An aerial photograph of a dense forest covered in a thick layer of snow. The trees are mostly evergreens, their branches heavily laden with white snow. The ground is a uniform white, creating a high-contrast scene. The perspective is from directly above, looking down on the forest canopy.

# When Geo Professionals Influence Decision Makers...

National Academies of Sciences,  
Engineering, and Medicine's  
Committee on Geological and  
Geotechnical Engineering (COGGE)

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# Discussion Topics

- My Risky Background
- What's the Orientation of Our Profession?
- Decision Making 101
- Lessons Learned in Influencing Decisions
  - What Doesn't Work Well
  - What Does Work Well
- Challenges and Opportunities in Our Profession

- **As USACE Infrastructure Leader:**
  - Owner and Self Regulator of +3,000 Infrastructure Systems
  - Changed culture from Standards to Risk Informed
  - Primary Communicator to the Administration, Congress, the “Watch-Dogs”, Internal Audiences, and the Public
  - Career Geotechnical Professional
- **As Private Consultant:**
  - The Same Thing for Clients in Industry



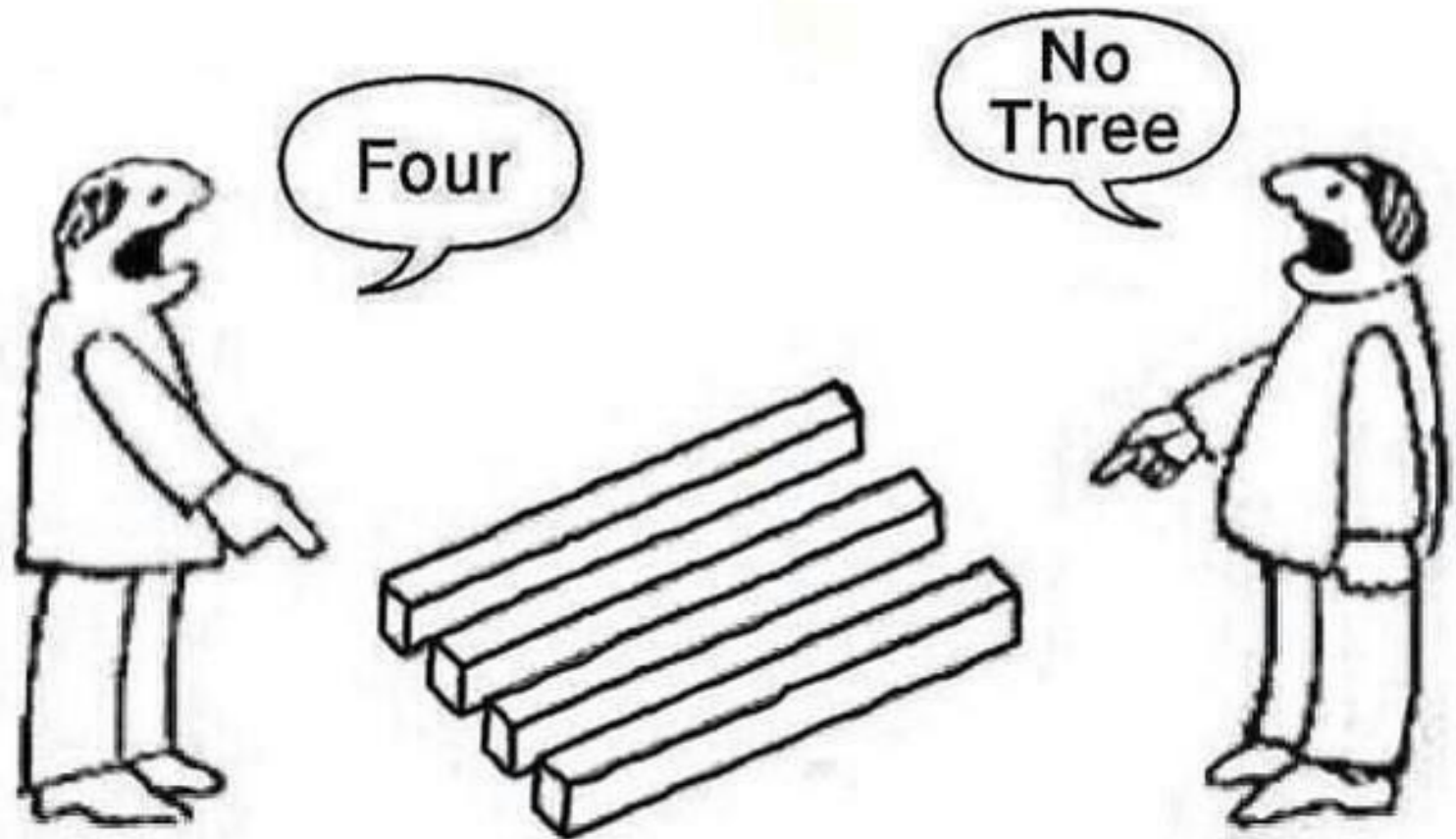
*Pulpit Rock, Norway*

(2,000 feet above the fiords of Norway)

**My Risky  
Background  
Influencing People**



Seek to  
Understand  
First



Why?



