

## Paradise Dam Essential Works Fact Sheet: Roller Compacted Concrete Sampling & Testing

**September 2020**

### **Background**

The Roller Compacted Concrete (RCC), that makes up the body of Paradise Dam, was placed in horizontal layers approximately 310mm thick. The joints between each layer of RCC are referred to as “lift joints”. The lift joints at Paradise Dam are a plane of weakness and could lead to failure of the dam during flooding.

Following the outcomes of the Building Queensland (BQ) “Options Assessment Report” in February this year, and work Sunwater was separately planning in parallel, Sunwater is undertaking additional sampling and testing of the RCC in the Paradise Dam to gain additional data on the condition of the lift joints to determine suitable remediation measures.

### **Who is undertaking this work?**

The retrieval and testing of RCC samples from Paradise Dam is overseen by Sunwater’s consultant GHD, as registered professional engineers in the State of Queensland. This is a requirement of the Queensland Professional Engineers Act, 2002.

Sunwater, has and continues to seek input from international experts, including the project Technical Review Panel, TatroHinds and potential additional experts, throughout the testing process.

### **Sampling and testing methodology**

Sunwater has developed a sampling and testing methodology for this work in consultation with national and international experts, including the project Technical Review Panel, TatroHinds and considering recommendations as developed by Rizzo International.

Block samples will be cut to the required size insitu allowing for testing with limited sample disturbance.

The primary requirement is that a lift joint is intact and in the middle of the sample. Its thickness only needs to be sufficient to lock one side of the sample in place and the shearing force applied on the other side of the lift joint. The surface area resisting the shearing force is the most relevant dimension in this type of testing.

This methodology will be trialled with block samples from the downstream face of the Secondary Spillway. Further changes to the methodology may be required based on the outcome of the trial.

### **What are we testing?**

We are testing the strength of the lift joints between the layers of RCC (refer to figures 1 and 2). The RCC lift joints at Paradise Dam present a plane of weakness in the body of the dam. Shearing strength, in this context, is the contact area between successive layers of RCC to resist sliding past one another when subjected to water loads from the upstream face of the dam.

