

INTISARI

ANALISIS NILAI KERENTANAN GEMPA DAN RISIKO RESONANSI BANGUNAN DENGAN DATA MIKROTREMOR MENGGUNAKAN METODE HVSR DI KAPANEWON SANDEN, KABUPATEN BANTUL, DAERAH ISTIMEWA YOGYAKARTA

oleh

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Kapanewon Sanden, Kabupaten Bantul merupakan wilayah pesisir di Cekungan Yogyakarta yang tersusun oleh endapan sedimen tebal dan berada pada kawasan rawan gempa sehingga berpotensi meningkatkan risiko kerusakan bangunan akibat resonansi. Penelitian ini bertujuan untuk menganalisis karakteristik dinamika tanah, indeks kerentanan seismik, serta potensi risiko resonansi bangunan bertingkat menggunakan data mikrotremor dengan metode Horizontal-to-Vertical Spectral Ratio (HVSR).

Data penelitian terdiri atas 43 titik pengukuran mikrotremor yang diolah menggunakan pustaka *hvsrpy* dalam ekosistem Python. Kualitas kurva dievaluasi berdasarkan uji reliabilitas dan uji kejelasan puncak mengacu standar SESAME (2004). Parameter yang dianalisis meliputi frekuensi dominan (f_0), faktor amplifikasi (A_0), dan indeks kerentanan seismik (K_g). Analisis potensi resonansi dilakukan dengan mengekstraksi nilai amplifikasi kurva HVSR pada frekuensi natural bangunan 1 hingga 10 lantai berdasarkan persamaan empiris SNI 1726:2019.

Hasil penelitian menunjukkan nilai f_0 berada pada rentang 1,07–2,70 Hz yang didominasi pada bagian tengah wilayah dengan orientasi barat laut–tenggara (Gadingharjo, sebagian Gading Sari, sebagian besar Murtigading, dan tengah Srigading). Hal ini mengindikasikan keberadaan lapisan sedimen lunak dan tebal. Nilai A_0 berkisar 1,24–4,96 dengan zona amplifikasi tinggi berada di utara Gading Sari dan Murtigading serta selatan dan barat daya wilayah penelitian yang menunjukkan tingginya kontras impedansi. Nilai K_g berkisar antara 0,88–18,66 dengan zona kerentanan tertinggi di Murtigading, sebagian Srigading, dan barat daya Gading Sari.

Analisis resonansi menunjukkan adanya pergeseran zona risiko dari pesisir pantai dan hilir Sungai Opak menuju utara dan timur wilayah penelitian seiring dengan pertambahan klasifikasi ketinggian bangunan. Hasil penelitian ini diharapkan dapat menjadi dasar dalam mitigasi gempa bumi, perencanaan tata ruang, dan pengembangan konstruksi bangunan bertingkat di wilayah rawan gempa.

Kata kunci: HVSR, indeks kerentanan seismik, mikrotremor, resonansi bangunan

ABSTRACT

ANALYSIS OF SEISMIC VULNERABILITY INDEX AND BUILDING RESONANCE RISK BASED ON MICROTREMOR DATA USING THE HVSR METHOD IN SANDEN SUBDISTRICT, BANTUL REGENCY, SPECIAL REGION OF YOGYAKARTA

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Sanden Subdistrict, Bantul Regency is a coastal area in the Yogyakarta Basin composed of thick sedimentary deposits and located in an earthquake-prone zone, thereby potentially increasing the risk of building damage due to resonance. This study aims to analyze the soil dynamic characteristics, seismic vulnerability index, and the potential risk of multi-story building resonance using microtremor data with the Horizontal-to-Vertical Spectral Ratio (HVSR) method.

The research data consists of 43 microtremor measurement points processed using the *hvsrpy* library within the Python ecosystem. The curve quality was evaluated based on reliability and clear peak tests referring to the SESAME (2004) standards. The analyzed parameters include dominant frequency (f_0), amplification factor (A_0), and seismic vulnerability index (K_g). The resonance potential was analyzed by extracting the amplification values of the HVSR curve at the natural frequencies of 1 to 10-story buildings based on the SNI 1726:2019 empirical equation.

The results showed that the f_0 values range from 1.07 to 2.70 Hz, which dominate the central part of the area with a northwest-southeast orientation (Gadingharjo, parts of Gadingsari, most of Murtigading, and central Srigading). This indicates the presence of a thick and soft sedimentary layer. The A_0 values range from 1.24 to 4.96, with high amplification zones located in the north of Gadingsari and Murtigading, as well as the south and southwest of the study area, indicating a high impedance contrast. The K_g values range from 0.88 to 18.66, with the highest vulnerability zones in Murtigading, parts of Srigading, and the southwest of Gadingsari.

The resonance analysis indicates a shift in the risk zone from the coast and downstream of the Opak River towards the north and east of the study area along with the increase in the building height classification. The results of this study are expected to serve as a basis for earthquake mitigation, spatial planning, and the development of multi-story building construction in earthquake-prone areas.

Keywords: HVSR, seismic vulnerability index, microtremor, building resonance