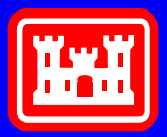
Curing Practices for Modern Concrete Production

Toy Poole
U.S. Army Corps of Engineers
August 2005



US Army Corps of Engineers®

Engineer Research and Development Center

Problems with Curing?

Curing Practices - Need for Revisions??

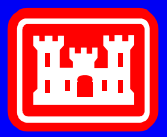
- Review major points of current practice
- Discuss effects of newer concrete practice

Purpose of Curing

- Conserve water
- Maintain favorable temperatures

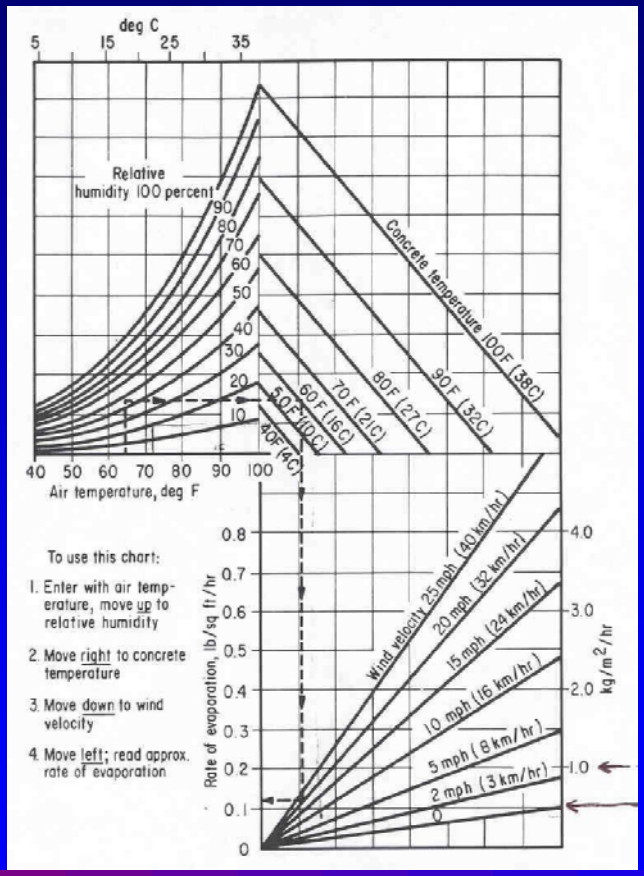
Current Practice

- Protect fresh concrete
- Apply final curing
  - After finishing
  - After sheen gone
- Duration of Curing
- Curing materials specs



