Roller-Compacted Concrete (RCC) Pavement

A 40-Year Legacy at Fort Cavazos

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Fort Hood → Fort Cavazos

Fort Hood was renamed **Fort Cavazos** on May 9, 2023, to honor **General Richard Edward Cavazos**, the first Hispanic American to earn the rank of four-star general in the U.S. Army in 1982.

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Roller-Compacted Concrete (RCC) Pavement

RCC combines relatively simple asphaltic pavement construction techniques with the **strength** and **durability** of Portland cement concrete (PCC) to provide an **economical alternative** to conventional concrete pavements

Curtesy of Morgan Corp.

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Early Development and Applications

- **1960s and 1970s**: The initial development of RCC, primarily driven by the need for economical and durable pavement solutions in engineered concrete structures.
- **Pioneering Projects**: The earliest references to RCC are linked to projects by the **Corps of Engineers**, who recognized its potential for various heavy-duty applications.

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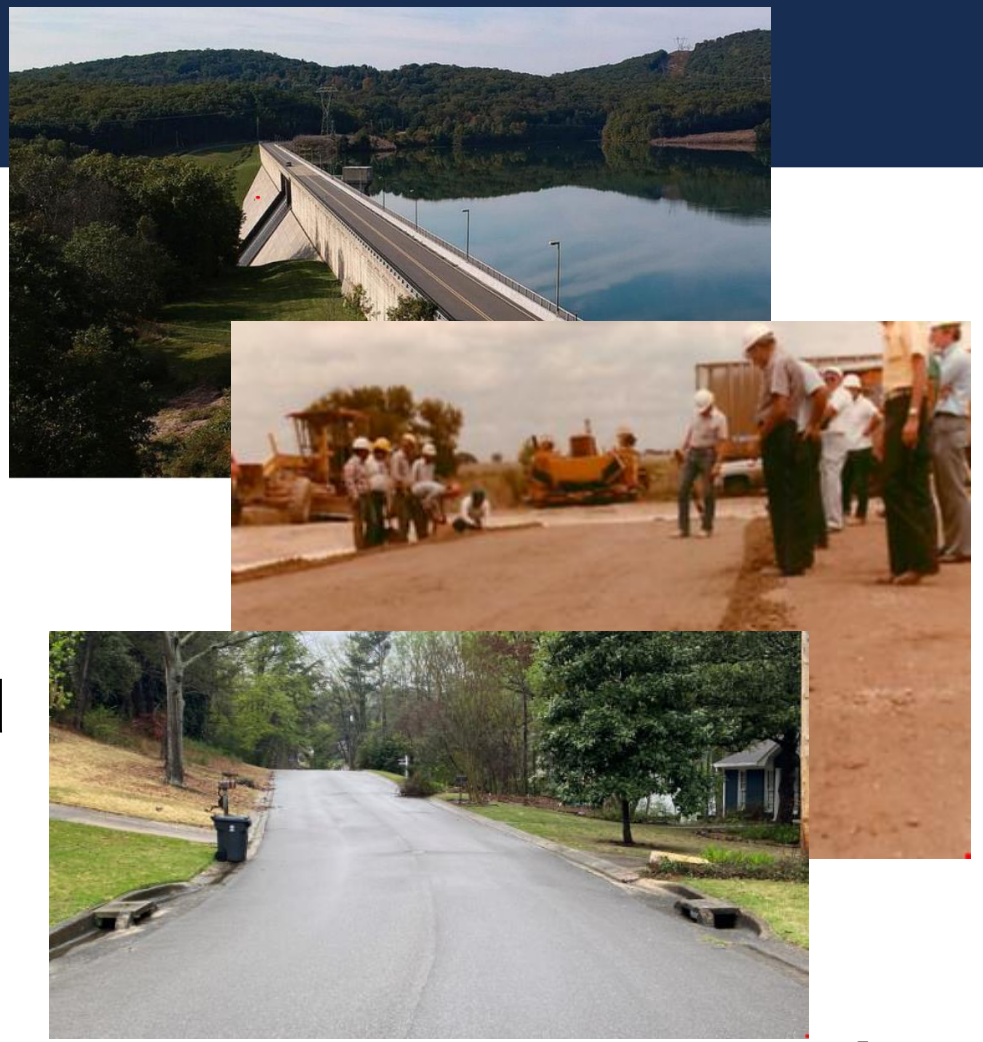
Adoption and Growth

- **1980s**: Significant growth in the adoption of RCC, with notable projects such as the RCC pavement at Fort Cavazos, TX.
- **Global Acceptance**: The rapid worldwide acceptance of RCC can be attributed to its economic benefits and successful performance in diverse applications.



