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ROAD FOUNDATION CONTRUCTION USING TYRE BALES – A LOW-ENERGY ALTERNATIVE

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ROAD FOUNDATION CONSTRUCTION USING TYRE BALES – A LOW-ENERGY ALTERNATIVE

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- Tyre Bales
- Costs / Other Key Issues
- Specification
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- Potential Applications
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Introduction to the Problems

- Large quantities of post-consume
  - 40M / 450kt UK pa
  - Ban on tyres to landfill
  - Pan-European problem:
  - USA estimated 2bn stockpiled tyres
    - Texas 69M stockpiled, 24M generated pa
- Design and construction of roads on soft ground is:
  - Complex and materials at limit of test techniques
  - Budgets constrained as traffic levels low

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Tyre Bales

- 1.55m x 0.83m x 1.33m (1.70m^3)
- Lightweight (810kg; 0.5 t/m^3 shape)
- Permeable (sand/gravel)
- Porous (62%)
- High bale-to-bale friction
- **Low energy process**
  - 6% of that for shred
- Low themal conductivity
  - (Good insulation)

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Costs and Other Issues

COST = MATERIALS
+ PLANT
+ LABOUR

- MATERIALS are generaly cost neutral
  - Compared to garnular fill
  - Transport distance will determine precise balance•

The use of correct PLANT will enable rapid placement and construction

- Similar savings made with respect to LABOUR

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Costs and Other Issues

- Supply and Production
- Handling
- Contamination Potential
  - Durability
  - Fire resistance
- Human health and safety

All addressed in TRL PPR045 and PPR080 … AND

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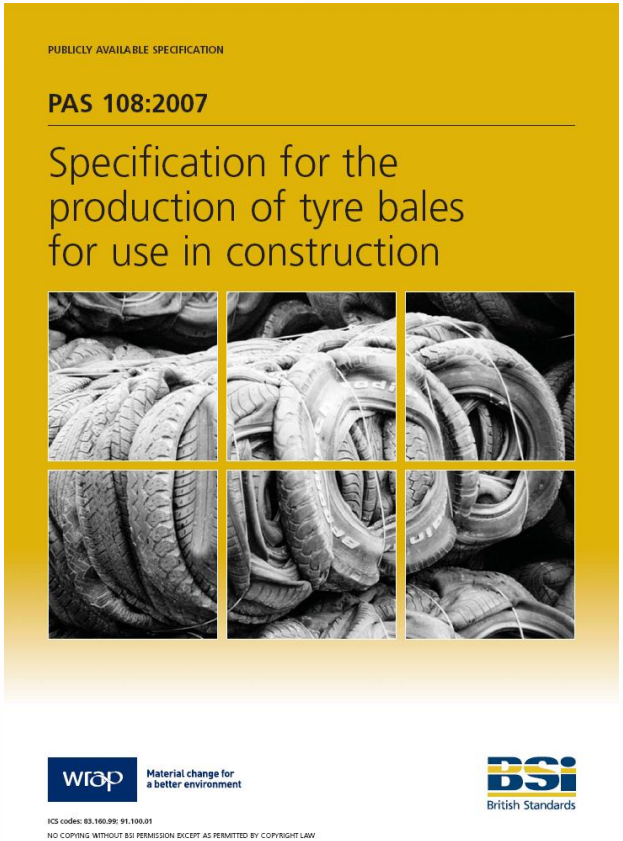
BSI PAS 108 - Specification

- Receipt, inspection, cleaning, handling & storage of tyres
- Production of bales
  - Target size/property based
- Factory production protocol
- Property measurement
- Properties & behaviours
- Applications in construction
- End of life service options



