



***Standing Committee on Concrete Technology
Annual Concrete Seminar 2007***

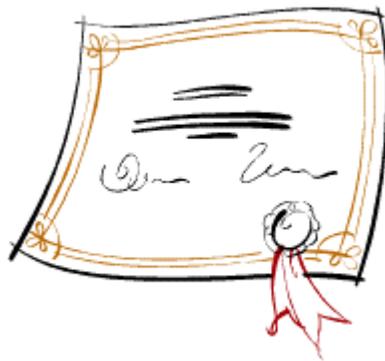
**High Workability Concrete for
Bored Pile Construction**

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Sequence of Work in Bored Pile Construction



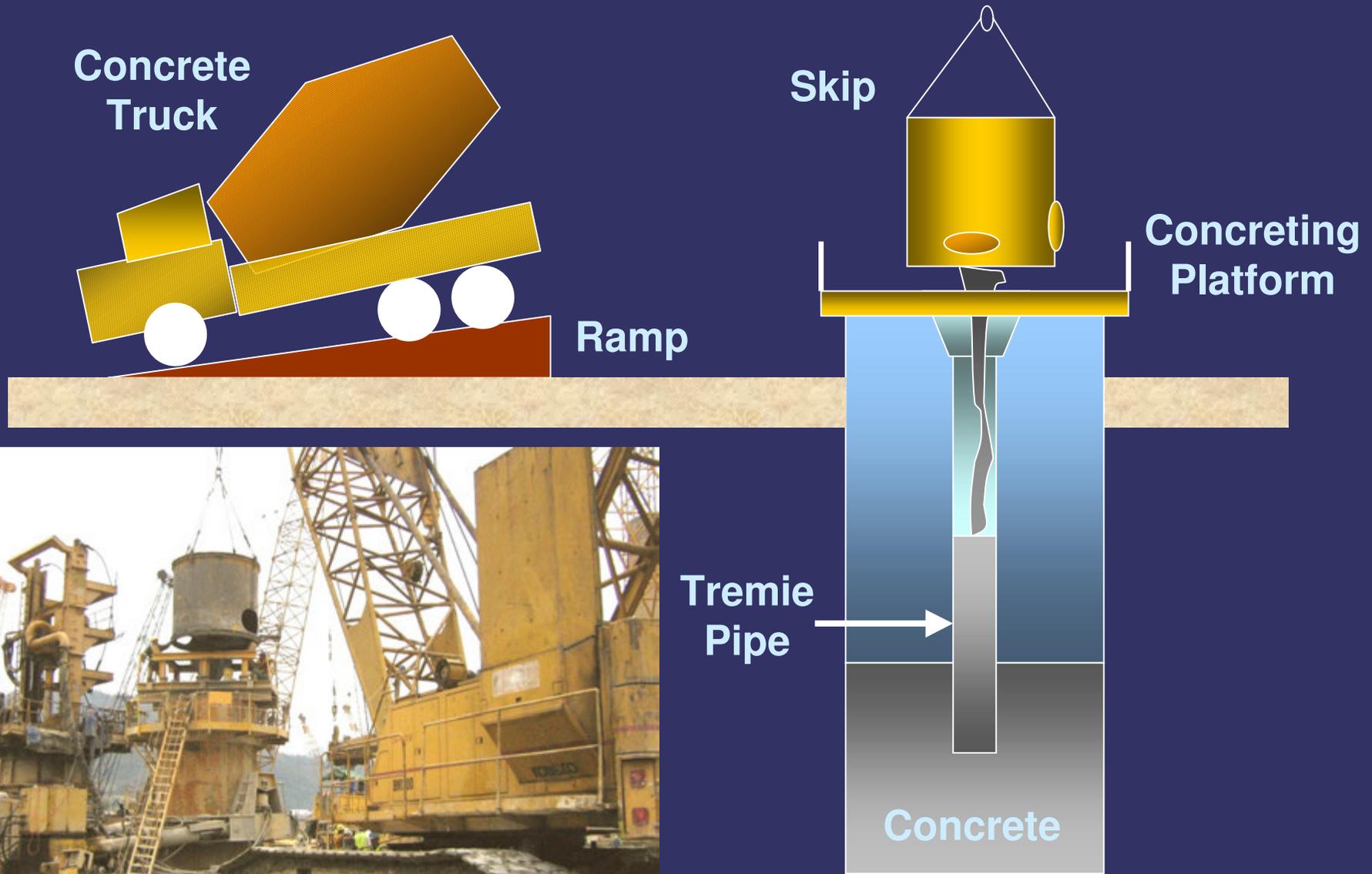


Presentation Scope

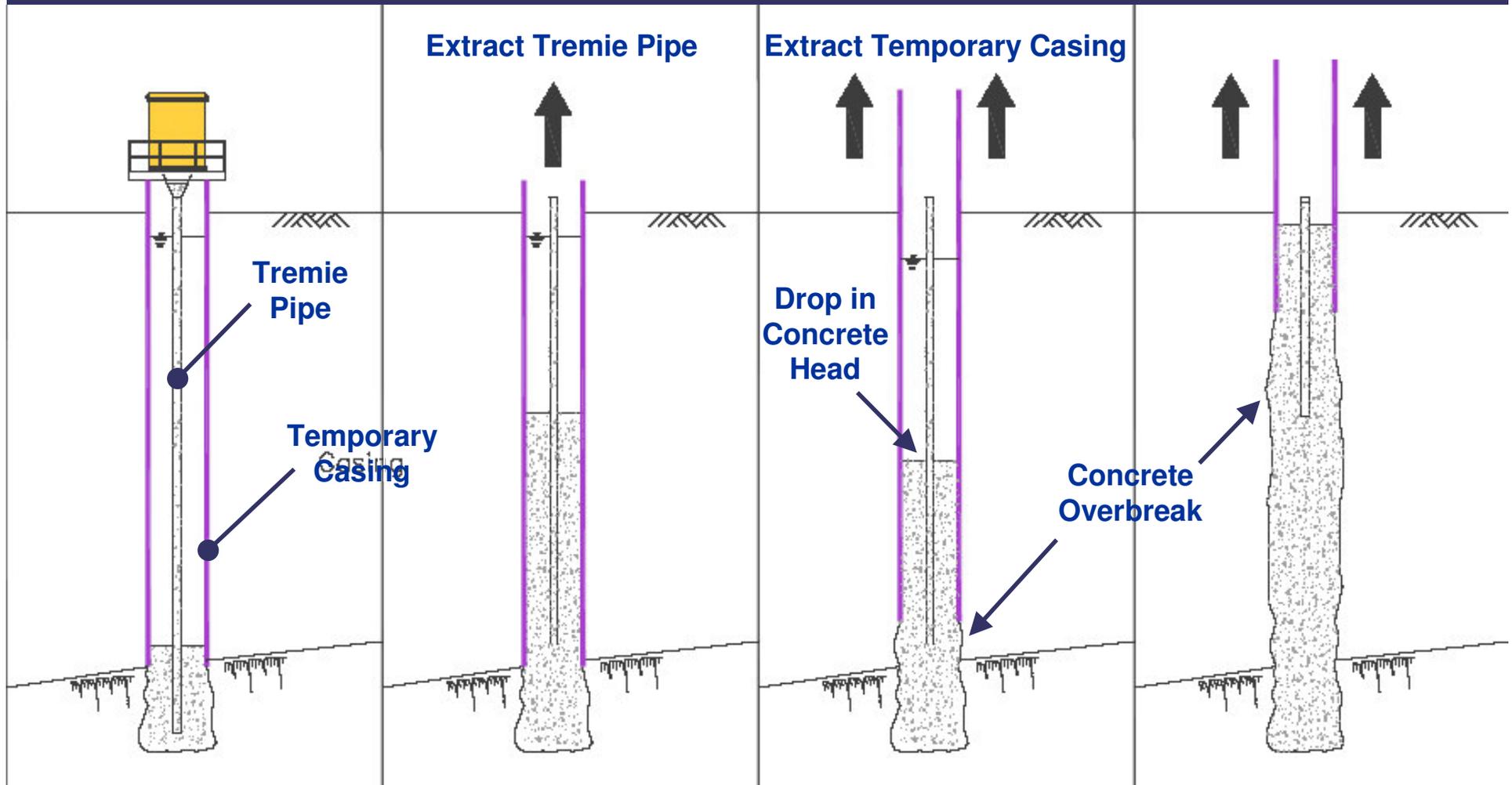
- **Method of Concreting Bored Pile**
- **Problems and Defects**
- **Deficiencies in Current Practice**
- **Proactive Approach**
- **The Way Forward**

