ABSTRACT

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The use of network survey vehicles (NSVs) has accelerated in recent years for the functional evaluation of highway assets. However, due to the lack of standardization in the condition monitoring process, there is inherent variability in documented data over space and time, due to the usage of multiple equipment, varying segment lengths, etc. This study aims to assess the data consistency of international roughness index (IRI) values across different NSV operators. In order to evaluate the reproducibility and repeatability of these devices, fifteen runs were conducted using three NSVs along a 6 km section of National Highway 44 (NH44).

The repeatability of NSV devices was evaluated using the coefficient of variation (CV) associated with the IRI estimates for different segment lengths and the number of NSV runs being averaged to determine segment IRI. The results indicate that CV reduces as the number of runs and the segment length under consideration increases. Consequently, there was a trade-off observed between segment length and number of runs clearly identified which can help practitioners to make decision in order to achieve a specific repeatable limit. Pairwise assessment was also conducted using metrics such as root mean square error (RMSE), mean absolute deviation (MAD), and modified mean absolute percentage error (M-MAPE) to compare data consistency between devices.

It was found that as the segment length increases, the error in the pairwise assessment reduces across all pairwise comparisons. Key findings reveal that high roughness sections and structural joints increase standard deviation across runs. Marked segments showed higher repeatability, while driving behavior and different pre-processing and post-processing techniques also contributed to variability.

The results across NSV devices suggest differences in sensitivity to observe pavement surface characteristics and measurement errors. The run-to-run variability is also observed to be a function of the average IRI of the segment. Finally, some exploratory analysis to uncover the sources of variation is performed. These insights highlight the need for managing data variability to enhance the reliability of pavement maintenance and management strategies.