

Design and Construction of Slabs-on-Ground

Applying ACI 318

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October 20, 2021



Concrete International Award
Concrete Q&A
November 2020



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Can I use ACI 318 to design slabs-on-ground?

1.4.8 This Code does not apply to design and construction of slabs-on-ground, unless the slab transmits vertical loads or lateral forces from other portions of the structure to the soil.

Reinforced Concrete is Designed to Crack

Concrete Carries Compressive Forces
Steel Carries Tensile Forces (after concrete cracks)

ACI 360R Guide to the Design of Concrete Slabs-on-Ground

Design Slabs-on-Ground for One of the Following Criteria:

- Cracking occurs beneath sawcut contraction joints
 - ✓ Unreinforced
 - ✓ Lightly Reinforced for Enhanced Aggregate Interlock
- Crack Width Control
 - ✓ Conventional Steel Reinforcing Bars (>0.5%)
 - ✓ Fibers
- Designed to Avoid Tensile Cracking
 - ✓ Shrinkage-Compensating Concrete
 - ✓ Post-Tensioned

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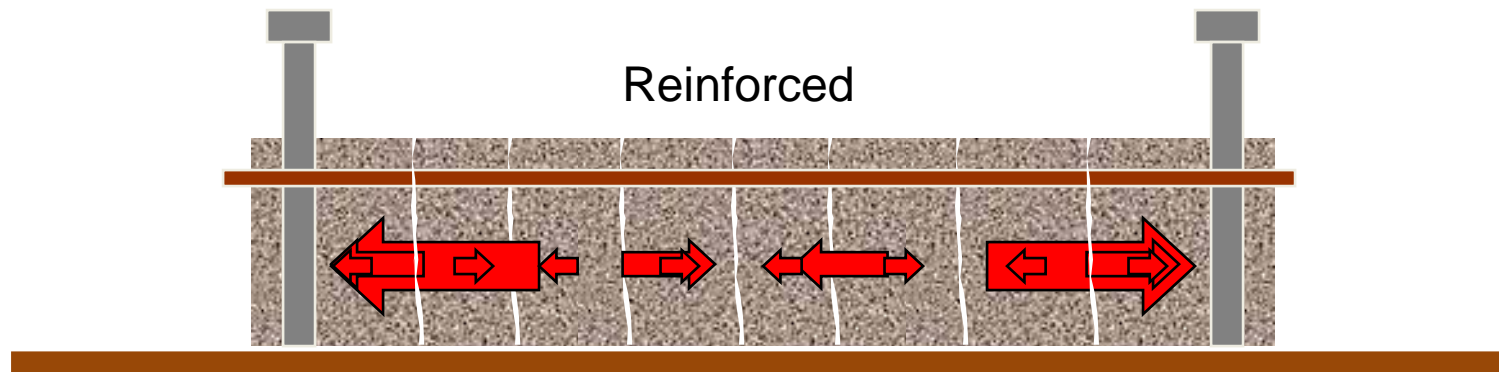
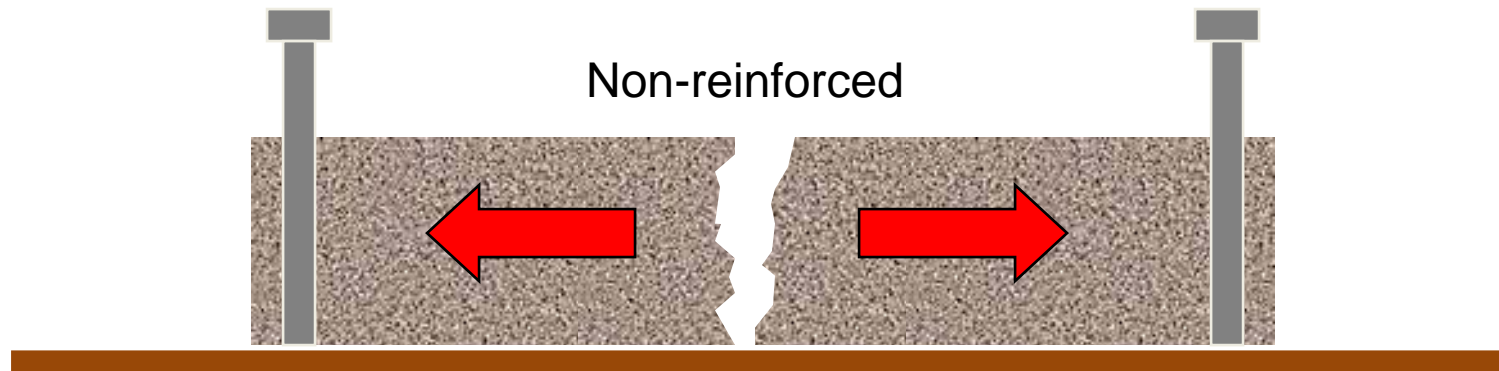


