ICOLD Tailings Dam Safety Bulletin WORKSHOP

November 18, 2021

Committee L – Tailings Dams and Waste Lagoons

Revised for May 28, 2022 Workshop – replaced Chapter 4 slides and Moved Chapter 7 on hydrotechnical to after section on Seismicity

ICOLD Committee L – Bulletin Working Group

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- Global International Standard for Tailings Management (GISTM Prepared by International Council of Mining and Metals (ICMM), Principle for Responsible Investing (PRI), and United Nation – Environment Programme (UNEP): Six Topics with 15 Principles and 76 Requirements
- Adopted by ICMM (27 major mining and metals companies)
- Mainly governance aspects but there are significant technical components

- ICMM developed a set of conformance protocols for GISTM
- ICMM developed a Good Practice Guide for Tailings Management – Governance and Implementation of Good Engineering Practice for Tailings Management

- ICOLD Tailings Dam Safety Bulletin is aligned with GISTM and provides technical guidance for tailings dam safety

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1. Introduction
2. Tailings Storage Facility Governance
3. Closure
4. Dam Classification
5. Site Characterization
6. Tailings Characterization
7. Design
8. Risk Management
9. Dam Failure / Breach Analysis
10. Emergency Preparedness and Response Planning
11. Construction
12. Operations

Appendix A Shear Strength Deformation Behaviour of Soils and Tailings
Appendix B Stability Analysis Framework for Tailings Dams with Contractive Soils

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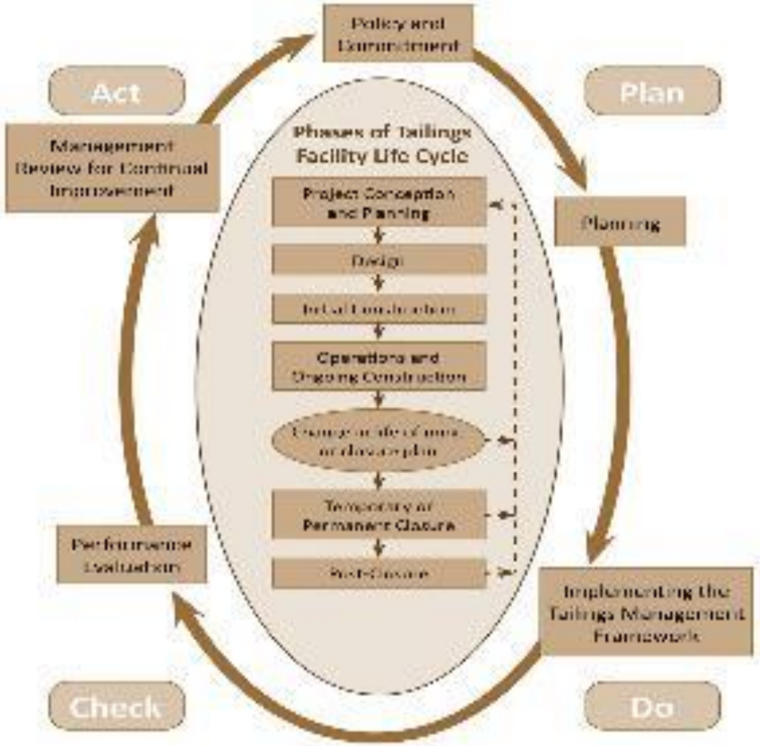
2 -Governance



Key Elements

-Roles and responsibilities – Mt. Polley example (AE, RTFE, EOR, Independent Reviewers)

-Tailings Management System

- Importance of audits, reviews and risk management
- Incident and Change management
- Documentation!!

3 - Closure

Key Elements

- ICOLD Bulletin 153: Sustainable Design and Post-Closure Performance of Tailings Dams (ICOLD, 2011)
- Returning the TSF to sustainable use/landscape
- Physical, Geochemical, Ecological and Social Stability
- Reduction of risk to negligible to non-credible
- Loading design considerations for closure
- Sustainable design considerations

4 - Dam Consequence Classification – Updated May 2022

- Various classification schemes.
- ICOLD classification based on the consequences of failure with respect to population, environment, societal and economic impacts.
- Similar to classification framework proposed by Global Industry Standard on Tailings Management (GISTM).

4 – Reasons for Dam Consequence Classification

- To inform the dam safety stewardship and management programs.
- Provide transparency with outcome of a dam failure.
- To meet a regulatory or stakeholder requirement.
- To support a comparison of TSFs in different regions and jurisdictions.

4 – Reasons for Dam Consequence Classification

- To inform the selection of design loading criteria
  - Design criteria based on dam consequence classification ➔ minimum
  - Need to consider potential impacts to Owner
  - Potential risks to life safety

4 - Dam Consequence Classification (cont'd)

- Assumed failure mode is physically possible and has a technical basis for occurrence.
- Supported by an estimated runout/inundation.
- Consequence Classification should **not** be considered as a measure of risk because likelihood is not taken into account.

4 - Dam Consequence Classification (cont'd) How do we do it?

- "Sunny day failure" or "Fair weather failure"
- "Flood failure" or "Wet weather failure"
- Initially assessed qualitatively with a simplified approach.
- More detailed dam breach analysis and inundation mapping may be required for High DCC and above.
- Indicator, combined with judgement.
- Does not replace regulations.

Comm

DCC similar to GISTM:

- Removed many numeric values
- Use Environmental Values
- Removed released contents chem.

Dam Failure Consequence Classification	Incremental Losses				
	Population at Risk[1]	Potential Loss of Life[2]	Environment[3,4]	Health, Social & Cultural	Infrastructure and Economics [5]
Low	none	none	Minimal short-term loss of environmental values. No expected impact on livestock / fauna drinking water. Limited area of impact and restoration feasible in short term.	Minimal effects and disruption of business and livelihood. No measurable effects on human health. No disruption of heritage, recreation, community or cultural assets	Low economic losses: area contains limited infrastructure or services
Significant	1-10	none	Limited loss or deterioration of environmental values. Potential contamination of livestock/fauna water supply. Moderate area of impact and restoration possible.	Limited effects and disruption of business and livelihood. No measurable effects on human health. Limited loss of regional heritage, recreation, community, or cultural assets.	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes. Moderate economic loss.
High	10-100	1 - 10	Significant loss or deterioration of critical environmental values. Potential contamination of livestock/fauna water supply. Potential area of impact 5 km^2 – 20 km^2. Restoration possible within a moderate time frame.	Many people affected by disruption of business, services, or social dislocation. Significant loss of regional heritage, recreation, community, or cultural assets. Potential for some short-term human health effects.	High economic losses affecting infrastructure public transportation, and commercial facilities, or employment. Moderate relocation / compensation to communities.
Very High	100-1000	10 to 100	Major loss or deterioration of critical environmental values including rare and endangered species of high significance. Potential area of impact >20 km^2. Restoration or compensation possible but very difficult and requires a moderate to long time frame.	A high number of people affected by disruption of business, services, or social dislocation for more than one year. Significant loss of national heritage, recreation, or community facilities or cultural assets. Significant long-term human health effects.	Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facilities, storage facilities for dangerous substances), or employment. High relocation/compensation to communities.
Extreme	> 1000	> 100	Catastrophic loss of critical environmental values including rare and endangered species of high significance. - Very large areas of potential impact. Restoration or compensation in kind impossible or requires a very long time.	A large number of people affected by disruption of business, services, or social dislocation for years. Significant National heritage or community facilities or cultural assets destroyed. Potential for Severe and/or long-term human health effects.	Extreme economic losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances or employment. Very high relocation/compensation to communities and very high social readjustment costs.

Dam Failure Consequence Classification	Incremental Losses				
	Population at Risk	Potential Loss of Life	Environment	Health, Social & Cultural	Infrastructure and Economics
High	10-100	1 - 10	Significant loss or deterioration of critical environmental values. Potential contamination of livestock/fauna water supply. Potential area of impact 5 km^2 – 20 km^2. Restoration possible within a moderate time frame.	Many people affected by disruption of business, services, or social dislocation. Significant loss of regional heritage, recreation, community, or cultural assets. Potential for some short-term human health effects.	High economic losses affecting infrastructure public transportation, and commercial facilities, or employment. Moderate relocation / compensation to communities.