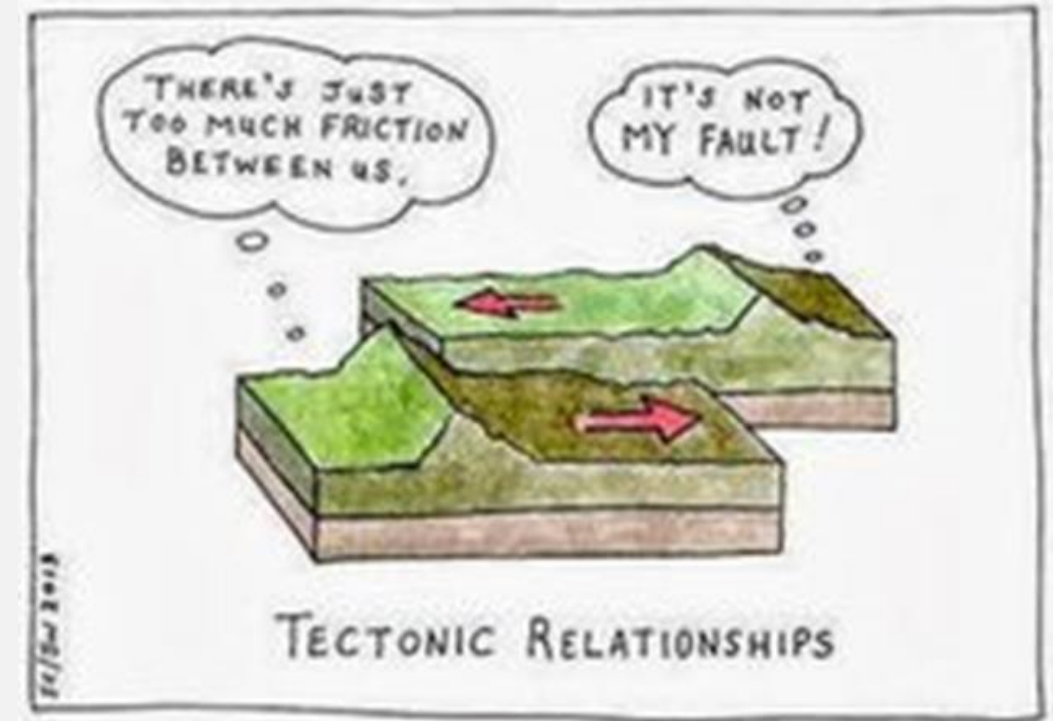


Make the  
Case



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- **Geo-Professionals Like To:**
  - Follow Standards, But Often Are Not Decision Oriented
  - Observe Things (drink & guess)
  - Tell you What They Did, Not Why
  - Address Uncertainty with Over-Confidence and More Data
  - Favor Precision over Accuracy
- **Geo-Professionals Don't Like To:**
  - Say What They Don't Know
  - Dumb Down Their Talking Points
  - Be Challenged By Decision Makers
  - Talk About Risks

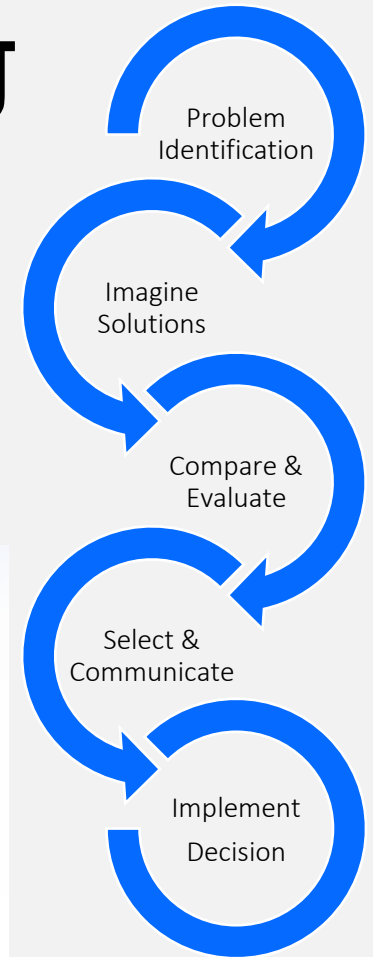


## Orientation of Our Profession




- Premature Understanding of the Problem
- Start with Final Answer and Find Problems that Fit
- The Decision Basis and/or Process is not Clear or a Best Practice
  - Standards Vice Risk Informed
- Selected Alternatives are not Communicated Effectively
  - Support Wanes
- ... and a General Rush to Implement
  - Decisions are Sub-Optimized
  - False Confidence Expressed

