



Interpreting Standard Testing Results

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What will fail?





When will it fail?

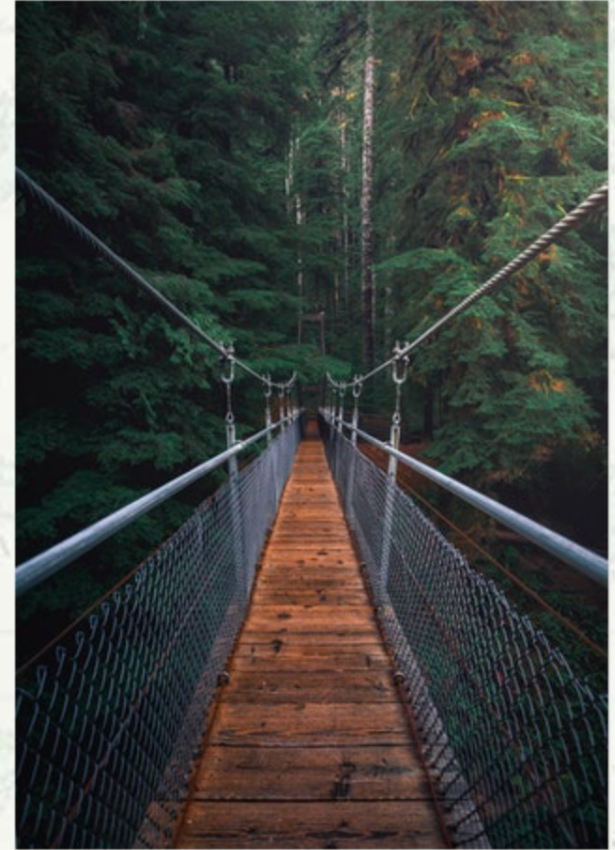
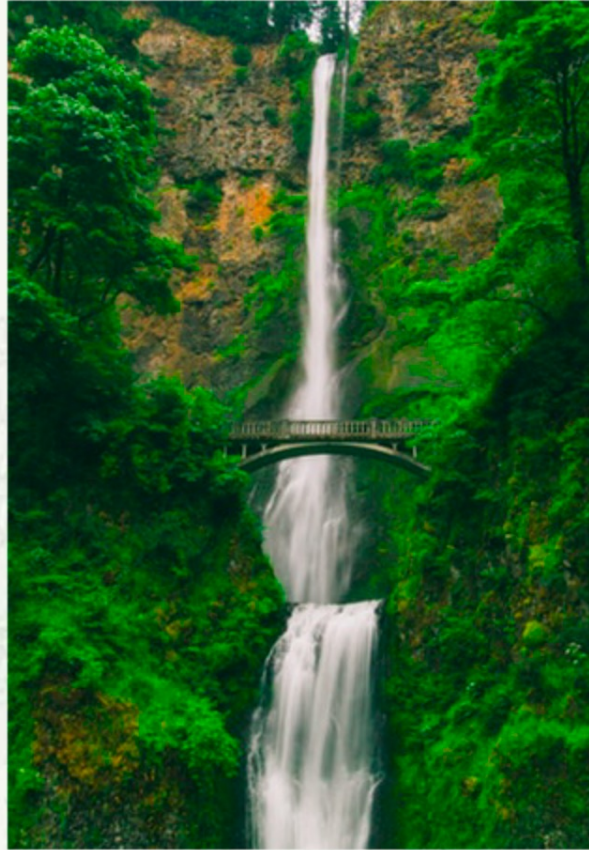
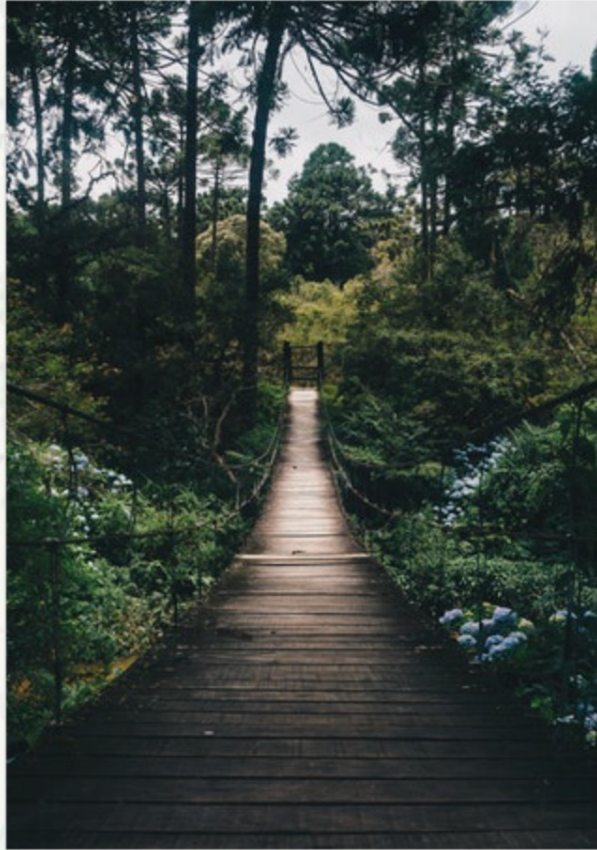
A wide-angle photograph of a long, multi-span bridge crossing a large body of water. The bridge features a series of concrete piers and steel truss structures. The sky is filled with soft, white clouds, and the water reflects the bridge and the sky. The overall scene is serene and expansive.

What is the
evidence?