Concreting of Bored Pile

General Setup



Stages in Bored Pile Concreting

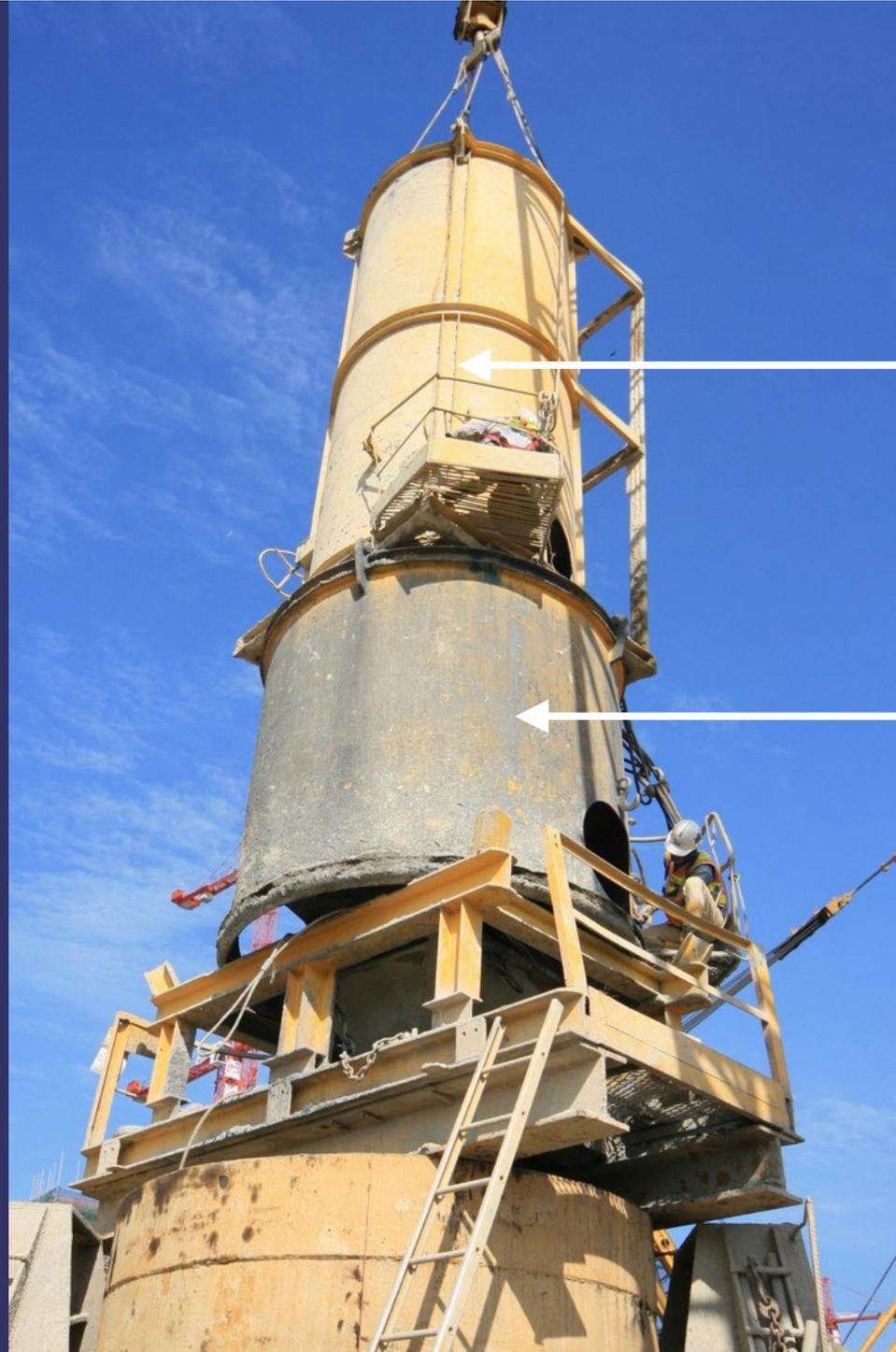


(1)

(2)

(3)

(4)



