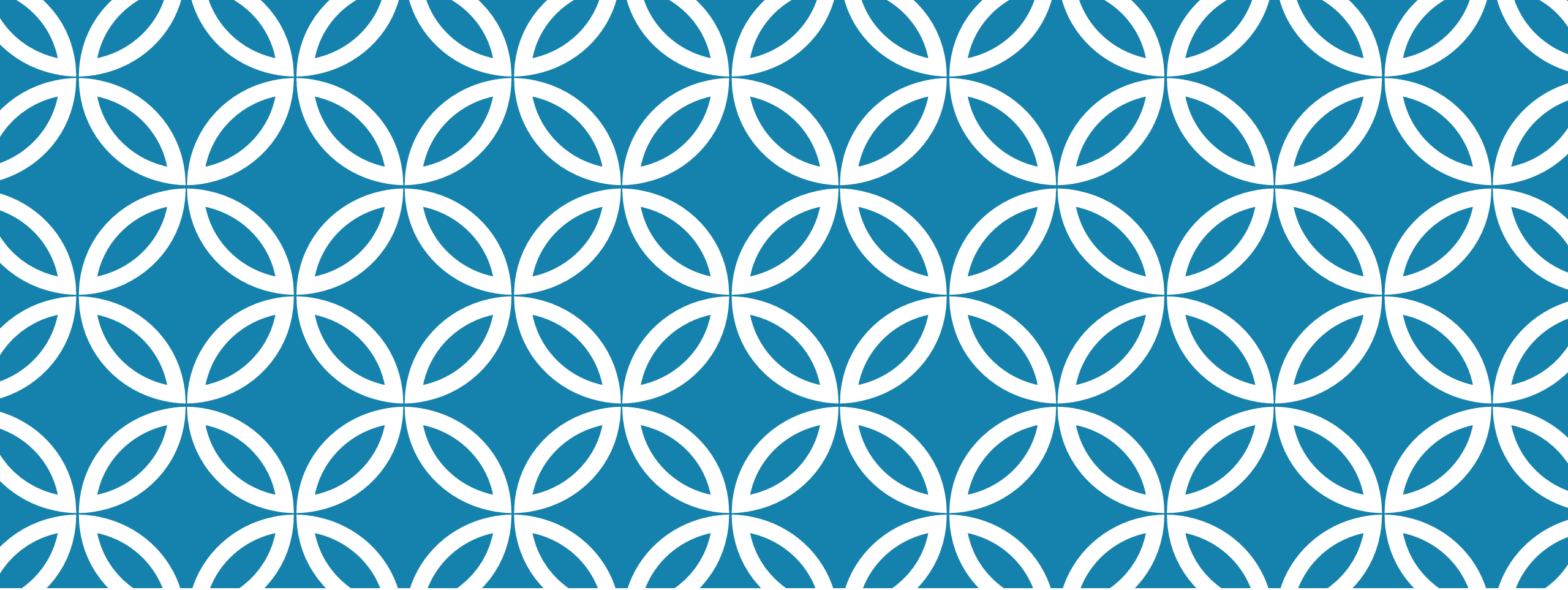


CONCRETE TECHNOLOGY MODULE SEMESTER 1 – LECTURE 9

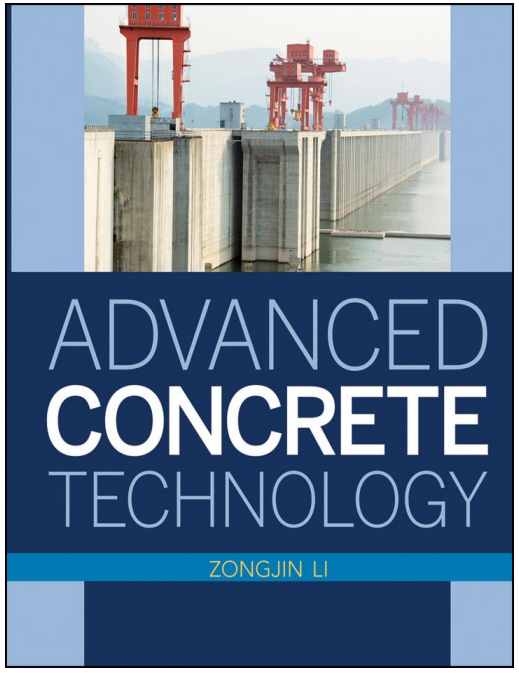
Dr. Khaldoon Shehab

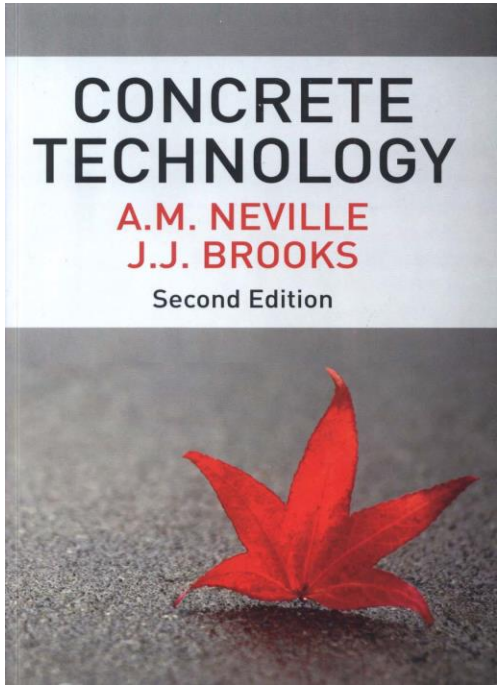
SEMESTER 1 OUTLINE

Item	Subject	Item	
1	**Introduction: Cement and Aggregate**		
2	**Manufacturing of concrete** - Mixing - Transportation - Placing and compaction - Curing - Finishing	**4**	**Strength of Concrete** - Compressive strength - Tensile strength - Modulus of rupture - Bond strength with steel reinforcement - Factors affecting concrete strength - Factor affecting concrete test
3	**Properties of Fresh Concrete** - Workability and Consistency - Segregation and Bleeding - Pressure on form work - Stripping of form	**5**	**Deformation of Concrete** - Creep - Shrinkage - Modulus of elasticity and Poisson's ratio

REFERENCES

- Concrete technology by Dr. Moaid Nory
- Advanced concrete technology by Zongjin Li
- Concrete Technology -2dn Ed by A.M. NEVILLE





LECTURE CONTENTS

1. **FRESH CONCRETE**
2. 3.1 WORKABILITY OF FRESH CONCRETE
3. 3.1.1 Definition of workability

FRESH CONCRETE

- Fresh concrete is defined as a fully mixed concrete in a rheological state that has not lost its plasticity.
- The fresh concrete stage covers the cement hydration stages I and II.
- The plastic state of fresh concrete provides a time period for transportation, placing, compaction, and surface finishing.
- The properties of fresh concrete have a large influence on construction speed and decision making.

3.1 WORKABILITY OF FRESH CONCRETE

The properties of fresh concrete affect the choices of handling, consolidation, and construction sequence. They may also affect the properties of the hardened concrete.

The properties of fresh concrete are short-term requirements in nature, and should satisfy the following requirements:

1. It must be easily mixed and transported.

2. It must be uniform throughout a given batch, and between batches.

3. It must keep its fluidity during the transportation period.

4. It should have flow properties such that it is capable of completely filling the forms.

5. It must have the ability to be fully compacted without segregation.

6. It must set in a reasonable period of time.

7. It must be capable of being finished properly, either against the forms or by means of trowelling or other surface treatment.