# Decision Making 101



**Common  
Mistakes to  
Avoid...**

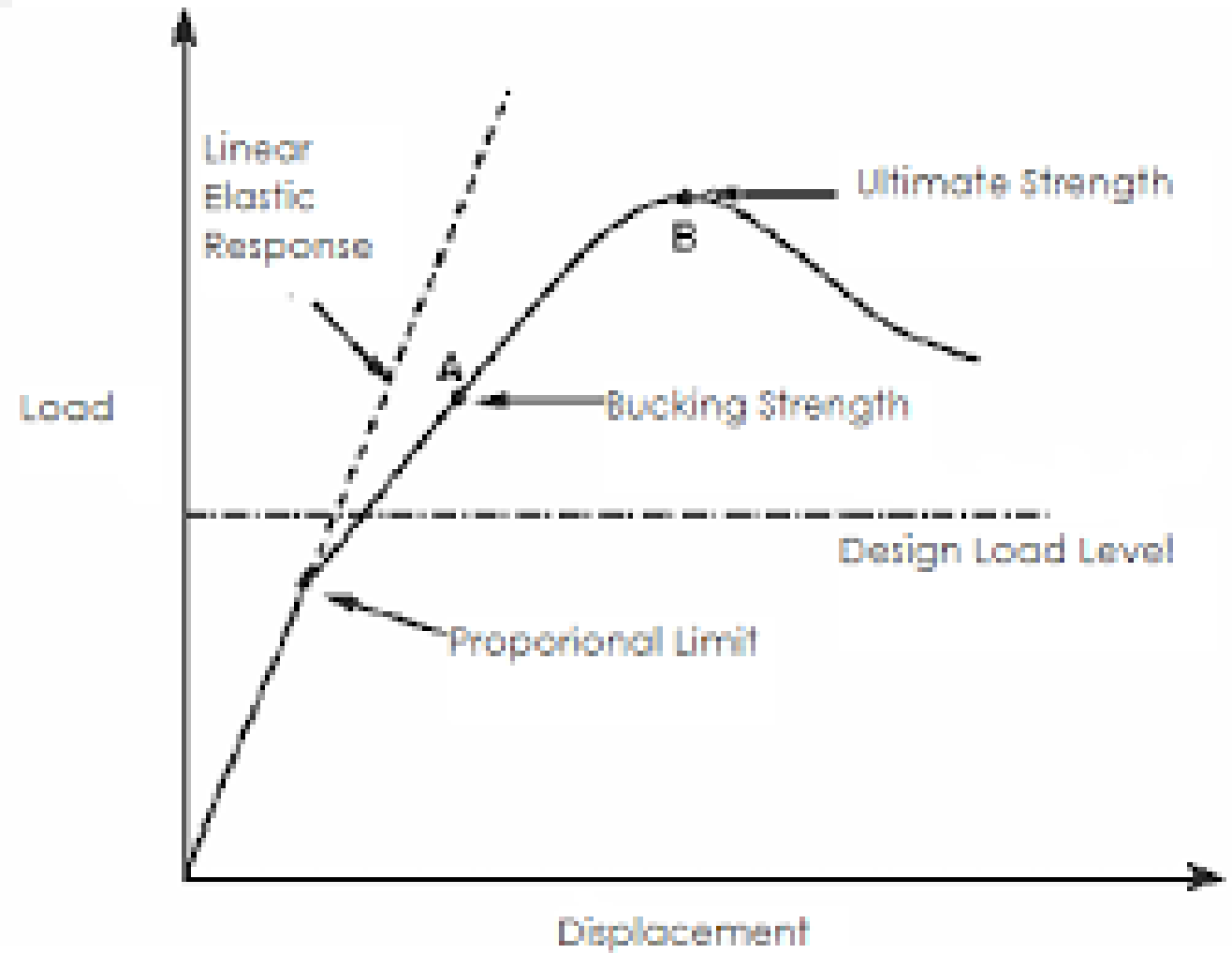


# Lessons Learned in Influencing Decisions

*What Doesn't Work Well!*

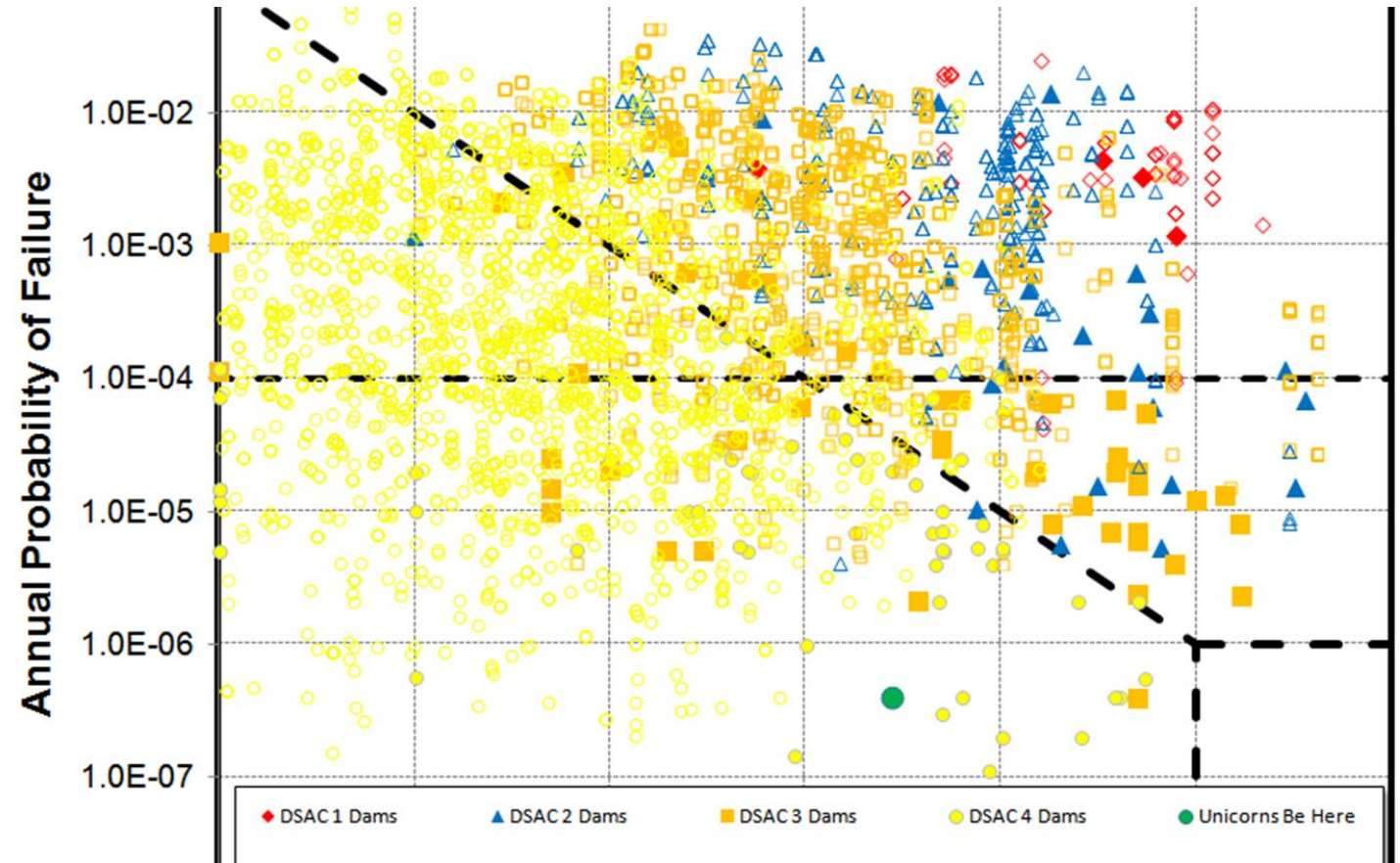
# Equating Limit States with Failure

Lessons on What Doesn't Work Well