Concrete

**Cement
Grout**

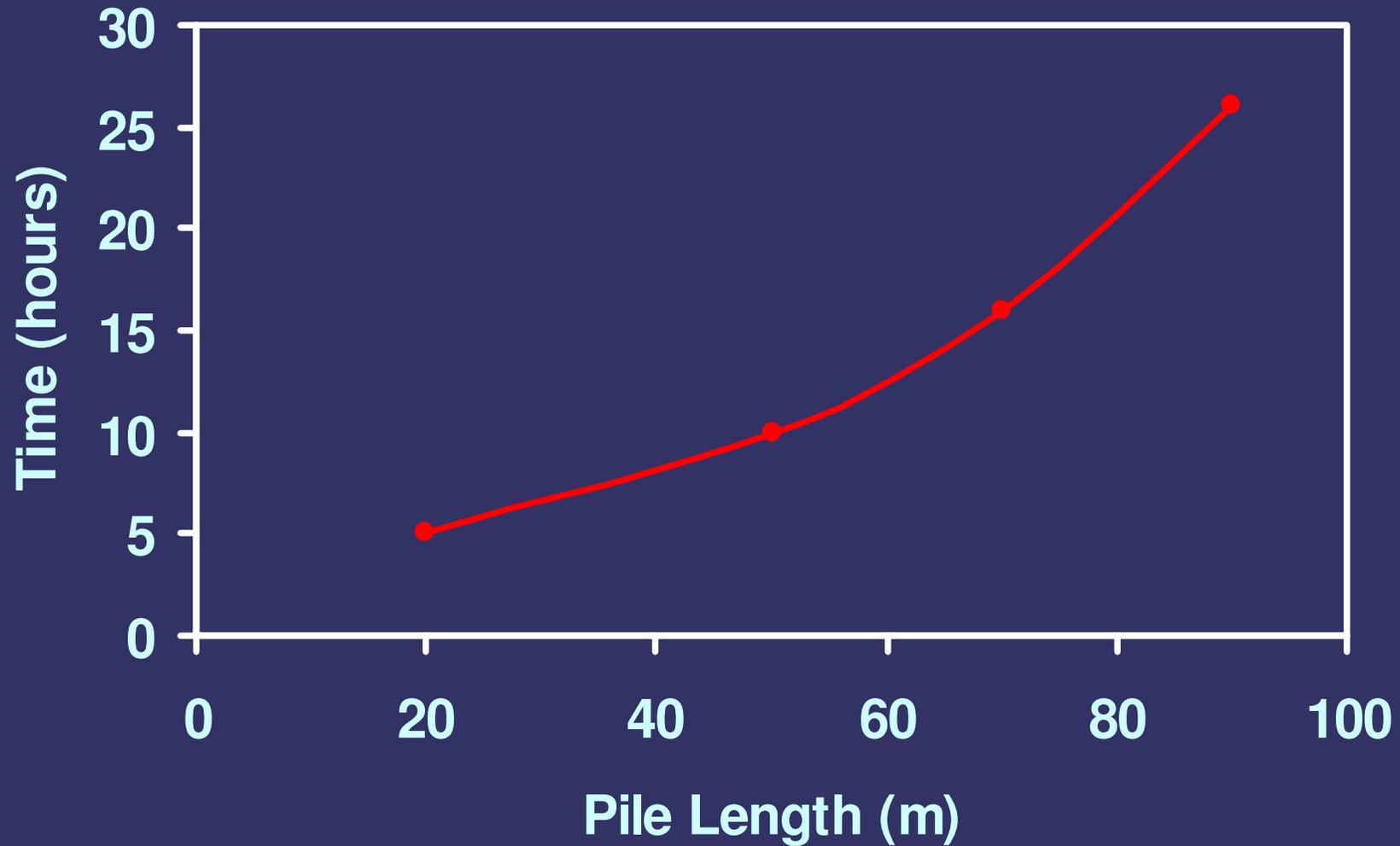
QA / QC

- **Slump tests / Flow table**
- **Check temperature ($\leq 32^\circ$)**
- **Cube samples to determine concrete strength**

