

# Roller-compacted concrete

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**Roller-compacted concrete (RCC)** or **rolled concrete** is a special blend of concrete that has essentially the same ingredients as conventional concrete but in different ratios, and increasingly with partial substitution of fly ash for Portland cement.<sup>[2]</sup> RCC is a mix of cement/fly ash, water, sand, aggregate and common additives, but contains much less water. The produced mix is drier and essentially has no slump. RCC is placed in a manner similar to paving; the material is delivered by dump trucks or conveyors, spread by small bulldozers or specially modified asphalt pavers, and then compacted by vibratory rollers.

In dam construction, roller-compacted concrete began its initial development with the construction of the Alpe Gera Dam near Sondrio in North Italy between 1961 and 1964. Concrete was

laid in a similar form and method but not rolled.<sup>[3][4][5]</sup> RCC had been touted in engineering journals during the 1970s as a revolutionary material suitable for, among other things, dam construction.<sup>[6]</sup> Initially and generally, RCC was used for backfill, sub-base and concrete pavement construction, but increasingly it has been used to build concrete gravity dams because the low cement content and use of fly ash cause less heat to be generated while curing than do conventional mass concrete placements. Roller-compacted concrete has many time and cost benefits over conventional mass concrete dams; these include higher rates of concrete placement, lower material costs and lower costs associated with post-cooling and formwork.



The rebuilt upper reservoir of the Taum Sauk plant, nearing completion in this photo, is the largest RCC dam in North America.<sup>[1]</sup>

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## Dam applications

For dam applications, RCC sections are built lift-by-lift in successive horizontal layers resulting in a downstream slope that resembles a concrete staircase. Once a layer is placed, it can immediately support the earth-moving equipment to place the next layer. After RCC is deposited on the lift surface, small dozers typically spread it in one-foot-thick (300mm) layers.<sup>[7]</sup>

The first RCC dam built in the USA was the Willow Creek Dam on Willow Creek, a tributary in Oregon of the Columbia River. It was constructed by the Army Corps of Engineers between November 1981<sup>[8]</sup> and February 1983.<sup>[6]</sup> Construction proceeded well, within a fast schedule and under budget (estimated \$50 million, actual \$35 million). On initial filling though, it was found that the leakage between the compacted layers within the dam body was unusually high. This condition was treated by traditional remedial grouting at a further cost of \$2 million, which initially reduced the leakage by nearly 75%; over the years, seepage has since decreased to less than 10% of its initial flow. Concern over the dam's long-term safety has continued however, although only indirectly related to its RCC construction. Within a few years of construction, problems were noted with stratification of the reservoir water, caused by upstream pollution and anoxic decomposition, which produced hydrogen sulfide gas. Concerns were expressed that this could in turn give rise to sulfuric acid, and thus accelerate damage to the concrete. The controversy itself, as well as its handling, continued for some years. In 2004 an aeration plant was installed to address the root cause in the reservoir, as had been suggested 18 years earlier.<sup>[6]</sup>



Willow Creek Dam, RCC gravity dam, Oregon, USA

In the quarter century since Willow Creek, considerable research and experimentation have yielded innumerable improvements in concrete mix designs, dam designs and construction methods for roller-compacted concrete dams; by 2008, about 350 RCC dams existed world-wide.<sup>[9]</sup> Currently the highest dam of this type is the Chinese Longtan Dam, at 216 m, with the Pakistani Diamer-Bhasha Dam under construction at 272 m.

## See also

- A list of roller-compacted concrete dams
- Asphalt concrete

## Further reading

- Berga, Luis (2003). *Roller Compacted Concrete Dams*. Taylor & Francis. ISBN 90-5809-564-9.

## References

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7. Portland Cement Association
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9. Brian Forbes, RCC – New Developments and Innovations (<http://www.ibracon.org.br/eventos/50cbc/CCR-apresentacoes/Forbes.pdf>) Brazilian International Roller Compacted Concrete (RCC) Symposium, Salvador, Brazil, 7Sept. 2008

## External links

- History of Concrete



Wikimedia Commons has media related to ***Concrete***.

(<http://inventors.about.com/library/inventors/blconcrete.htm>)

- Database of Worldwide Roller Compacted Concrete Dams ([http://rccdams.co.uk/database\\_search.php](http://rccdams.co.uk/database_search.php))

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