



Hydraulic structures. Dams and reservoirs

Concrete dam engineering -3

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**Strengthening of master curricula in water resources
management for the Western Balkans HEIs and stakeholders**

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conventional concrete -method of placing



Roller-Compacted Concrete (RCC)

Concept and significance

- **major shift in the construction practice of mass concrete dams!**
- traditional method of placing, compacting, and consolidating mass concrete is a slow process
- construction of earth and rock-filled dams speedier, more cost-effective.

first application of RCC technology in 1974

The repair of the collapsed intake tunnel of **Tarbela Dam** proved that :

- material had more than adequate strength and durability
- maximum placement of $18,000 m^3$ of RCC in one day is still the world's record

Definition:

roller compacted concrete (RCC) is a concrete compacted by roller compaction.

The concrete mixture in its unhardened state must support a roller while being compacted!

RCC differs from conventional concrete in its **consistency requirement**:

- **be dry enough** to prevent sinking of the vibratory roller equipment
- **be wet enough** to permit adequate distribution of the binder mortar in concrete during the mixing and vibratory compaction operations

Sequence of placement



Sequence of placement



Sequence of placement



Sequence of placement



Materials

- **Cement**

when RCC is to be used in mass concrete, the recommendation of selecting cements with **lower heat generation** should be followed

Materials

- **Mineral admixtures**

are used extensively in RCC mixtures

to reduce

→ the adiabatic temperature rise of concrete

→ and costs,

+ to improve durability

Class C fly ash, slag, and natural pozzolan have been used

Materials

- **Chemical admixtures**

Air-entraining and water-reducing admixtures are used in RCC compositions

Set-retarding admixtures can extend the time up to which the concrete lift should remain unhardened
→ reducing the risk of cold joints with the subsequence lift

Materials

- **Aggregates**

Aggregates greater than 76 mm in diameter are seldom used in RCC because they can cause problems in spreading and compacting the layer!

Concrete Mixture Proportioning

Method I

uses the principles of soil compaction **to produce a lean RCC**, optimum water content of the concrete is the one that produces the maximum dry density of the mixture.

The overriding criteria are the **compressive and shear strength** since the dam using this type of concrete typically will have a **waterproof upstream face made either by traditional mass concrete or precast panels**.

Concrete Mixture Proportioning

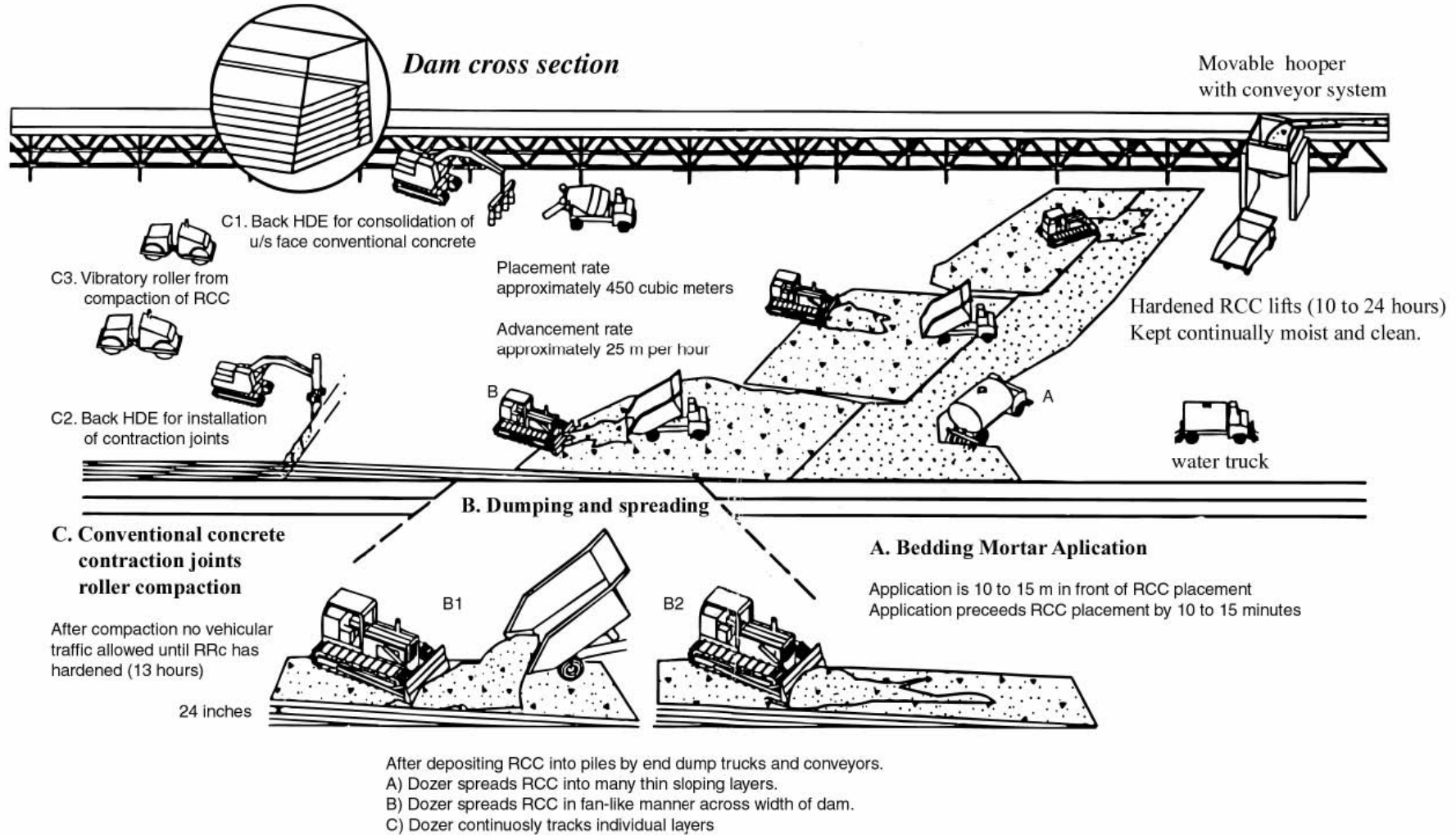
Method II

traditional concrete technology methods to produce **high-paste RCC** mixtures.

Upper Stillwater Dam and Elk Creek Dam are examples of dams that were built using this approach.

The overriding criteria are **the shear strength between the lifts and low permeability of concrete** since **no protective, impermeable face** is used upstream .

Construction Practice



Typical work layout for RCC placement



RCC Dam - Teesta Low Dam

<https://www.youtube.com/watch?v=EBG3CiY7LAI>

<https://www.youtube.com/watch?v=s-qVTuPgBjo>

- Oroville Dam- roller-compacted concrete (RCC) for the emergency spillway