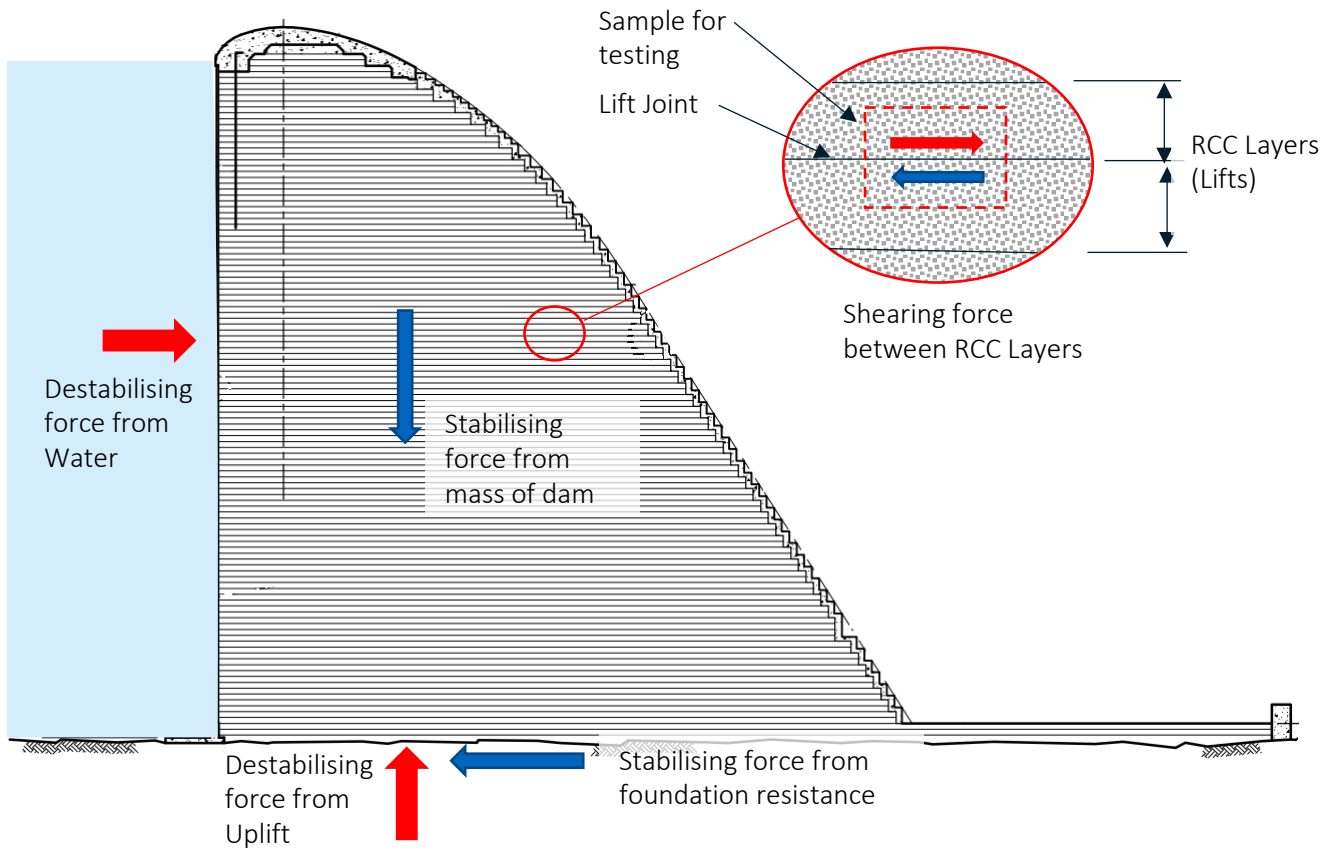


Figure 1 – Paradise Dam Spillway Section – Depiction of how forces relate to shear strength of lift joints

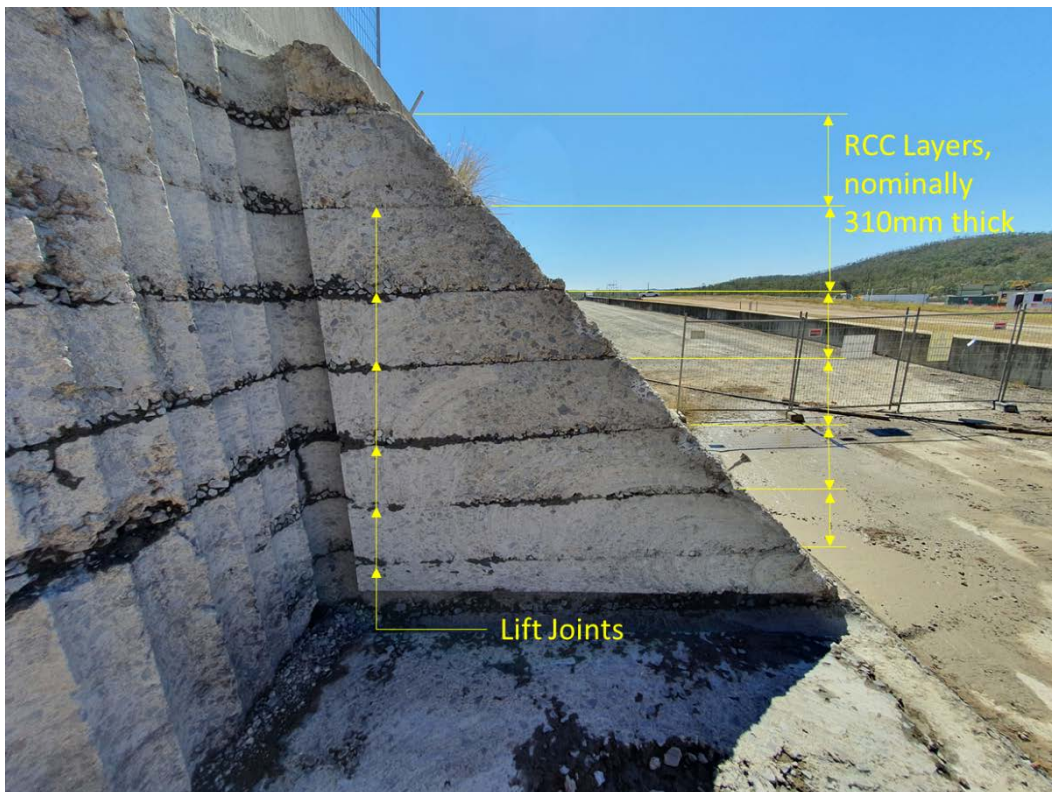


Figure 2 – Paradise Dam RCC – Photo taken of wedge removed from downstream side of Paradise Dam Secondary Spillway to remove blocks for testing

## **What size blocks will be tested?**

The original intention was to take block samples sized 300mm square x 600mm deep. However, the best laboratory apparatus identified in Australia for the trial requires a block size of 270mm square x 200mm deep.

