



Process Capability, Tolerance, and Reliability

Fred Schenkelberg

A photograph of a rustic wooden suspension bridge spanning a small stream in a dense forest. The bridge is constructed from weathered wooden planks and beams, with a simple railing. Sunlight filters through the trees, casting long, dark shadows of the bridge's structure onto the wooden deck. The background is filled with lush green foliage.

Part Variation



Stress Variation

A photograph of the Golden Gate Bridge in San Francisco, California, taken during sunset or sunrise. The bridge's iconic orange-red towers and suspension cables are silhouetted against a sky with soft, warm clouds. The water of the San Francisco Bay is visible in the foreground, reflecting the ambient light. The overall mood is serene and majestic.

Stress/Strength

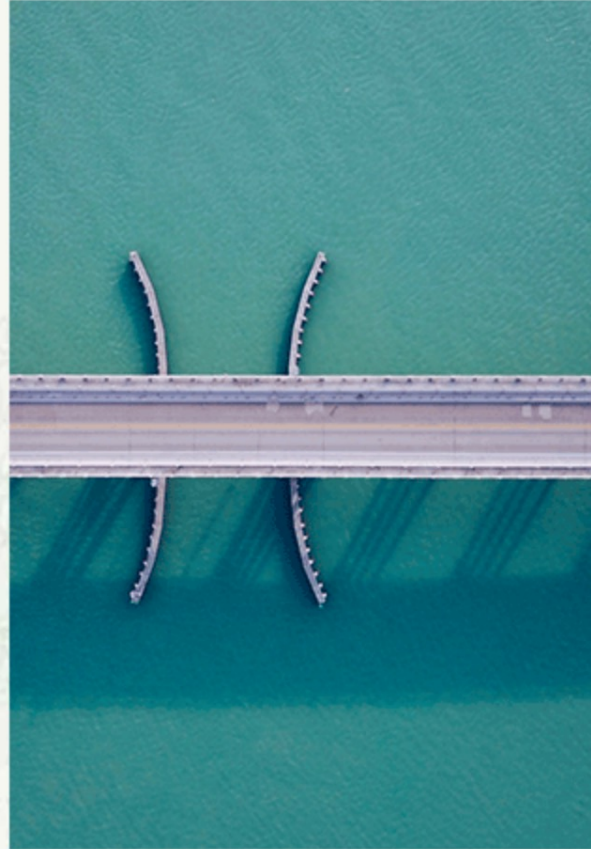
Everything varies

Sometimes it matters

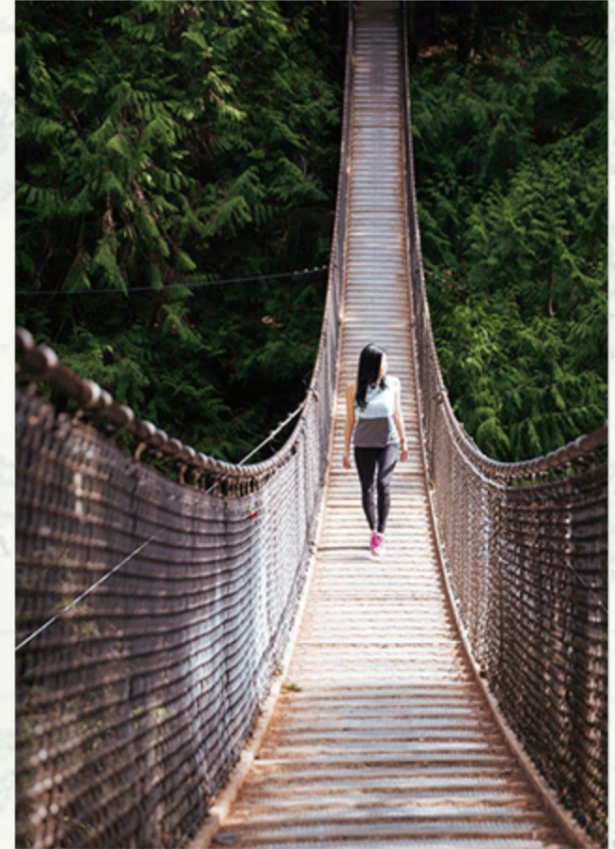
Concept Overview



Process



Tolerance



Reliability

Process Capability

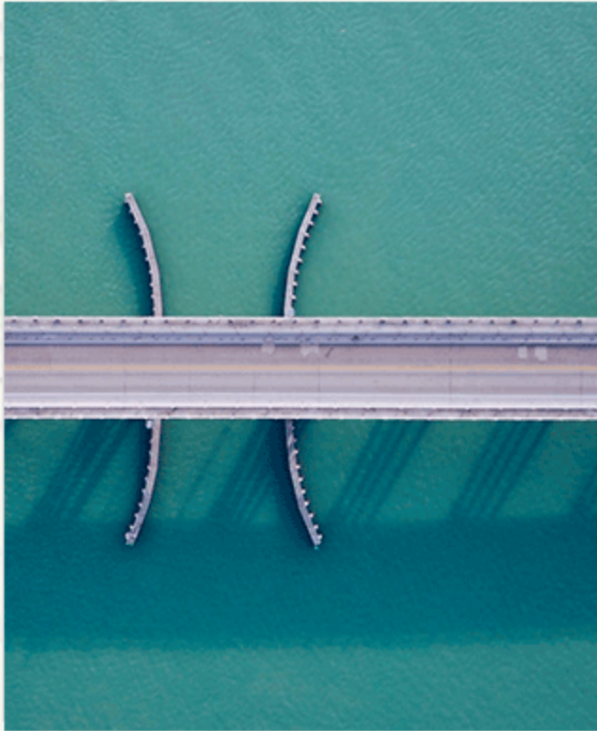


This is how well the variation fits within the tolerance

A stable process (use SPC)

$$C_{pk} = \min \left[\frac{USL - \hat{\mu}}{3\hat{\sigma}}, \frac{\hat{\mu} - LSL}{3\hat{\sigma}} \right]$$

Tolerance



Allowable variation
to meet design intent