4 - Dam Consequence Classification (cont'd)

- Mis-perception – by designing a dam for High consequences (1 to 10 lives lost), then it is acceptable to have more than 10 fatalities.
- Not the intent of the Dam Consequence Classification framework.
- Key purpose of DCC: provide rational, objective, and transparent framework for classifying the dam.
- Owner to decide on design criteria that considers potential risks to life safety.

4 - Dam Consequence Classification (cont'd)

- GISTM introduced "credible failure modes".
- ICMM provided further definition to CFMs.
- There is still not a consensus in the industry on how to define CFMs.
- From ICOLD's perspective (focus on design and safety assessment), did not address CFMs, focused on failure mode that is physically possible and has a technical basis for occurrence.
- Recognize the failure modes for emergency planning should consider likelihood.

4 - Dam Consequence Classification (cont'd)

- Can change over time with changes to TSF and the external environment.
- Consequence Classification (in combination with potential losses to the Owner) should guide investigation, design, construction, operation and closure.

5. Site Characterisation - Objectives

Establish conditions and parameters that characterize the site and may impact and/or would be impacted by TSF:

- Design
- Construction
- Operations
- Closure

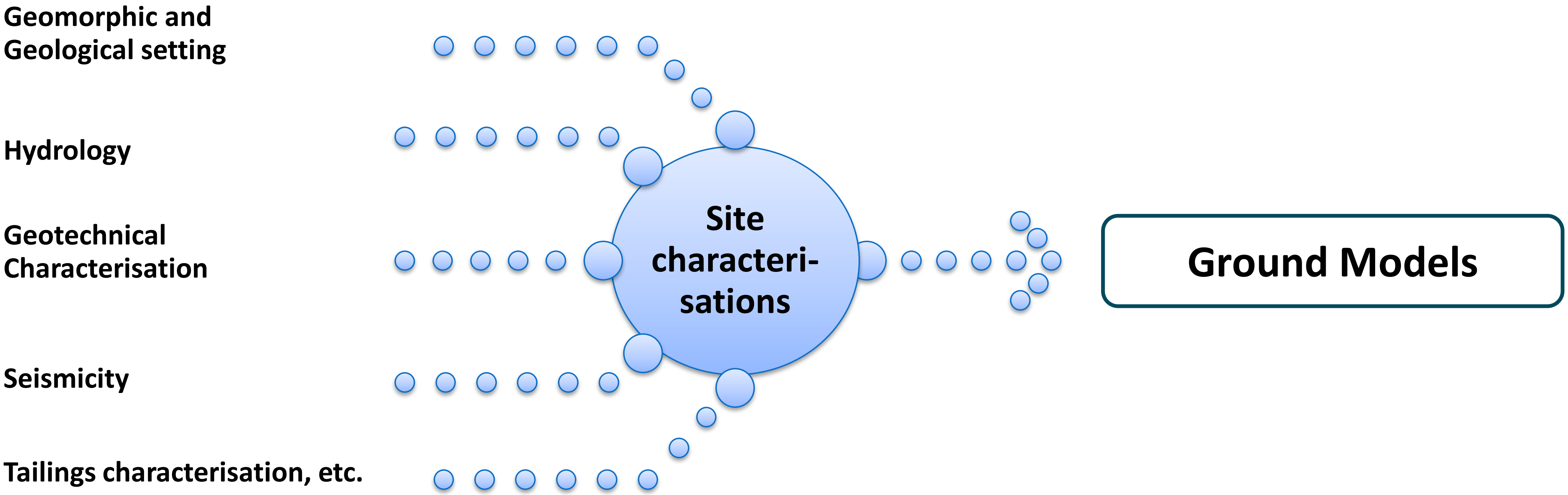
Covers the dam site, the TSF area and the potential dam break impact zone, deposited tailings, dams and associated structures

5. Site Characterisation (cont'd) - Methods

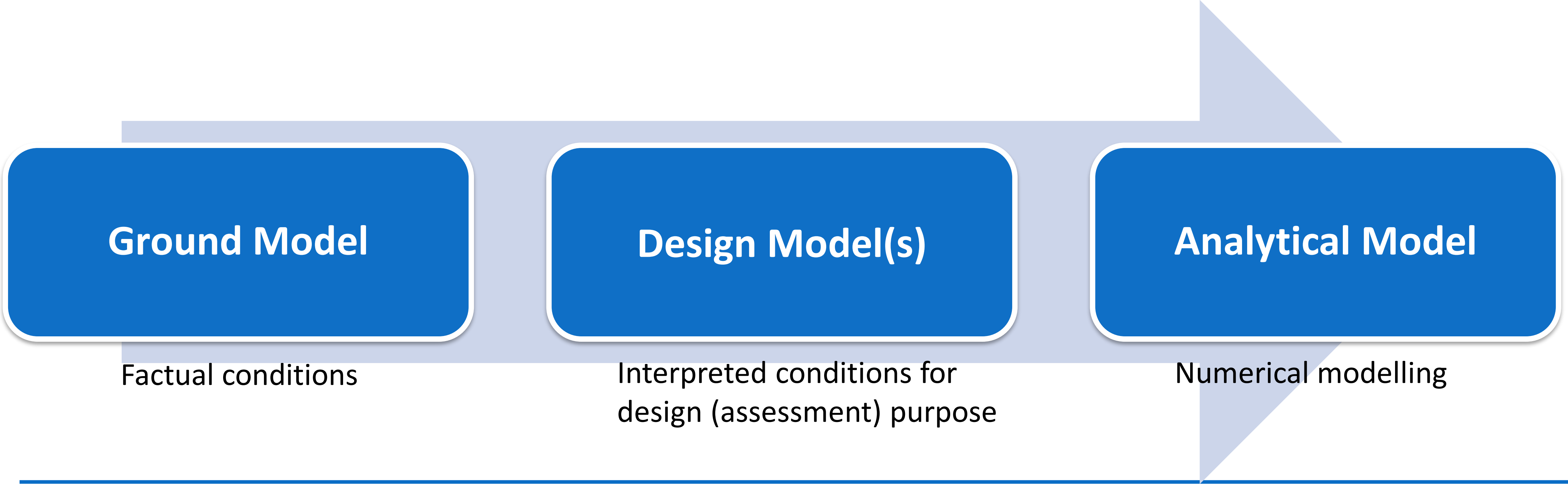
Iterative process of studies and investigations to continually improve the understanding of the TSF site including:

- Social and Environmental setting
- Geomorphology
- Climate and Hydrology
- Geological and geotechnical conditions
- Hydrogeology
- Seismicity

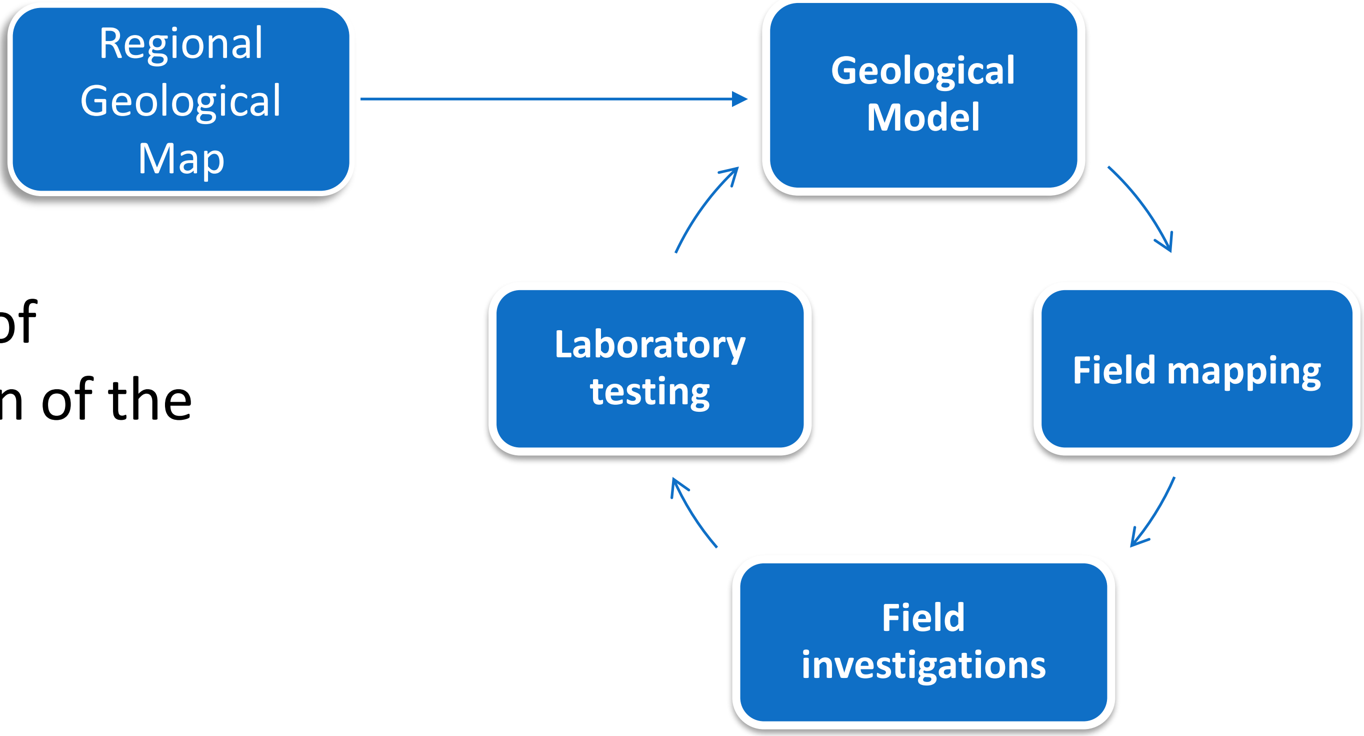
5. Site Characterisation (cont'd) - Outcomes