What do you want to
know from

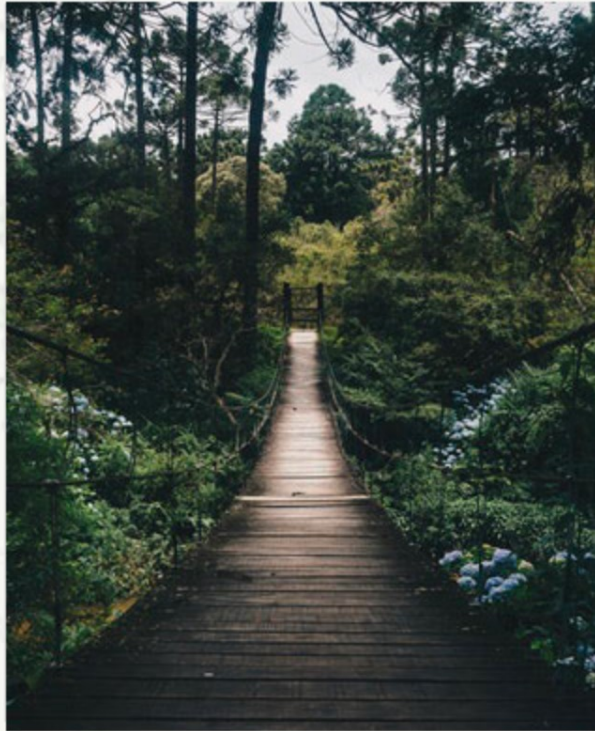
your reliability
testing?

Let's do some testing



Prototypes Environmental Life

Prototype Testing



This is all about failure mechanisms

What are testing for? What are we trying to learn?

Functional
Stability
Environmental
Safety
Reliability
Usability

what else?

Environmental Testing



How many environmental factors do you consider?

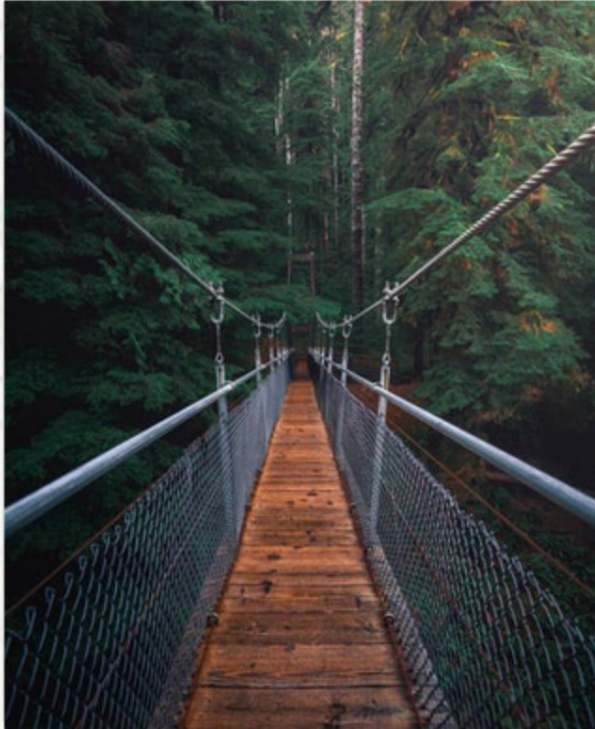
What is the purpose of environmental testing?

What are the risks with such testing?

Is environmental testing a form of reliability testing?

A listed limitation of Mil Std 810 includes: the test methods do not apply to reliability testing.

Life Testing



Life of what?

Do we really know what stress to apply?

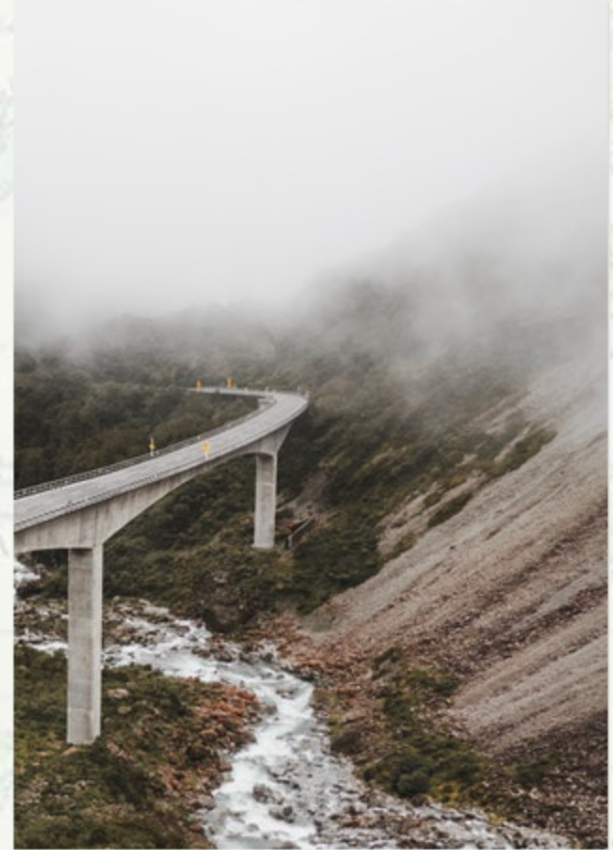
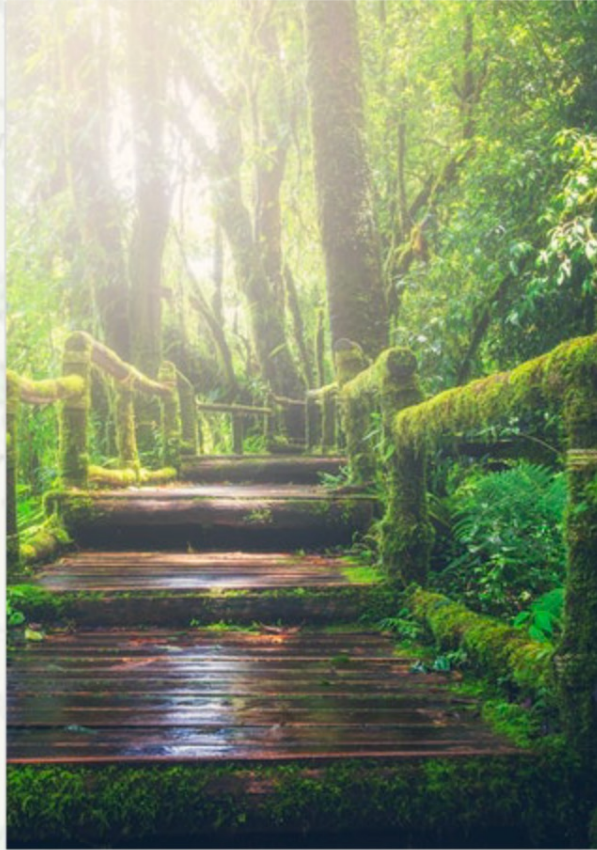
Can we interpret the test results?

