**Problem**

Clay swelling damages in pavement = $1 billion costs annually

**Treatment**

- Clay
- Water
- Lime (CaO)

How do clay properties affect reaction?

How do clay properties react over time?

How does strength increase over time and why?

**Methodology**

- Clay (Kaolinite) + Slaked lime (Ca(OH)2) → Compaction & Maximum Stress Curve Generation

- Long-term sample preparation with curing time up to 2 years

- Unconfined Compressive strength test

- Post curing samples processing:
  1. Strength test (Unconfined Compressive Strength test)
  3. Drying of solid chunks for solid test, acetone drying for NMR, IPA drying for XRD & TGA.

**Data Synthesis**

**Strength data analysis**

- Strength is increasing linearly over time up to 1 year followed by a 14% decrease in the second year.

**Qualitative Analysis of Clay-Lime Reaction**

- Two separate hydration products are formed over time.

**Quantitative Analysis of Clay-Lime Reactions**

1. Both XRD & NMR show slight decrease in hydration product at 540 days of curing.
2. Following similar pattern, kaolinite peak area also slightly decreased at 540 days in NMR.
3. XRD shows complete portlandite consumption after 180 days.

**Comparison between TGA & SRD**

- Ca mass balance:
  1. Total quantifiable Ca is less in XRD after 180 days due to portlandite consumption and amorphous hydrate.
  2. TGA data plateaus after 540 days.

- Following similar pattern, kaolinite peak area also slightly decreased at 540 days in NMR.

**Concluding hypothesis**

- 1. Due to incongruent dissolution of kaolinite, initially an amorphous CSH/CAH forms from depending on preferential release of Si/Al.
  2. After a year, when enough Si/Al becomes available, startinglite is formed scavenging the Ca from the earlier product and disturbing the matrix, reducing strength.