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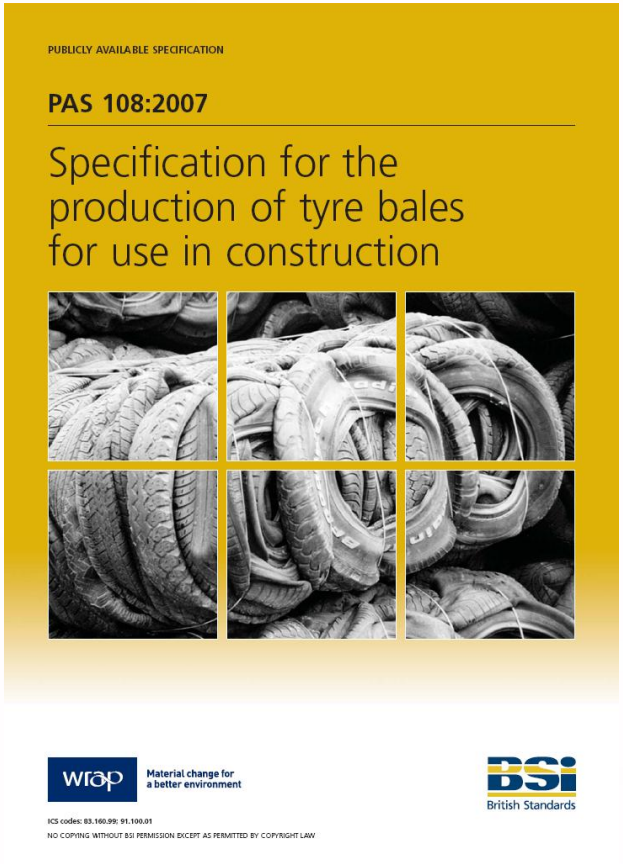
BSI PAS 108 – Specification

- Prepared by TRL and HRW
- Funded by WRAP

Waste Management

- Lays the groundwork for a
  - Quality Protocol (QP)
  - As for recycled aggregates
- To take Tyre Bales out of the waste stream



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Potential Applications

- Road foundations
- Lightweight fill
- Slope failure remediation
- Gravity retaining walls
- Drainage layers
- Stormwater management
- Environmental barriers
- River embankment and coastal defence works

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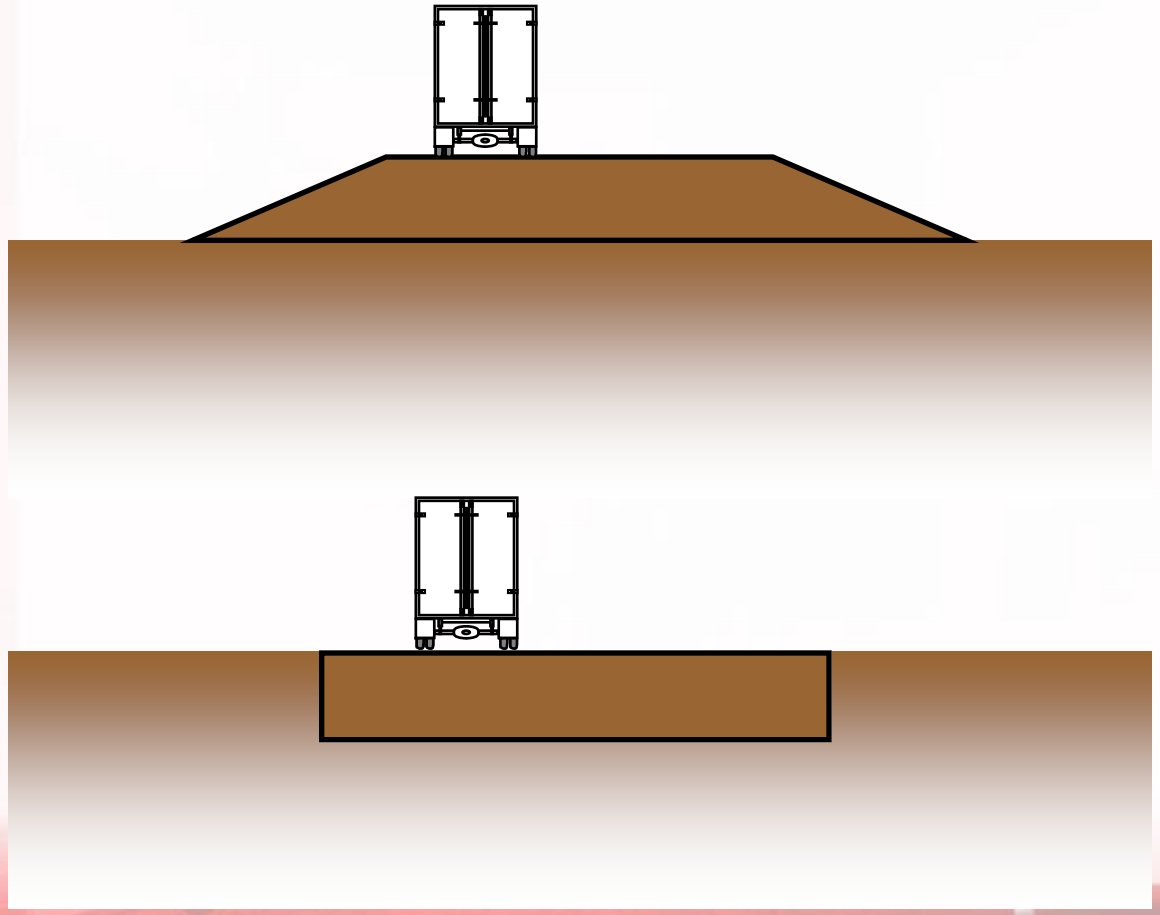
Road Foundations – Floating vs Buried Construction