5. Site Characterisation (cont'd) – Flow



5. Site Characterisation (cont'd)– Geological and geotechnical model



Systematic, iterative process of determination and verification of the conditions at the TSF site.

5.Site Characterisation (cont'd) – Site Seismicity

Objectives:

Establishes the design ground motions for

- Seismic response assessment
- Seismic-induced deformation analyses
- Liquefaction assessment

for both the dam and the foundations (including tailings)

5. Site Characterisation (cont'd) – Site Seismicity

Process:

Seismotectonic assessment

Regionals tectonic conditions, seismic sources and local seismicity

Seismic hazard assessment

Probabilistic Analyses
Deterministic Analyses

Design Ground Motion Model

Design response spectra
Design PGA

5. Seismic Site Characterization (cont'd)

- Provides recommendations for thorough characterization of the seismic setting. Site-specific seismic hazard analysis should be performed for most tailings facilities.
- Greater emphasis on Probabilistic Methods (PSHA) but retains consideration of Maximum Credible Earthquake (MCE), by deterministic methods.
  - Recognizes that MCE may have relatively low recurrence interval along plate margins where seismic activity is very high.
  - In relatively stable regions, the design earthquake may not need to be greater than the 84th percentile MCE.
- Suggests that the selection of seismic design criteria for High, Very High and Extreme consequence TSFs may sometimes require a consensus of a panel of seismic experts.

6. Tailings Characterisation - Objectives

Determine tailings conditions and parameters for

- The structural performance the dam (to be included in the Ground Model)

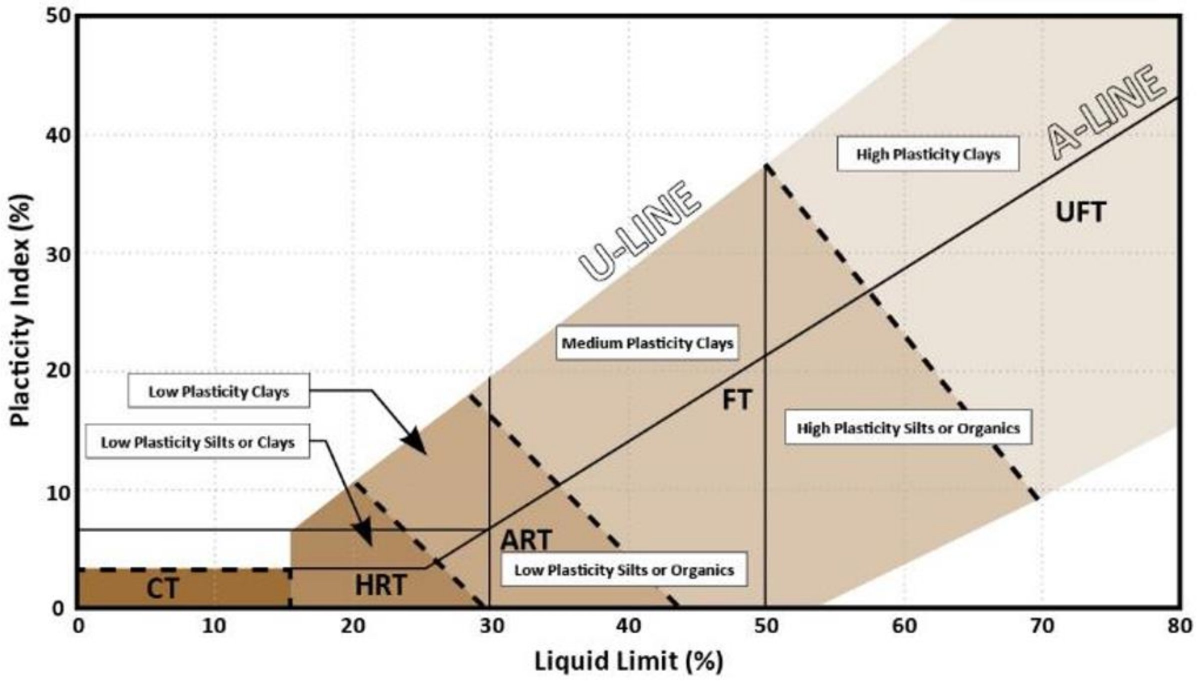
  Crucial for upstream raised dams

- Assessment of the TSF impact
  - Tailings emission – dust, seepage, radiation etc.
  - Impact of the potential dam breach onto the downstream area

Based on ICOLD Bulletin 181 Tailings Dam Design – Technology Update

6. Tailings Characterisation – Classification

- **Geotechnical aspects**
  - PSD, SG, Plasticity, etc.
- **Geochemical aspects**
  - Toxicity (primary and secondary), neutral leaching and acid drainage potential, chemical stability, etc.



6. Tailings Characterisation (cont'd) – Tailings Classification

Tailings Type	Symbol	Description (compare)	Example of mineral/ore
Coarse tailings	CT	Silty SAND, non-plastic	Salt, mineral sands, coarse coal rejects, iron ore sands
Hard Rock tailings	HRT	Sandy SILT, non to low plasticity	Copper, massive sulphide, nickel, gold
Altered Rock tailings	ART	Sandy SILT, trace of clay, low plasticity, bentonitic clay content	Porphyry copper with hydrothermal alteration, oxidized rock, bauxite. leaching processes
Fine tailings	FT	SILT, with trace to some clay, low to moderate plasticity	Iron ore fines, bauxite (red mud), fine coal rejects, leaching processes, metamorphosed/weathered polymetallic ores
Ultra Fine tailings	UFT	Silty CLAY to CLAY, moderate to high plasticity, very low density and hydraulic conductivity	Oil sands (fluid fine tailings), phosphate fines; some kimberlite and coal fines

6. Tailings Characterisation - Geotechnical Parameters

- Shear Strength
- Compressibility
- Permeability
- State (density, void ratio, moisture content, etc.) under current and future loading conditions
- Rheology

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7. Design

Key Elements

- Risk Informed Design
- Dam failure modes
- Design criteria
- Slope stability (drained, undrained, seismic)
- Hydrotechnical
- Environment

7.5 – Risk Informed Design

Andy Small

- Goes beyond traditional standards based
- Enhancement to standards based design
- Linked to observational method
    - Predict and measure performance
    - If performance not suitable, implement contingency measures
    - Not suitable for dams with brittle elements or unable to implement contingency measures

7.5 – Risk Informed Design (cont'd)

- Performance-Based Risk-Informed Safe Design (Morgenstern, 2018)
  1. Identify key failure modes
  2. Identify performance parameters
  3. Establish performance criteria
  4. Establish trigger, action, and response plans (TARPs)
  5. Monitor and document performance (assess safety or implement contingency measures)
- PBRISD calls for significant rigor

