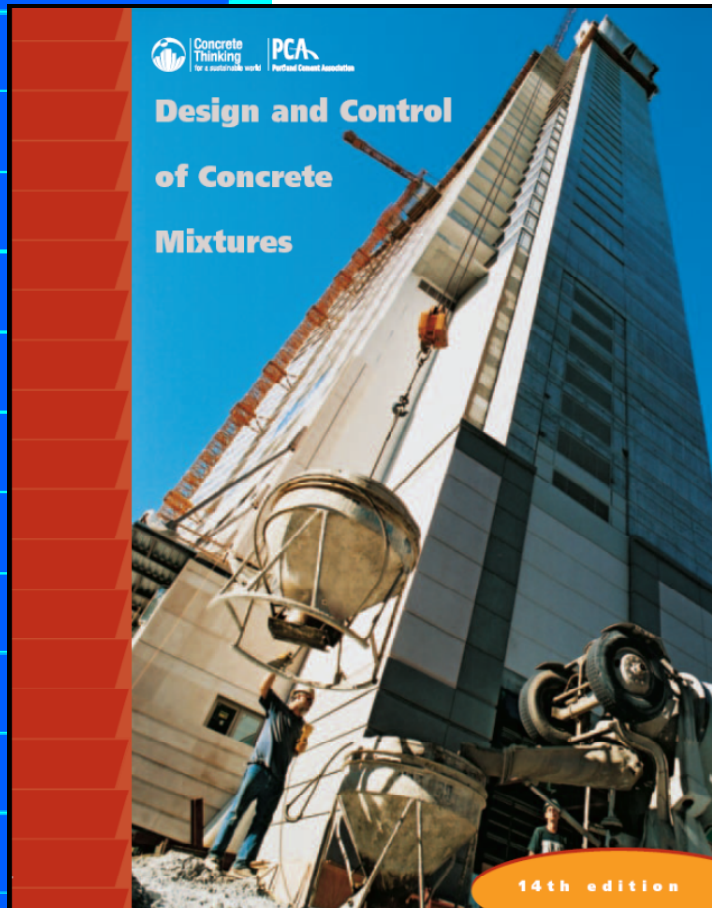


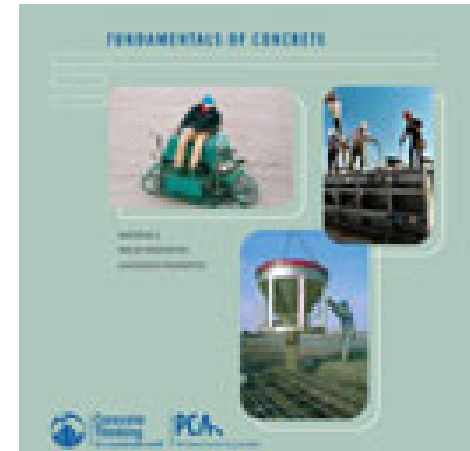
# Fundamentals

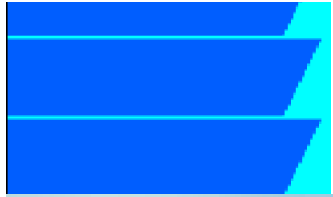


# References



- *Design and Control of Concrete Mixtures*, EB001, PCA 2002 (rev. 2008)
- *Fundamentals of Concrete*, CD062, PCA 2007





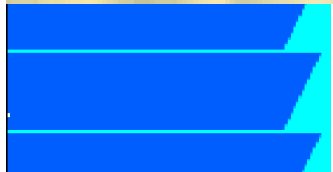
**Up to 8% Air**

**7-15% Cement**

**60-75% Aggregates  
(Coarse and Fine)**

**14-21% Water**

# Components of Concrete



# Types of Concrete

Design and  
of Concrete  
Mixtures



- Bookcrete
- Labcrete
- Realcrete

# Quality Concrete

- A mixture of CEMENT, WATER, and AGGREGATES that will meet the requirements under which it is expected to serve.