How well do we know the use conditions?

How well do you know the failure mechanisms and which to evaluate?

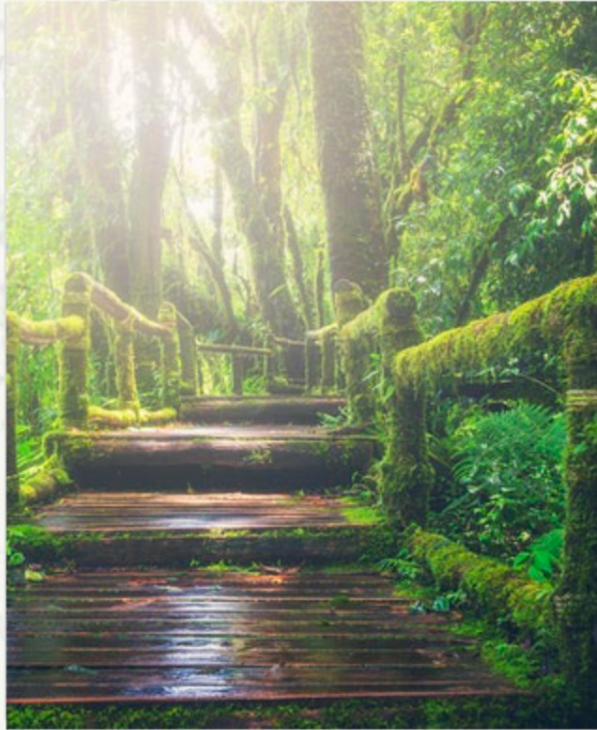
What does each test
accomplish?

Testing Conditions



Normal Use Fixed Profile Accelerated

Normal Use Conditions



Do we have time for this?

Which set of stresses is normal? worst case? and how do you know?

Example: how many times do you drop your phone a year?

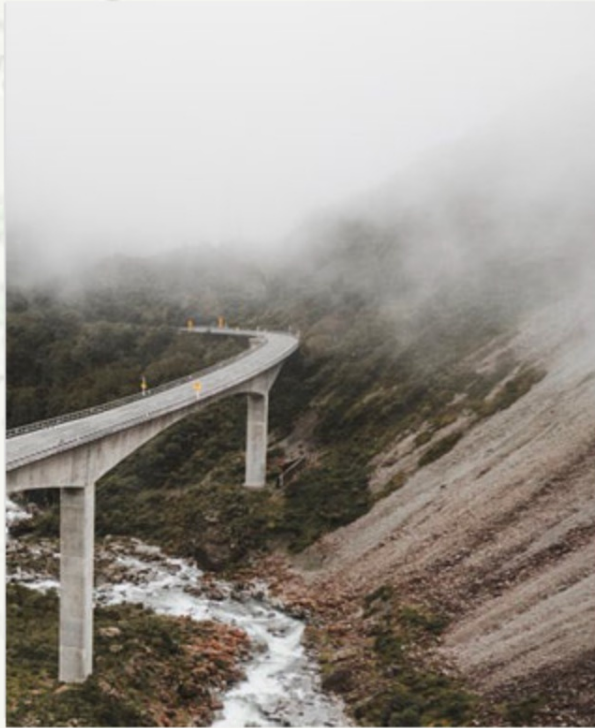
Fixed Profile Conditions



How did this profile come into existence?

Is there any meaning behind:
85%RH & 85°C for 1,000 hours?
0°C to 100°C thermal cycling?
when use -40°C to 125°C ?

Accelerated Conditions



What do we give up when cheating time?

