Fiber Reinforced Shotcrete
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OUTLINE

• Basic Mechanics of shotcrete
• Aim of addition fibers
• Fiber types
• Application area of fibers
• Alternative to fibers
• Conclusion
SHOTCRETE

- Water + Cement + Aggregate
- Brittle than metals and polymers
- Have microcracks
- Load + microcrack ➔ Macrocracks
WHY FiBER?

• To stop propagation of macrocracks
• To enhance dynamic fracture toughness
• To increase tensile strength
• To bond in matrix at microcrack level
• To increase absorption of energy
• To enhance impact resistance
Initial crack formation Pull-out - high ductility Yielding - low ductility

Rain + CO₂

Ground Movement

Water infiltration

Exterior crack formation
FiBER TYPES

- **Metallic**
  - (Carbon steels, nonalloy steels, aluminium)

- **Natural**
  - (Asbestos, cellulose, carbon)

- **Synthetic**
  - (Nylon, polyproplene, polyacronydrile)
Steel fibers
FIGURE 1: Types of steel fibres. *(Source: CSTR 63)*
Advantages of sfrs

• Improve toughness
• Reduce shrinkage cracking
• Improves safety
• Reduce rebound
• Optimizes sprayed lining thickness
Synthetic fibers
Where we use ?
Building of tunnels
mining industry
slope facing
Stabilization of excavations
Alternatives to fiber
wire mesh

• High rebond
• Have voids
• Time lose
• Expensive
Conclusion

Effective
Efficient
Economic