What is the minimum reinforcement for slabs-on-ground?

Slabs-on-Ground can be Designed Unreinforced.

- Joint Spacing, Depth, and Timing
 - ✓ Extended Joint Designs
 - ✓ Joint Stability and Load Transfer
 - Smooth Dowels (Bars or Plates)
 - Enhanced Aggregate Interlock (~0.10% Steel)
- ACI 318 Minimum Temperature Shrinkage Reinforcement
 - ✓ 0.18%
 - ✓ May Not Allow Joints to Widen Enough to Avoid Random Cracking

Cracks in Concrete Due to Restrained Shrinkage





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Can Concrete with a Total Air Content Above 3% be Hard-Troweled Successfully?

Using Power Finishing Equipment on Concrete Results in the Following:

- Near-Surface Concrete is manipulated and Reoriented
 - ✓ Floating embeds coarse aggregate, removes slight imperfections and voids in surface, and compacts/consolidates surface mortar.
- Entrained or smaller entrapped air voids coalesce into larger air voids, potentially near the surface. If large enough, these voids can result in **surface blisters**.
- Further densifying by angled trowels or combination blades can flatten the near-surface voids into larger lenses of air that can result in **surface delaminations**.

Surface Blisters/Delamination



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What Can be Done to Protect Slabs-on-Ground That Will be Subjected to Various Exposure Conditions as Defined in ACI 318?

Freezing/Thawing (Exposure Category F)

- Air-entrained concrete?
 - ✓ Must only be screeded, bull floated, and broom textured.
- Trowel-finished concrete?
 - ✓ Non-air-entrained.
 - ✓ Must be kept “dry” (Class F0) – below Critical Saturation.
- Air Entrain concrete subjected to Limited (F1) or Frequent (F2) exposure to water or to water & deicers (F3).



