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## DMSA TECHNICAL NOTE (TN-011)

### Delayed Setting of Concrete

#### SM TECHNICAL LOGIC

SM TECHNICAL LOGIC is DMSA's engineering investigation series that explains real concrete problems through practical site experience and engineering reasoning. Each Technical Note follows a structured approach to identify symptoms, investigate root causes, apply relevant IS codes and recommend preventive solutions that engineers, consultants and quality teams can implement on site.

#### Objective

To help engineers understand the causes of delayed setting of concrete, systematically investigate the problem, identify the root cause and implement suitable corrective and preventive measures without compromising concrete quality.

#### Problem Statement

Delayed setting is one of the most common issues encountered in ready mixed concrete and site concreting. Concrete that remains plastic for an unusually long period delays finishing operations, formwork removal, construction schedules and early strength development. The problem may arise due to materials, batching, environmental conditions, transportation or site practices and therefore requires systematic investigation rather than assumptions.

#### Background

Setting of concrete is the process by which freshly mixed concrete gradually loses its plasticity due to the hydration of cement. It is different from strength development, which continues long after the concrete has set.

Delayed setting does not necessarily indicate poor quality concrete. In many cases, it is an intended property to facilitate transportation, pumping or placement under hot weather conditions. However, excessive delay beyond the expected setting time indicates that one or more factors require investigation.

#### Symptoms

- Concrete remains plastic for several hours after placement.
- Surface finishing is delayed.
- Bleeding continues for an unusually long duration.
- Concrete cannot support finishing equipment.
- Formwork removal is delayed.
- Slow early-age strength development.
- Construction activities are delayed.
- Customer complaints regarding slow hardening.

#### Possible Causes

##### Material Related

- High dosage of retarding admixture.
- Cement-admixture incompatibility.
- Cement with slow hydration characteristics.
- High fly ash or GGBS replacement.
- Variation in cement composition.
- Incorrect admixture selection.

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## Production Related

- Incorrect admixture dosage.
- Excess water addition during batching.
- Incorrect batching sequence.
- Poor calibration of admixture dispenser.
- Incorrect moisture correction.

## Transportation Related

- Excessive transit time.
- Additional admixture added during transit.
- Continuous drum rotation for extended periods.
- Delay in unloading.

## Site Related

- Water added at site.
- Delay in placement.
- Low ambient temperature.
- Rain during concreting.
- Improper communication between plant and site.

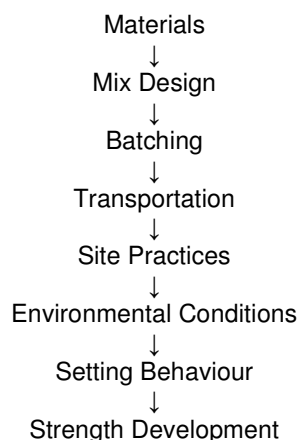
## Investigation Checklist

- ☐ Verify mix design.
- ☐ Check cement source and batch number.
- ☐ Verify admixture type and dosage.
- ☐ Check batching records.
- ☐ Review moisture correction.
- ☐ Measure concrete temperature.
- ☐ Verify ambient weather conditions.
- ☐ Check transit time.
- ☐ Verify site water addition.
- ☐ Compare with laboratory trial mixes.
- ☐ Review setting time history of previous batches.
- ☐ Verify calibration records of batching plant.

## Root Cause Analysis

Never conclude that delayed setting is caused only by admixture.

Investigate every stage:



A systematic investigation generally identifies the actual cause without unnecessary changes in mix design.

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## Recommended Solutions

- Verify admixture dosage and recalibrate dispensing equipment.
- Conduct cement-admixture compatibility tests.
- Review cement source if recent changes have occurred.
- Optimize SCM replacement levels where required.
- Control water addition at plant and site.
- Improve delivery planning to reduce transit delays.
- Monitor concrete and ambient temperatures.
- Maintain proper communication between plant and site.
- Conduct fresh laboratory trials before modifying the mix design.

## Preventive Measures

- Establish cement-admixture compatibility before production.
- Calibrate batching equipment regularly.
- Maintain strict quality control records.
- Monitor seasonal changes affecting setting time.
- Train batching plant and site personnel.
- Standardize admixture dosing procedures.
- Review trial mixes whenever materials are changed.
- Monitor transit time for every supply.

## Important Do's

- Verify the actual setting time before taking corrective action.
- Maintain complete batching records.
- Monitor concrete temperature.
- Use calibrated dispensing equipment.
- Investigate all influencing factors systematically.
- Compare field observations with laboratory trials.

## Important Don'ts

- Do not blame admixture without investigation.
- Do not increase cement content unnecessarily.
- Do not add accelerator at site without approval.
- Do not change mix design based on one incident.
- Do not ignore temperature and transit time.
- Do not permit uncontrolled water addition.

## Relevant IS Codes

- IS 456
- IS 10262
- IS 9103
- IS 4926
- IS 516

## Practical Tips

- Compare the affected batch with previous successful batches.
- Check whether the cement source has recently changed.
- Record concrete temperature during dispatch and placement.
- Review actual transit time instead of estimated time.
- Verify the calibration status of admixture dispensing equipment.
- Never recommend changes until the complete investigation is finished.



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## SM Insights

Delayed setting is not always a defect. In many projects, controlled retardation is intentionally used to facilitate transportation, pumping and placement. Problems arise only when the delay exceeds the designed setting time. Most field cases are caused by a combination of cement characteristics, admixture dosage, temperature, transit conditions and site practices rather than a single factor. A structured investigation helps identify the true cause and avoids unnecessary rejection of concrete or changes to the mix design.

## Key Learning

Delayed setting should always be investigated systematically. Sound engineering decisions are based on facts, records and testing rather than assumptions. Understanding the interaction between materials, production, transportation and site practices is essential for resolving the issue effectively.

## Need Technical Assistance?

DMSA provides engineering investigation, root cause analysis and practical site solutions for concrete setting problems, durability concerns and quality control practices.

Version 1.0

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