Is this just wishful
thinking?

Reliability



A lot of variables at play here

The probability of successful function over specified duration and within specified environment.

How can

tolerancing
go wrong?

Focus on Variation



Measure



Manage



Monitor

A historical map of Asia and Oceania, showing various regions like Siberia, China, and New Holland. The word 'Meaure' is overlaid in orange.

Meaure



A historical map of the world, showing continents and oceans in a classic, aged style. The word "Manage" is overlaid in a large, orange, serif font, centered on the map. The map includes labels for "NORTH AMERICA", "SOUTH AMERICA", "AFRICA", "ASIA", "EUROPE", "INDIA", "AUSTRALIA", "ANTARCTICA", "NORTH OCEAN", "SOUTH OCEAN", "INDIAN OCEAN", "PACIFIC OCEAN", "ATLANTIC OCEAN", "MEDITERRANEAN SEA", "RED SEA", "ARABIAN SEA", "BENGEAL SEA", "CHINA SEA", "JAPAN SEA", "KORAIAN SEA", "YAMATO SEA", "KAMOMOTO SEA", "KURILE ISLANDS", "JAPANESE ISLANDS", "FORMOSA", "TAIWAN", "HONG KONG", "MACAU", "HAINAN", "SINGAPORE", "MALACCA", "CEYLON", "SRI LANKA", "INDONESIA", "MALAYSIA", "PHILIPPINES", "VIETNAM", "LAOS", "BURMA", "CAMBODIA", "THAILAND", "SIAM", "BURMA", "INDIA", "AFRICA", "EUROPE", "ASIA", "OCEAN".

Manage



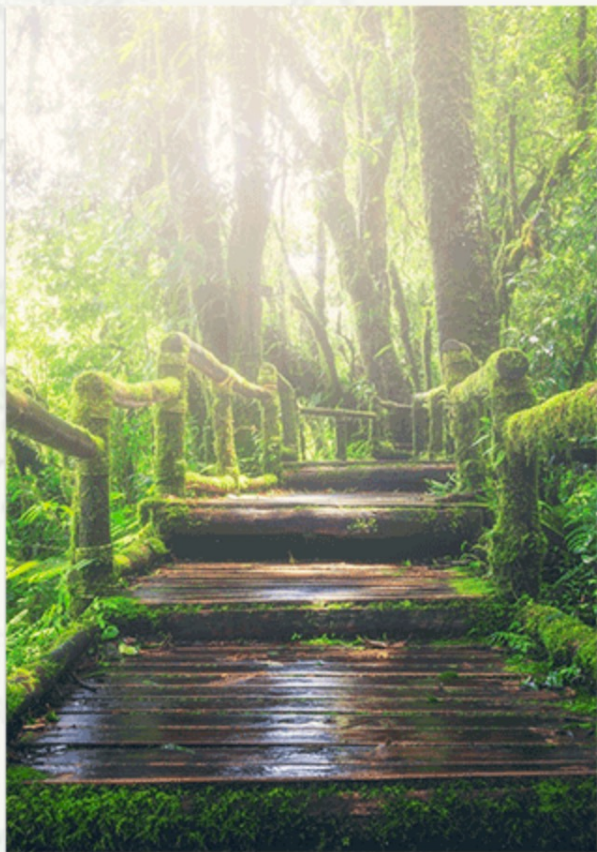


Monitor



How important is
the measurement
system?