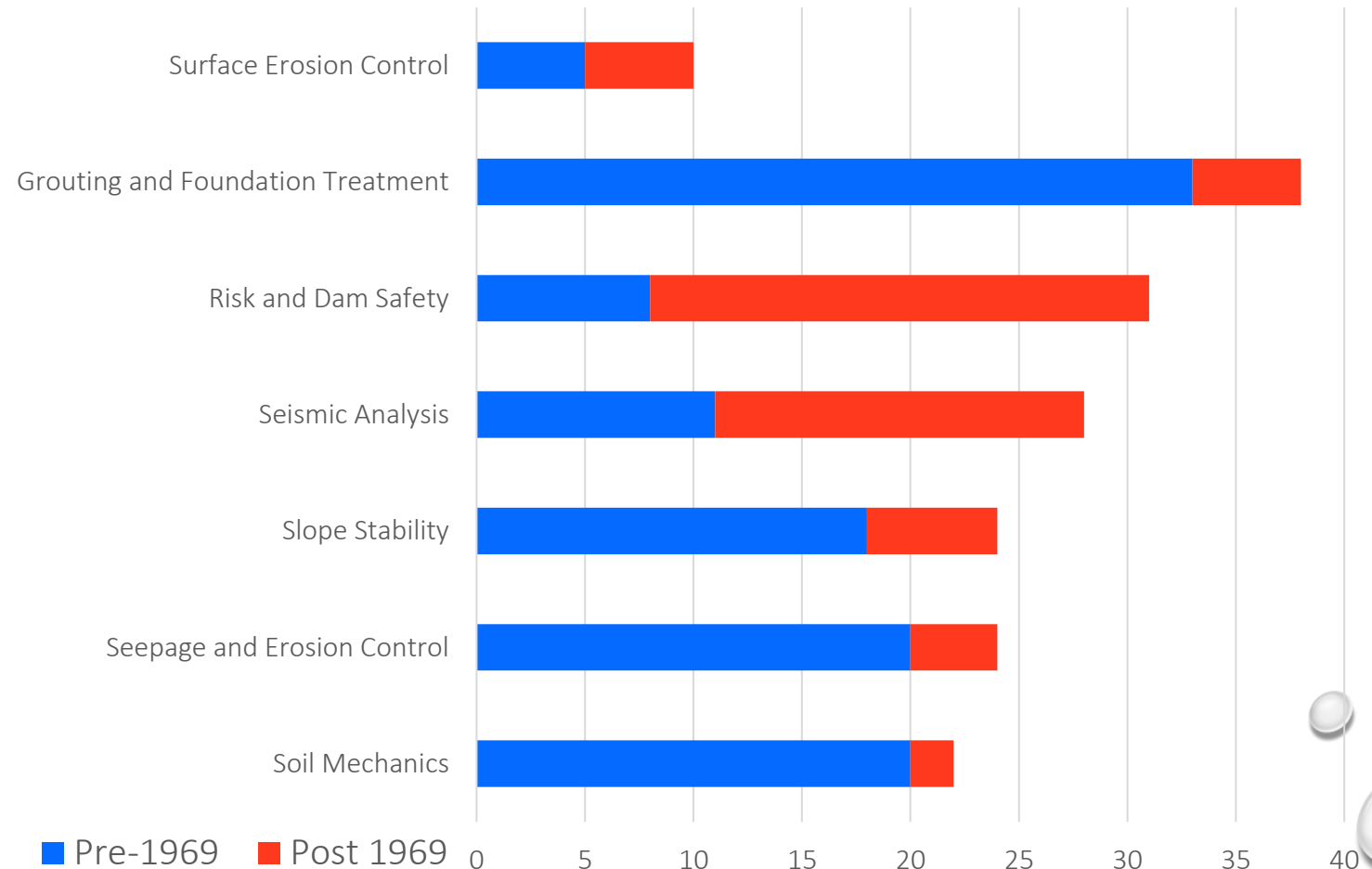
This is what  
following  
limit states  
has resulted  
in....



# State of the Art Advancements In Geotechnical Design

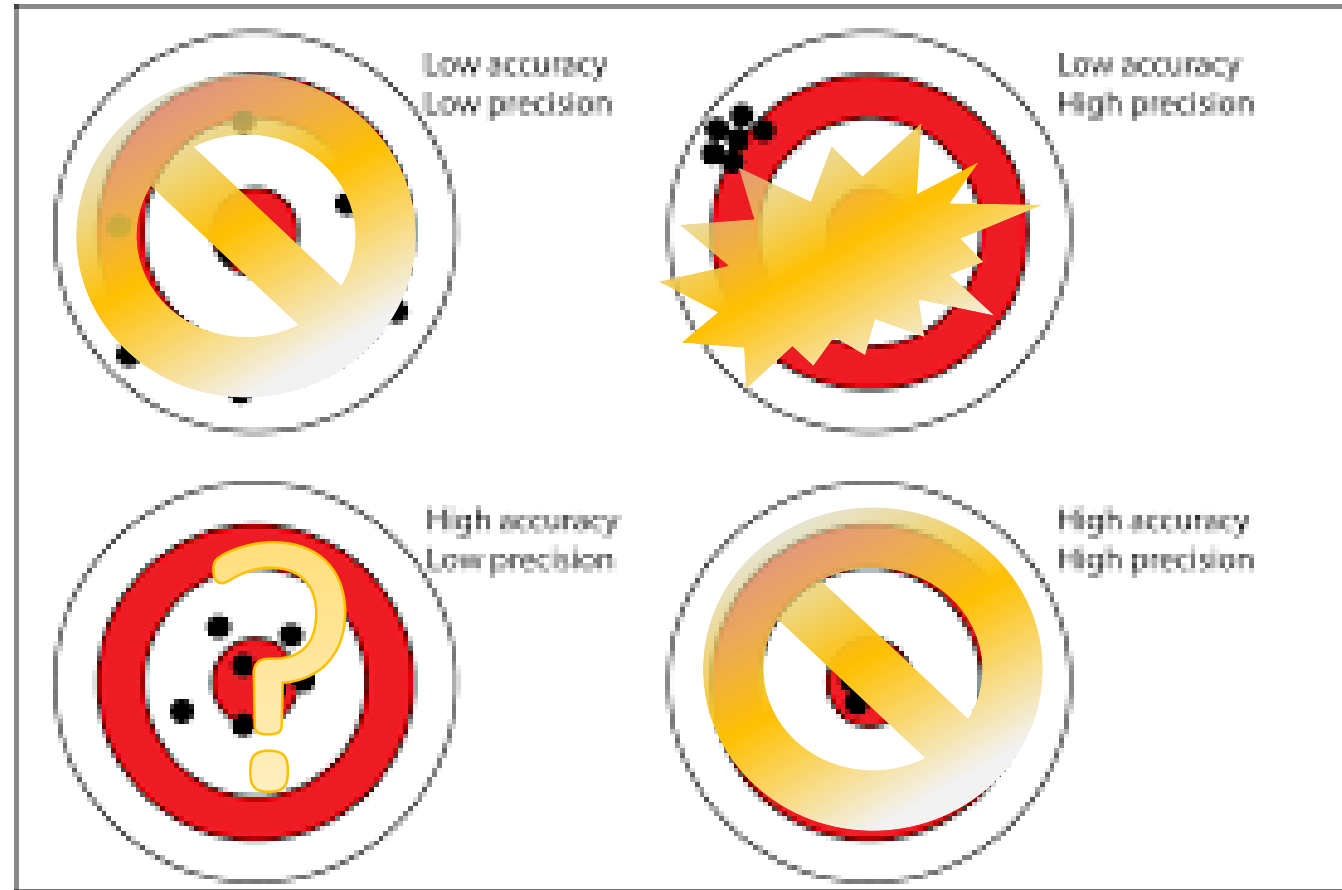
When Did Major  
Advancements in Our  
Profession Occur?