# Fresh Concrete Properties



- Consistency
- Workability
- Uniformity
- Bleeding
- Setting & Hardening

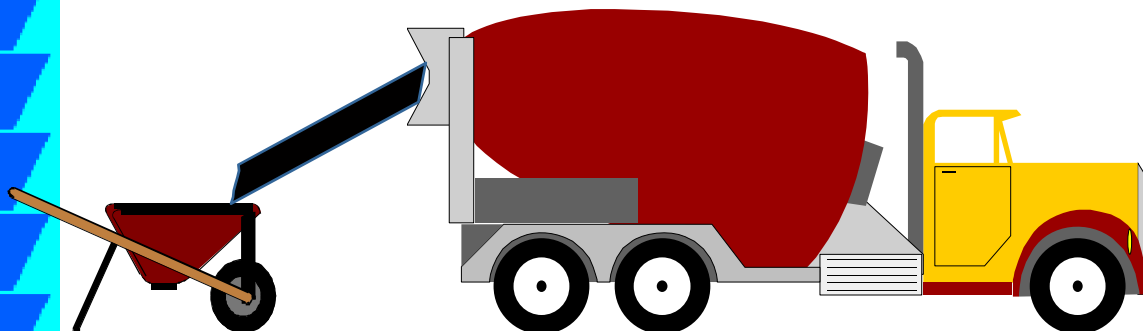
# Hardened Concrete Properties



- Drying Rate
- Strength
- Durability
- Permeability & Watertightness
- Abrasion Resistance
- Volume Stability & Crack Control

# ESSENTIALS of Quality Concrete

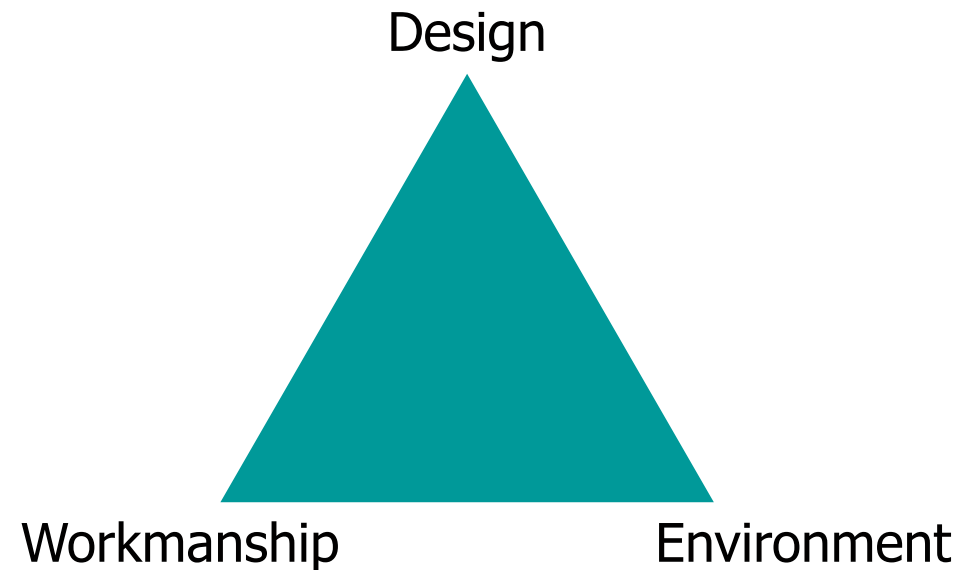
1. Suitable Materials
2. Proper Proportioning, Mixing, and Transporting
3. Proper Placing & Consolidation
4. Proper Finishing & Jointing
5. Proper Curing





# Avoiding Problems

- Design- Constructibility
- Mix Design
- Materials Selection
- Placement Procedures
- Environment



# Design-Constructibility

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- Reinforcement location
- Tolerances
- Joints



# Mix Design

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- Materials
- w/cm
- Slump
- Strength
- Durability
- Aesthetics

# Materials Selection

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- Cement
- Supplementary Cementing Materials
- Water
- Aggregates
- Admixtures

# Placement

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- Transportation
- Placement
- Consolidation
- Finishing
- Curing

# Environment

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- Hot & Cold Placement
- Freeze-Thaw Cycles
- Chemical





# Summary

## Desired Properties of Concrete:

- Consistency
- Workability
- Uniformity
- Bleeding
- Setting & Hardening
- Drying Rate
- Strength
- Durability
- Permeability & Watertightness
- Volume Stability & Crack Control



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