Presentation on
Geosynthetics Water Barriers in Kadamparai Dam

Exposed Geomembrane After 10 Years of Installation

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Kadamparai stone masonry dam, 67 m high, 478 m crest length (masonry section), was completed in 1984. The dam is pumped storage scheme with a capacity of 4X100 MW
Kadamparai dam, the upstream face
At first impoundment it was observed a maximum seepage of 1,120 lpm
The seepage through the drainage gallery gradually increased well above the allowable limit.
During 1990 to 1994, various ways and means have been tried to minimize leakage by doing from the crest vertical drilling and grouting at close intervals. These methods were unsuccessful and the seepage kept increasing (up to 38,000 lpm)

Leakage collection at downstream
During 1999 racking and packing at selected locations was carried out on the upstream face of the dam, including chemical treatment in underwater conditions.
In fact the chemical treatment proved to be totally unsuccessful because it became unbounded with the masonry and peeled off.

Chemical grout came out through the drainage gallery by leaving more cavities inside the masonry body of the dam.
Cementitious materials and fines were eroded and collected in the drainage gallery.
Next attempt was racking joints which have to be filled up with cement mortar and pointing had to be carried out. Even then the leakage rate was going up.

During the process of racking and pointing it was found out that the mortar was without any cement content at some locations.
In June 2003, Carpi Tech SA, a waterproofing specialist contractor from Switzerland, was invited to study the conditions of Kadamparai dam and to suggest remedial measures for watertightness.
The contractor CARPI took over the site by end of November 2004 and started preparatory works which ended by December 2004.

Shotcrete with reinforcement was placed only along the ground line, to smooth the surface and allow installation of the geomembrane perimeter seal.
Installation of the geomembrane system started in middle of January 2005. Installation was performed from special travelling platforms suspended from the crest and which were imported from Italy.
Installation of vertical lower profiles started in mid-January 2005
The stainless steel profiles which fasten the geocomposite to the face of the dam, are adjusted to follow the shape of the upstream face and fastened by chemical anchors placed in the stone masonry.
The OFC (Optical Fiber Cable) for leak detection, has been placed along the perimeter seal, behind the geocomposite.
A high transmissivity non-compressible geonet was placed along the perimeter seal to collect the drained water and convey it to the discharge point in the gallery.
A geotextile was installed on the upstream face, to protect the geomembrane against puncturing.

Geotextile, 2000 g/m²
The anchoring profile at crest consists of a batten strip, placed over the surface smooothened with mortar. Ventilation pipes avoid formation of vacuum behind the geocomposite.
The PVC geocomposite was laid over the antipuncturing geotextile.

Geocomposite

2.5 mm PVC + 500 g/m² geotextile
The tensioning profiles stretch the geocomposite and anchor it by vertical lines, imposing minimum stress to the material.
The external tensioning profiles are covered by a PVC geomembrane strip which is heat welded to the parent geomembrane below.
The perimeter watertight seal is created, by placing chemical anchors, bedding mortar, geocomposite, gasket, stainless strip batten strip. Then the specified torque is applied to the bolts of the anchors.
The works have been completed on April 8, 2005, 10 weeks after installation of the first profiles started. Impounding began on April 12, 2005.
Kadamparai dam fully impounded (July 2005)
KADAMPARAI dam

Conclusion

Before repair

38,000 lpm

After repair

80 lpm
Maintenance After Installation

Absolutely ZERO Maintenance in this 10 Years of service

Observations after 10 Years of Service

- Geocomposite still intact
- No indication of any kind of damage to the fixation devices
- Kadamparai Power House able to generate power to its full capacity
- Leakage still around 100 liters/min
After nearly 10 years of service, without any maintenance cost, the system ensures water proof with leakage rate around 100 liters/minute.
After 10 Years of service, the gallery and the upstream face of the dam still remains intact.
Conclusion

- Live Evidence of Zero maintenance Dam with respect to Leakage
- No anomalies reported by the department since its installation