65%  
Before  
1969



# Choosing Precision Over Accuracy

Lessons on What Doesn't Work Well



*"I'd rather be approximately right than precisely wrong."*

J.M. Keynes



# Uncertainty Paradox

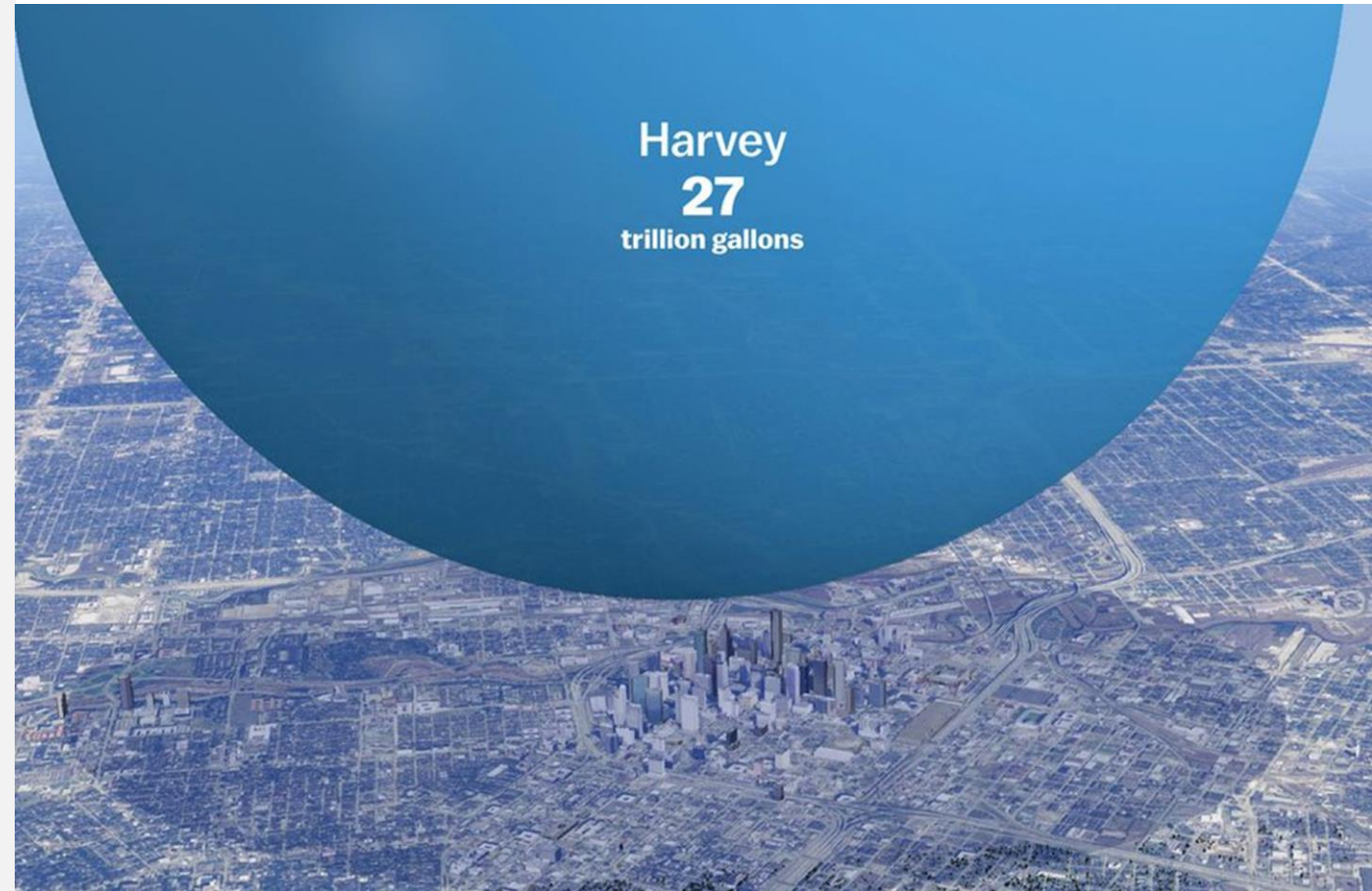
- Engineers Believe Decision Makers Demand Precision and certainty so We ***DOUBLE DOWN*** on what we know (and ignore the rest)

“Houston, Texas recorded the largest Rainfall on record within the continental United States. Over 60 inches of precipitation in 48 hours. That’s when the gage broke.”

an H&H friend of mine...