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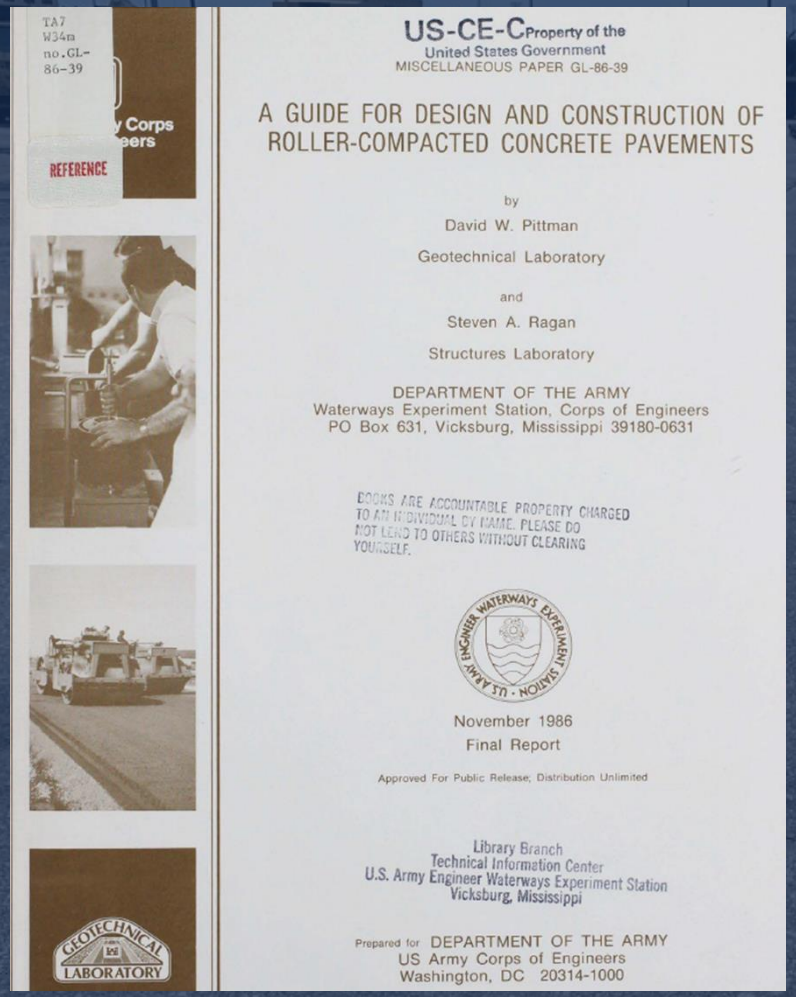

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- **1983**: Placement of RCC pavement
  - Making one of the early applications recorded of this innovative material.
- **1986**: Development of A Guide for Design and Construction of RCC Pavements
  - One of the earliest RCC references produced by the Corps of Engineers.
  - The Fort Cavazos RCC pavement was referenced in the guide.

Then and Now…

Proven Durable and Resilient Pavement

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RCC Mixing and Pug Mill

1980's

Today

Curtesy of Morgan Corp.

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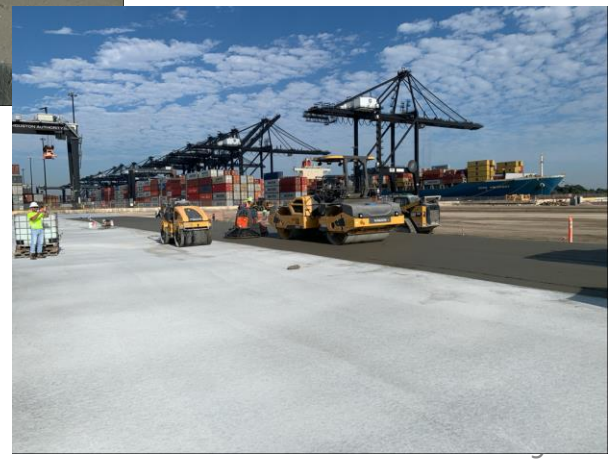
Paving Machine and Finishes