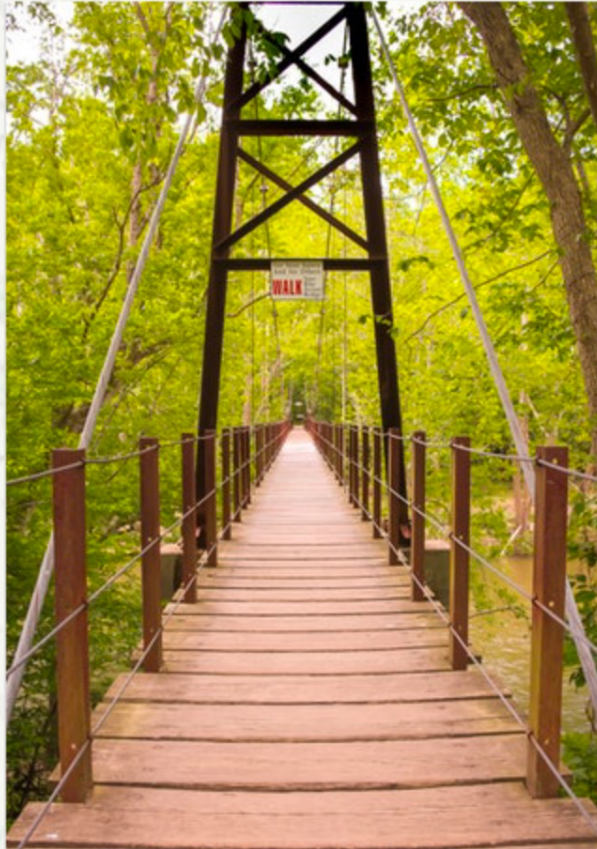
It is very difficult to meaningfully accelerate multiple failure mechanisms?

Do you have a model to interpret accelerated to use conditions?

How can we
translate

this information?

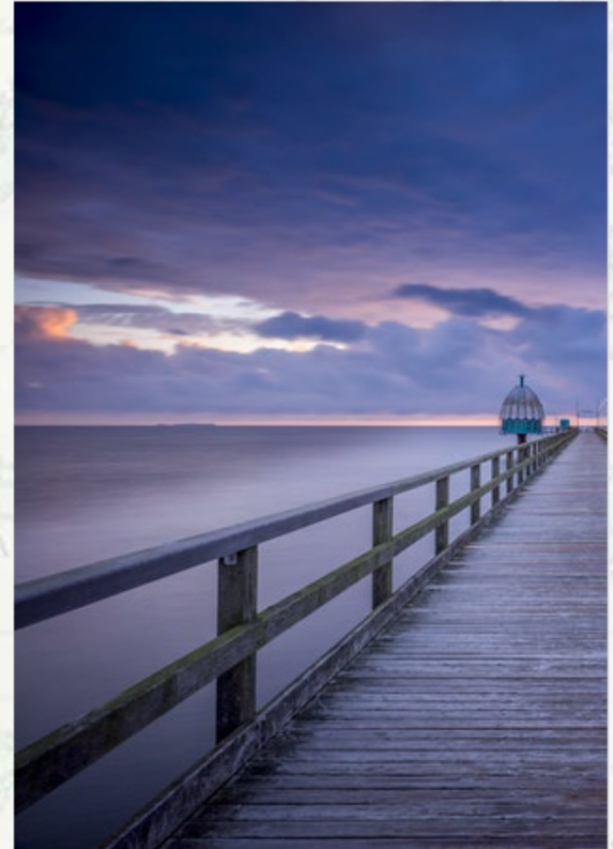
Variability



Conditions

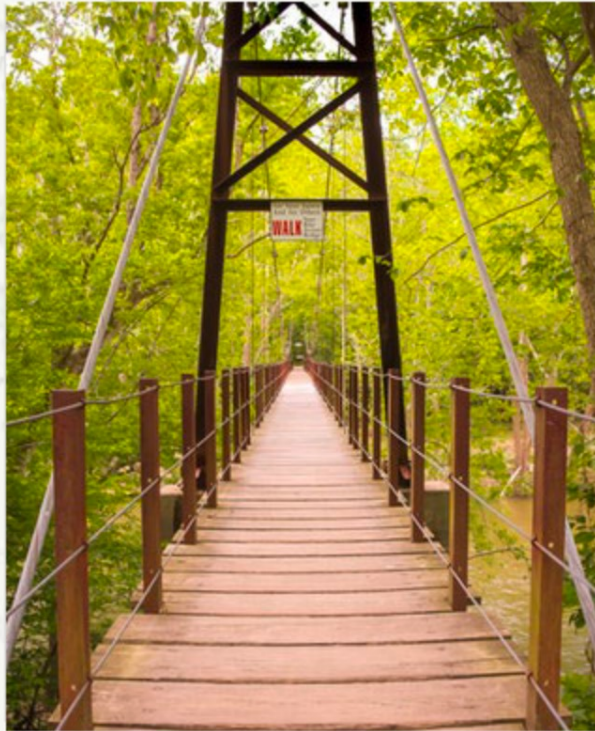


Use



Statistics

Variability of Conditions



Even climate conditions change

How much force do you exert on a button? handle? bottle? lever? etc.

Is the ambient temperature the only one of concern?

testing
shipping
storage
installation
use

Variability of Use Stresses



if only customers would
apply only one stress at a
time

Mil-Std 810

Altitude, Temperature (low, high, shock)
Fluids, Sunshine, Rain, Humidity, Fungus
Salt Fog, Sand and Dust, Immersion
Explosive Atmosphere, Acceleration
Vibration, Acoustic Noise, Shock
Pyroshock, Acidic Atmosphere
Gunfire Vibration, Ballistic Shock
Temperature-Humidity-Vibration-Altitude
Icing/Freezing Rain
Vibro-Acoustic/Temperature

Variability & Statistics



Does every unit produced
respond to stress the same
way?

What does passing a test mean?

