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FOR RESEARCH ON  
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# Industry Case Study

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# NIL - National Infrastructure Laboratory, Southampton



# National Infrastructure Laboratory



Large Structures Testing Laboratory



Testing and Structures Research Laboratory



# National Infrastructure Laboratory



Geomechanics Laboratory



Geotechnical Centrifuge Facility



# Large Structures Testing Laboratory



## Key facilities:

- 30m x 15m strong floor
- 1,000l/min hydraulic ring main
- Load frames and dynamic actuators up to 2.5MN
- Data rich measurement system
- Non-contact, non-destructive measurement techniques
  - Digital Image Correlation (DIC)
  - IR thermography, Thermoelastic Stress Analysis (TSA)

# Case study: asphalt bed for railway track systems



- An asphalt trackform overlain by ballast may allow reduced trackbed thickness at critical locations and avoid the need for costly bridge reconstruction
- Laboratory tests on four trackbed designs simulated 2 years of traffic on a busy route
- The research identified minimum ballast layer and asphalt thicknesses using revised ballast gradations
- Further tests simulated 2 years of true train loading to validate the performance of the preferred design under different characteristic load patterns
- Industry partners AECOM, Network Rail, Rhomberg Sersa, RSSB



# Future plans



## Research

- Performance of multi-slab rigid railway track systems
- Fatigue testing of railway electrification large components
- Experimental testing of scaled reinforced concrete bridge piers (EPSRC)
- Shock loading of steel frame connections (representative of sudden column failure)
- Wind turbine blade section demonstrator. Multi-axial testing with optical measurement techniques – (EPSRC, Siemens Gamesa)
- Hybrid testing demonstrators

## Undergraduate projects

# Testing and Structures Research Laboratory



## Key facilities

- Large range of static and dynamic test machines (1 kN to 630 kN)
- Temperature chambers (-260°C to 850°C)
- High strain rate test facilities (VHS, inertial impact rig (gas gun), drop tower)
- Composite materials manufacturing area
- Non-contact, non-destructive measurement techniques
  - Digital Image Correlation (DIC)
  - IR thermography, Thermoelastic Stress Analysis (TSA)
  - High speed and Ultra-High speed imaging (up to 8M fps)



# Case study: drainage material and slope stability



- Investigators studying a catastrophic slope failure wished to compare the mechanical performance of large particle size drainage material taken from site with that of a standard grading, at high and low confining stress
- Cylindrical specimens 300φ x 600 were prepared and tested in the large triaxial test apparatus. The effect of confining stress and of saturation were investigated
- The effects of fines, of saturation and of confining stress (or burial depth) on strength behaviour were reported.
- Industry partner: ORR



# Future plans



## Research

- Stainless steel shear connections
- Stainless steel rebar
- Fatigue testing of railway electrification small components
- Composite materials testing

## Enterprise

- Commercial in confidence

## Undergraduate projects

# Geomechanics Laboratory



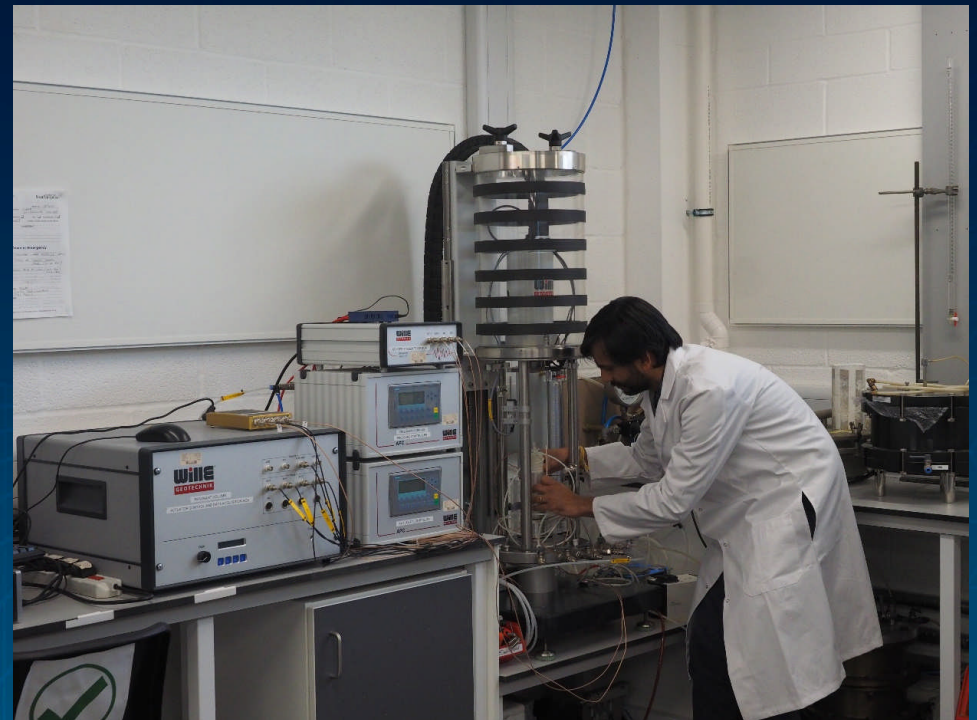
## Key facilities

- standard and advanced soil element testing apparatus
- custom build machines for testing ballast in bulk and single particle contacts
- assembly and testing of field instrumentation

# Case study: properties of backfill material subjected to dynamic events



- Dynamic loads caused by events such as earthquakes or imposed by railways, machine foundations and wind turbines, generate stress waves inside soil masses
- Two backfill blend mix design and preparation procedures were tested in the resonant column apparatus for mechanical response to dynamic loads
- The results are being applied in the nuclear industry to optimise design for performance, cost and carbon
- Industry partner: Laing O'Rourke



# Future plans



## Research

- EPSRC proposal for advanced laboratory testing of high-quality mudstone samples recovered from site
- advanced laboratory element testing of high quality specimens to investigate strength, stiffness and dissolution parameters for salt rock

## Undergraduate teaching and projects

# Geotechnical Centrifuge Facility



## Key capabilities

- 130 g tonnes
- 200 rpm, ~60 m/s
- triaxial actuators impose loads on the sample in flight
- equipped for remote monitoring to facilitate collaborative working at distance

# The time machine





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