1983

2023



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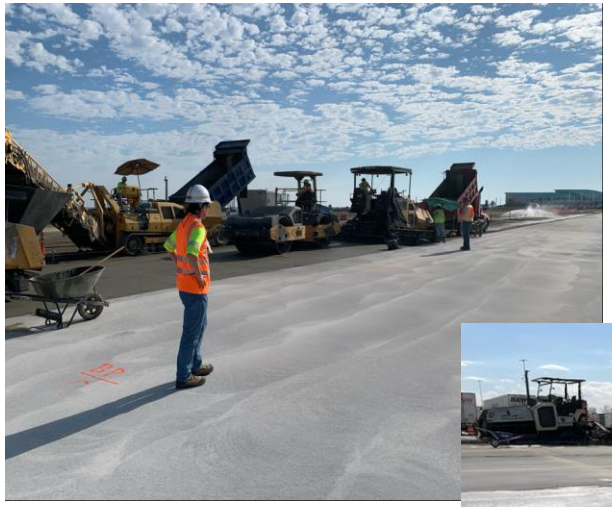
Paving Machine and Finishes (cont.)

1983

2023



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A Test Strip Then…

Auger Modification

Cold Joint Preparation

Test Strip

Test Specimen

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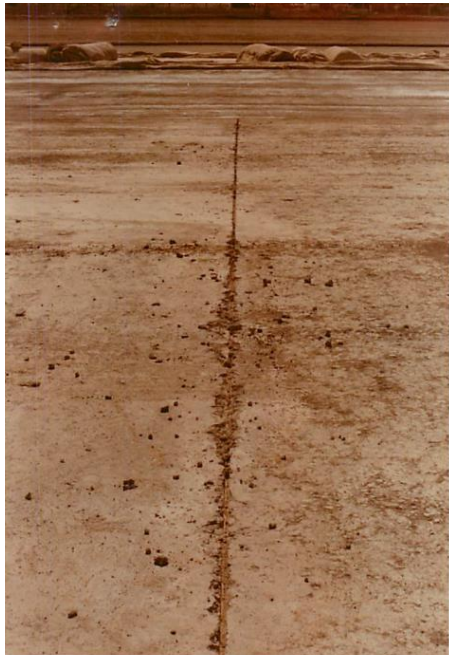
Challenges and Learnings

- Little was known about joints or the controlling of joints.
  - Natural joints and cracks were used instead of saw cuts



Typical Sawed Joint – Note surface Spalling

Typical Crack Highlighted in Black for Clarity

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Challenges and Learnings (cont.)

FACTS AND EVENTS
R.C.C - FORT HOOD, TEXAS

Contract for Tactical Equipment Maintenance Facility
Contract Number DACA63-83-C-0188
Prime Contractor - Boyd-Ferm, Inc.
R.C.C. Sub-contractor - Odell Geer Inc.
N.T.P. Acknowledged September 9, 1983
Contract Amount - $2,804,792.00

Prime Bid - 6900 c.y. +/- of Roller Compacted Concrete lump sum of $300,
395.00 or $43.53/c.y.
Prime Bid - $3.00/cwt for cement
Prime Proposal for Modification to add Fly Ash $2.90/cwt

Prime Contractor awarded a sub-contract for R.C.C. January 1984.

1. A conference was held at the Area Office on 7 & 8 September 1983 to review and discuss previous R.C.C. projects and the upcoming Fort Hood project.

2. The Portland Cement Association sponsored a conference in Denver on 26 July 1983 and in Austin 1 December 1983 at which SWD, FWD and Area Office people attended.

3. Contractor submitted materials to SWD laboratory on 8 March 1984; however, he changed cement suppliers and new cement arrived in laboratory on 9 April 1984. Trial batch designs were made 9-13 April 1984 in SWD laboratory. W.E.S. - Vicksberg studied the materials and determined a range of trial mixes prior to 9-13 April 1984. A meeting was held in the SWD laboratory on 19 March 1984 to plan and discuss trial batches and laboratory procedures. Representatives for SWD, FWD, SWD laboratory, W.E.S. and Area Office attended.

4. Two small dams and some hike/bike trails were built in Austin, Texas in the Spring of 1984 by the city and a developer. Visits were made to the site, discussion held with the A.E. (Freeze & Nichols) and testing laboratory (T.E.T.C.O. of Austin).

5. The contractor's plant for producing R.C.C. started to arrive on site on 11 May 84. The contractor erected and calibrated the plant from 11 May 1984 through 1 June 1984.