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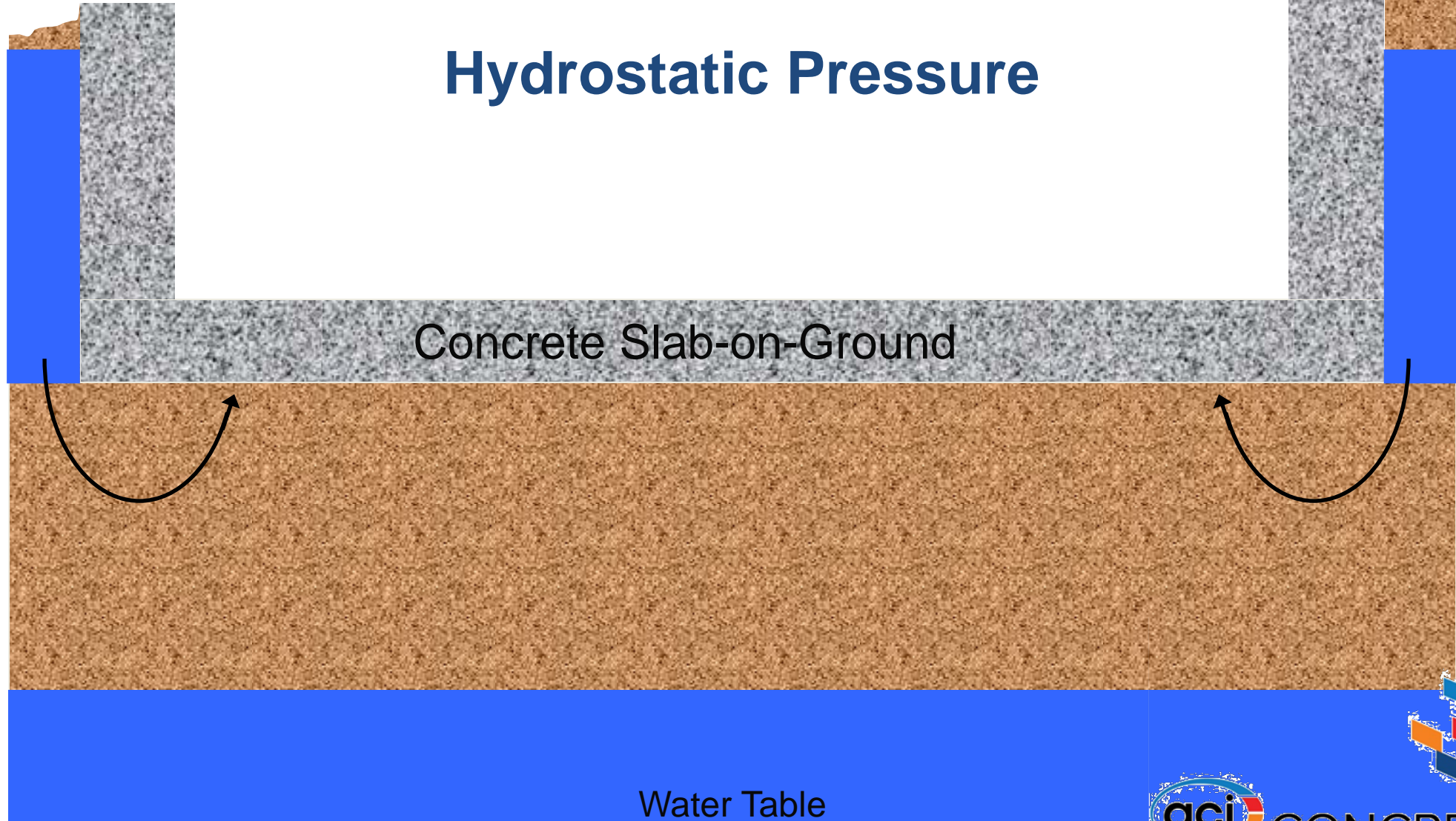


What Can be Done to Protect Slabs-on-Ground That Will be Subjected to Various Exposure Conditions as Defined in ACI 318?

Exposure Categories W, S, and C

- Category W is exposure to water in service
 - ✓ Classes W0 (dry), W1 (not low perm), and W2 (low perm)
- Category S is exposure to water-soluble sulfates in soil
 - ✓ Classes S0-S3 depending on how much sulfate in soil
- Category C is Corrosion Protection of Reinforcement
 - ✓ Classes C0 (protected from moisture, C1 (moisture but no chlorides, and C2 (moisture with chlorides)

