



## **REPAIR/REPLACEMENT OPTIONS FOR CONCRETE LINED IRRIGATION CHANNELS**

### **GUIDELINES FOR JOINT REPAIR AND POST CONSTRUCTION JOINT INSTALLATION**





# 1 Overview

The purpose of this guideline is to list some of the maintenance procedures commonly used to repair joints in concrete lined irrigation channels. Many of these techniques can also be used to install new joints in existing concrete lining to control cracking and or accommodate foundation movement.

One of the major problems with concrete lined channels and box flumes is that concrete works will often out last the seals used in the joints between the concrete sections. It can prove quite costly if over the lifetime of a channel the joint seals require replacement several times. All of the procedures discussed in this document are labor intensive and/or require the use of expensive products. Minimising the number of joints that require repair and ensuring that optimum repair procedures are used, greatly reduces the maintenance costs associated with these channels.

Information has been sought from suppliers, installers and research facilities within Australia as well as several sources overseas, with a few of these establishments supplying input to this report.

There are many issues that are common to the repair of cracks and joints. The guideline on “Crack Repair” gives further information.

Visits to sites in Queensland, New South Wales and Victoria have been carried out to assess what is currently considered the best practice. Some “hands on” experiences have been documented and some of those appear as case studies included in this package.



## 2 Issues to be Considered

When considering a repair option for joint repair/replacement there are several issues that need careful consideration. Firstly a thorough investigation of the existing channel should be carried out by a person well experienced in issues relating to concrete deterioration and repair. This investigation will need to comment on specific issues such as:

- Age of the channel
- Existing channel use
- Commercial value of the channel
- Possible future requirements for the channel
- The state of the foundation materials
- Damage from weathering
- Damage from external factors
- Type of damage
- Existing life expectancy
- Amount of “down time” required for repair
- Life expectancy for each repair option
- Cost of complete replacement of channel

If it is intended to employ the services of a contractor for the supply and installation of the new sealing mechanism a detailed summary should be prepared highlighting all of the site problems and channel conditions. This summary should be forwarded to each potential contractor to enable them to make a sound assessment of the requirements for the project. This procedure should also be followed when the manufacturer is only supplying a sealing material.

Care should also be taken when selecting materials for repairing joints in concrete lined irrigation channels as all suppliers tend to believe that their product is the right product for the job. There are many products that will achieve essentially a similar result with widely varying costs, application rates and labour requirements. When requesting information from a supplier, they should detail the following:

- Estimated application rate per repair;
- Estimated time required per repair;
- Relative cost per application;
- Suitability of the material for the desired application;
- Life expectancy of the product once installed;
- Ability for the product to be used by non-specialised construction crews.



### 3 Product Type and Method Details

The following repair methods and associated products were examined as part of this research.

**Rubber Insertion Seals** - The rubber seal system examined is a self-locking (to a certain degree self-sealing) rubber strip that is available in varying sizes to suit most sealing requirements. The seal is generally provided on a per metre basis. The basic installation method is to remove and excavate the existing joint and replace it with the rubber seal.

**Bitumen Based Joint Filler** - This product is designed to replace/overlay the existing joint sealant. Due to its putty like consistency when heated, this material is suitable for bonding to vertical faces.

**Hydrophobic Polyurethane Grout** - This product is injected into joints via a grease nipple like coupling and when the product makes contact with water it reacts to form a water tight seal.

**Rapid Set Marine Mortar** – It is a cement based product that was specifically developed for underwater repair and restoration work.

### 4 Installation Considerations

**Rubber Insertion Seals** - The installation procedure used is to place the rubber insertion seals directly into the excavated/cleaned joint. This method of joint repair was employed primarily on trapezoidal concrete lined channels, however it has the potential to be used on box flume joints.

**Bitumen Based Joint Filler** – Bitumen based joint fillers may be applied to many types of joint repair as the sealing agent has a suitable consistency to bond to a wide variety of surfaces and locations.

**Hydrophobic Polyurethane Grout** - Hydrophobic polyurethane grout is mainly suitable for joint repair where there is a failure of the internal joints of box flumes. There are a number of other possible applications for hydrophobic polyurethane grout.

**Rapid Set Marine Mortar** - This product has proven suitable for most types of joint repair in concrete lined irrigation channels. Due to its rapid setting nature, care needs to be taken in the preparation as it has the potential to 'go off' prior to the completion of the installation.



## 5 Summary and Recommendation

**Rubber Insertion Seals** – This product is suitable for where there is joint failure only and the existing joint is not difficult to remove. This method is quite labour intensive in the removal of the existing seal and the hands-on installation of the new rubber insertion seal.

### **Bitumen Based Joint Filler -**

Bitumen based fillers can be used to fill joints and wide cracks. They have some flexibility when cured and as such can accommodate some future movement. The three day consolidation period required for most bitumen based joint fillers may be a problem if minimal supply disruption is critical.

**Hydrophobic Polyurethane Grout** – This repair option is suitable mainly for internal joints where access can not be readily gained to the sealed area. This material is not intended to replace the existing sealing mechanism (although it may surround and possibly protect the seal). In some cases the existing seal may continue to deteriorate and therefore require further treatments. The cost of this method is difficult to estimate, as the quantity of product used will depend on the extent of damage and the width of crack/joints to be sealed.

Due to the aggressive way in which this material reacts with water it has quite strict preparation/application and clean-up procedures that to the uninitiated may prove complicated. It is envisaged that as familiarity with the product improves so will the installers ability to handle some of these difficulties.

**Rapid Set Marine Mortar** – This is a very versatile material that can be produced in a near slurry like consistency for the bottom and sides of trapezoidal of channel as well as prepared to a putty like consistency for insertion into the vertical joints commonly found in box flume channels.

The product can be applied successfully under water when prepared to a putty like consistency.

There are some difficulties when learning how to prepare the material and maintain it at a suitable consistency. This is overcome as the operational personnel become more familiar with the material.

The material is not ideally suited for areas with high foundation movements as it sets quite rigidly and has little flexibility.

### Further Information

Further information on this document can be obtained by contacting the author, Mr Scott Walton of Department of Natural Resources, Engineering Services (Queensland) on (07) 4783 0555.