7.9 – Slope Stability Assessment

Andy Small

- Slope instability is a common cause of TSF failures
- Slope failure of TSFs in the last decade resulted in
  - > 300 deaths
  - Contamination of many km2 of land and > 1,000 km of rivers
  - Astronomical direct and indirect economical losses
  - Potential for slope failure exists in closed and decommissioned TSFs

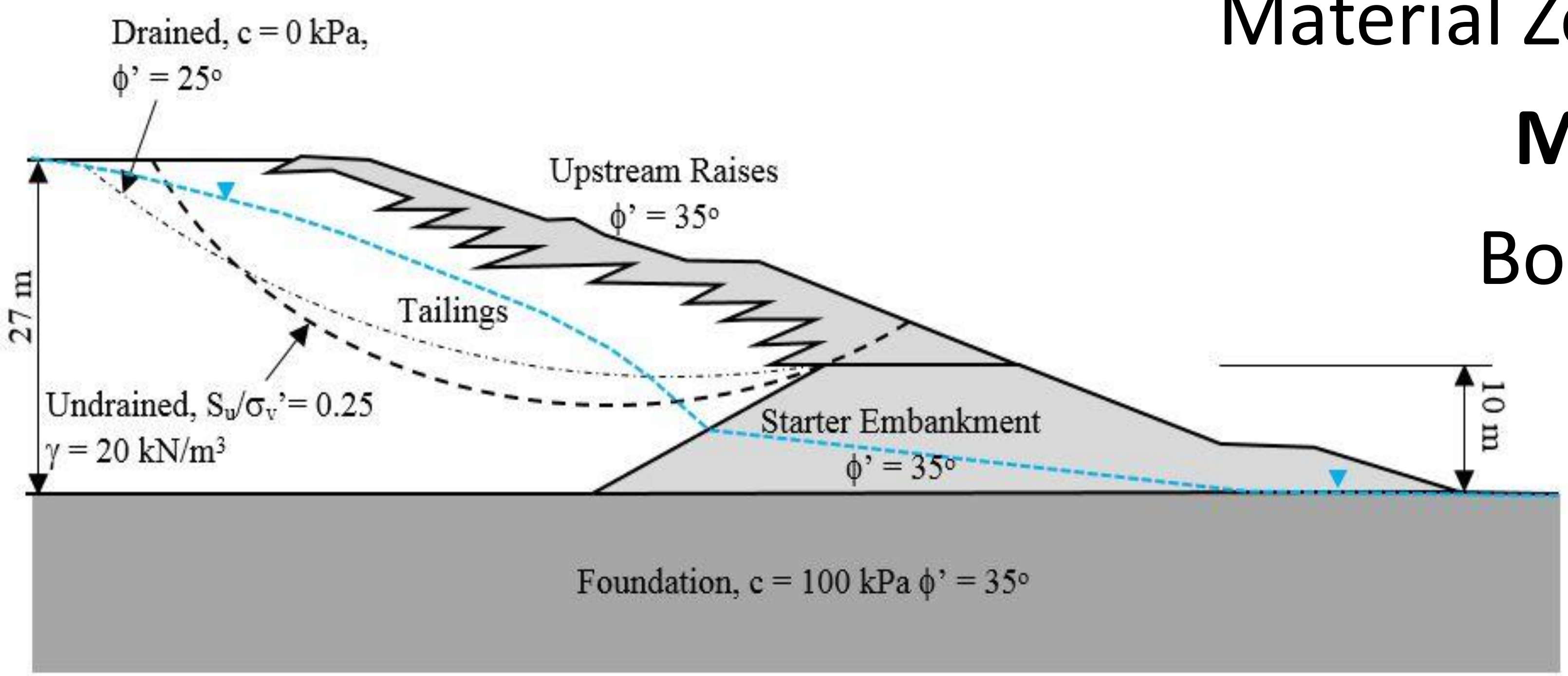
7.9 – Slope Stability Assessment (cont’d)

1. Understand Site Conditions
2. Consider Relevant Failure Modes
3. Conduct Stability Analysis
4. Evaluate Results

7.9 – Slope Stability Assessment (cont'd)

- Limit equilibrium (L-E)
  - Challenges with L-E, especially when contractive elements are present
  - Screening tool
- Non-linear deformation analyses (NDA)
  - Better represent complex conditions
  - Range of uncertainties in material parameters still limitation

7.9 – Slope Stability Assessment (cont'd)



Material Zoning & Geometry

Material Properties

Boundary Conditions

Design Loads

7.9 – Slope Stability Assessment (cont'd)

- Considerations
  - Consequences of failure
  - Complexity
  - Contractive/dilative
  - Variability and uncertainty
  - Comprehensiveness of site investigations and geotechnical monitoring
  - Strain-incompatibility of the different materials forming the dam and its foundation
  - Use of observational method

7.9 – Slope Stability Assessment (cont'd)

- Target Factors of Safety:
  - For static conditions, target minimum FOS > 1.5
  - For post-liquefaction conditions, target minimum FOS > 1.1
- For planned, operating or closed dams
- Assumes good practices for site characterization, selection of parameters, etc.

7.9 – Slope Stability Assessment (cont'd)

- Consider range of conditions
- If contractive elements in dam, consider undrained failure (FOS > 1.5 for peak strengths)
- For clay foundations, consider residual strengths

7.9 – Slope Stability Assessment (cont'd)

- Target FOS not specified for:
  - End of Construction
  - Rapid Drawdown
  - Seismic and post-seismic loading for dams with dilative soils

7.9 – Slope Stability Assessment (cont'd)

- Adjustments to target FOS
  - Increase target FOS to account for:
    - » Closure, uncertainty, strain incompatibility, changes in soil properties or loading conditions over time
  - Decrease target FOS if:
    - » Comprehensive site characterization and implementation of Observational Method

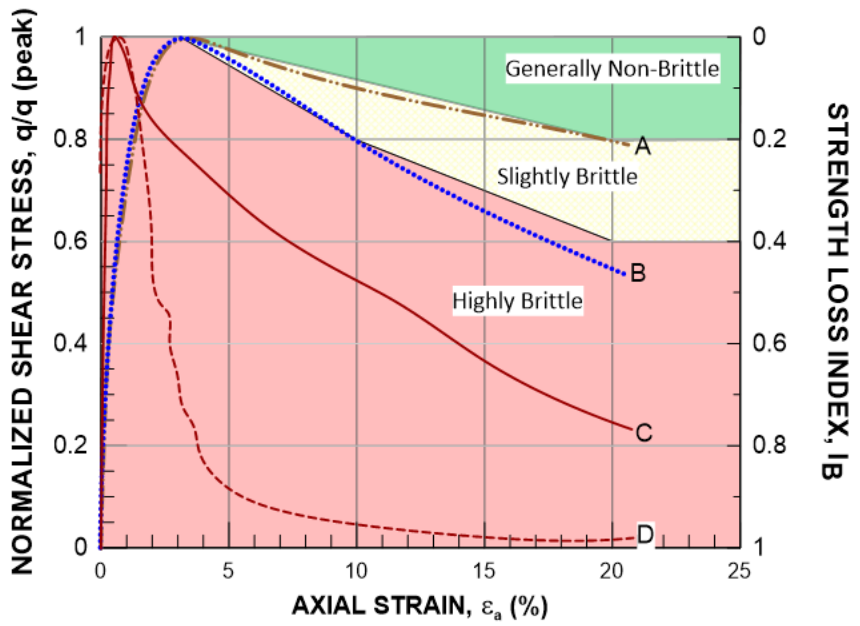
Appendix A – Shear Strength & Deformation Behavior

Paul Ridlen

- Presents fundamental concepts of shearing behavior, especially as relates to tailings.
  - Addresses apparent gaps in understanding in tailings dam practice that have contributed to past failures.
  - Attempts to present complex soil mechanics at a level to be understood by someone with a technical background in engineering or science, but without the benefit of advanced degrees or education in soil mechanics.

Appendix A – Shear Strength & Deformation (cont'd)

- Fundamental concepts elaborated in the appendix:
  - Drained versus undrained shearing
  - Dilative versus contractive behavior
  - Strain-softening (weakening) versus strain-hardening behavior
  - Brittle versus ductile behavior.