Hydrostatic Pressure

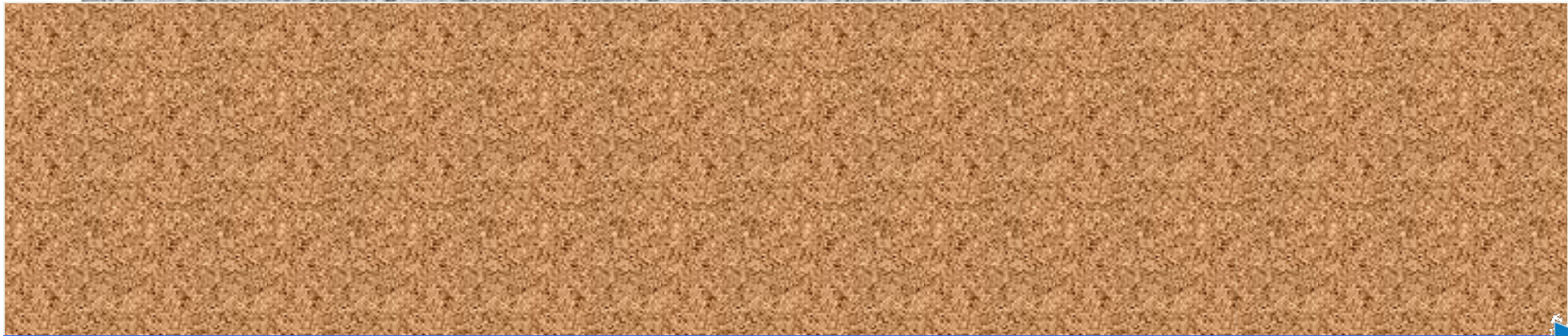


Concrete Slab-on-Ground

Water Table

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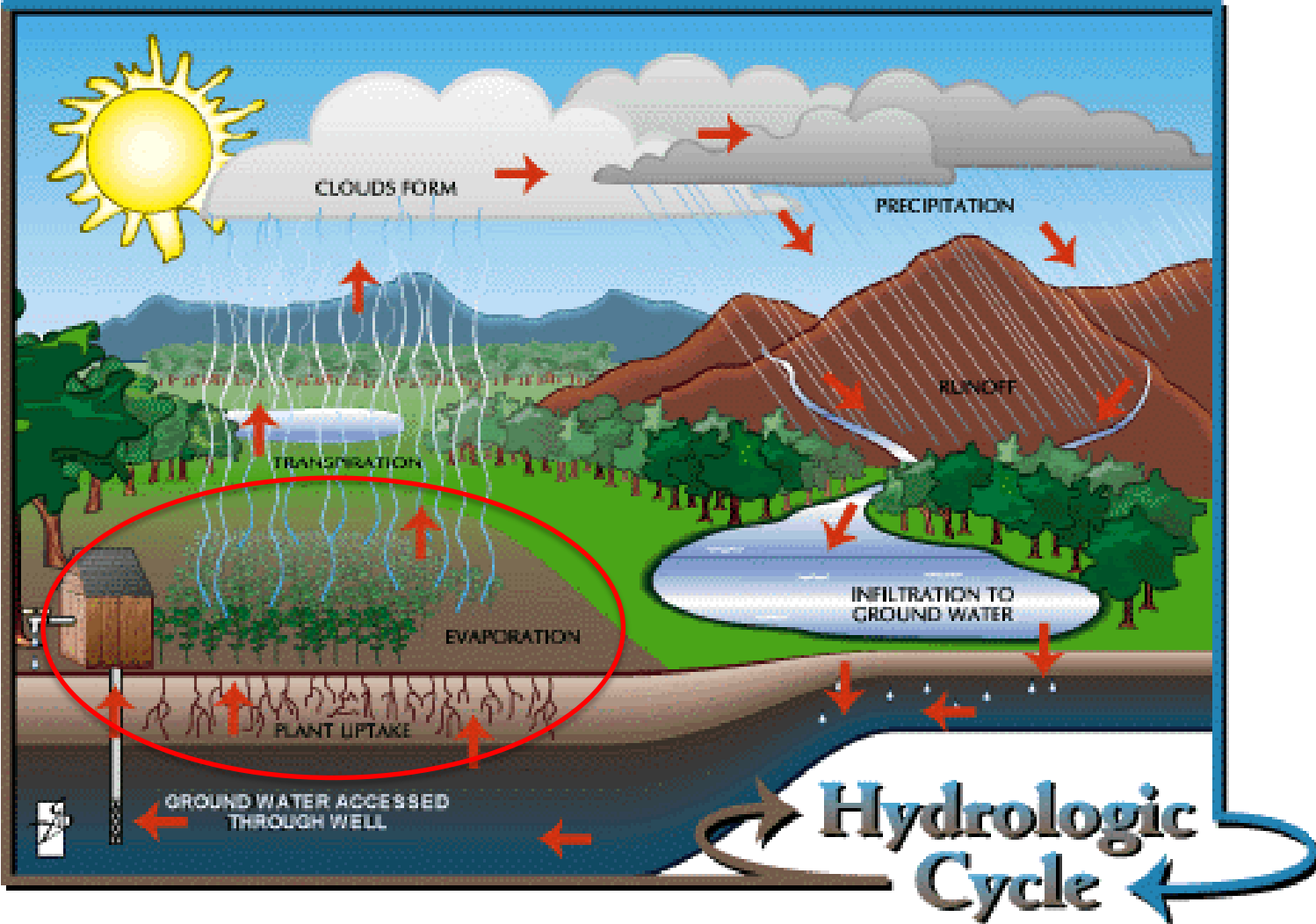