- Compaction plays an important role in ensuring the long-term properties of the hardened concrete, as **proper compaction is vital in removing air from concrete and in achieving a dense concrete structure.**
- Subsequently, **the compressive strength of concrete can increase with an increase in the density.** Traditionally, compaction is carried out using a vibrator.
- Nowadays, the newly developed self-compacting concrete can reach a dense structure by its self-weight without any vibration.

3.1.1 Definition of workability

Workability of concrete is defined in ASTM C125 as the **property determining the effort required to manipulate a freshly mixed quantity of concrete with minimum loss of homogeneity (uniform).**

The term manipulate includes the early-age operations of placing, compacting, and finishing.

Mindess et al. (2003) defined the workability of fresh concrete as "***the amount of mechanical work, or energy, required to produce full compaction of the concrete without segregation.***"

Workability of fresh concrete consists of two aspects: **consistency and cohesiveness.**

- **Consistency** describes how easily fresh concrete flows, while
- **cohesiveness** describes the ability of fresh concrete to hold all the ingredients together uniformly.

- **Traditionally, consistency can be measured by a slump-cone test, the compaction factor, or a ball penetration compaction factor test as a simple index for fluidity of fresh concrete.**

- **Cohesiveness** can be characterized by a Vebe test as an index of both the water-holding capacity (the opposite of bleeding) and the coarse-aggregate-holding capacity (the opposite of segregation) of a plastic concrete mixture.

The **flowability** of fresh concrete influences the effort required to compact concrete.

The easier the flow, the less work is needed for compaction.

- Workability must be related to the type of construction and methods of placing, compacting, and finishing.

- Concrete that can be readily placed in a massive foundation without segregation would be entirely unworkable in a thin structural member.

- Concrete that is judged to be workable when high-frequency vibrators are available for consolidation, would be unworkable if hand tamping were used.

- ***A concrete mixture that cannot be placed easily or compacted fully is not likely to yield the expected strength and durability characteristics.***


Thank you for
your
attention!