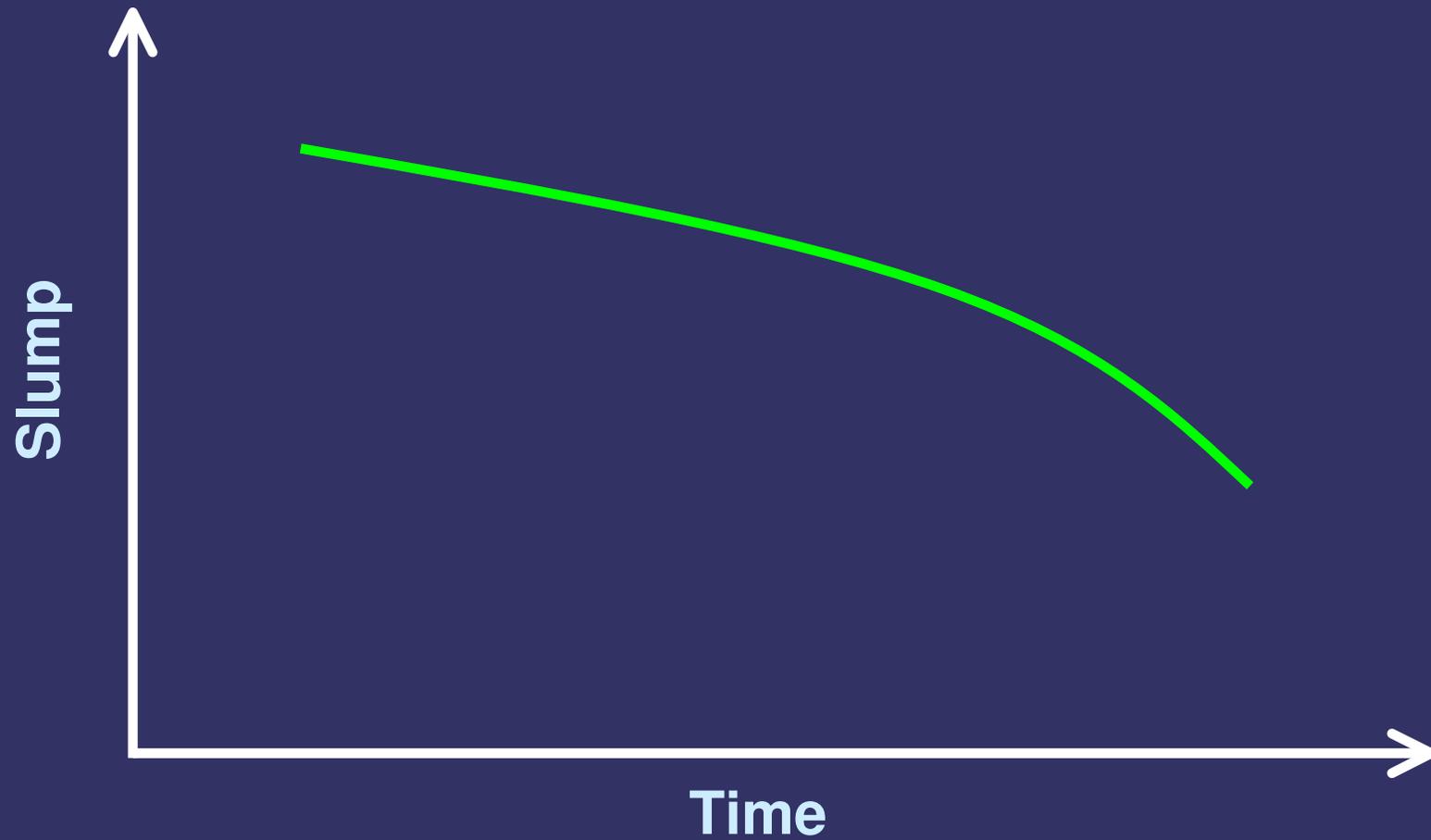
Concreting Takes Many Hours



Concreting Time Varies With Pile Length



Slump Varies With Time



Common Problems Encountered

- Temporary casing cannot be withdrawn
- Tremie pipe cannot be withdrawn
- Blocked tremie pipe
- Reinforcement cage rides up with temporary casing