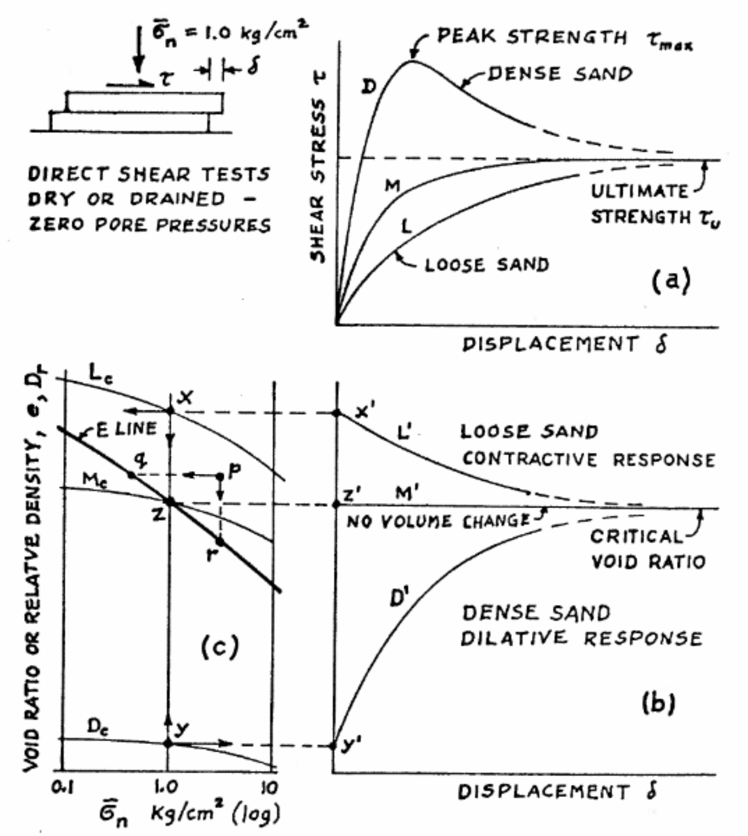


Appendix A – Shear Strength & Deformation (cont'd)

- Additional Guidance and Cautions
  - CPT Based measurement of in situ state and soil properties
  - Liquefaction and residual (post-liquefied) strength
  - Selection of appropriate shear strength parameters for design and analysis
    - Level of conservative appropriate to the level of uncertainty
    - Pros and cons of laboratory versus field data
  - Stress-dependent behavior (e.g., effect of OCR)
  - Partial saturation
  - Progressive failure
  - Strain compatibility of dissimilar materials and other strain-related concerns

Appendix A – Shear Strength & Deformation (cont’d)

Dilatancy: volume change may accompany shearing of any granular material. This is important to understand strength in tailings and natural soils.



Plots of direct shear tests on dense and loose sand from the classic publication by Casagrande (1975)

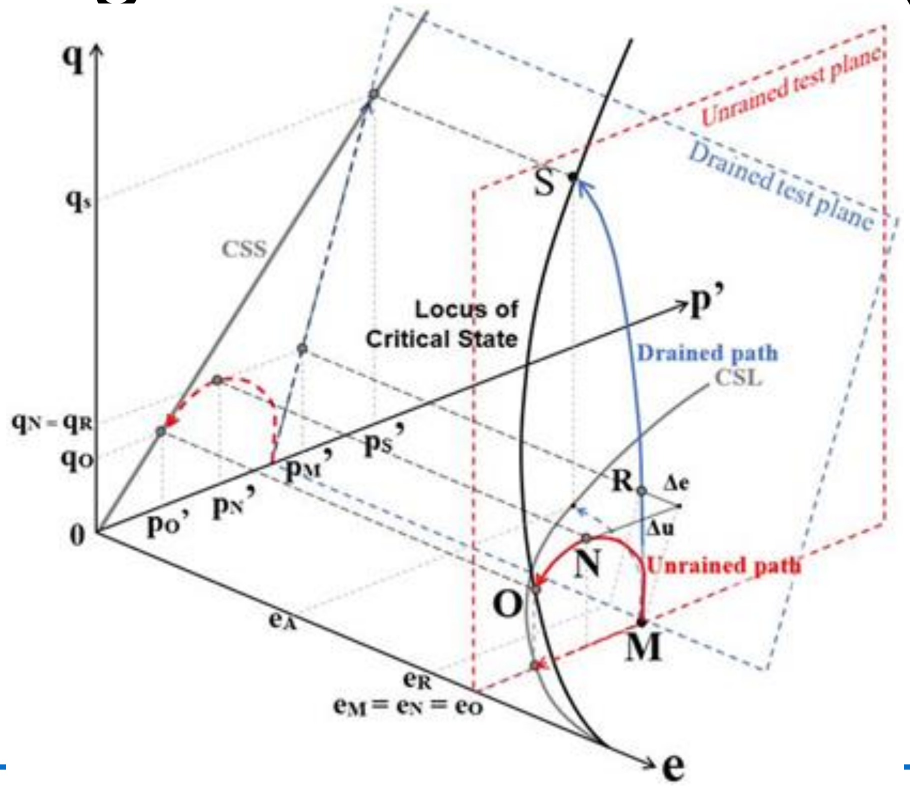
- Dense sand -> increase in volume
- Loose sand -> decrease in volume

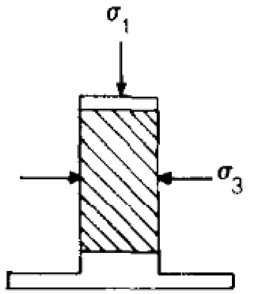
Appendix A – Shear Strength & Deformation (cont'd)

Drained vs. Undrained Shearing

- Drained = constant pore water pressure shearing
  Volumetric changes during shearing

- Undrained = constant volume shearing
  Generation of shear-induced pore water pressures