3 samples

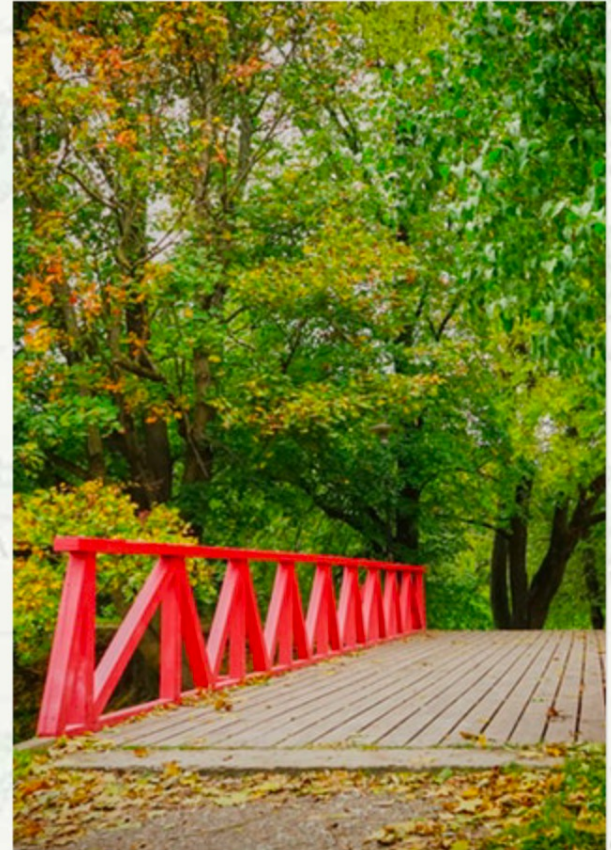
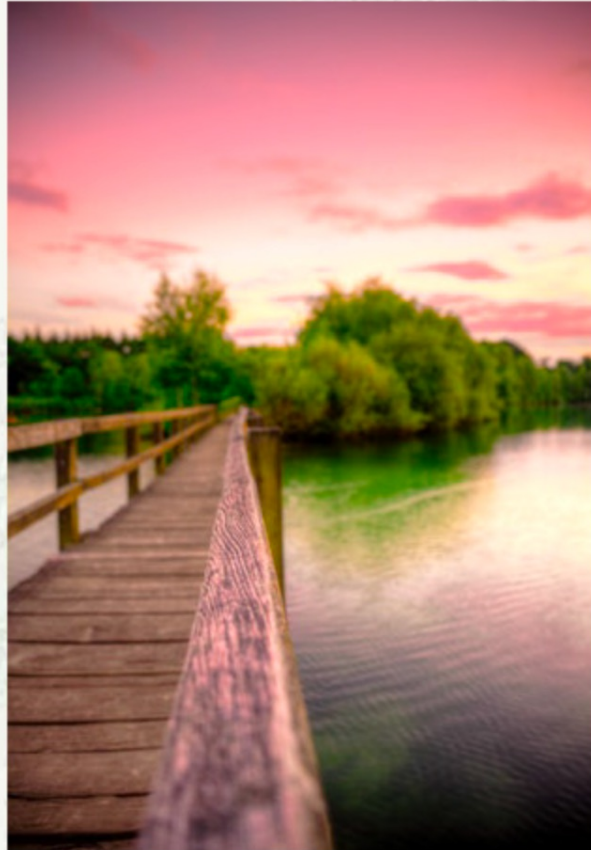
22 samples

77 samples

How do you
establish

sample sizes?

An Example



Data sheet

Temp Cycle

High Temp

Table 2 – Performance & Reliability: Test Methods and Conditions (Commercial Only)

Stress	Reference	Test or Inspection Method
Terminal Strength	JIS-C-6429	Appendix 1, Note: force of 1.8 kg for 60 seconds
Board Flex	JIS-C-6429	Appendix 2, Note: 3.0 mm (minimum)
Solderability	J-STD-002	Magnification 50X. Conditions:
		a) Method B, 4 hours at 155°C, dry heat at 235°C
		b) Method B at 215°C, category 3
		c) Method D at 260°C, category 3
Temperature Cycling	JESD22 Method JA-104	1,000 cycles (-55°C to +125°C), measurement at 24 hours ±4 hours after test conclusion
Biased Humidity	MIL-STD-202 Method 103	Load Humidity: 1,000 hours 85°C/85% RH and 200 VDC maximum. Add 100,000 Ω resistor. Measurement at 24 hours ±4 hours after test conclusion
		Low Volt Humidity: 1,000 hours 85°C/85% RH and 1.5 V. Add 100 K ohm resistor. Measurement at 24 hours ±4 hours after test conclusion.
High Temperature Life	MIL-STD-202 Method 108/EIA-198	1,000 hours at 150°C with 1.0 X rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0 VDC, for 1,000 hours.
Vibration	MIL-STD-202 Method 204	5 G for 20 minutes, 12 cycles each of 3 orientations. Note: use 8" X 5" PCB 0.031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10 – 2,000 Hz.
Mechanical Shock	MIL-STD-202 Method 213	Figure 1 of Method 213, condition F.
Resistance to Solvents	MIL-STD-202 Method 215	Add aqueous wash chemical, OKEM Clean or equivalent.

Impressive List(?)



Do you do something like this?

Which are environmental or reliability?

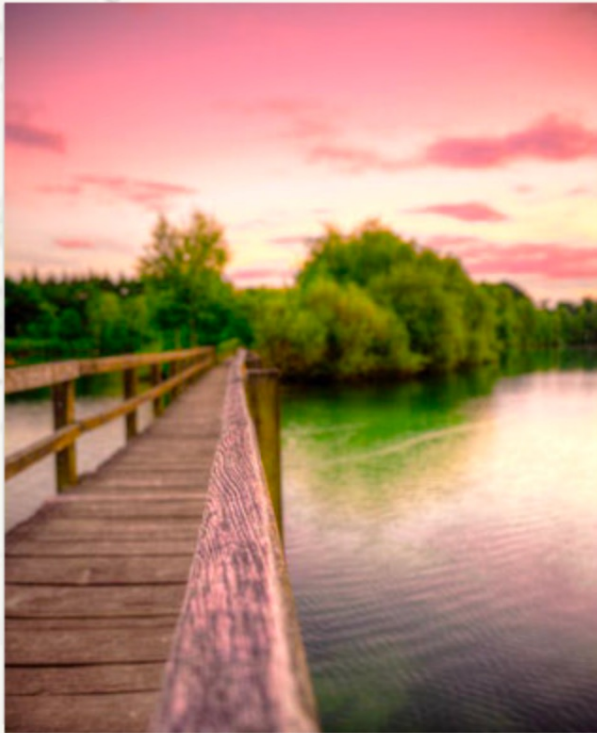
How many samples? number of lots?

