

Consideration of General Waveform creation method for Road Simulator Durability Test

- Comparison and Investigation of Time History Waveforms Derived from Road Surface PSD and Measured Time History Waveforms -

**Takayuki Nakamura¹⁾ Kouki Satou²⁾ Kohei Mino³⁾ Yusuke Suzuki⁴⁾ Atsuhito Nakamura⁵⁾
Ryo Okabe⁶⁾ Syuzo Hirayama⁷⁾ Kosei Fukatsu⁸⁾ Yusuke Kasai⁸⁾ Hisami Oishi⁸⁾**

1) Toyota Motor Corporation 1, Toyota-cho, Toyota, Aichi 471-8572, Japan 2) SUBARU Corporation 1-1, Subaru-cho, Ota, Gunma 373-8555, Japan 3) Honda R&D Co., Ltd. 4630, Shimotakanezawa, Haga-machi, Haga-gun, Tochigi 321-3393, Japan 4) Daihatsu Motor Co., Ltd. 2-1-1, Momozono, Ikeda-city, Osaka 563-8651, Japan 5) Mitsubishi Fuso Truck&Bus Corp. 4300, Washijuku, Sakura, Tochigi 329-1411, Japan 6) Mitsubishi Motors Corporation 1, Nakashinkiri, Hashime-cho, Okazaki Aichi, 444-8501, Japan 7) MTS Japan Ltd. ArcaCentral Bldg.8F 1-2-1, Kinshi, Sumida-ku, Tokyo 130-0013, Japan 8) Kogakuin University 1-24-2, Nishi-shinjuku, Shinjuku, Tokyo 163-8677, Japan

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We examined the applicability of generating time-history waveforms from road surface power spectral density (PSD) derived from field driving data, as part of the activities of a working group on road input standardization. An improved method to reduce the influence of driving operation inputs was applied to calculate road surface PSDs for selected road categories, and the calculated PSDs were used as input data for waveform generation (Fig. 1). The displacement time-history waveforms were generated as stationary Gaussian random processes by randomizing spectral phases, without directly reversing the PSD calculation procedure.

The generated displacement waveforms were evaluated through frequency-domain and time-domain analyses, focusing on amplitude-frequency characteristics and cumulative damage. Level crossing analysis was applied to obtain amplitude-frequency distributions, and cumulative damage was calculated using the fourth-power S-N rule combined with the modified Miner's rule. For comparison, the same evaluation procedures were applied to displacement time histories derived from measured field driving data.

The comparison results were analyzed in terms of road surface characteristics. Under road conditions with relatively high input levels and amplitude distributions close to Gaussian characteristics, the cumulative damage calculated from the generated waveforms showed reasonable agreement with that obtained from measured data (Fig. 2). In contrast, for road conditions where non-Gaussian and non-stationary characteristics, such as dominant impulsive inputs, were observed in the measured data, discrepancies between generated and measured results became evident; the applicability and limitations of the waveform generation approach were summarized, and issues related to alternative methods such as group delay processing were studied as subjects for future investigation.

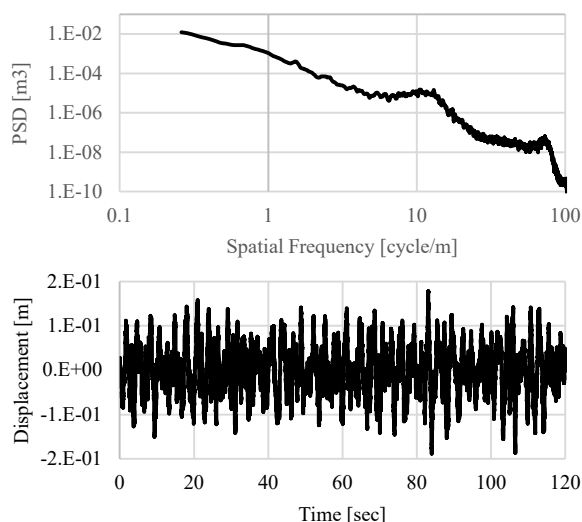


Fig. 1 Road surface PSD of rough road route 1 and calculated displacement time history based on the PSD

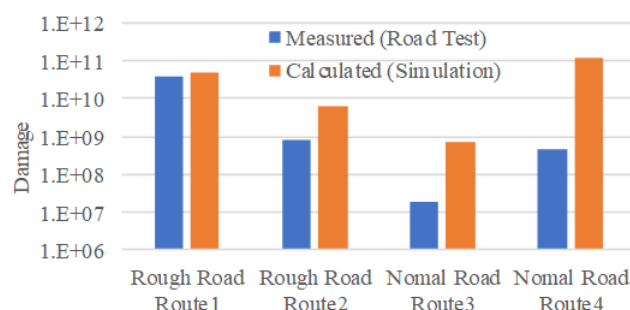


Fig. 2 Comparison of displacement damage between measured data and calculated time history