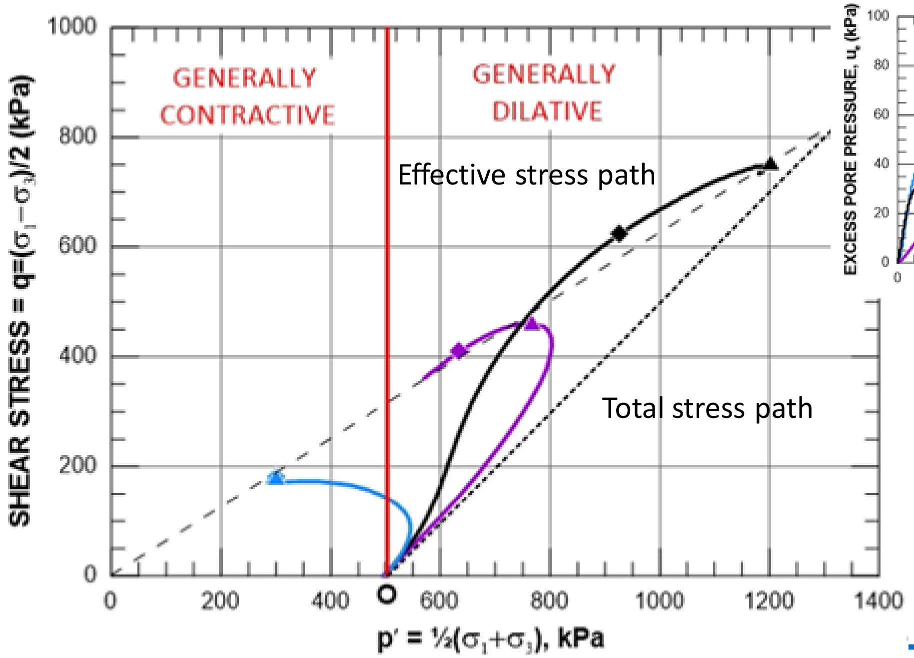


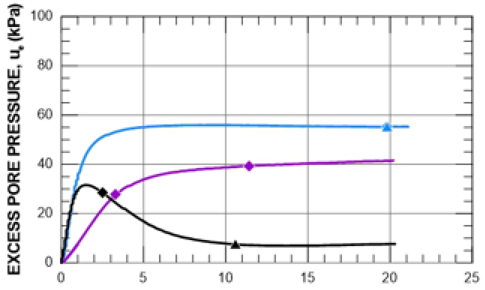
$q = \sigma_1 - \sigma_3$

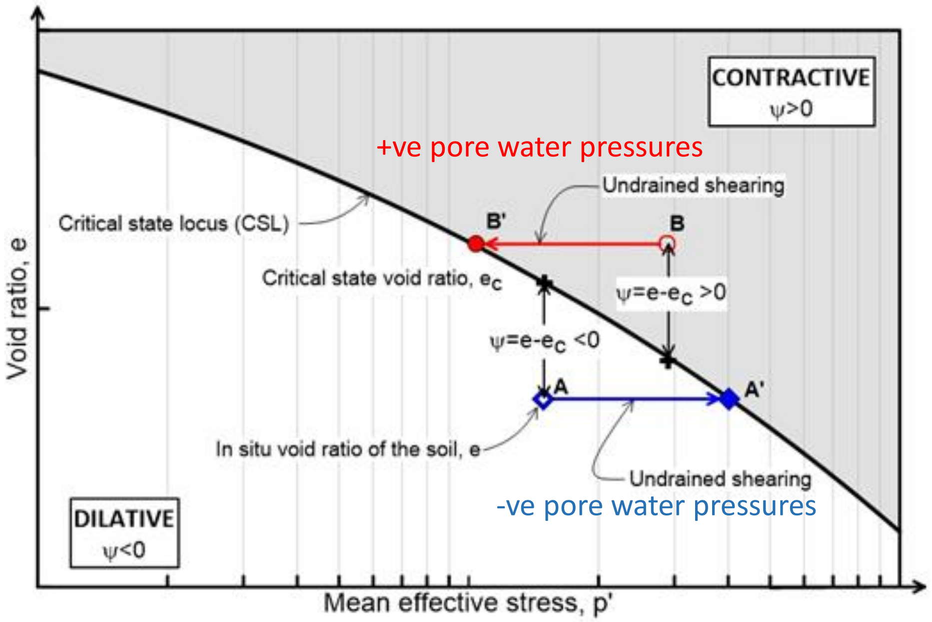
$p' = (\sigma_1' + 2\sigma_3')/3$

Appendix A – Shear Strength & Deformation (cont'd)

Dilative vs. **Contractive** behaviour -> density and stress control strength

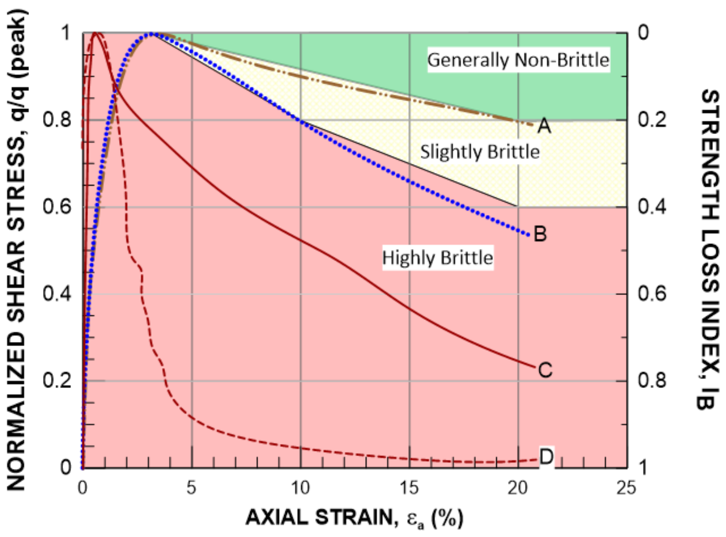






Appendix A – Shear Strength & Deformation (cont'd)

Brittleness during undrained shearing



- Bishop (1973) proposed the definition of a brittleness index that, for an undrained case, reads:

$$I_B = \frac{(c_u)_f - (c_u)_r}{(c_u)_f}$$

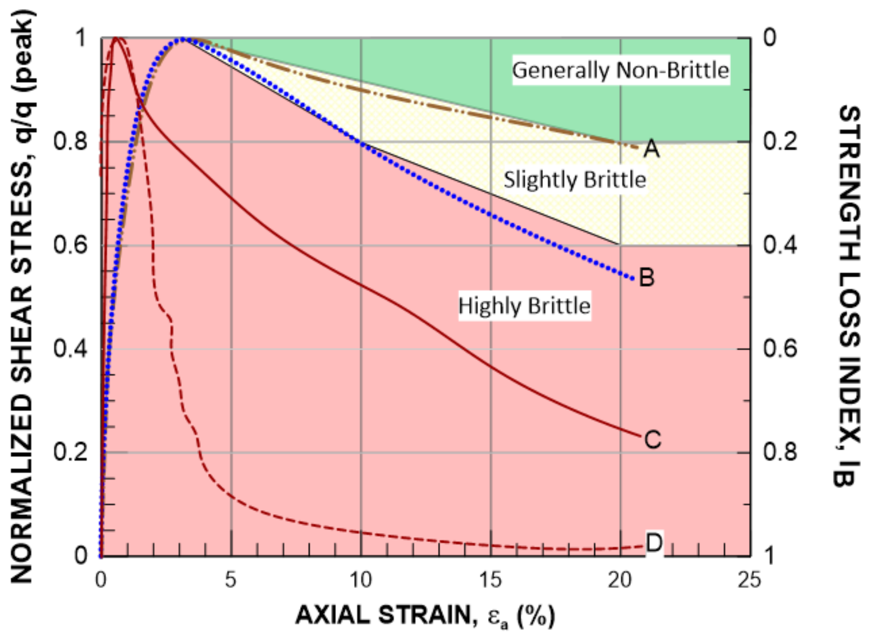
$(c_u)_f$ is the peak undrained shear strength

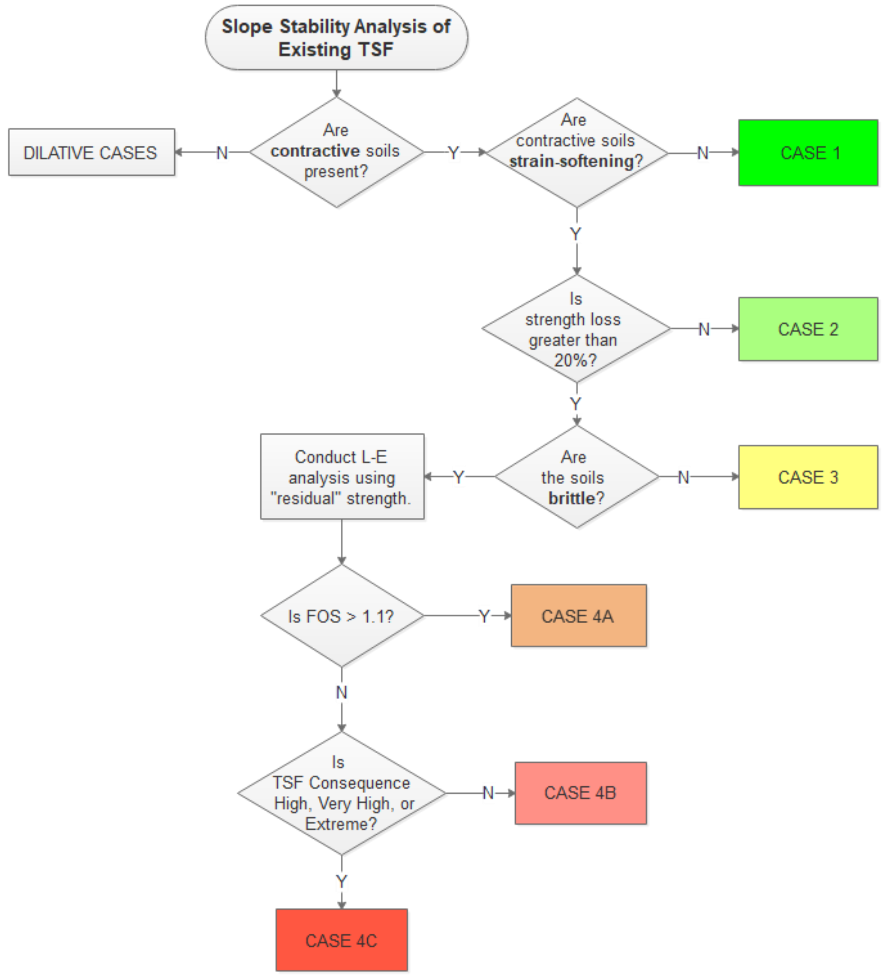
$(c_u)_r$ is the residual (critical state) undrained shear strength.

- Robertson (2020) suggests renaming as "strength loss index" to recognize the usefulness of I_B as a measure of the magnitude of strain softening.