What is really at risk with this component?

Can we answer simple questions, like:

- will this work with our expected use?
- will this work long enough?

Temperature Cycling



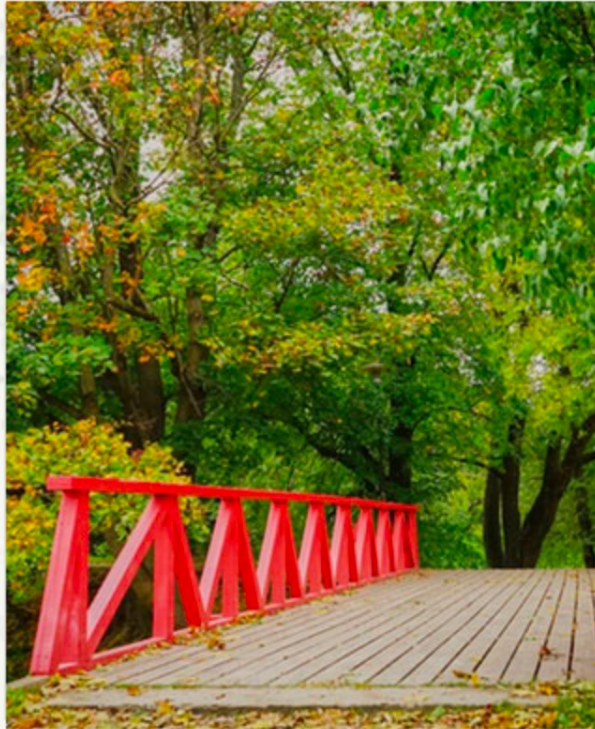
JESD22 Method JA-104

Under Scope

This test is conducted to determine the ability of components and solder interconnects to withstand mechanical stresses induced by alternating high- and low-temperature extremes. Permanent changes in electrical and/or physical characteristics can result from these mechanical stresses.

25 samples from JESD47 zero failures

High Temperature Life



Nice method - of what use?

Under Purpose of Test Method:

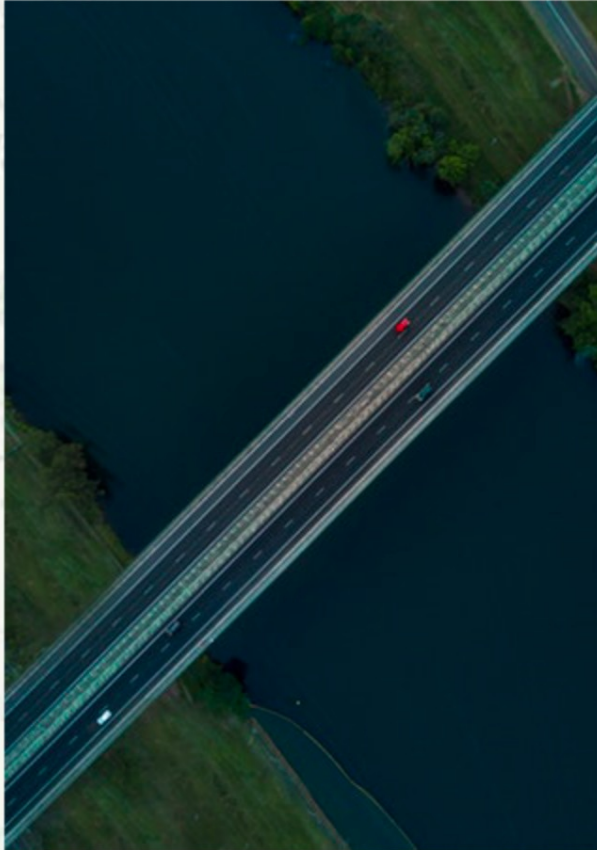
This test is conducted for the purpose of determining the effects on electrical and mechanical characteristics of a part, resulting from exposure of the part to an elevated ambient temperature for a specified length of time, while the part is performing its operational function.

Sample size not specified.

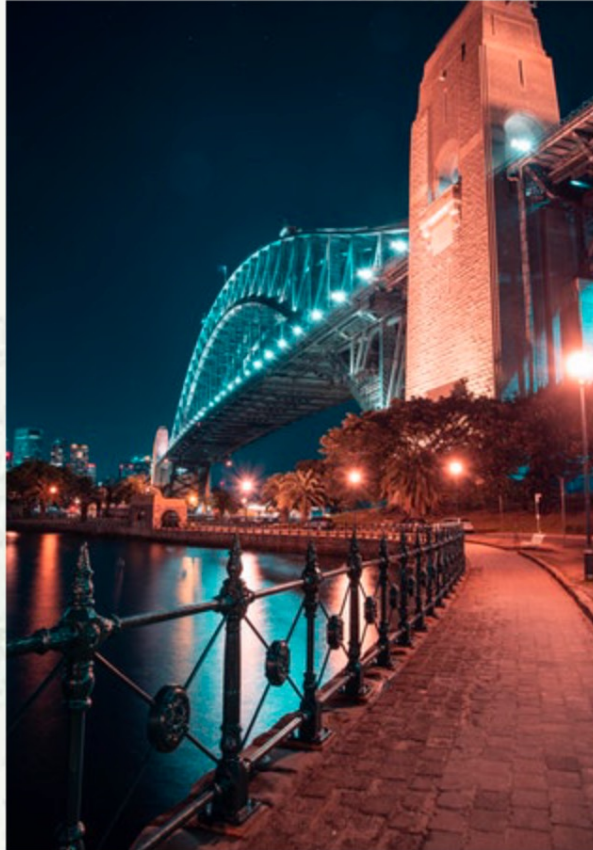
What conclusions

can we draw?