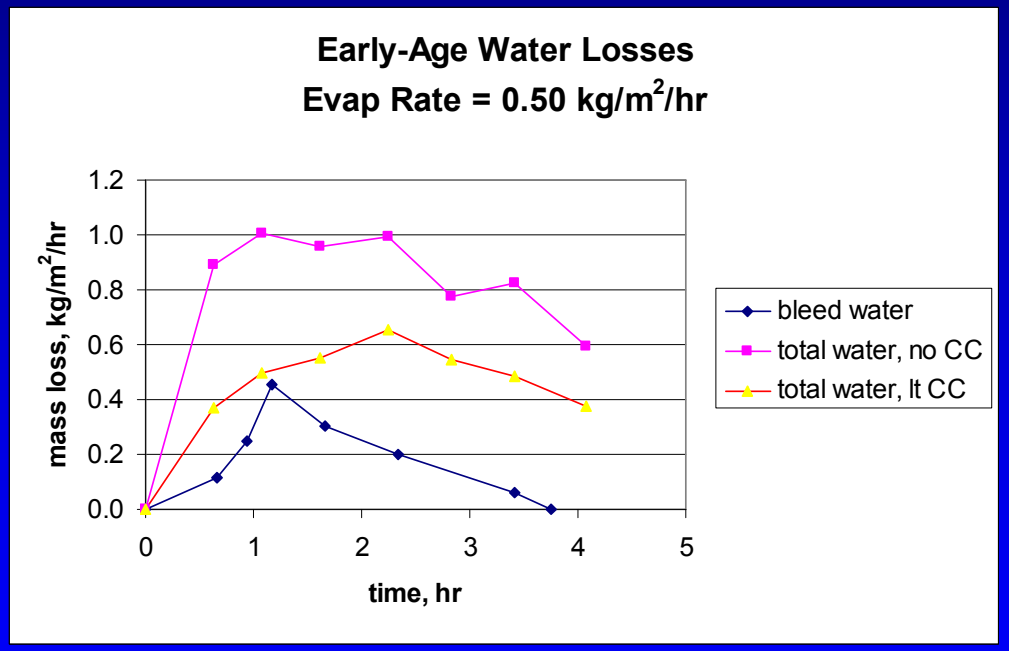
Protect Fresh Concrete

- Critical evap rate
  - 0.5, 1.0 kg/m^2/h
- Based on “old time” bleeding rates



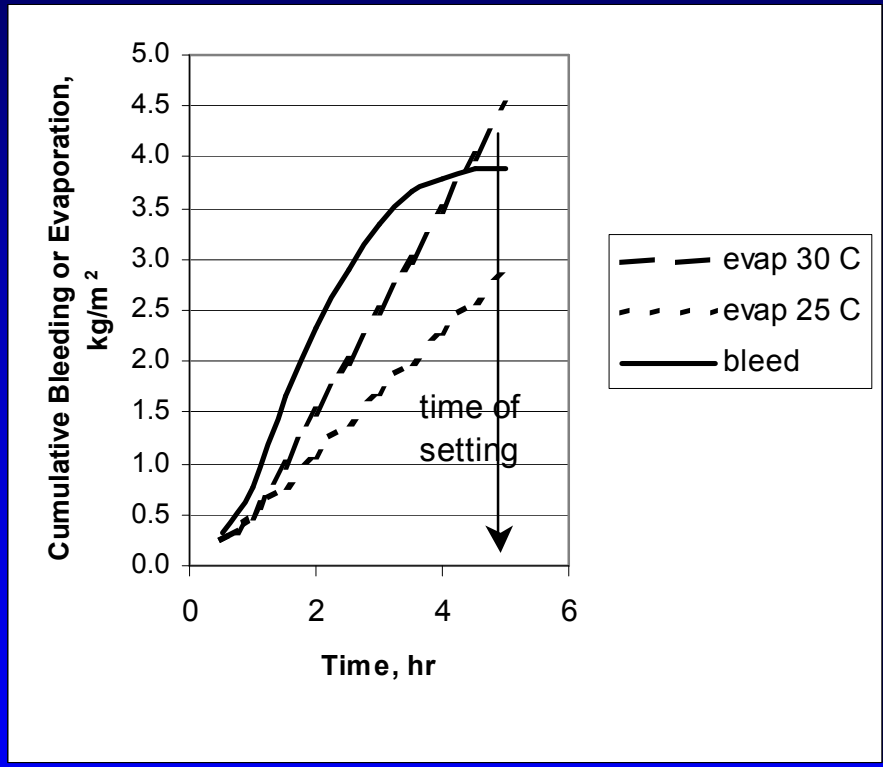
Low w/c Concrete

- Low w/c concretes
  - Evap rates <0.5 kg/m^2/h
- Action: More care to reduce drying
- Cool concrete
- Evap reducers
- Misting



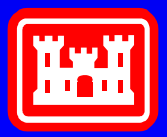
Action

- Action: reduce evaporation
- Cool concrete



Current Practice

- Protect fresh concrete
- Apply final curing
  - After finishing
  - After sheen gone
- Duration of Curing
- Curing materials specs



Apply Final Finishing

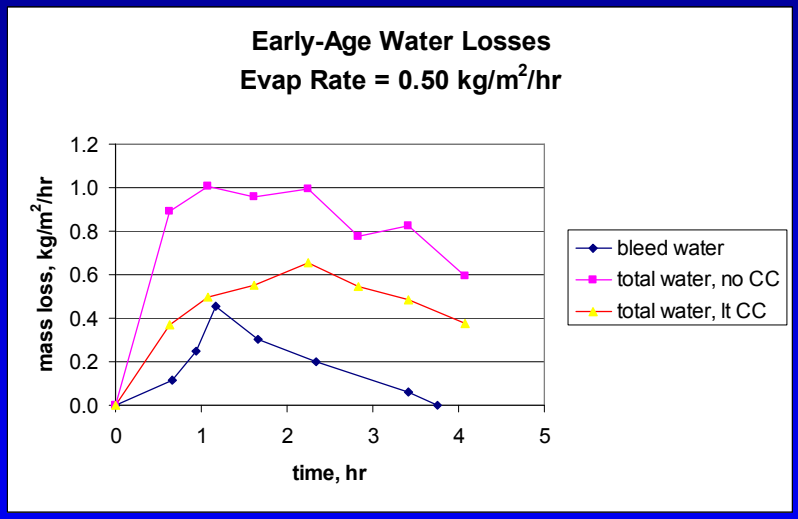
- After finishing
- After sheen disappears

Problem

- Pavements
  - Little bleed
  - Finishing ~ placing
- Curing compounds
  - Applied soon after placing
  - May not perform

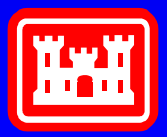
Uniformity of Application

Early Application of Curing Compound



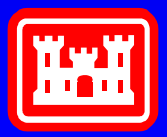
Early Application of Water, Mats

- If before TOS
  - Erosion
  - Marring



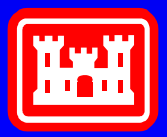
Resolution

- Delay application???!!!
- Live with consequences



Current Practice

- Protect fresh concrete
- Apply final curing
  - After finishing
  - After sheen gone
- Duration of Curing
- Curing materials specs

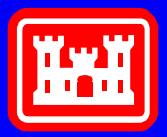


Duration of Curing

- Corps of Engineers - prescriptive
  - Based on cement type
  - Presence of pozzolan
- State DoT's – prescriptive
  - Based on time – 3 – 10 days
- ACI – mixed spec
  - Time
  - % f'c

Emerging Technologies

- Maturity
  - ASTM C 1074 based
- NDT
  - ultrasonic



Current Practice

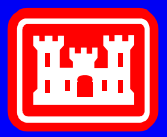
- Protect fresh concrete
- Apply final curing
  - After finishing
  - After sheen gone
- Duration of Curing
- Curing materials specs

Curing Materials – Curing Compounds

- Water Retention
  - CE: 0.31 kg/m^2 @ 7 days
  - Old Bu Rec: 0.86 kg/m^2 @ 7 days
  - ASTM:
    - C 309: 0.55 kg/m^2 @ 3 days
    - C 1315: 0.40 kg/m^2 @ 3 days
  - State DoT's: <0.3 kg/m^2 @ 3 days
- Drying Time – 4 hours

Water Retention (?, Loss?) Requirements

- True value??
  - Some early work – 0.7 kg/m^2
  - Other work - 1.0 kg/m^2 in several days
- Major problems with testing
  - Often not done
  - Precision of TM (C 156)
    - d2s = 0.20 kg/m^2



Drying Time Problems
Low VOC Materials

Evaporation Reducers

- No Specs
- No TM's
- ASTM C 9.22

The End!