



Roughness can have a detrimental effect on the pavement's serviceability, therefore it is important that it be prevented or minimized. Runway roughness is often the first step in a vicious cycle that can lead to the premature failure of a pavement. As aircraft respond to roughness, these responses increase the pavement loading which, in turn, creates more roughness. This cycle can shorten the pavement's useful life.

Pavements often start out smooth, however, over time and after thousands of operations, a pavement profile can change and begin to develop areas of roughness. Profile shape changes due to settlement or other dynamics influencing the pavement's profile can create areas of roughness. Therefore, it is important to monitor a runway's profile throughout its service life.

Runway roughness can come in many forms; ranging from short wavelength events, multiple events in succession to long wavelength events.

There are two necessary components to identify runway roughness; **profile measurement** and **data analysis**.

1 | **Profile Measurement** - the profiling device must accurately capture the wavelength and amplitude of the roughness event and must also accurately locate the event along the runway's length. Common profiler types currently available are:

External Reference Device
Provides True MSL Profile Data



Inclinometer
Provides True MSL Profile Data

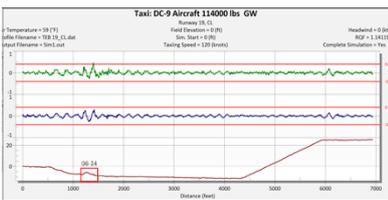


Inertial Profiler
Does Not Provide True MSL Profile Data

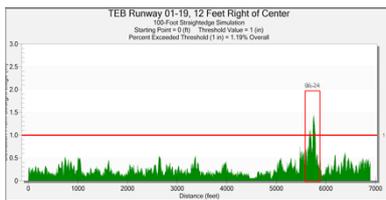


2 | **Data Analysis** - Because interpreting roughness can be subjective, the analysis of the profile data must use criteria to determine what is too rough and what is acceptable. This analysis must also be capable of evaluating *all* roughness types regardless of wavelength or amplitude. Current methods of analysis are:

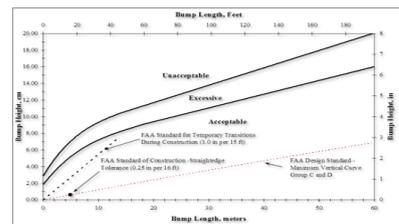
Aircraft Simulation
Predicts Aircraft Response to Measured Profile Data



Simulated Straightedge
Variable Length Straightedge and Allowable Deviation Threshold



Boeing Bump Index
Single Event Analysis Only



Summary - Runway roughness can be a difficult but an important problem to diagnose. Roughness can shorten a pavement's useful life due to the increased loading environment and increase the operational and support costs for the aircraft itself.

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