Floating Construction

Mass of construction is additive
Risk of settlement
Surface ‘crust’ remains intact
Settlement adjacent to construction
Greater land take

Buried Construction

Mass of construction is not additive
Lesser risk of settlement
Surface ‘crust’ breached
Disposal of material
Excavation support
Basal heave
Hydrogeology affected

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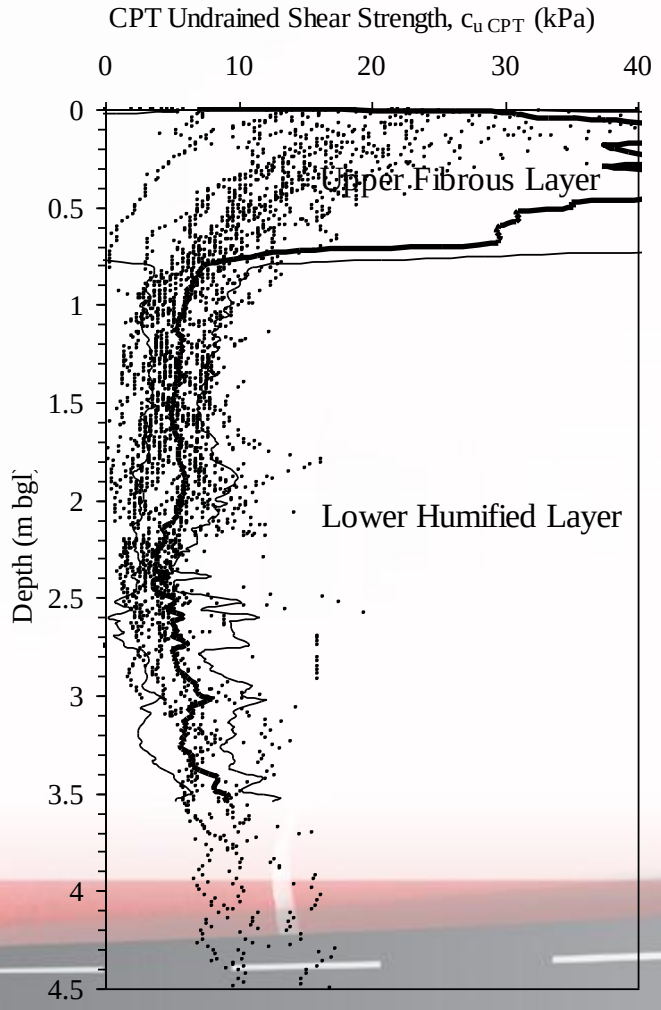
Road Foundations – Crust Effect in Peat



