The effect of particulate contamination on the infiltration rates of synthetic turf surfaces

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The consequence of poor infiltration

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Hypotheses

1. Infill contamination ↑ - Infiltration rate ↓

   (reduced pore space)

2. Greater contamination of urban pitches than rural pitches

   (environmental effects)

Materials used in testing

Infill materials (from Garside sands, UK)

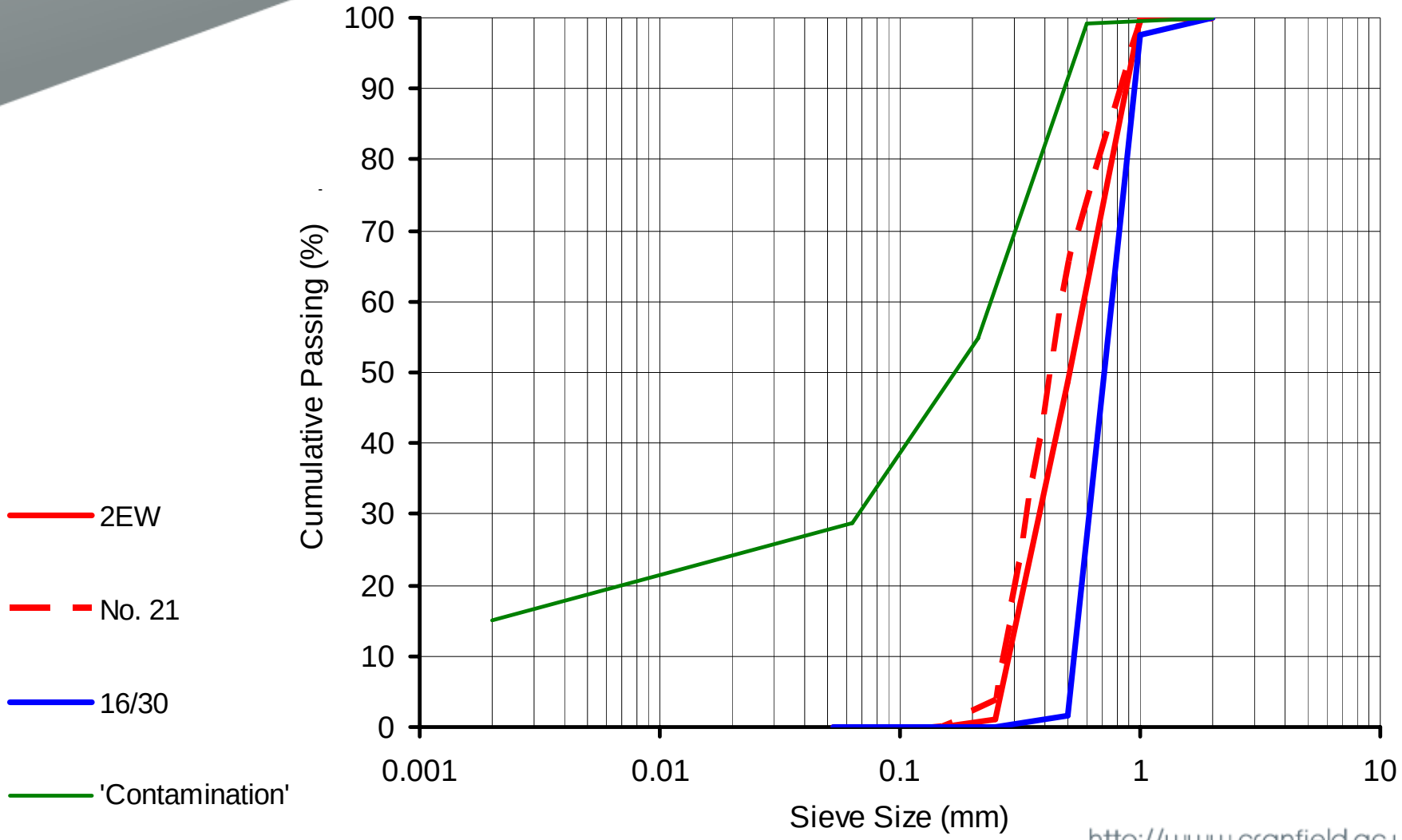
16/30	1.00mm - 0.50mm
No 21	0.71mm - 0.25mm
2EW	0.71mm - 0.25mm