Defects

Honeycomb

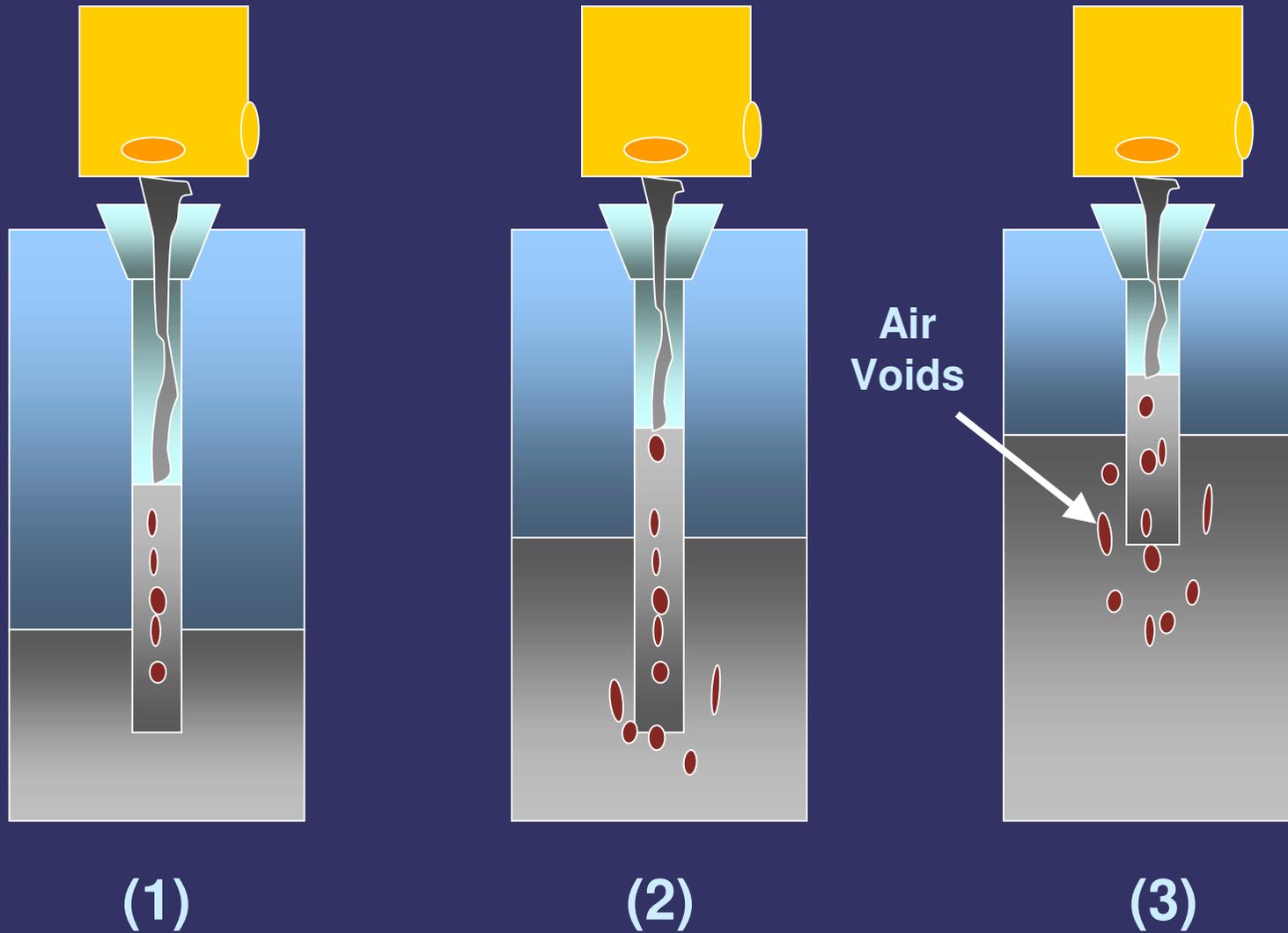


- Reduced workability affects self compaction

Air Voids



Entrapped Air Inside Concrete During Pouring



Segregated Concrete



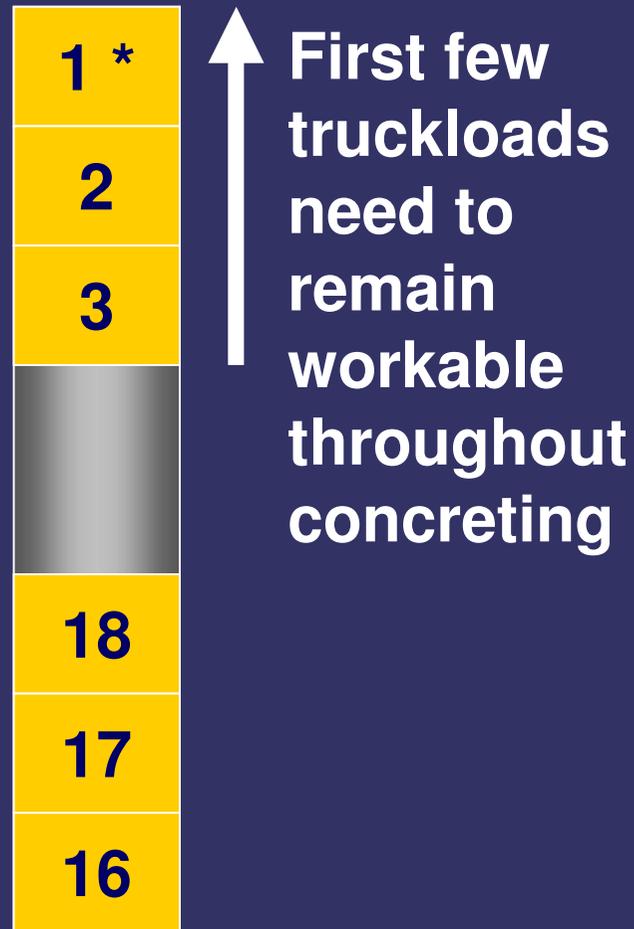
- Additive quantity needs fine-tuning

Remedial Actions

- Grouting
- High pressure water jet to remove “weak” concrete, followed by pressure grouting
- Stitched pile
- Additional pile