# Telling Instead of Showing

Lessons on What Doesn’t Work Well



The Volume of Water that Fell on Houston  
During Hurricane Harvey

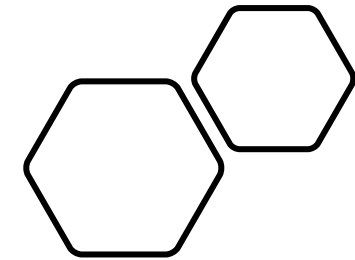
# Carpet Bombing Vice Using Science to Address Uncertainty

Lessons on What Doesn't Work Well



*If the Air Force Flew Missions Like Some  
Geotechnical Engineers Investigated Foundations*





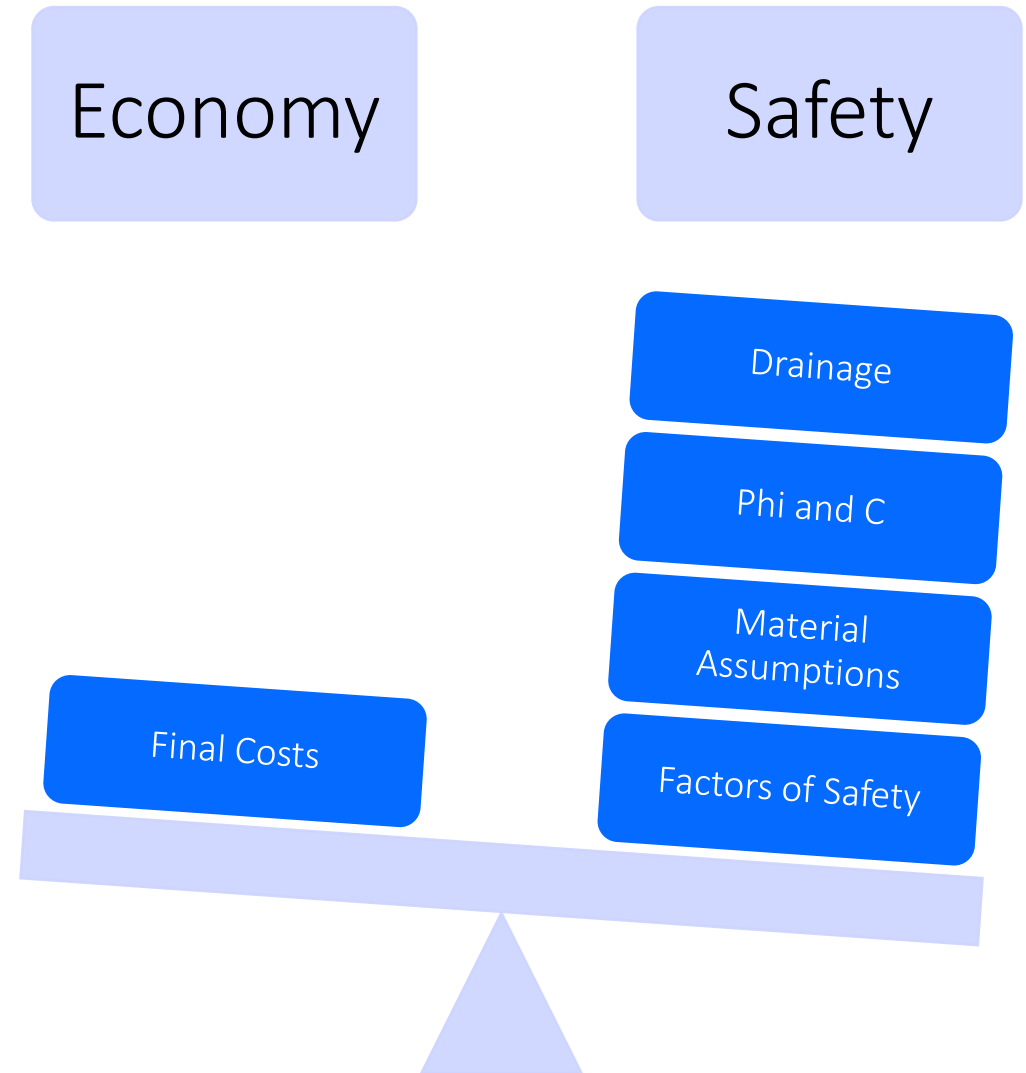
## Not Having a Practical Understanding of the Problem

- Lessons on What Doesn't Work Well

What's Better, 20,000 PSI rock or 2,000 PSI Concrete?

# The Tyranny of Incremental Conservatism (Disguised as Safety)

Lessons on What Doesn't Work Well





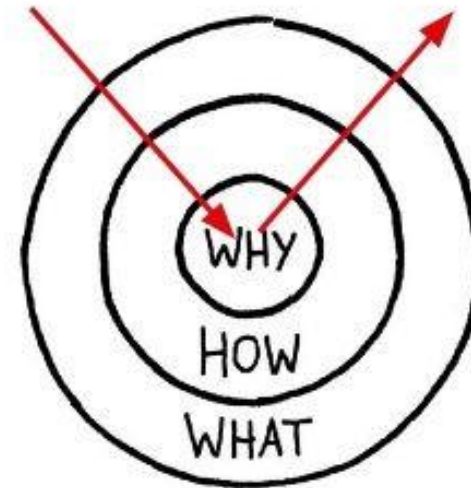
# Stop Describing “What” Instead of “Why”

Lessons on What Doesn't Work Well

## Start with the why (not with the what)

Outside in / Conventional

Inside out in / Remarkable



**Why?** = The Purpose

What is your cause? What are your values?

