

SAFE BUILDING

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What is safe building?

- Life of a reinforced building lasts 50 years or longer;
- Safe building means it will not collapse during span of life;
- A safe building can not collapse all on a sudden without warning

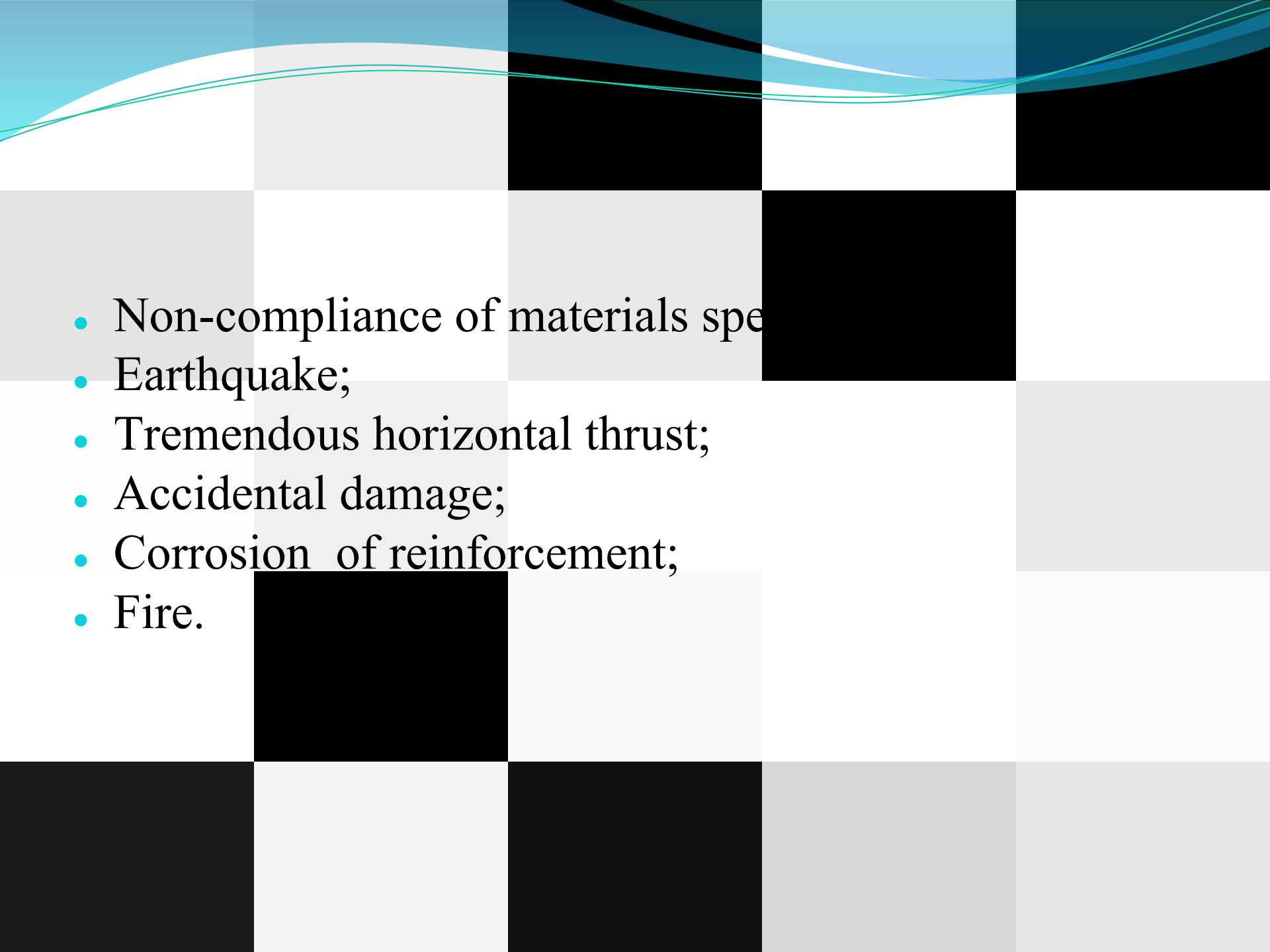
How to look at safety of buildings?