Water Table

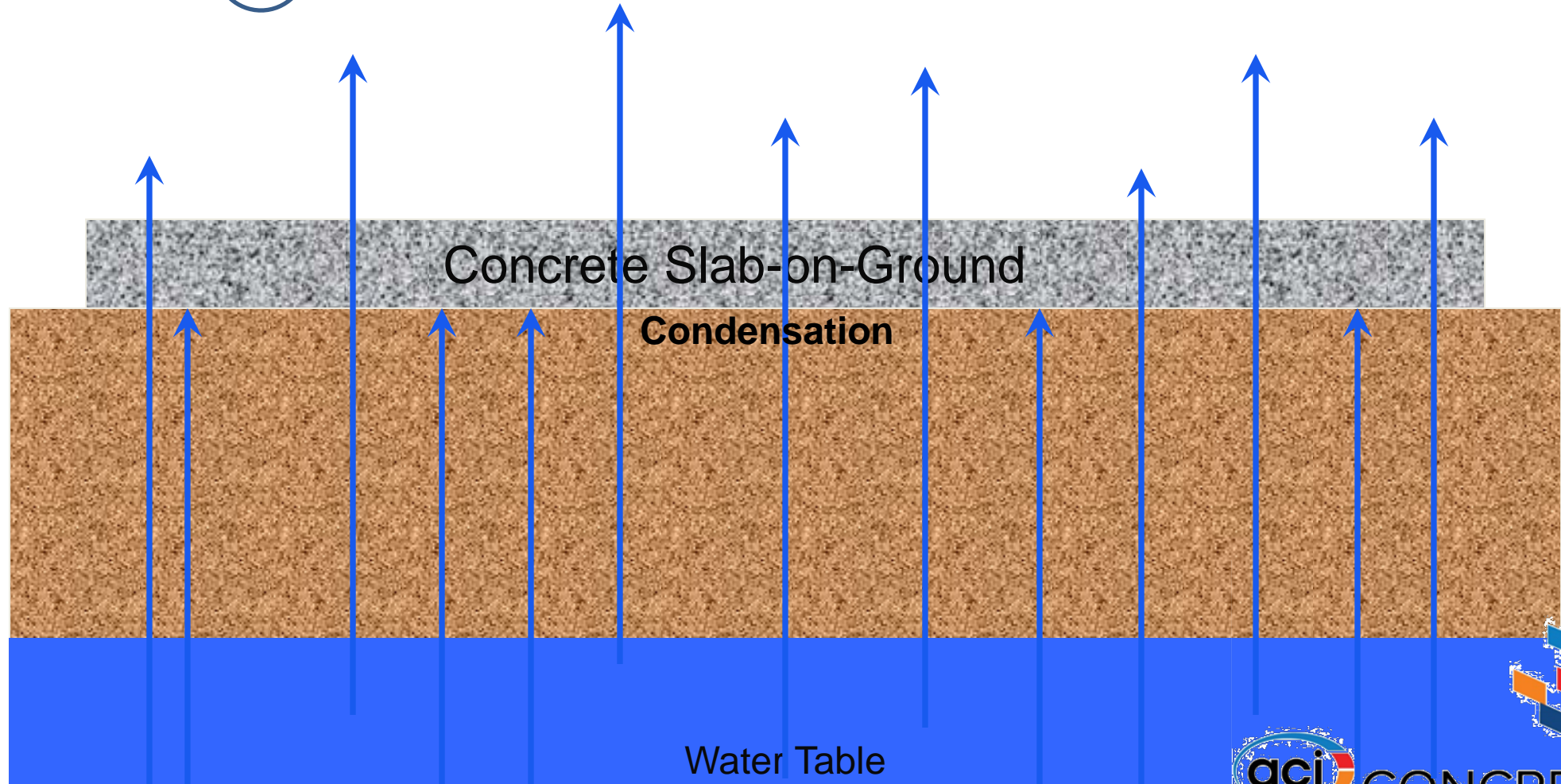
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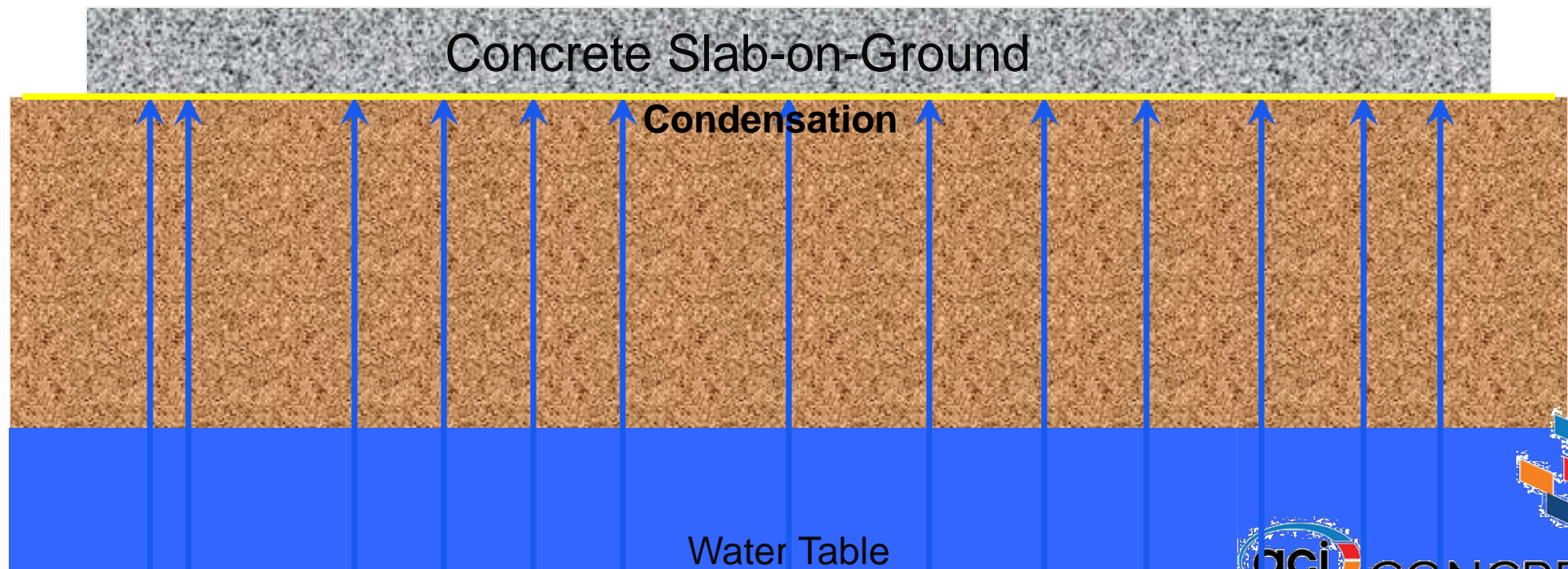
