**Concrete Behavior under Impact**

### Size Effect
Concrete Strength reduces with increase in specimen size. Mainly caused by change in failure mode from plasticity to fracture.

\[ \sigma_{\text{S}} = \frac{B f_t}{1 + \frac{D}{D_0}} \]

- \( B, D_0, L_1, L_2 \) = constants
- \( D/D_0 \) = relative structural size ratio
- \( f_t \) = tensile strength

### Loading Rate Effect
Concrete strength increases with higher strain rates. Caused by inertial effects.

### Strain Rate Effect

**Present Study: Combined Testing and Simulations**

**Sample Results**

- **Druker-Prager Plasticity Model - 5 m/s Impact Max. stress**
- **Druker-Prager Plasticity Model - 7 m/s Impact Max. stress**
- **Modulus of Elasticity**
- **High-Strength Concrete**

**Key Conclusions**
- A dynamic Size Effect that differs from the static Size Effect was observed.
- The existence of Size Effect was verified in parameters other than strength (e.g., modulus of elasticity and strain at maximum stress).
- The Size Effect Law predicted, almost exactly, the static strength values for both the high-strength and the normal-strength concrete cylinders.
- A variation of concrete strength with the variation of loading rate was observed.
- Two finite element models were developed using ABAQUS EXPLICIT. A Druker-Prager Cap Plasticity model and a Brittle Fracture model.