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Road Foundations – Design Approaches

- Analytical input to design limited
  - Strength/stiffness of soils
  - At / below lower limit of reliable measurement
  - Sampling process highly disruptive
- Design generally experience and specification-led

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Road Foundations – Excavation & Preparation

- Excavation – if buried construction
- Use low ground pressure plant
- Dry weather working
- Preparation
  - Geosynthetic separator
  - Protect geoysnthetic
  - Construct in cells

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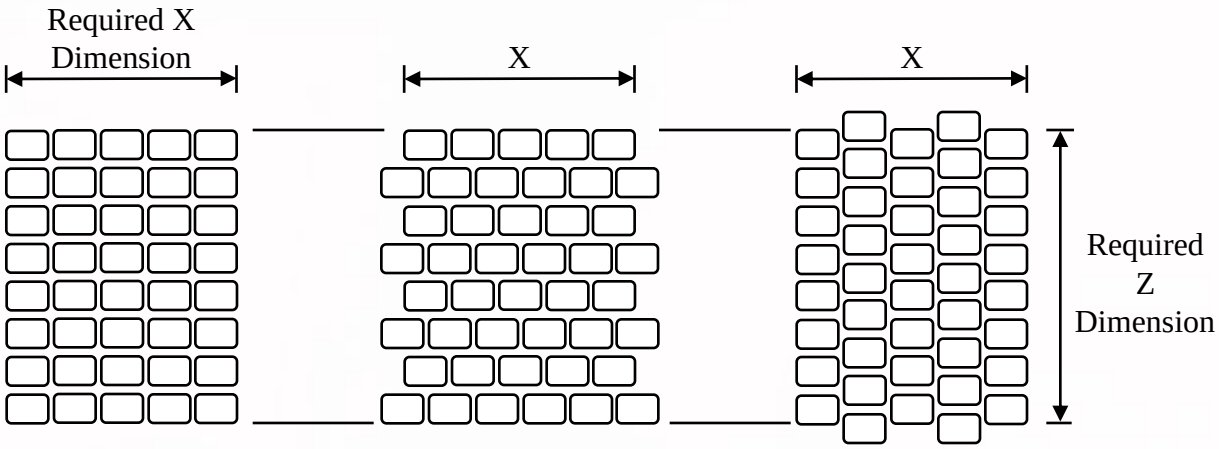
Road Foundations – 2D Alignment



(a) Chessboard
Simple to construct
Used successfully
Low lateral resistance
Needs friction to resist

(b) Stretcher bond
Good lateral resistance
Uses more bales (10%)
Castellations need to be filled
Staggered edge
Differential settlement

(b) Staggered
Similar to stretcher bond
Staggered edge
Differential settlement
Affect running surface

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Road Foundations – Filling of Voids

- Bales must be tight together
- Fill at edges and corners
- Very important
- Maximises stiffness & strength
  - Geosynthetic separator
  - Protect geoysnthetic
  - Construct in cells
- 150 to 300mm layer above

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Road Foundations – Pavement

- Determined by traffic flow/type
- Crossfalls and
- important
- Maximises stiffness & strength
  - Geosynthetic separator
  - Protect geoysnthetic
  - Construct in cells
- 150 to 300mm layer above

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Concluding Remarks

- Tyre bales are a potential means of dealing with waste tyres
- More importantly they have significant beneficial properties
- Demonstrated through projects in UK, USA
- Primary objective to support emerging
- Signs that this is being achieved

THANK YOU

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