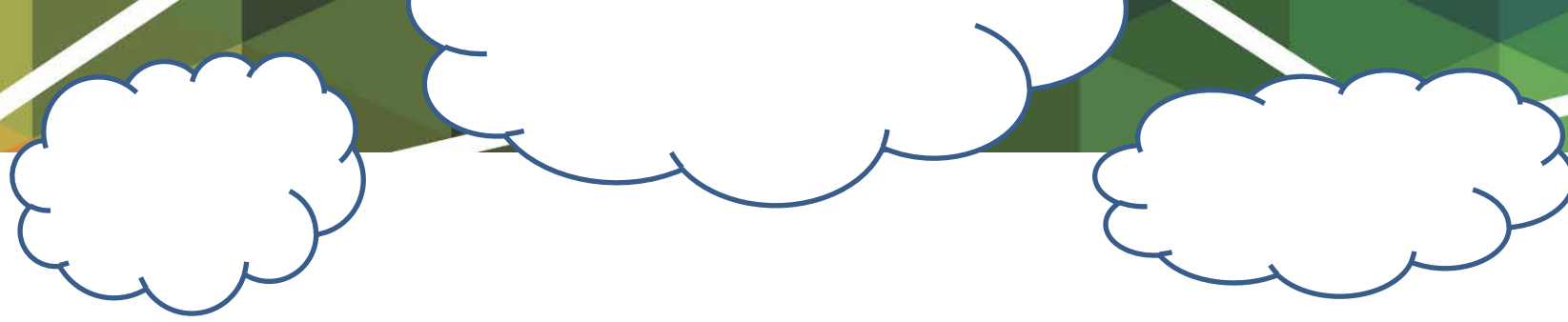
In the Hydrologic Cycle, Moisture Goes Through Phase Changes from Liquid to Vapor to, Potentially, Solid.