A sample size of 600mm was initially determined based on taking a full layer of RCC on each side of a lift joint. This is not necessary for testing. A sample 200mm deep with the lift joint running through the middle has been confirmed with TatroHinds as suitable for obtaining accurate results. The key component for TatroHinds recommendation for block sampling is to provide for an increased shear plane surface area, the 270mm square (consistent with the recommended nominal 300mm square), being higher than the previously tested 150mm diameter cores.

## **Laboratory selection**

The Trilabs laboratory in Brisbane will conduct the tests. This is an accredited Brisbane laboratory that can provide surety of results.

## **Have international laboratories been considered?**

Using an international laboratory is not preferred as it would introduce additional transport risks of damaging the samples and increase the time to get results.

Sunwater has approached the University of Canterbury in Christchurch. While their apparatus may have the capability to undertake the RCC testing, it would not be available for a minimum of 12-18 months.

Sunwater will not delay the testing as we are committed to provide laboratory certified results to BQ by early 2021 and want to ensure that a solution for the dam is determined as soon as possible.

## **Testing apparatus**

The selected apparatus (shown in Figure 3) is a GCTS-300 that can apply 100 tonne normal and shearing loads (i.e. bi-directional loading) to a 270mm square x 200mm deep RCC sample.

The RCC sample is placed within the shearbox which distributes the force into the bottom part of the sample (below the lift joint). A constant normal force is applied by a hydraulic ram to the top of the sample, which simulates the vertical forces the sample would experience within the dam.

The Shear Force is then applied at a very slow rate (0.1mm/min) and movement measured. This slow shearing rate is to ensure that the minute change in movement when the bond between layers initially breaks can be measured precisely. The point when the bond is broken is referred to as the Peak Strength.

The test continues until residual strength is reached, which is the point when the shear stress stabilises during shearing.

Figure 4 shows in section how the RCC block is tested.