Appendix B – Analysis Framework for Contractive Soils

- Presents a logical framework for selection of analysis techniques and selection of an appropriate factor of safety when the minimum targets cannot be met.
- Emphasizes that for new facilities, the use of contractive materials in structural zones should be avoided. If not possible, then the design must consider the potential for undrained shearing. Brittle materials should never be allowed in the structural zones of a dam.
- For existing facilities, it may be necessary to accommodate existing contractive and/or brittle materials in the structural zones. The treatment of tailings dams when these materials are present should consider the downstream consequences.
- Emphasizes the importance of the FOS calculated using post-liquefied (residual) shear strengths over the static FOS.


Generally Non-Brittle
Slightly Brittle
Highly Brittle
A
B
C
D
NORMALIZED SHEAR STRESS, q/q (peak)
STRENGTH LOSS INDEX, IB
AXIAL STRAIN, ε_a (%)
0
0.2
0.4
0.6
0.8
1
5
10
15
20
25


Slope Stability Analysis of Existing TSF
Are contractive soils present?
DILATIVE CASES
Are contractive soils strain-softening?
CASE 1
Is strength loss greater than 20%?
CASE 2
Are the soils brittle?
CASE 3
Conduct L-E analysis using "residual" strength.
Is FOS > 1.1?
CASE 4A
Is TSF Consequence High, Very High, or Extreme?
CASE 4B
CASE 4C
Y
N

7.10 - Seismic Design Criteria

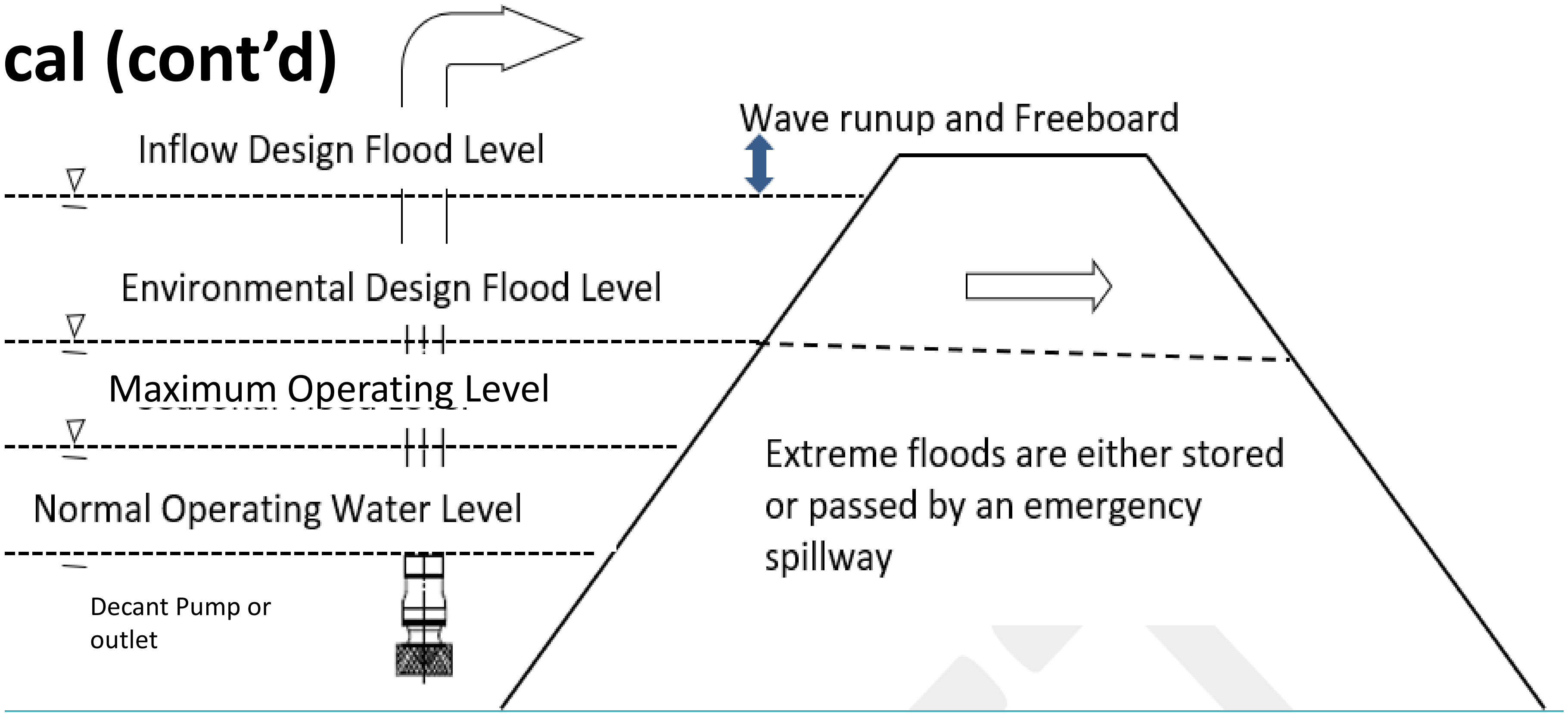
- Generally, have followed the minimum criteria recommended by the Global Industry Standard on Tailings Management.
- Four footnotes added:
    1) The selection of the probabilistic or deterministic (scenario-based) design earthquake ground motions should consider the seismic setting and the reliability and applicability of each method.
    2) The criteria presented are guidance for suggested minimum criteria. Each facility should be assessed for the potential to increase the design criteria to reduce risk (ALARP).
    3) The maximum credible earthquake (MCE) may also be referred to as Scenario Based Earthquake (SBE) which highlights the requirement to consider different scenarios when selecting the MCE. The MCE/SBE is based upon a deterministic seismic hazard assessment.
    4) When the consequences of failure are Extreme, a larger design ground-motion level may be justified. In such cases, a risk-based approach based on PSHA to ALARP should be considered.

7. Hydrotechnical

TSFs as much about water as tailings

- A minimum water pond to allow settling of fines and, geochemical attenuation.
- Temporary storage of normal seasonal inflows (rainy season or snowmelt periods).
- In cold climates: storage of water to account for ice
- Temporary storage of process water that could cause environmental harm if released, known as the Environmental Design Flood (EDF)
- Storage or routing of the Inflow Design Flood (IDF). Flood design determined by Consequence Category

7. Hydrotechnical (cont'd)



7. Hydrotechnical (cont'd)

- Operating levels should be based on detailed water balance
- Emergency spillway recommended
- If floods temporarily stored, then must be removed over appropriate time
- Desirable to minimize water storage

7. Hydrotechnical (cont'd)

- Selection of the return period and duration of EDF must consider:
  - water quality,
  - regulatory requirements,
  - the rate and duration of overflows,
  - the environmental sensitivity of the receiving environment,
  - downstream flow in the receiving environment and recipient,
  - downstream mixing characteristics, and
  - public perception
- Typically, AEP 1:10 to 1:200 and duration weeks to months

Environmental design is a important component of closure to provide long term geochemical and ecological stability of the TSF. As discussed in Section 6.2.3, geochemical characterization of the ta

Classification, hydrotechnical, environmental

Classification, hydrotechnical, environmental

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7. Environmental

- Need to considers the effects of the TSF on the receiving water quality, the potential for dust emissions, and potential effects on flora and fauna.
- Important to provide long-term geochemical and ecological stability.
- Chemical and geochemical characterization of the tailings and process water is required to inform the design
- Contaminant transmission in groundwater needs to be well understood

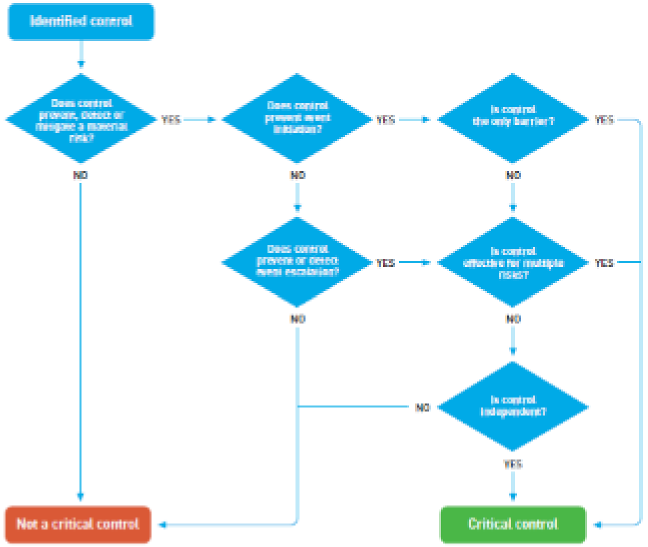
7. Environmental (cont'd)