Deficiencies in Current Practice

First In Last Out



* Indicate order of truckload

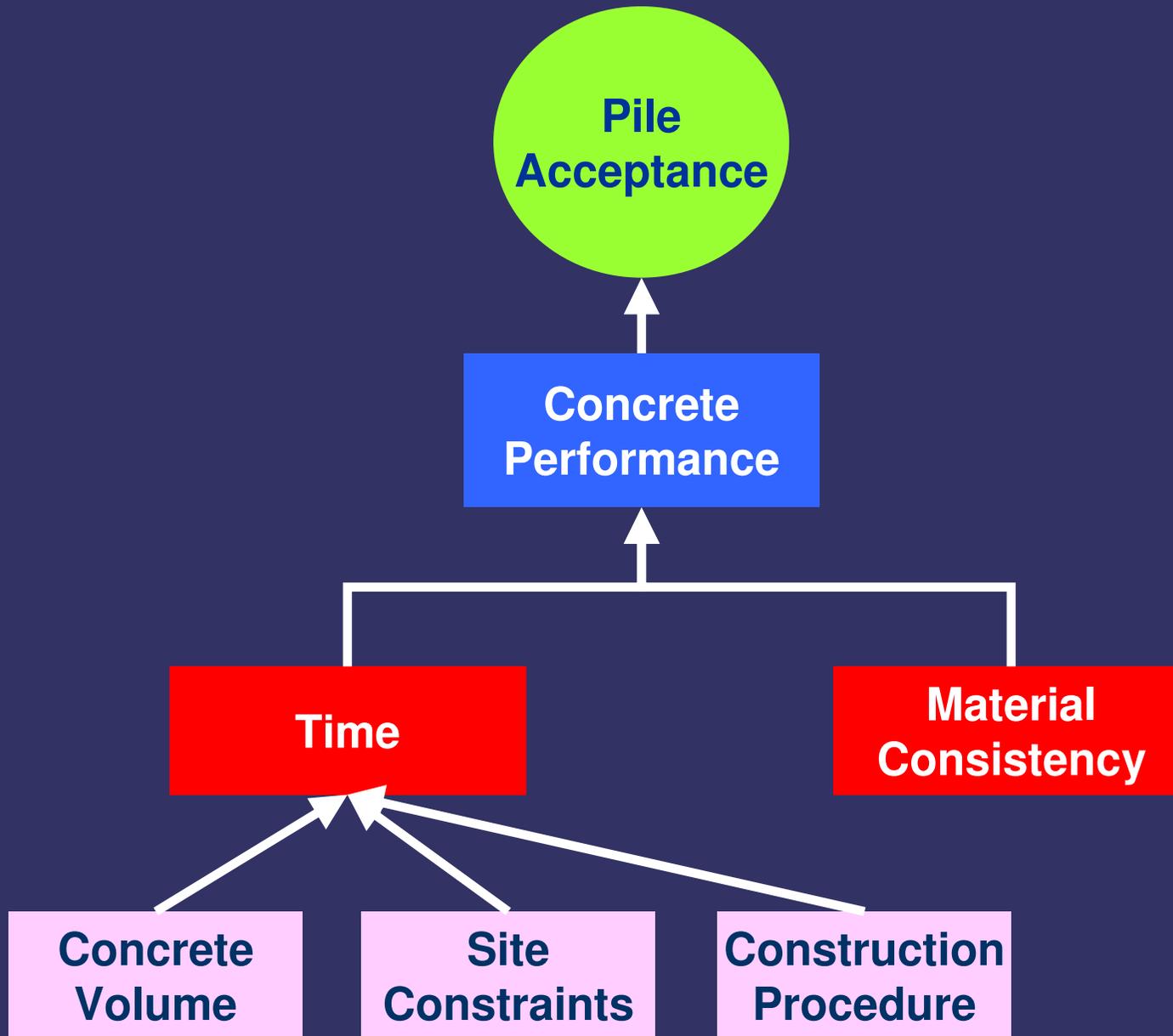
Deficiencies in Current Practice

- **Large piles / deep piles mean large concrete volume**
- **Specification / Contract Document**
 - Single slump value specified on drawing
 - Workability vs time not considered
 - Lack of flexibility in interpretation
- **Quality control**
 - Need to control consistency in material properties

The Proactive Approach

- **Need to Consider**
 - **Specification**
 - **Concrete volume (related to pile size and depth)**
 - **Site constraints (physical or environmental restrictions)**
 - **Site location (travel time to site from batching plant)**