- Looking at safety by an engineer
- “If a doctor fails in his diagnosis only one patient dies, but
- If an engineer fails in his diagnosis thousands of people

Why building collapse?

Following are the factors:

- Wrong foundation design;
- Wrong super structure design;
- Non-compliance of building Code ;
- Over loading and vibration;
- Bad co

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- Non-compliance of materials specifications;
 - Earthquake;
 - Tremendous horizontal thrust;
 - Accidental damage;
 - Corrosion of reinforcement;
 - Fire.

How to prevent building collapse ?

Following steps are to be strictly followed during design:

- Soil test is to be carried out by an experienced engineering company;
- According to report foundation and super structure design has to be done by an experienced civil engineer;
- Bangladesh Building Code(BNBC) and ACI Code load factors are to be considered during design;
- Quality of materials is to be specified by the design engineer;
- Construction methodology is to be specified;
- Construction is to be supervised by an experienced civil

For a safe building we must have clear focus about
quality of concrete and quality of steel. Focusing on
how quality concrete can be manufactured.

Let us see what is Concrete?

- Concrete is a carefully proportioned mixture of Cement, Sand, Stone aggregates and water for harden;
- Cement and aggregates chemically interact to bind the aggregates into a solid mass;
- Wide range of strengths can be achieved with appropriate adjustment of proportions of constituent materials.

What is Reinforced Concrete?

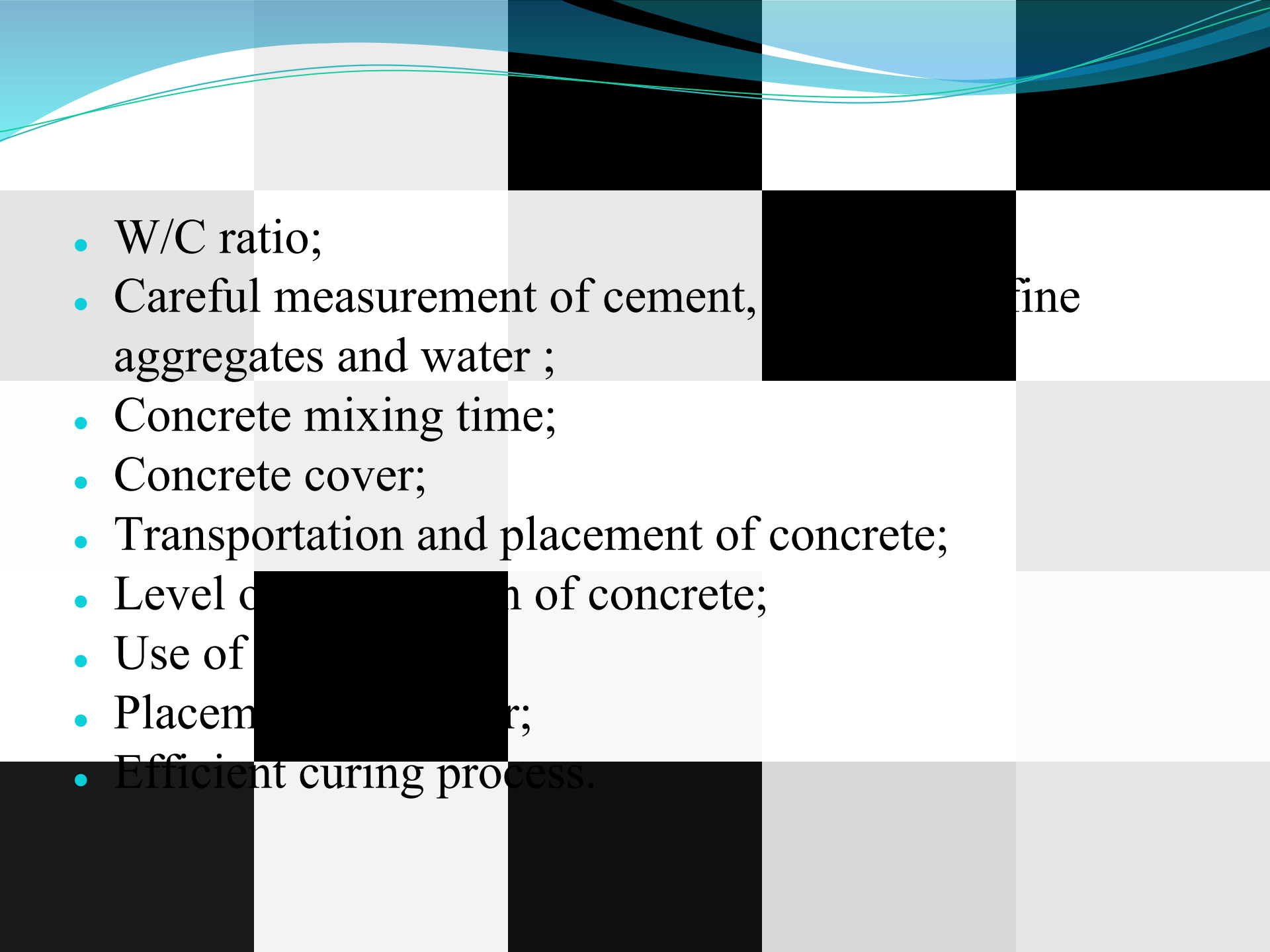
- We know concrete can not resist tension. Reinforced concrete is to be well supported to prevent the development of tension by using high-tension steel in the concrete. Whenever high tension reinforcement is embedded in concrete it is called **reinforced concrete**. This composite material resists not only **compression** but also bending, other direct tensile actions, horizontal thrust and dynamic vibration. Without **reinforcement**, any type of concrete building or structure would not have been possible.

