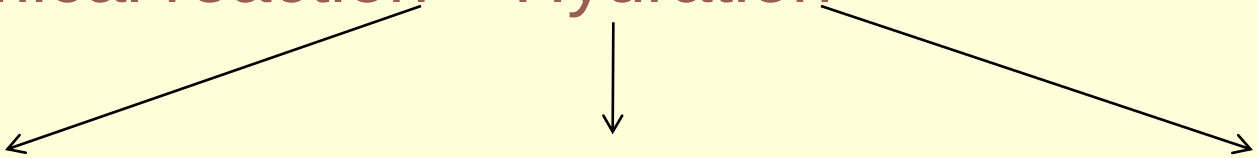
Portland Cement and Concrete

How Cement Works

Water mixes with Portland cement and starts a chemical reaction – Hydration



Setting Heat Shrinking

Faster setting = higher heat = shrinkage cracking

(in general)

Cement particles bond to each other over time. The longer they are kept moist, the stronger the bond.

Cement Types

Type I – normal or standard

Type II – Modified, slight sulfate resistance

Type III – High Early Strength, high heat, quick setting

Type IV – Low heat , slow setting

Type V – Sulfate Resistant

Air Entraining

Forms tiny bubbles in the mix

Resists freeze/thaw effects

It is often added at cement plant

IA, IIA, IIIA

Aggregate

- Blend of varying sizes – **grading** important for economy of mix
- Strength, durability, wear resistance critical
- Chemical compatibility with cement and reinforcing steel

Water

Potable or drinkable

Admixtures

- Accelerators
- Retarders
- Water reducers
- Plasticizers
- Never use admixtures unless they have been called for by the engineer!

Concrete Mixes

- Sometimes specified by “sack”
- One sack of Portland cement = 94 #
- 5 sack mix would have 470 # of cement
- More precise method is by pounds of each ingredient
- Cement
- Water
- Fine aggregate
- Coarse aggregate

Major Tests for Concrete

Slump test – workability of the mix

Air test – determines the amount of air entraining in the mix

Temperature – may be critical in extreme conditions

Cylinder test – to determine the design strength at 3,7,&28 days

Core test – drilled cores from set concrete to test strength

Reinforcing (Rebar)

Reinforcing bars – provide tensile strength for the composite piece

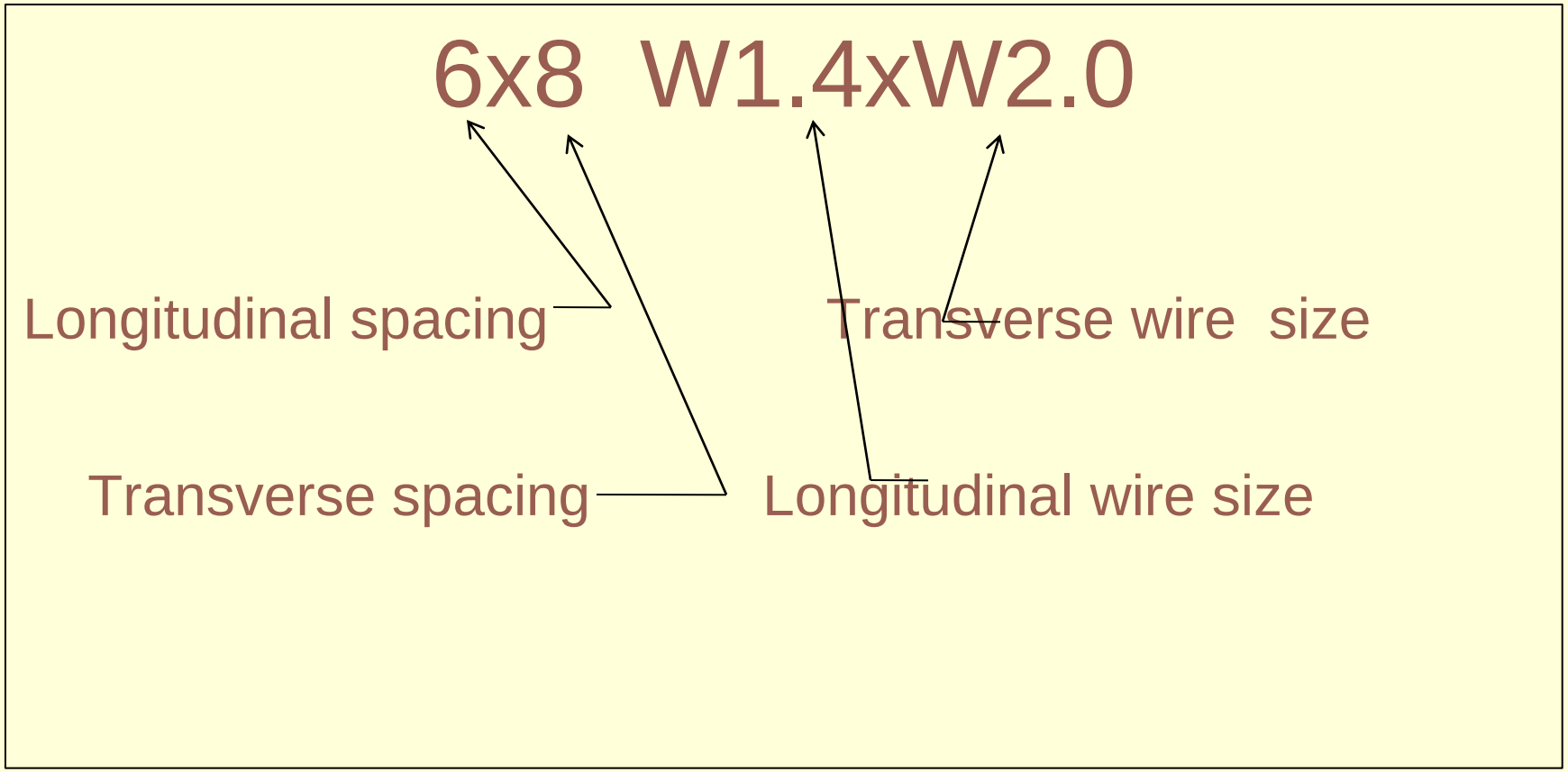
Welded wire fabric – not considered reinforcing if made of light gage wire- reduces cracking and excess shrinkage in slabs

Rebar Sizes

Number	Diameter
#3	3/8”
#4	1/2”
#5	5/8”
#6	3/4”

Number is over 8.

Welded Wire Fabric



Formwork

Huge hydrostatic loads (150 pcf approx)

Bracing critical

Wall forms require ties through forms

Column forms

Release agent

Weight of Concrete

Consider concrete to weigh about 150 pounds per cubic foot

27 C.F. = about 4000 pounds/ CY

Trucks carry 10 yards = 40,000 #

Trucks weigh about 26,000 #

Total weigh = 66,000 #

Ready Mix Vs. Site Mix

- Quality control is main concern
- Access to site is a consideration
- Small jobs may us sacked concrete @ 80# per sack (about ½ C.F.)

Placing Concrete

- Forms braced and leveled. Clean of debris
- Move concrete from truck to placing site
  - Chute, buggy, pump, bucket, conveyor belt
- Consolidate (beware of segregation)
- Screed (slab)
- Float (slab)
- Trowel (slab)
- Finish (slab)
- Cure

Precast Concrete

- Precast
- Pre-stressed
  - Pre-tensioned
  - Post-tensioned