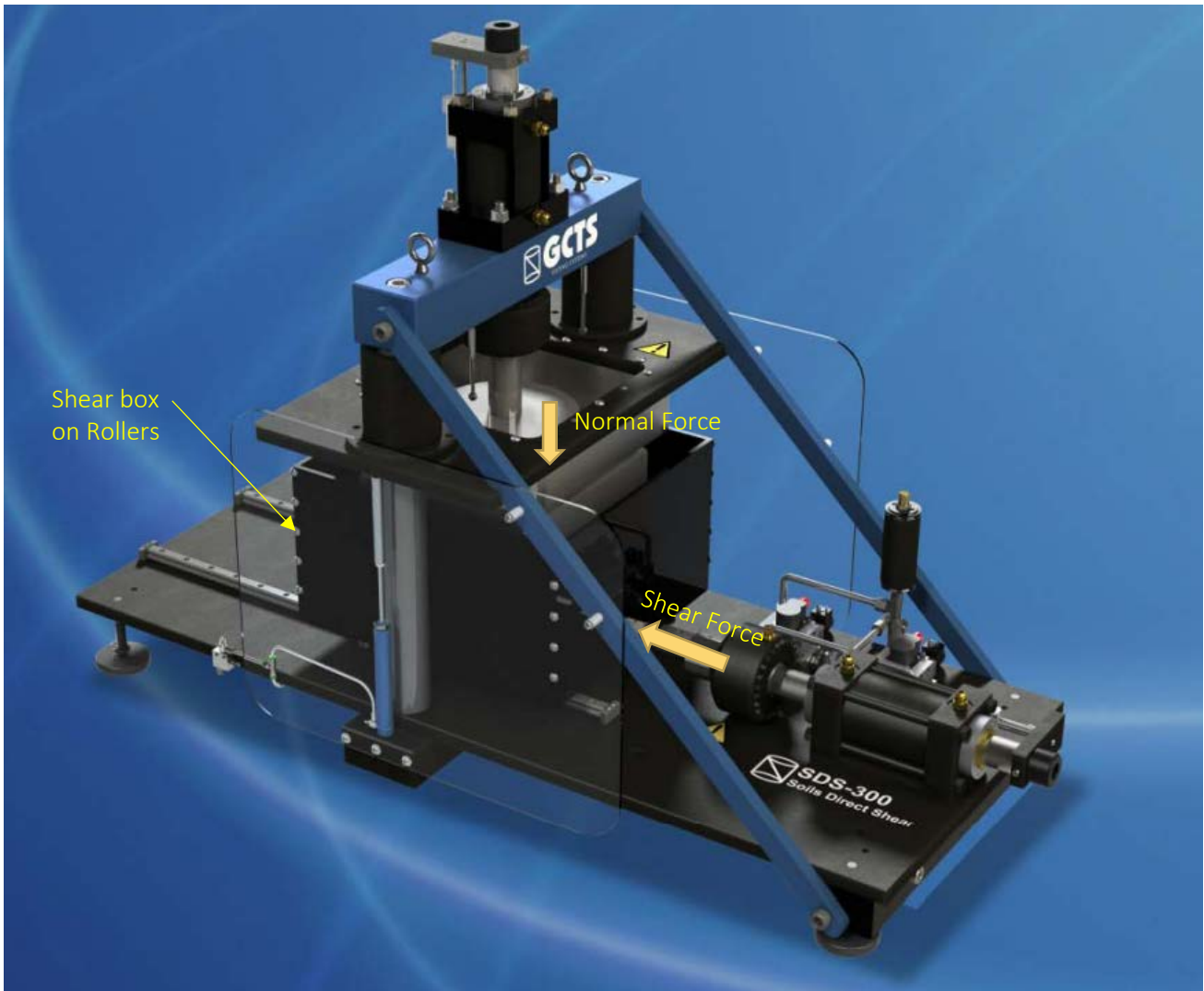


Figure 3 Shear box test apparatus

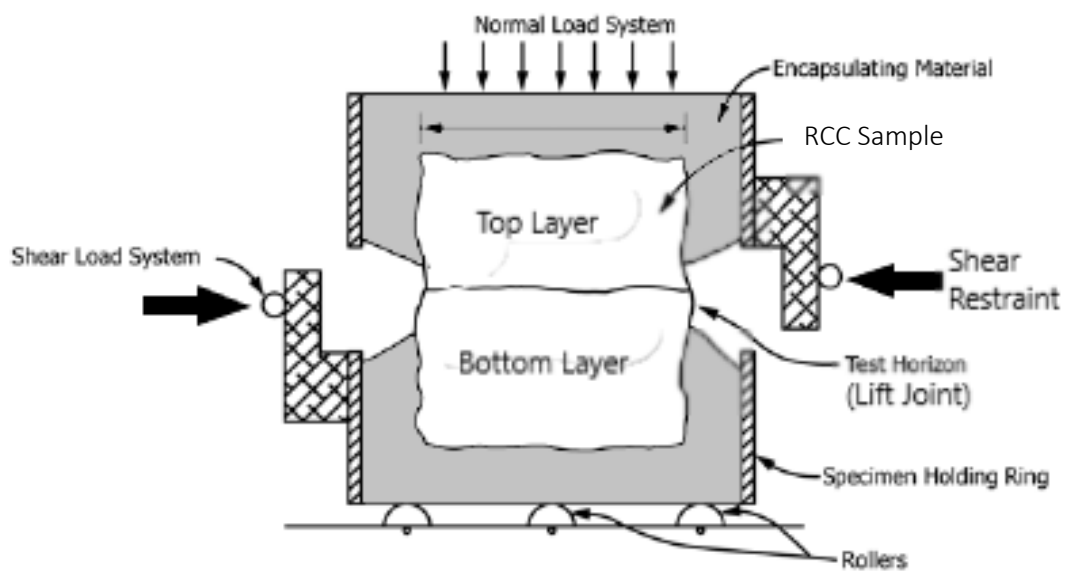


Figure 4 - Section - direct shear test of RCC lift joint

## Core samples

Sunwater will also drill 200mm diameter vertical core samples (up to 20m long) in the Primary Spillway and up to 50m long inclined cores which start in the abutments and go into the Primary Spillway. Coring in this manner will intercept many more lift joints that can be sampled, and the shear strength tested. In addition to coring at a larger diameter than has previously been undertaken at Paradise Dam, Sunwater will utilise specialised triple tube core barrels which is the best technology available for core recovery.

