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Three Approaches to Accelerated Life Testing



When will this fail?



Will this last long enough?

We need
an
answer
soon...



Do you currently
do ALT?

The ALT Idea



Apply Stress

ALT Idea

Not just any stress

Within 'reasonable' range

Best when directly connected to failure mechanism of interest

Very difficult to do well with multiple failure mechanisms



Monitor for failure

ALT Idea

Please avoid pass/fail monitoring

Be specific on what to monitor

Be open to any anomaly

This requires a clear understanding of what is considered a failure



Interpret Results

ALT Idea

The data collected is just the start

Compare to objective/requirements

Make sure the results get to the
right people that need the
information

This implies there is an objective



What are we

assuming?

ALT Framework



Challenges

ALT Framework

samples, samples, samples

Lack of understanding of:

- ALT practices

- Variability & Statistics

- Risks of extrapolation



Constraints

ALT Framework

samples, samples, samples

funding

monitoring capability

facilities and test rigs/chambers

time



Assumptions

ALT Framework

Samples represent the population

The plan will excite the failure mechanism of interest

Any models or data fits are close enough to be useful

Failures occur independently in testing and in the field



What is the

‘best’ ALT?

Test to Pass



Features/Benefits

Test to Pass

Easy to plan and monitor

Often a minimum sample size

Easy to interpret and explain

May lead to shorter test time

Considered conservative



Assumptions

Test to Pass

The accelerated stress actually accelerates the failure mechanism of interest

The model for acceleration factor is true and accurate

The monitoring will catch failures if/when they occur



Risks

Test to Pass

The acceleration model is faulty

Other failure mechanisms occur

If there is a failure, there isn't enough data to get meaningful results

Wrong stress, wrong failure mechanisms, faulty monitoring

Faulty/misleading results



How much does

an ALT cost?

Test to Failure



Features/Benefits

Test to Failure

Can verify if stress is exciting failure mechanism of interest

You have hard evidence when failures occur

Time and sample efficient if underlying model is accurate

May only need one stress level



Assumptions

Test to Failure

Acceleration factor model is true and accurate (single stress case)