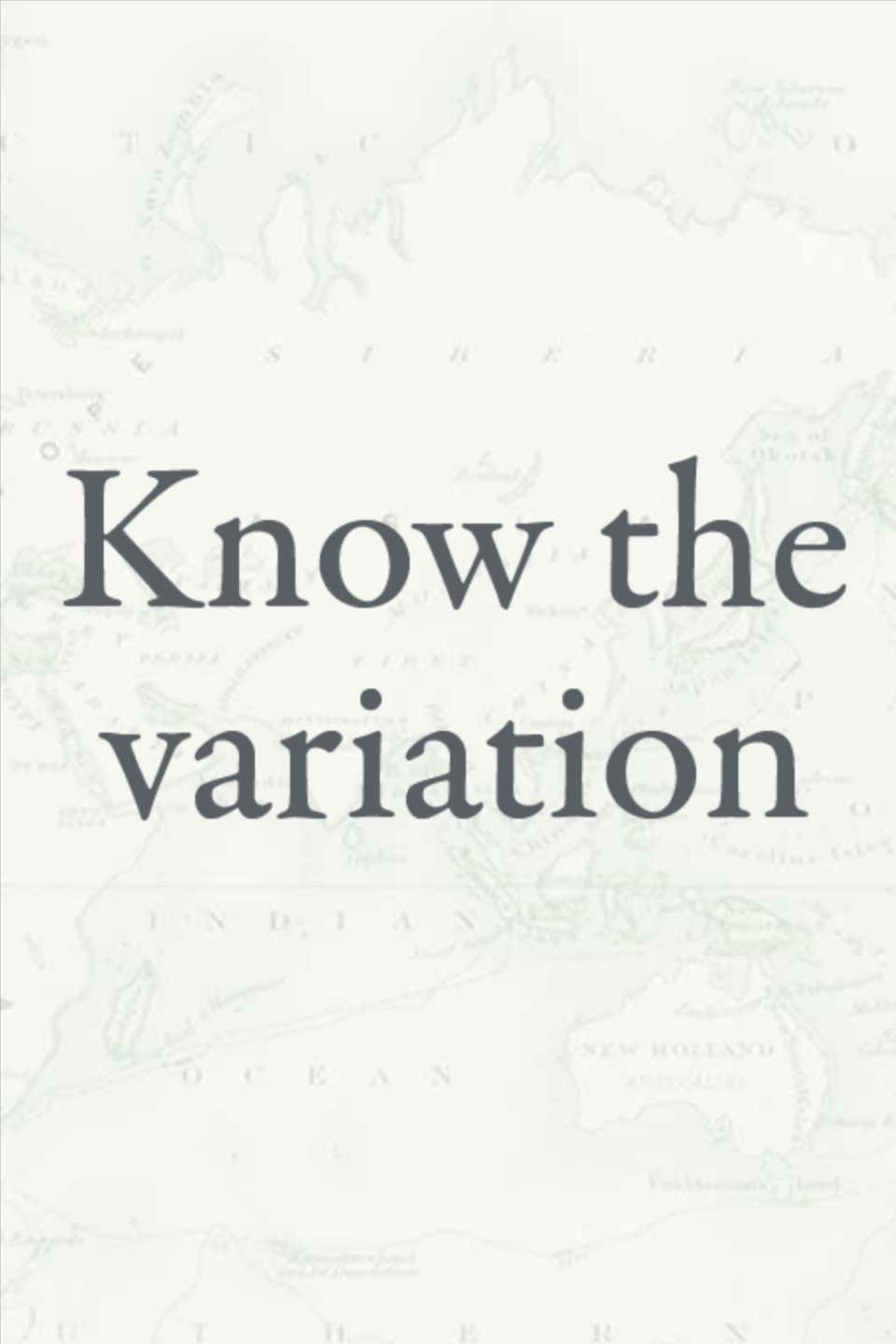
Tolerance & Reliability



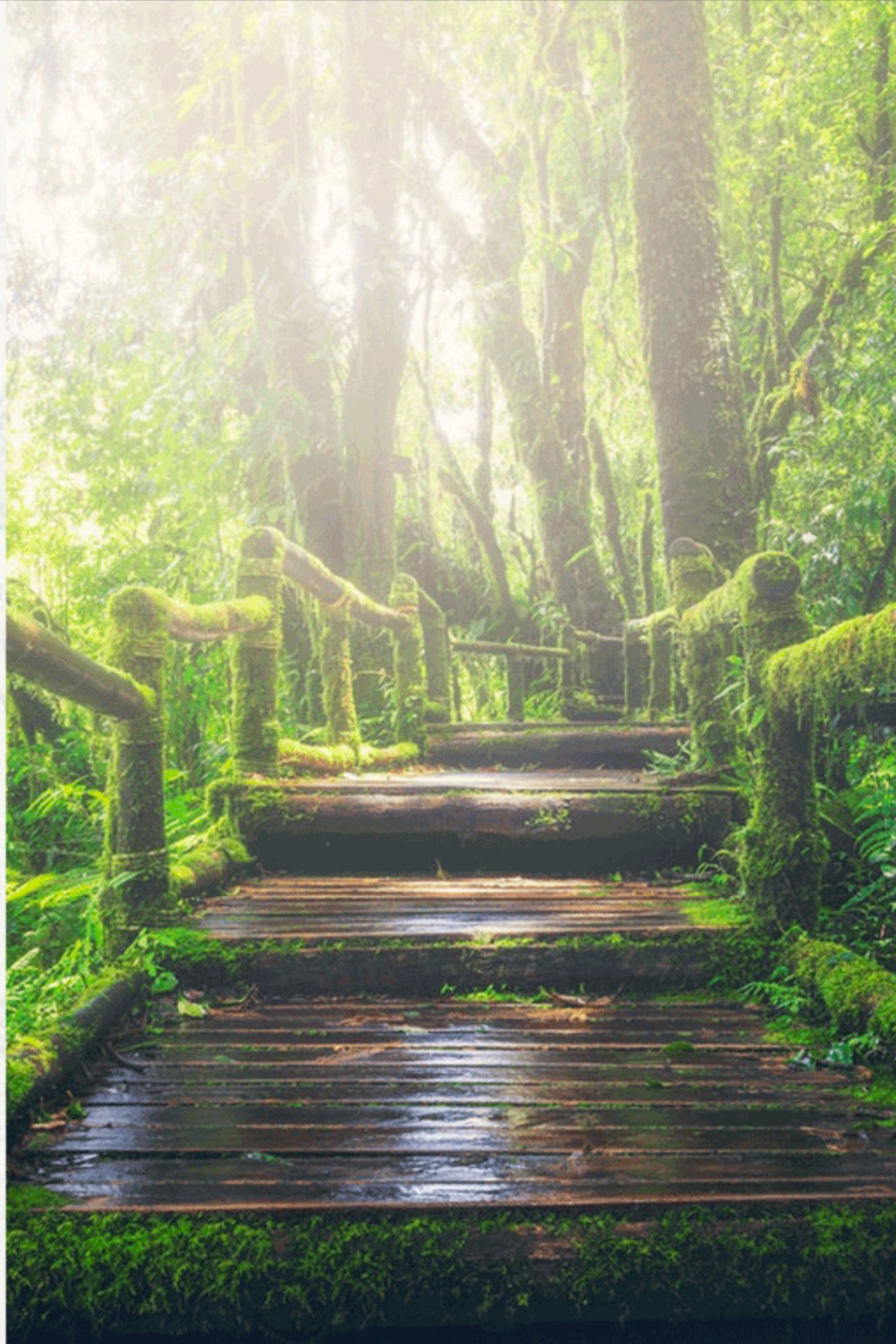
Variation

Tolerance

Reliability



Know the
variation



Set
informed
tolerances





In Summary

Sometimes the right approach



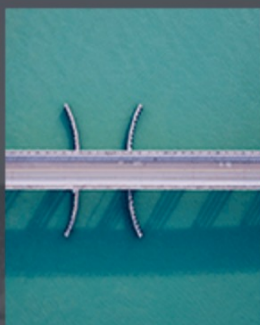
Design to be effective



Mind the collateral damage



All screens should end promptly



More Information

Visit [AccendoReliability.com](https://www.AccendoReliability.com)

Let me know if you have any questions.

Check out the reliability engineering podcast network at [Reliability.FM](https://www.Reliability.FM)

Go out and question then plan to end any currently running stress screens.