Figure 5 shows an example core taken previously from Paradise Dam.

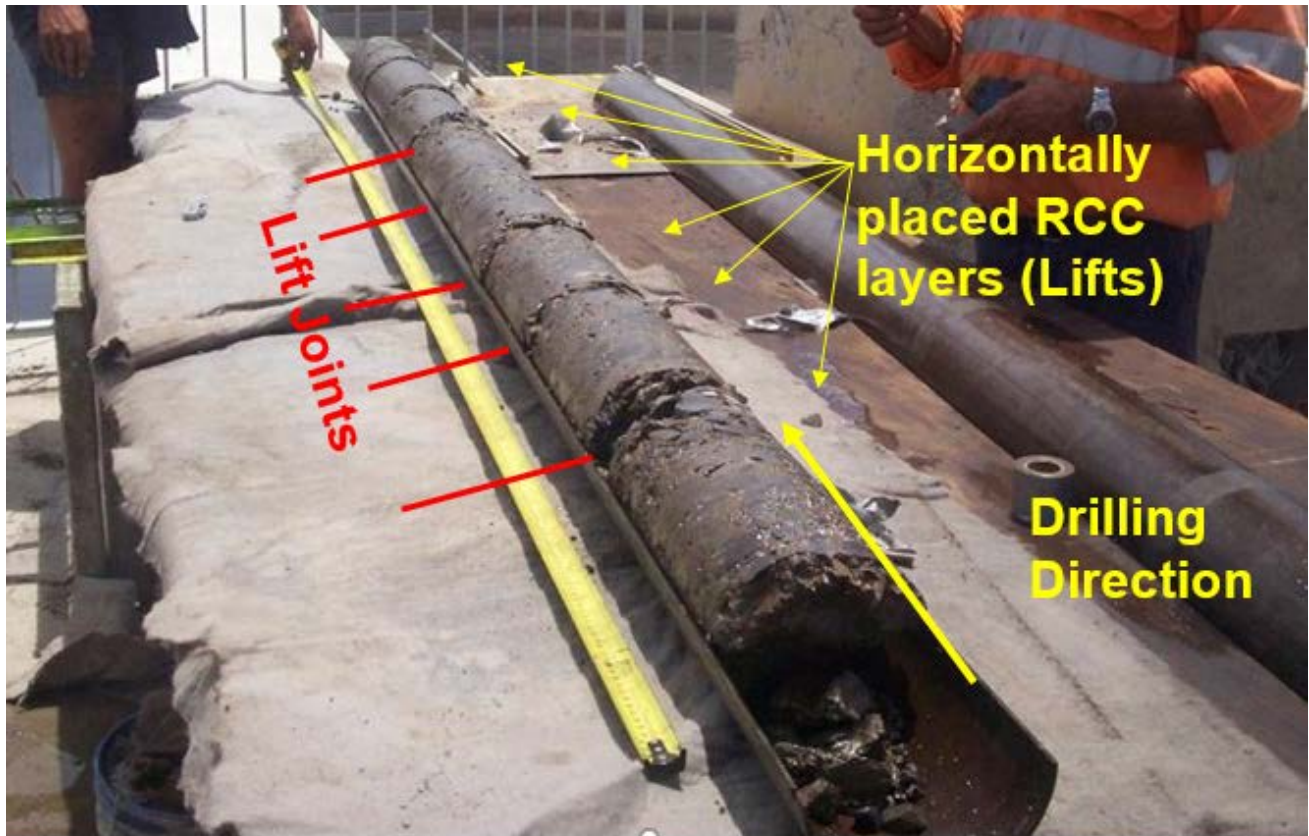


Figure 5 — Example of an RCC vertical core sample

## Timing & results

The sampling work commenced in July. Acquiring samples is a careful and slow process with samples to be taken progressively from the Secondary Spillway, then the Primary Spillway over coming months. Samples will be sent to the laboratory for testing and results will be available progressively.

A full and final set of results is anticipated to be available to provide to BQ in early 2021 to facilitate the further evaluation of options for the long-term future of Paradise Dam.

## Stakeholder engagement

Sunwater is committed to ongoing stakeholder engagement to ensure there is transparency of the RCC testing process. We will share progress updates as the methodology is trialled and results become available.

## Questions?

Please contact us on 3120 0270 or [paradise.dam@Sunwater.com.au](mailto:paradise.dam@Sunwater.com.au) with any questions.