Track21: Railway track for the 21st Century

Ballast & Sleepers

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Industry Steering Group – 13 December 2010
Objectives

- Develop fundamental understanding of how grading affects the internal stability, strength, resilient mechanical response and drainage of ballast.

- Investigate the potential of “soft” techniques to improve the characteristics of ballasted track systems.

- Investigate the potential of different sleeper types and sleeper/ballast interface modifications to improve the performance of ballasted track.
Progress

• Recruitment
  • 3 students recruited and about to start
    • Taufan Candra (Southampton)
    • Olufemi Ajayi (Southampton)
    • Sydney Laryea (Nottingham)
  • Identifying postdoc for practice review

• Modelling
  • Element and box tests using realistic DEM particles (Southampton and Nottingham)
Aims of modelling

- Detailed, particle-scale numerical investigation.
  - Effect of particle shape, grading, gluing, reinforcement and resin injection.
  - Understand in detail the mechanisms responsible for the observed behaviour.
Progress in modelling

- Box test
- Vertical cyclic load through sleeper

(Nottingham)
Progress in modelling

- Triaxial test
- Monotonic load
- **External view**
- **Slice view**

(Southampton)
Plans (next 6 months)

- 3 PhD students will start
  - Taufan Candra (Southampton)
  - Olufemi Ajayi (Southampton)
  - Sydney Laryea (Nottingham)
- Practice review
- Modelling
  - Continue refining current models.
  - Start introducing bonding/reinforcement.
Plans (next 6 months)

- Start two students working on rig tests.
  - Effect of sleeper type and interface modifications.

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Plans (next 6 months)

• Review of ballast specifications.
  – Literature, practice, field data.

• Start one student working on triaxial tests.
  – Initially coarse sand, scaled ballast soon after.
  – Effect of grading, gluing, reinforcement and resin injection.
Plans (next 6 months)

- Continue triaxial and box tests.
- Hollow-Cylinder tests.
  - Principal stress rotation.
- Start introducing bonding/reinforcement.
What we need

• Review of ballast specifications:
  – Access to literature, key people and field data.

• Triaxial tests and numerical modelling.
  – Practical bounds to particle size.
  – Other possible methods of reinforcement.

• Rig tests.
  – Sleeper types and materials that are more likely to be of practical use.
  – Other possible modifications that should be considered.
End of WA2