Concrete properties:

- **Workability:** It is the property which enables concrete to be compacted fully whatever the method used.
- **W/C Ratio:** Water cement ratio is the most important factor governing the strength of concrete. Quantity of water to be mixed in 1 m³ of concrete (50kg cement) excluding water already contained in the aggregate.
- **Grading of aggregates:** For workability, strength, denseness and impermeability of concrete depend on grading of aggregates. It means proper proportion of different sizes of aggregates (Coarse and Fine aggregate).

Responsibility of a construction engineer to ensure the following for quality concrete production:

- Trial Mix design of concrete to meet required strength;
- Quality and type of cement;
- Quality of aggregates;
- Size of aggregates;
- Gradation of aggregates;
- Shape and texture of coarse aggregates;
- Maximum nominal size of coarse aggregate;
- F.M of fine aggregate ;

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- W/C ratio;
 - Careful measurement of cement, aggregates and water ;
 - Concrete mixing time;
 - Concrete cover;
 - Transportation and placement of concrete;
 - Level of compaction of concrete;
 - Use of admixtures;
 - Placement method;
 - Efficient curing process.

Benefit from using high-strength steel and high-strength, dense and durable concrete:

Material strength psi	section	Mix	Cement kg	Steel - % - Kg	Total cost
f _c ' = 4500 psi f _y = 72000 psi	20" x 20"	1 : 1.25 : 2.5	352.5	1% - 92	12,713.00
f _c ' = 4000 psi f _y = 72000 psi	20" x 20"	1 : 1.25 : 2.5	352.5	1.6% - 136	15,485.00
f _c ' = 3000 psi f _y = 72000 psi	22" x 22"	1 : 1.5 : 3	365.5	1.7% - 161.5	18,179.00

Be aware of Ready Mix Concrete :

Project	Testing date	Required strength psi	Test report by supplier - psi	Project test result - psi
Chattol	23.06.11	3000	4213.81	1414.44
Chattol	12.07.11	3000	4445.33	1296.8
Chattol	30.07.11	3000	3090.00	1562.87



Thank you very much