia umumnya didesain dengan kategori kepentingan struktur "sangat penting" dengan faktor modifikasi respon 1,5 supaya struktur dapat mencapai level performa seismik yang baik. Akibatnya, jumlah tiang pancang yang digunakan cukup banyak. Di sisi lain, struktur yang didesain dengan kategori kepentingan struktur "penting" dengan faktor modifikasi respon 3,5 dapat mengurangi kebutuhan jumlah tiang, tetapi level performa seismiknya tidak sebaik struktur "sangat penting". Dalam rangka meningkatkan performa seismik struktur, suatu perangkat peredam gempa dapat diaplikasikan. Perangkat yang digunakan dalam penelitian ini yaitu *shear panel damper* (SPD). Penggunaannya diharapkan dapat mempertahankan performa seismik struktur *slab on pile* kategori "penting" sehingga selevel dengan struktur *slab on pile* kategori "sangat penting".

Struktur *slab on pile* yang digunakan dalam penelitian ini yaitu struktur viaduk *simply support hollow slab on pile group* (SHSPG). Tiga model struktur dimodelkan dan dianalisis secara numerik dengan mempertimbangkan efek prategang pada tiang pancang. Struktur tiang pancang dimodelkan dengan penampang *fiber* dan idealisasi titik jepit. Model struktur yang dianalisis yaitu Model A, Model B, dan Model C. Model A didesain dengan kategori kepentingan "sangat penting", sedangkan Model B dan Model C didesain dengan kategori kepentingan "penting". Delapan perangkat SPD ditambahkan pada Model C pada setiap arah untuk meningkatkan performa seismiknya. Analisis yang dilakukan mencakup analisis modal, analisis *pushover*, dan analisis riwayat waktu nonlinier. Analisis riwayat waktu nonlinier dilakukan dengan menggunakan tujuh pasang rekaman gerak tanah dari lokasi lain yang diskalakan dan disesuaikan dengan karakteristik gempa Yogyakarta.

Berdasarkan analisis modal, periode fundamental ragam pertama Model A adalah 0,644 detik (translasi arah transversal), Model B adalah 0,989 detik (translasi arah longitudinal), dan Model C adalah 0,978 detik (translasi arah transversal). Analisis *pushover* tiang pancang menunjukkan bahwa kedalaman jepit tiang pancang adalah 5000 mm. Berdasarkan analisis riwayat waktu nonlinier, level performa seismik Model A jauh lebih baik daripada Model B. Adanya penambahan SPD mampu mempertahankan level performa seismik Model C sehingga sama dengan level performa seismik Model A dengan kontribusi 34,28% - 53,03% dalam mendisipasi energi gempa.

Kata kunci: faktor modifikasi respon, pemodelan numerik, analisis riwayat waktu nonlinier, energi disipasi.

ABSTRACT

In Indonesia, slab on pile structure is commonly designed using the "critical" operational category with a response modification factor of 1.5 so that the structure can achieve a high level of seismic performance. As the result, the structure will require many spun piles. On the other hand, the structure designed as an "essential" category with a response modification factor of 3.5 can reduce the amount of spun pile, but cannot perform high seismic performance level as the "critical" structure. In order to upgrade seismic performance of the structure, a seismic damping device can be applied. The device used in this study is shear panel damper (SPD). Hopefully, its application can keep seismic performance of "essential" slab on pile structure at the same level as "critical" slab on pile structure.

The slab on pile structure used in this study is a simply support hollow slab on pile group (SHSPG) viaduct. Three structure models are modeled and analyzed numerically considering the prestress effect of the spun pile. The spun piles are modeled using fiber section and fixity depth idealization. The structure models are Model A, Model B, and Model C. Model A is designed as a "critical" structure, while Model B and Model C are designed as "essential" structures. Eight SPD devices are applied to Model C in each direction to upgrade its seismic performance level. The analysis carried out includes modal analysis, pushover analysis, and nonlinear time history (NLTH) analysis. The NLTH analysis is executed using seven pairs of recorded ground motions from other locations that have been scaled and adjusted to the seismic characteristics of Yogyakarta.

Based on modal analysis, the natural periods of the first mode of the structures are 0.644 s for Model A (transverse translation), 0.989 s for Model B (longitudinal translation), and 0.978 s for Model C (transverse translation). The pushover analysis shows that the fixity depth of the spun pile is 5000 mm. Based on NLTH analysis, the seismic performance level of Model A was much better than Model B. The application of SPD devices can keep the seismic performance level of Model C so that it is the same as Model A with 34.28% - 53.03% contribution in dissipating seismic energy.

Keywords: *response modification factor, numerical model, nonlinear time history analysis, energy dissipation.*