PCI MIDWEST
A Chapter of Precast/Prestressed Concrete Institute

PRECAST FOCUS

REBAR VS STRAND IN REINFORCING CONCRETE

Technical Comparison of Reinforcement Methods

Concrete inherently possesses high compressive strength but is comparatively weak in tension. To overcome this limitation, reinforcement is introduced, most commonly through steel materials such as rebar (reinforcing bar) and prestressing strand. These two reinforcement types serve different structural functions and are selected based on specific engineering requirements.

Rebar

Rebar typically consists of carbon steel rods with surface deformations (ribs) engineered to maximize mechanical interlock and bond with the surrounding concrete matrix. Diameters commonly range from #3 (9.5 mm) to #18 (57 mm), with yield strengths typically at 40, 60, or 75 ksi. Rebar is arranged according to structural drawings and secured with wire ties at intersections, forming the reinforcement cage for cast-in-place or precast elements. Its primary purpose is to resist tensile, shear, and sometimes compressive stresses induced by live and dead loads, temperature fluctuations, and shrinkage. Placement tolerances and concrete cover are governed by codes such as ACI 318.

Strand

Prestressing strand consists of high-strength steel wires (usually 7-wire) helically wound and typically 0.5 or 0.6 inches in diameter. Strand is manufactured to higher strength standards, often exceeding 270 ksi (ASTM A416). In prestressed or post-tensioned concrete, strand is tensioned either before (pre-tensioning) or after (post-tensioning) the concrete cures, applying a compressive force that counteracts in-service tensile stresses, thus minimizing crack propagation and deflection. Anchorage devices or chucks transfer the strand force into the concrete. Strand's smooth surface requires specialized end anchorage and grout to ensure load transfer and corrosion protection.

Key Differences

- Structural Function: Rebar provides passive reinforcement; strand supplies active, pre-applied compressive forces via prestressing.
- Material Properties: Rebar yields at lower strengths (typically 60 ksi); strand is engineered for much higher tension loads (up to 270 ksi).
- Installation: Rebar is manually placed and tied; strand requires hydraulic jacking equipment for tensioning and anchorage systems.
- Applications: Rebar is standard in slabs, beams, walls, and columns; strand is essential for long-span, prestressed elements such as girders, bridge decks, and precast components.

In conclusion, rebar and strand address distinct engineering challenges in reinforced concrete design, with selection based on the required structural performance, span, and load conditions.

PCI MIDWEST Mike Johnsrud, PhD, PE • Executive Director
612-760-6101 • info@pcimidwest.org • www.pcimidwest.org