- "allowable" seepage rate should be estimated to support engineering design of seepage control measures.
- Becoming increasingly necessary to predict the fate of contaminants (contained within the tailings seepage water) in the surrounding environment.
- A monitoring program for surface and ground water quality should be in place.
- Air quality may also be a concern with some TSFs, with dust generation from exposed tailings beaches possibly requiring special control

7. Environmental (cont'd)

- Design measures to mitigate potential water quality effects could include:
  - Treating process water prior to discharge into the TSF, for example by eliminating use of cyanide
  - Processing to segregate and manage tailings, for example flotation separation of sulphides to reduce volumes of PAF tailing.
  - Adding minerals or chemicals to neutralize the reactivity of sulphides, such as adding limestone to increase alkalinity, or
  - Compaction and/or saturation of sulfidic tailings to inhibit oxidation to mitigate the AMD potential

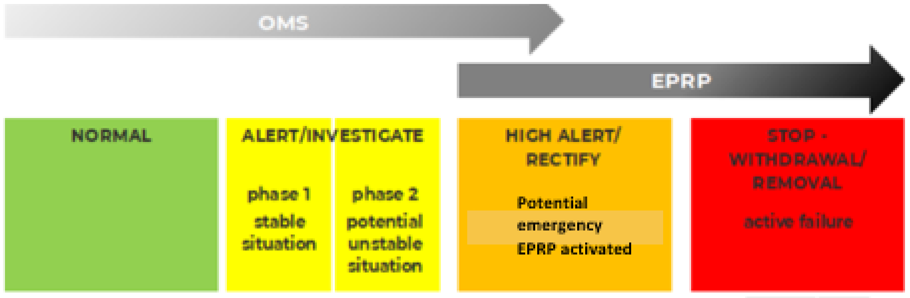
8. RISK MANAGEMENT



Source: Adapted from BHP Billiton.

Key Elements

- Understand the potential failure mechanisms
- Risk assessment (semi-qualitative and qualitative)
- Key preventative controls and assurance/verification examples
- Critical controls
- TARPS
- Monitoring the right things



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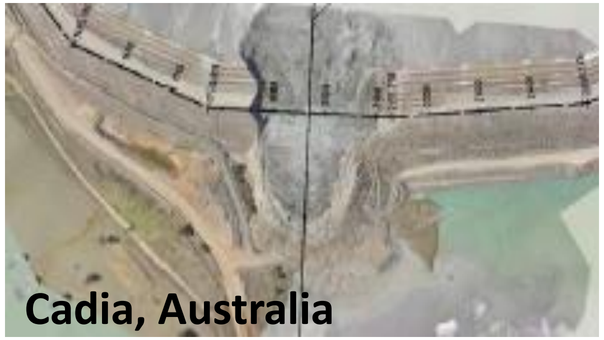
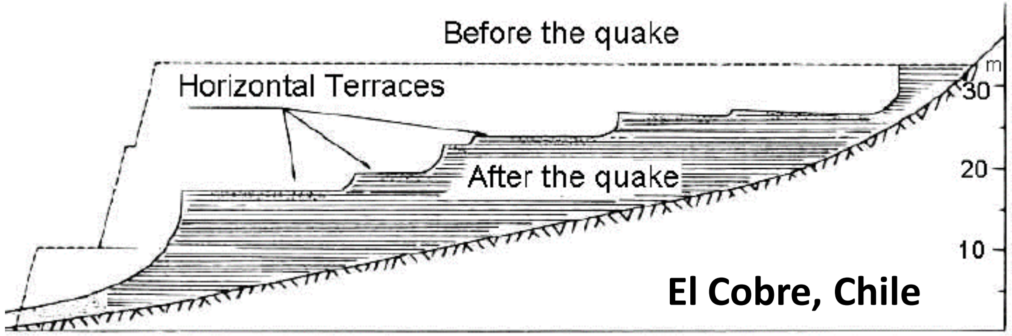
Committee L – WORKSHOP – Tailings Dam Safety Bulletin

9. DAM BREACH ASSESSMENT



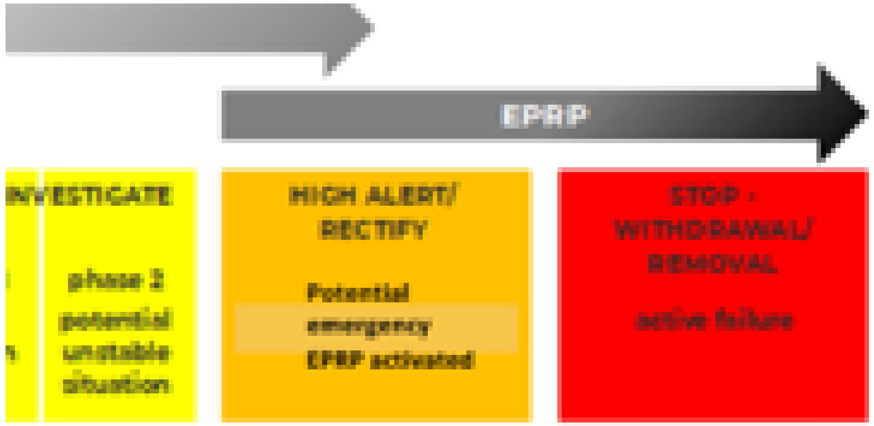


(Dobrv el al. 1967)

Key Elements

- Understanding tailings properties & liquidity index
- Not all tailings liquefy (static and seismic)
- The biggest “unknown” is the quantity of tailings release
- Many DBA make unrealistic assumptions of what happens to the tailings
- Water eroded tailings is normally the most significant mechanism of tailings release
- Residual liquefaction of tailings is poorly understood

10. EMERGENCY PREPAREDNESS AND RESPONSE PLANNING



Key Elements

- Link emergency preparedness to physically possible failure modes
- Transition from Operational TARPS to EPRP Alert Levels
- Being prepared for potential issues/failures (e.g. emergency spillway excavations)

11 - Construction

- Construction management, supervision and QA/QC must ensure the design intent is met
- EOR is responsible for the design, documentation and specifications
- The EOR is required to certify that the dam has been constructed in conformance the design intent.

11 - Construction (Contd.)

- EOR must sign off on :
    - Foundations
    - Construction materials
    - Construction methods
    - Changes to design during construction

11 - Construction (Contd.)

Documentation

- "As Constructed" drawings showing geotechnical conditions
- Construction reports
- Data management system for all construction records

11 – Operation

- Should be in accordance with approved procedures,
- Should be documented in an OMS Manual,
- Should be overseen by an appropriately qualified team
- Must meet the design intent
- Must achieve environmental requirements

11 - Operation (Contd.)

- Control distribution to meet spatial and consolidation requirements
- Maintain pool level, pool position and freeboard
- Optimise recycling of water
- Control dust generation
- Ensure separation of contact and non-contact water

11 - Operation (Contd.)

- Control tailings distribution to meet spatial and consolidation requirements
- Maintain pool level, pool position and freeboard
- Optimise recycling of water
- Control dust generation
- Ensure separation of contact and non-contact water

11 - Operation (Contd.)

Operation, maintenance and Surveillance Manual

- Should be completed prior to commissioning and be updated regularly
- Should include description of the facility
    - Tailings characteristics
    - Roles and responsibilities
    - Deposition plan, deposition method and schedule
    - Key design Criteria

11 - Operation (Contd.)

Operation, maintenance and Surveillance Manual

- Should include:
  - Monitoring and Surveillance requirements
  - Risk register
  - Maintenance requirements
  - Critical Controls and Trigger Action Response Plans
  - Maintenance requirements
  - Training requirements
  - Summary of Emergency Preparedness and Response Plan

SUMMARY

- Comprehensive bulletin that provides guidance for good governance and good design, opertion and closure of tailings facilities.
- Draft Bulletin to be complete December 2021
- Distribution to Tailings Committee members for review
- Translation and final editing for approval in Marseille 2022