**How?** = The Process


The specific actions to realize the Why

**What?**

What do you do? The result of Why. The proof

The Golden Circle according to Simon Sinek





# Lessons Learned in Influencing Decisions

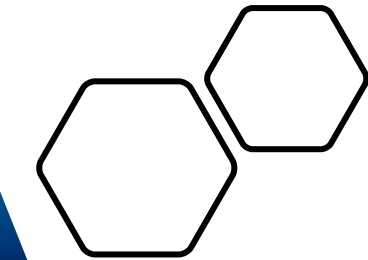
*What Works Well!*

More Data  
More Precision  
The Uncertainty Paradox

10% Knowledge

Research  
Education  
Studies  
Science  
Professional Journals  
Case Histories  
Experience  
Expertise

90% Knowledge  
Uncertainty



# When Uncertain, Leverage Science First

Lessons on What Works Well



# Learn to Be Decision Oriented

Lessons on What Works Well

- There are multiple design criteria on a single project – the resistance ( $\Omega$ ) to risk-informed design processes can be defined with the following equation\*:

$$\text{Resistance Factor}(\Omega) = e^{\text{Number of Criteria}} * \beta^2 + \Phi^4$$

where  $\beta$  = number of design engineers involved

$\Phi$  = number of structural engineers involved

- *Decision makers are more comfortable making risk-informed decisions than design engineers*

\*This formula is attributed to Nate Snorteland,  
Director of the USACE Risk Management Center



# Understanding How Things Can Fail and the Consequences

Lessons on What Works Well



Challenger Explosion, 1986



# Standards Based Understanding of Risk

$$FS_{GS} = 1.0$$

Based on lab data, specific loading

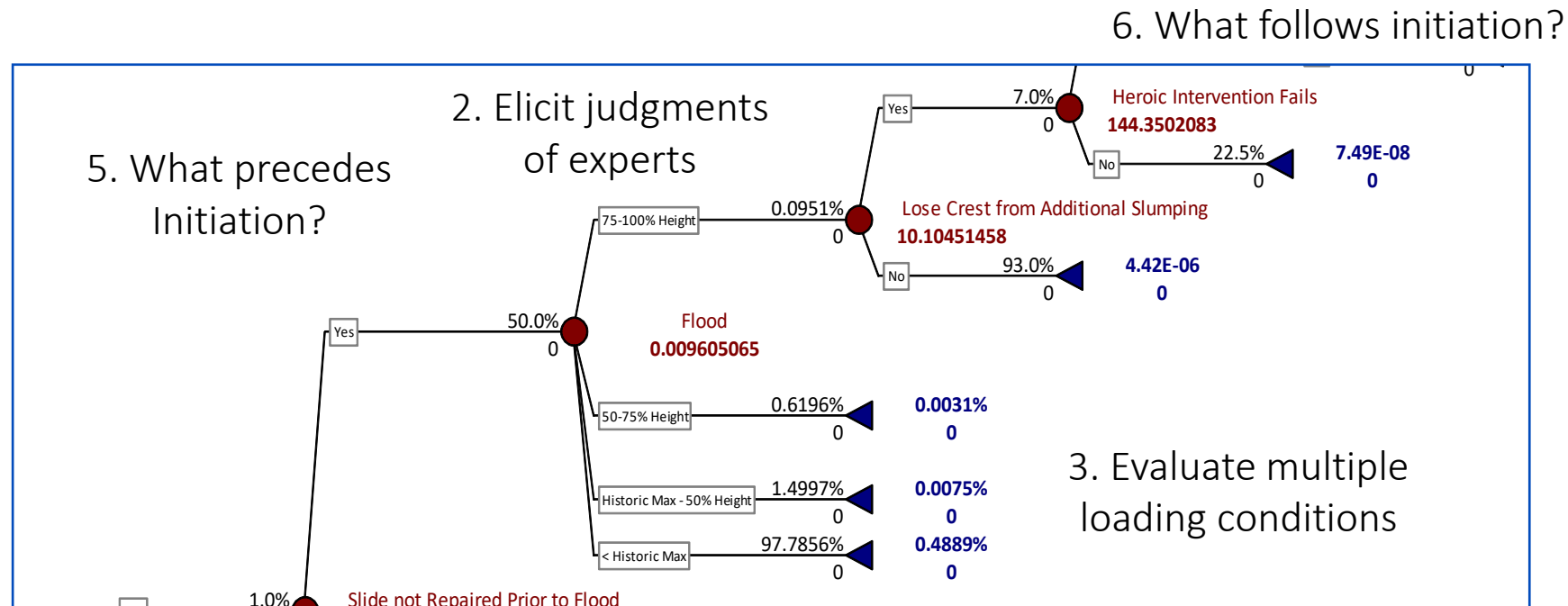


Is it safe?

How confident are you?

What should you do?