Route to Pile Acceptance



SUCCESS STORY

Hong Kong – Shenzhen Western Corridor



**Delivery
~ 3 hours**



Grade 45/20

- **Designed slump 200mm**
- **Workability 5 hours**



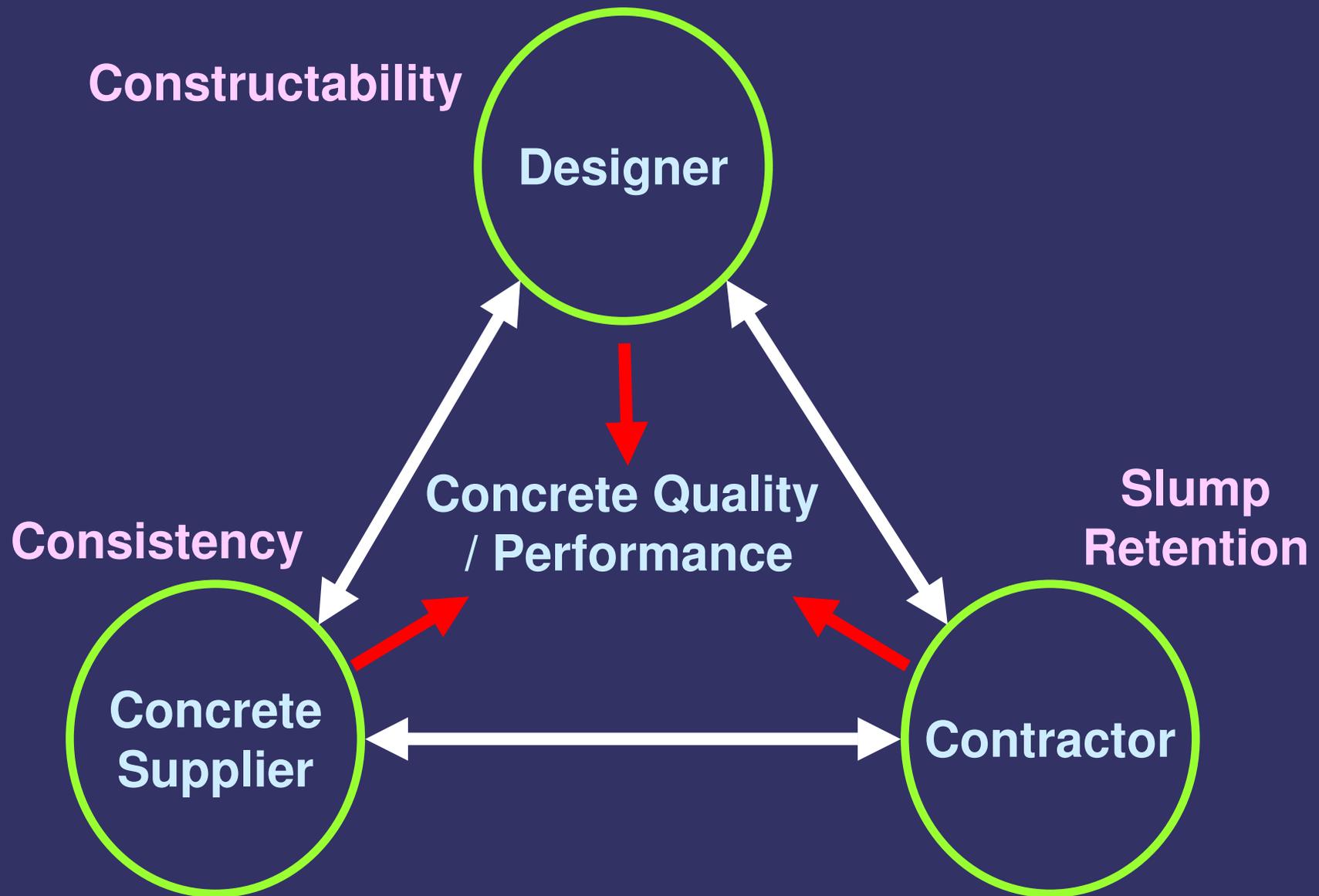
SUCCESS STORY

Hong Kong – Shenzhen Western Corridor

- Supplier formulated a special concrete mix with enhanced workability
- Engineer relaxed concreting time to 5 hours
- Contractor checked workability prior to pouring
- Side-effect : minor segregation, need to pour additional concrete to avoid undercasting

Way Forward

Concrete Triangle



The End