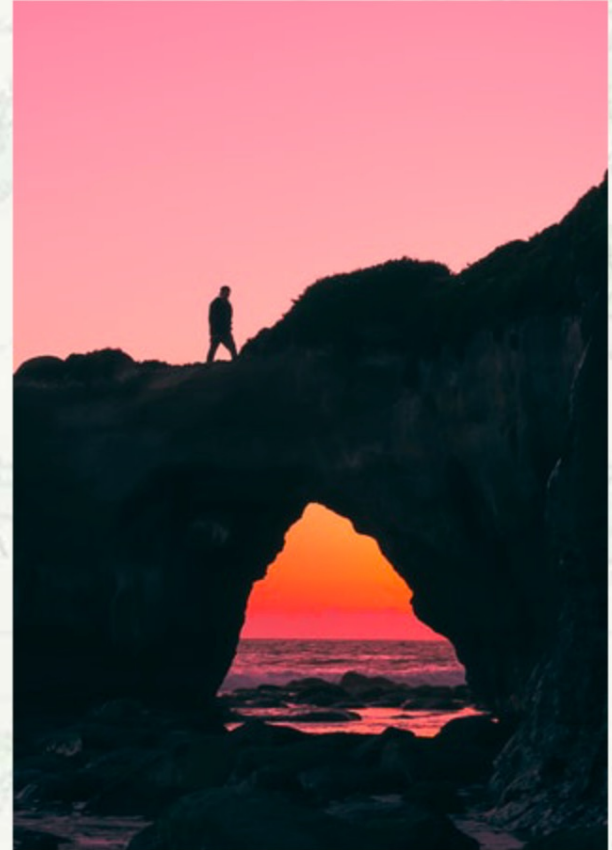
Three Questions



What

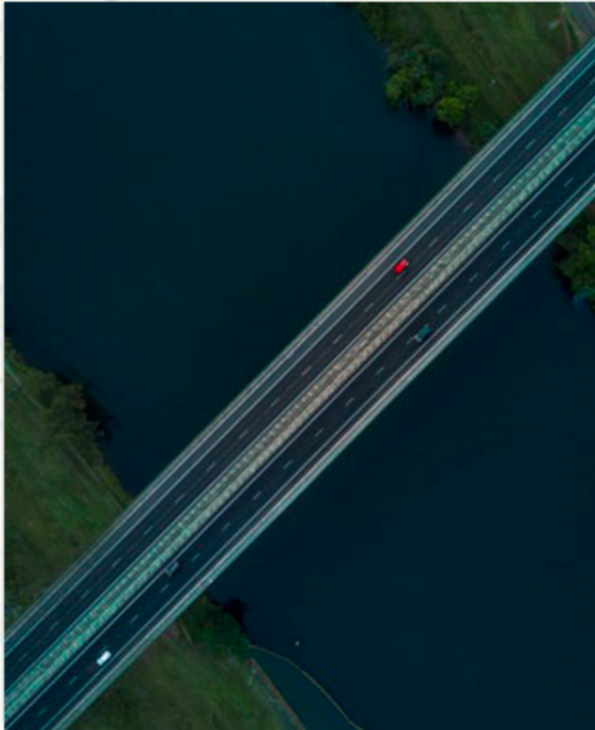


When



Data

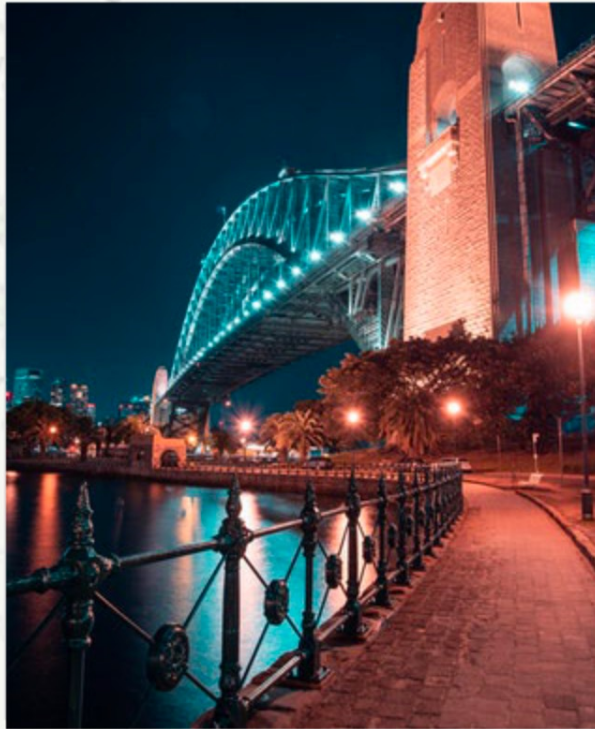
What will fail?



Be specific!

What specific failure mechanism(s)?

When will it fail?