# Improving the Understanding of Risk

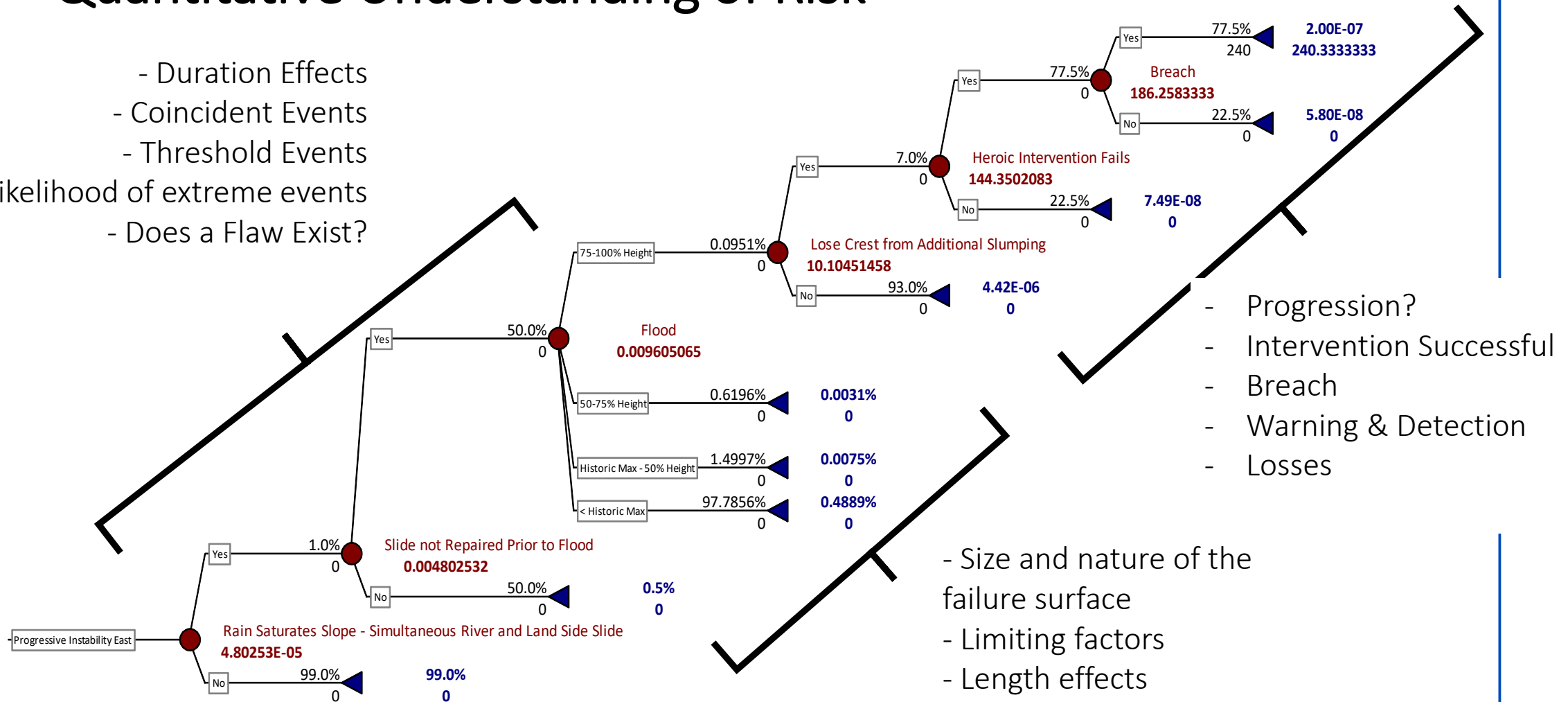


1. Recognize Initiation  
Is one part of failure  
Continuum

4. Consider past  
performance

# Quantitative Understanding of Risk

- Duration Effects
- Coincident Events
- Threshold Events
- Likelihood of extreme events
- Does a Flaw Exist?



- Progression?
- Intervention Successful
- Breach
- Warning & Detection
- Losses
- Size and nature of the failure surface
- Limiting factors
- Length effects
- Uncertainty in Materials
- Case Histories & Models

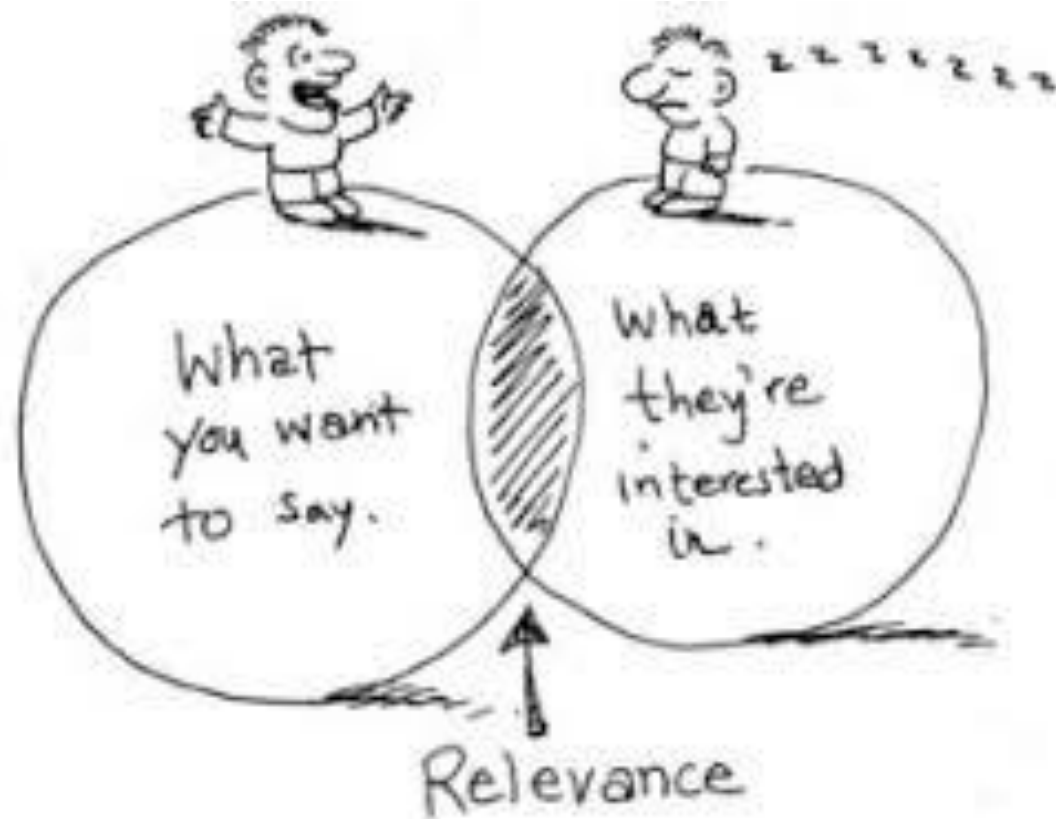


"THE FOOL TELLS ME **HIS** REASONS.  
THE WISE MAN PERSUADES ME WITH  
MY OWN."

*Aristotle*

# Respect Your Audience

Lessons on What Works Well



- Confidence and Independence
  - The Full Truth
  - Evidence



# Explain Ideas Considered But Not Chosen

Lessons on What Works Well





# Challenges and Opportunities for Our Profession

Improving Geo-Decision  
Making and Communication

# Challenges:



Improving Geo-Decision Making & Communication

- Not All Decision Makers are About Better Decisions
- Moving Away from Standards as a Decision Metric
- The Comfort of Geo Speak
- We are One Failure Away from Being Not-Credible
- Resilience and Sustainability Cost More in Short Term



# Opportunities:

Improving Geo-Decision Making & Communication

- Leveraging Big Data
- Help Decision Makers Move Away from BCR to Risk
- Visualization
- Be Better Advocates (Lobby the Right People)
- Tell Better Stories (Where are Our TED Talks?)
- Cooperate More



# Something to think about...



## Why is Risk Embraced in Concept But Not in Geo Practice?

Reference: Ignacio Escuder-Bueno & Eric Halpin (2016): Overcoming failure in infrastructure risk governance implementation: large dams journey, Journal of Risk Research



Thank You

