REPAIR/REPLACEMENT OPTIONS FOR CONCRETE LINED IRRIGATION CHANNELS

CASE STUDY

JOINT REPAIR WITH RUBBER INSERTION SEALS

Case Study – Rubber Insertion Seals

1 Background

This case study is based on a method employed in the Mareeba Dimbulah Irrigation Area (MDIA) in North Queensland for the repair of concrete lined channel joints. The MDIA has about 400km of channels and pipeline, of which about 60km is concrete lined trapezoidal channel and 30km is box flume channel.

This document describes the installation procedure used for rubber insertion seals (see Figure 1) which are placed into the excavated/cleaned joint. This method of joint repair was employed primarily on trapezoidal concrete lined channels, however the method may well be used on box flume joints also. The seal is self-locking (to a certain degree self-sealing) and once the old joint has been suitably treated, requires little other attention prior to insertion.

FIGURE 1

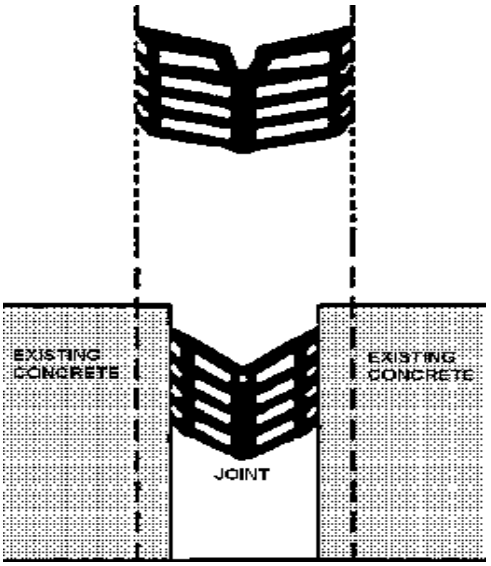

FIGURE 2

2 The Problem

The problem of failing joints in concrete lined irrigation channels in the MDIA is quite significant (see Figure 2 for an example of a deteriorated joint under repair) and can directly contribute to loss of water and loss of potential revenue. The channel discussed in this case study was first highlighted as leaking by a local landowner who had noticed losses and some external discharge.

A major problem with leaking channels is that when water from the channel seeps into the surrounding foundation material (often plastic or erosive soils). Erosion, subsidence or shrinking and swelling of the foundation material can cause significant damage to the structural integrity of the concrete lining itself.

The concern is that if this leakage was to continue unchecked, entire sections of channel could be severely damaged and require replacement at a much greater expense.

Joint deterioration from aging/weathering (of concrete and joint seals) is a significant cause of failure in the MDIA and the repair option employed with this type of deterioration requires careful consideration. In these cases the concrete itself is often so deteriorated that there is little point repairing the joint (geomembrane lining may prove to be a more suitable option in this case). Another type of failure is caused by poor/inappropriate construction techniques employed at the time the channel was built. If joints in irrigation channels are not installed using suitable procedures and appropriate materials the result can often be premature joint failure. Most failures are often a combination of both mechanisms.

3 Solution

The following step-by-step procedure is one of the methods that have been employed in the MDIA for the repair of joints in trapezoidal channels.

Step 1.
The channel was drained and allowed to dry. The “Out of Service” time will largely depends on the proposed extent of the works.

Step 2.
All joints were thoroughly cleaned before the installation of new joint sealant. The existing sealant was removed with a joint plow, or similar equipment, which removed any joint seal and back-up material. Any procedure or equipment which results in damage to the concrete should be terminated and other methods employed. Hand tools were used to remove materials from irregular joint faces.

Step 3.
A high-pressure water jet was used to remove all debris and mortar paste from the joint. High-pressure air was used to blow out residual free water and debris in the joint reservoir. After air blowing, joint faces were inspected for cleanliness and loose debris.

Step 4.
When clean and dry, a layer of silicon was placed in the joint seal reservoir ensuring the entire base of the joint was covered. The Silicon was applied as an added precaution.

FIGURE 3

Step 5.
A self-sealing, pre-fabricated rubber insertion seal was then pushed into the exposed joint by hand with an insertion tool to hammer the seal home (Figure 3). Great care was taken to ensure that the rubber seal was embedded all the way to the bottom of the joint. Ideally there should be no part of the seal protruding from the joint once it is installed.

Step 6. A protective coating of bituminous paint (see Figure 5) was then placed over the rubber joint to protect it from weathering (primarily sunlight) and damage that could be caused during channel cleaning operations. The protective coating was not effective and soon pealed away.

FIGURE 4

FIGURE 5

4 Conclusions:

- Some sealant products previously used have proved to be unsuitable to the relatively harsh conditions of an irrigation channel environment for example: rapid wetting/drying and UV radiation.
- The prefabricated rubber strip can be supplied for approximately $10 - $20 per linear metre. Most rubber supplier will be able to provide the same or similar product.
- The application of the silicon base (Step 4) was included as an additional precaution does not appear to have a significant affect on the joints seal.

If it is proposed to insert the seal without the silicone a trial of a few joints should be undertaken to prove this procedure performs adequately.

- The method described in this case study is quite labor intensive and requires a lot of manual labour in the removal of the existing seal and the hands-on requirement for installing the new rubber insertion seal.

- In the future, joint faces may be re-faced using a self-propelled concrete saw with diamond blades (see Figure 5 for example of saw cut joint). The saw should have a gang mounted blade with the outside blades spaced to slightly enlarge the joint and remove all materials which adhere to the joint faces. The blade should be stiffened with dummy blades or washers. Immediately after cutting a high-pressure water jet should be used to remove all debris and mortar paste from the saw cuttings. This method has proven successful with similar repairs and would obviously provide an improved surface for the rubber seal to be inserted into.

- A concrete saw could also be used to cut new or additional joints where required in an existing concrete lining.

FIGURE 6

5 References/Acknowledgments:

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Further Information

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