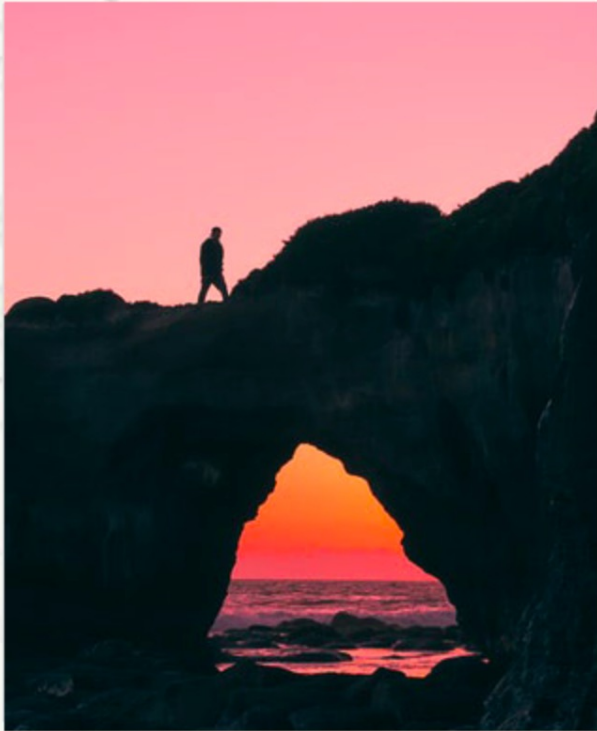
We're talking time to failure distribution here.

On average is not useful
nor is all samples passed

When should we expect the 1st failure or
1st percentile to fail?

Bonus points is early life and wear out
elements described.

Supporting Data?



Show me the data.

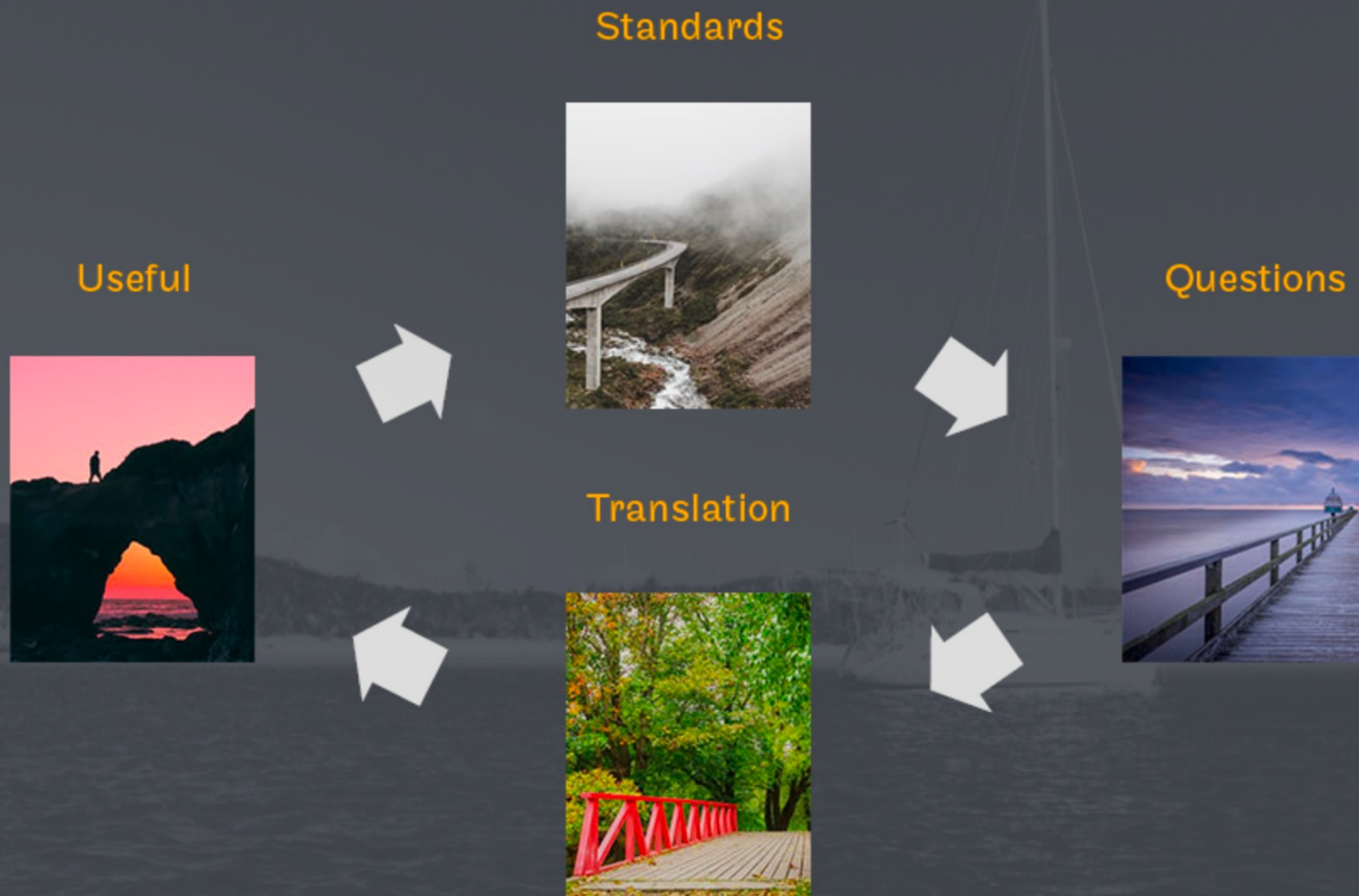
Details, details, details

Bonus is it included assumptions and how to best interpret.

What else can

we do?

In Summary



More Information

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