INTISARI

Jembatan merupakan sebuah konstruksi penghubung dua ruas jalan yang terputus karena adanya rintangan dengan elevasi permukaan yang lebih rendah. Seiring berjalannya waktu, jembatan mengalami penurunan kualitas karena beberapa faktor seperti beban lalu lintas, umur, cuaca, dan beban gempa sehingga perlu adanya suatu upaya untuk monitoring kesehatan jembatan. Salah satu upaya monitoring jembatan *non-destructive* yaitu pengujian dinamik struktur. Dalam perencanaannya, jembatan memiliki frekuensi alami yang bernilai tetap, penurunan frekuensi pada jembatan mengindikasikan bahwa terjadi penurunan kualitas jembatan.

Dalam penelitian ini digunakan balok prategang *post tensioned* dengan *curved layout*. Data vibrasi dieksitasi dengan metode *ambient vibration test* dan *forced vibration test* (berupa pemukulan hammer di tengah bentang). Perekaman data vibrasi dilakukan tepat setelah beban sepenuhnya di *release*. Pengolahan data vibrasi menggunakan bantuan aplikasi *DEWESoft* dan FFTDW08D.

Frekuensi balok prategang saat kondisi awal (tanpa retak) yaitu 20.4214 Hz. Setelah balok dibebani dengan gaya sebesar 1.08 beban rencana (beban rencana = 45.225 kN pada 1/3 dan 2/3 bentang), frekuensi mengalami penurunan 4.17%. Penurunan frekuensi tertinggi, dengan nilai 5.44% dicapai setelah balok dibebani 3.25 beban rencana (terjadi retak geser di daerah dekat tumpuan). Pada saat beban di *release*, retak yang sebelumya ada cenderung menutup karena baja prategang masih bersifat elastis. Hal itu diperkuat dengan nilai lendutan sisa yang relatif kecil (0.437 mm–2.590 mm). Penutupan retak menyebabkan kekakuan pada balok prategang tidak mengalami penurunan yang signifikan. Selain itu, penutupan retak juga menyebabkan nilai *damping ratio* tidak berubah secara signifikan dengan nilai sebesar 1.22% hingga 1.80%.

Kata kunci: Jembatan, Balok prategang, Frekuensi, Rasio redaman, Penutupan retak, FFT

ABSTRACT

The bridge is a construction connecting two roads that are cut off due to obstacles with lower surface elevations. Over time, the bridge has decreased in quality due to several factors such as traffic loads, age, weather, and earthquake loads so that there needs to be an effort to monitor the health of the bridge. One of the non-destructive bridge monitoring efforts is structural dynamic testing. In its planning, the bridge has a natural frequency of a fixed value, a decrease in frequency on the bridge indicates that there is a decrease in bridge quality.

In this study, post tensioned prestressed beams with curved layout were used. Vibration data was excited by ambient vibration test and forced vibration test (in the form of a hammer strike at mid-span). Vibration data recording was carried out right after the load was fully released. Vibration data processing uses the help of DEWESoft and FFTDW08D applications.

The frequency of the prestressed beam in the initial condition (without cracking) is 20.4214 Hz. After the beam was loaded with a force equal to 1.08 design load (design load = 45.225 kN at 1/3 and 2/3 span), the frequency decreased by 4.17%. The highest decrease in frequency, with a value of 5.44%, was achieved after the beam was loaded with 3.25 design load (shear cracking occurred in the area near pedestal). When the load released, cracks that previously existed tend to close because the prestressing steel is elastic. This is evidenced, by the small residual deflection (0.437 mm–2.590 mm). Crack closure also causes the damping ratio value not change significantly with a value of 1.22% to 1.80%.

Keywords: *Bridge, Prestressed beam, Frequency, Damping ratio, Crack closure, FFT*