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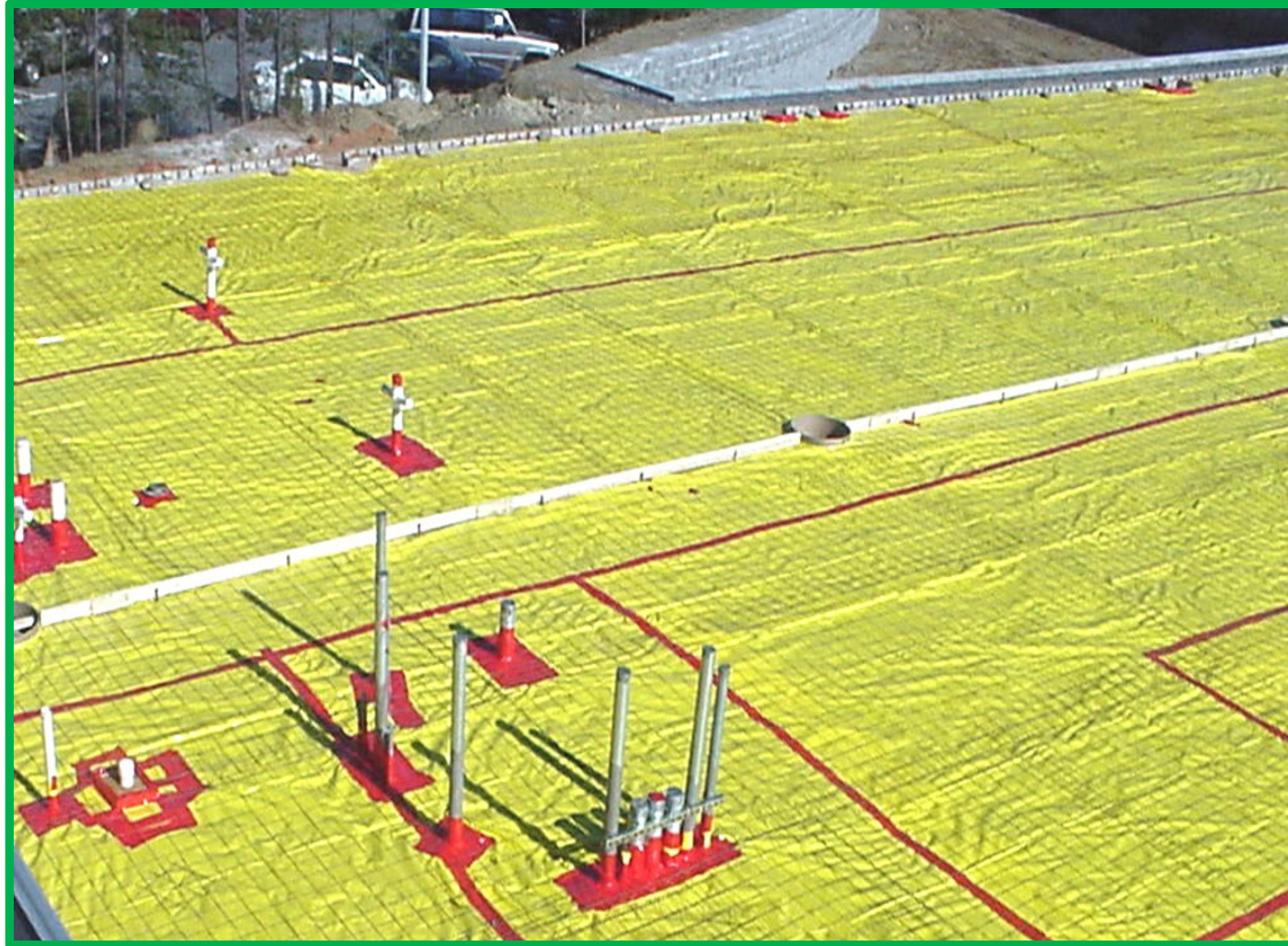
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Solution Chemistry



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Vapor Retarders/Barriers
DO NOT
Cause Curling/Warping!



Concrete Slab-on-Ground



Water Table

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Thank You!

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