6. On 4 June 1984 the contractor attempted to place his test strip. He attempted to lay 13"-14" loose material with the asphalt spreader for a compacted thickness of 11½" +/- ½". This did not work as the machine gouged a void in the center portion. He then attempted to place an approximately 8-10" layer with motor grader as a first lift and then place a 4-6" lift on top with his asphalt spreader. This worked better as it did not gouge the center portion. It started raining during the placement of the second lane and no density tests were taken, no compaced effort could be made, no finish obtained.

7. A meeting was held on 5 June 84 at the Area Office with FWD, SWD, WES, OCE, etc. to discuss the test strip. It was the consensus of the group that the best way to place R.C.C. was in a single lift. Also, based on SWD mix designs, it was agreed to decrease the compacted thickness to 10 inches +/- ½ inch.

8. Meeting held with the contractor on 6 June 84 to discuss the test strip. The contractor was told his first test strip was unacceptable and he would be required to construct another test strip. It was agreed to place 1 - 100 foot lane as opposed to two short lanes. The contractor also does not like wet curing; therefore, we agreed to wet cure 1/2 and use curing compound on the second half.

9. The second test strip was constructed on 8 June 84 with alot more success, a better end product, better control/testing.

10. On 11 June 84, a short strip was placed along side of the 8 June 84 strip to evaluate three types of longitudinal joints (all cold joints). Part on the strip was against a vertical joint, a 45° joint and rough joint as produced by the asphalt lay down machine.

11. On 2 July 84, a meeting was held with the contractor to further discuss the R.C.C.P. It was agreed to cut out the in-place specimens on 5 Jul 84 and prepare them for breaking on 6 Jul (day 28). The laboratory (TETCO) on their own cut the samples on 4 Jul. Since nobody was notified nor witnessed the cutting, the samples were cut again on 5 Jul as originally planned. Two men (Austin Concrete Coring) cut and trimmed 3-6" cores and 3-6" X 6" X 21" beams from 2-8 p.m. See charts.

12. The specimens cut on 5 Jul were tested on 6 Jul: Cores @ TETCO and beams at CTAO. A meeting was held in the afternoon to evaluate strength tests/mix design. Agreed 16% on compressive strength equals flexual strength; use 96% field density of 158#/c.f. (actual field unit weight of mix).

13. Contractor started 0830, 9 Jul 84; problems with laydown machine on first lane, but placed 3 lanes. Problems with unconfined edge and surface. Matt cured.

14. 10 Jul place approximately 100 feet and broke sand conveyor belt @ plant.

15. 11 Jul placed 4 lanes - beginning to get operation working. Noticed first crack (transverse) in 9 Jul lanes - sawed 50 - 60 foot joints @ approximately 1000 in.

16. 12 Jul placed 4 lanes - sawed one joint (middle of lane) @ 0800 - big mess. Raveled out bad. Made decision to not saw anymore joints. Wet matt 3 lanes - direct cured with compound last lane.

JUL 31 1984

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Rolled concrete defies tanks

The Corps of Engineers is applying its knowledge of using roller-compacted concrete in dams to paving parking lots. Roller-compacted concrete increases the pavement's strength, reduces labor costs and eliminates reinforcing steel.

Odell-Geer Construction Co., Inc., Harker Heights, Tex., placed a roller-compacted slab as part of a $2.8-million contract for construction of a tactical equipment facility at Fort Hood, Tex.

The project included a 500 x 328-ft tank parking area that has a 10-in.-thick nonreinforced pavement. Normally, the Corps would have used a 9-in.-thick reinforced concrete slab. While the required flexural strength was 650 psi, the roller-compacted concrete reached 1,025 psi. Each cu yd of the paving mix included 300 lb of portland cement and 150 lb of flyash. The material was placed in a 12-in.-thick loose course. Then a 10-ton vibratory roller with double steel wheels compacted the mixture to the required 96%. After rolling, the pavement was sprayed with a membrane curing compound. The slab does not have longitudinal or transverse joints.

It took 11 days to complete the slab, the result of equipment breakdowns and the experimental nature of the job.

Once start-up problems are overcome, however, Craig expects that roller-compacted paving will take much less time than conventional paving. Craig says the Fort Hood project turned out so well that the Corps later modified the mix—replacing sand and rock with cement and flyash—and used it to replace bad asphalt pavement on a runway, as a base material overlaid with aspalt. It also used the material to control erosion along drainage ditches.

Army parking lot constructed using roller-compacted concrete for added strength.


Thank you!

CCT Team

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