



Repair/Replacement of Concrete Lined Irrigation Channels

Case Study Channel Repair with Liquid Boot

California Aqueduct
Palmdale, California, USA

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1. General

1.1 Background

The California State Department of Water Resources, operates and maintains the California Aqueduct, one of the worlds largest gravity fed potable water channel systems, The Aqueduct is in excess of 1,000km long with only two transitory pump stations assisting flow over two mountain ranges. In the past the DWR has tried numerous systems when vital 'repair work' (ie. 320,000m²) was needed. Invariably, all these systems required that the channel be shut down for extensive periods.

FIGURE 1



1.2 Site Conditions

The Aqueduct is constructed of formed concrete panels with an HDPE liner sandwiched between two layers of concrete. In general the Aqueduct is bordered each side by a service road 6.0m wide, the system is inspected daily along its entire length by DWR employees and by Helicopter.

1.3 Extent of Problem

Following violent storms, extensive damage occurred to approximately 8,000m² of Aqueduct near Palmdale, California. The old concrete was excessively cracked allowing water under the original panels and causing massive differential settlement, which led to blowouts in various sections resulting in flooding of neighbouring properties and a small town.

2. Adopted Solution

Various options were considered for an emergency repair of the canal and were costed accordingly. All options excluding the adopted solution called for the system to be shut down in excess of two weeks which would have exhausted reserve supplies for the DWR clients, principally the City of Los Angeles.

Options considered consisted of: -

- Saw cutting and removing the affected area, lining the exposed embankment with HDPE and shotcreting over the liner.
- Patching the area without removal of existing concrete and shotcreting over the patches.

2.1 Adopted Repair Option

Due to the time constraints imposed on the canal owners and with additional cost savings, although important, savings were secondary to the repair option selected, The DWR chose to use “Liquid Boot”.

The canal was emptied between two Locks, which are located approximately every ten kilometres. Following emptying, the canal walls and invert were pressure washed to remove built up dirt and silt. A transverse ditch was saw cut 50m upstream and 50m downstream from the affected area as well as a conventional ditch at the top on each side of the canal to act as an anchor point for the geotextile fabric. The affected area was removed back to bare dirt and compacted to 90%, as this was being carried out a tack coat of “Liquid Boot” was spray applied over the entire surface area in liquid form, this allows the membrane to seal any smaller cracks in the concrete. Geotextile fabric in 4m wide rolls was placed over the surface area and into the transverse and side trenches. The geotextile acts as reinforcement for the membrane.

“Liquid Boot” was then spray applied by two teams of four applicators working around the clock, mostly in sleeting and below freezing conditions.

FIGURES 2-5





Immediately following the application of “Liquid Boot” a second layer of Geotextile fabric was placed over the membrane. The shotcrete crews commenced placing 50mm concrete wear course over the “Liquid Boot” membrane and concrete filled the trenches to anchor the membrane below the wear course.

3. Conclusions

All of this work was carried over a period of five days in mid winter in freezing conditions and the canal was reopened by midnight of the fifth day. Considering the volume of water flowing through the canal and the hydraulic flow rate it was considered necessary to apply the concrete wear course to combat the abrasiveness of the water. The initial set of the membrane allows the concrete to be placed immediately, saving time over conventional membranes where curing time is required for more than 72 hours. Where the flow rate is less significant, “Liquid Boot” can be spray applied directly onto the concrete following crack repair without the need for a concrete wear course.

Further Information

Further information on this document can be obtained by contacting the author, Mr Barrie Rogers of Rotec Australia Pty Ltd whose company is involved in the application of “Liquid Boot” in Australia. Barrie can be contacted on (02) 9300 9629.

During August 1999 Rotec Australia will be carrying out demonstrations for the Murrumbidgee Irrigation District, Griffith office at the direction of Mr Mick Turner {Ph: (02) 6962 0223}. The trial will consist of spray applying “Liquid Boot” over an area of severely cracked irrigation canal, which will be prepared similar to the Aqueduct project. The crack repair will utilize “Liquid Boot” trowel grade which is a slow setting pliable version of “Liquid Boot” mixed by hand and pointed into the cracks.