Monitoring catches failures as they occur

Other failure mechanisms do not mask the one's of interest

Accelerated stress creates same failures as experience in use



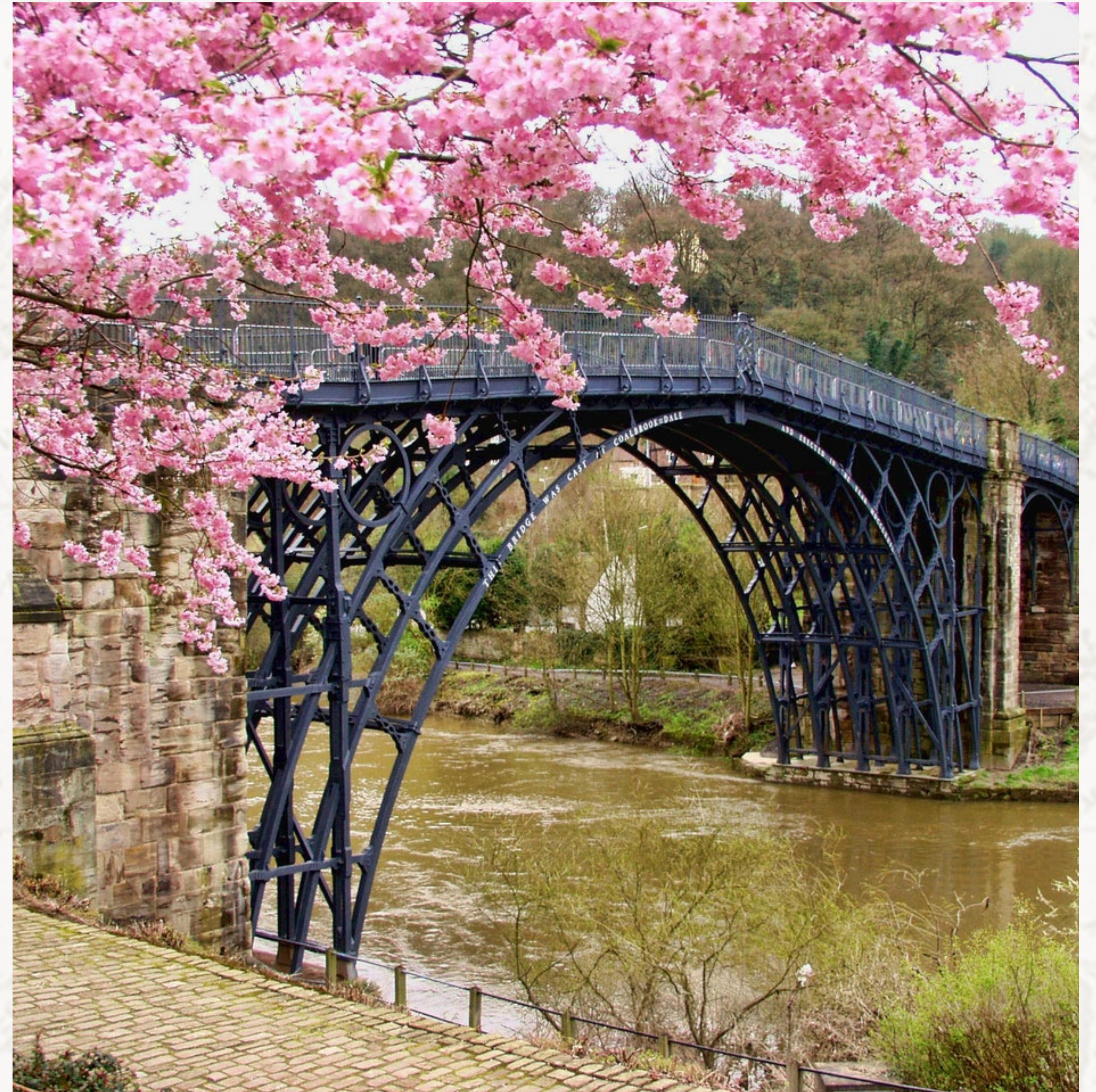
Risks

Test to Failure

Results end up being erroneous

Failures do not occur for extended time frame

Other mechanism dominate



What is the

value of an ALT?

Degradation Testing



Features/Benefits

Degradation Testing

Do not have to wait for failures

May be able to avoid use of censored data (all units 'fail')

Time and sample efficient



Assumptions

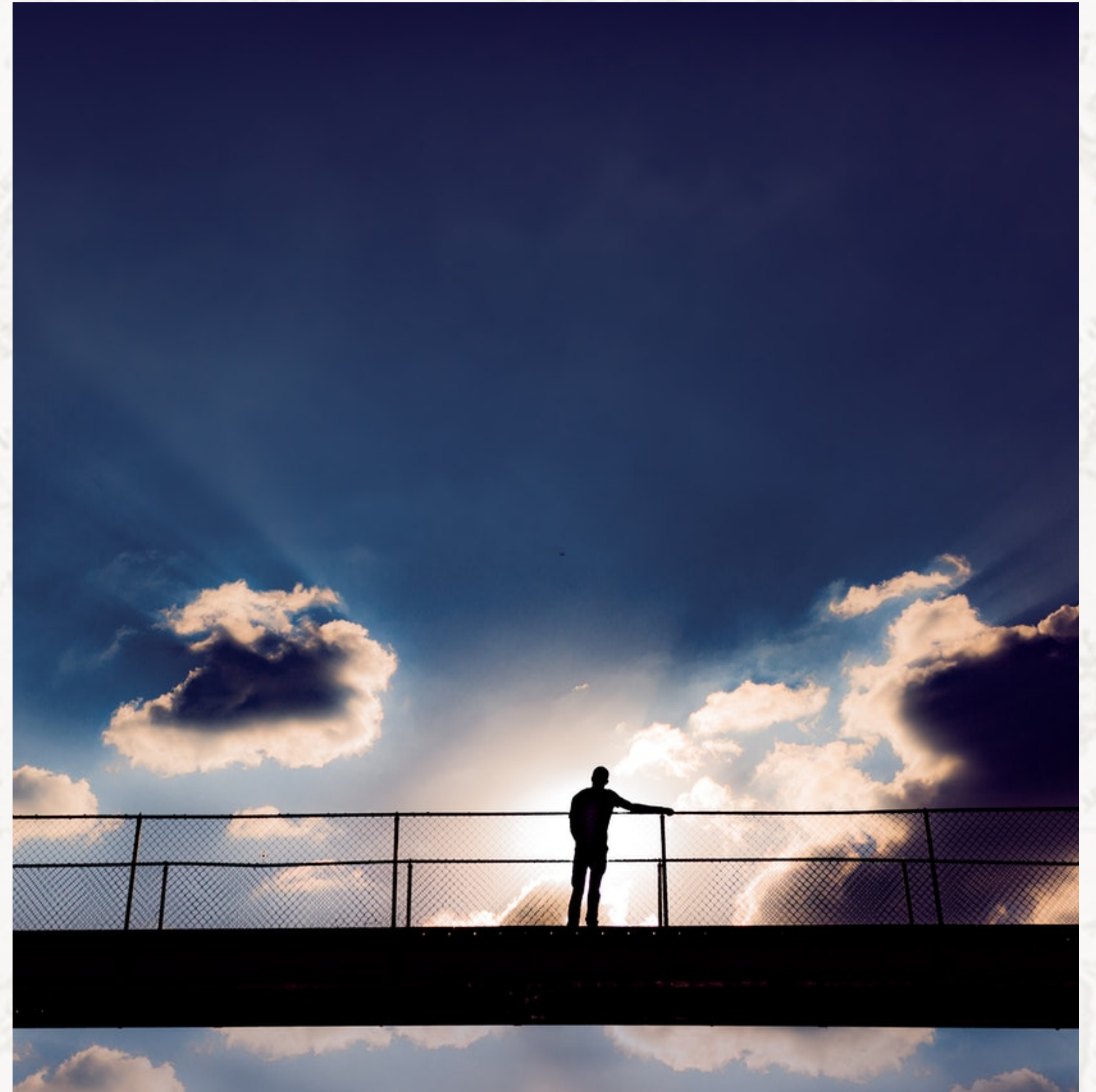
Degradation Testing

Monotonic degradation

Defined threshold for failure

There is a model to related rate of degradation to use conditions

Test conditions cause failures same as in use conditions



Risks

Degradation Testing

Two sets of extrapolations increase influence of even a small error

Non-linear degradation completes analysis

Results hard to explain and to understand



What is challenging
about doing an ALT?

Thanks

see more at AccendoReliability.com