Added contamination

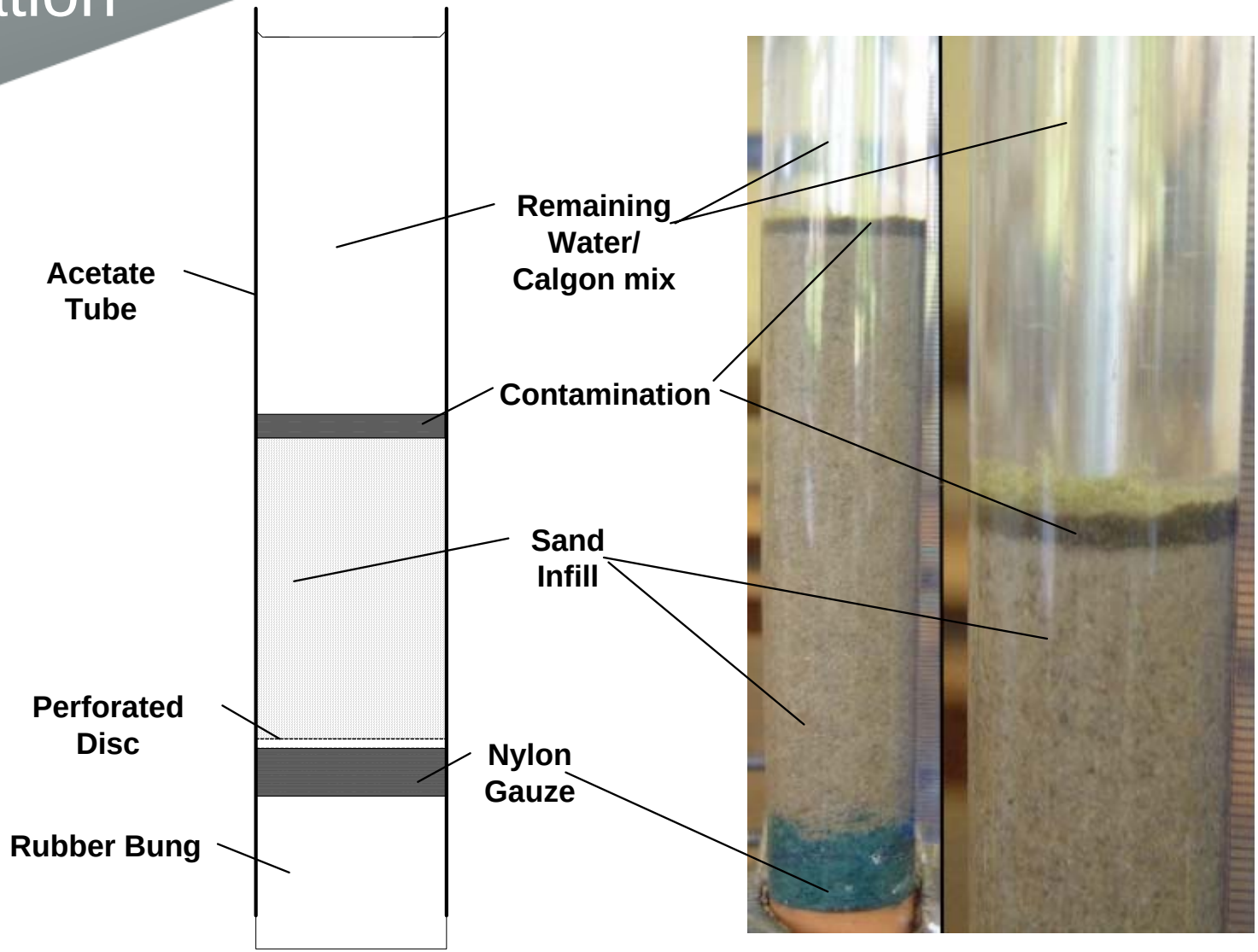
Sandy loam - graded to a particle size < 500 µm

(71.2% medium-fine sand, 13.6% silt, 15.2% clay)

Particle size distribution of infill



Quantification of contamination



Calibration of separation tubes

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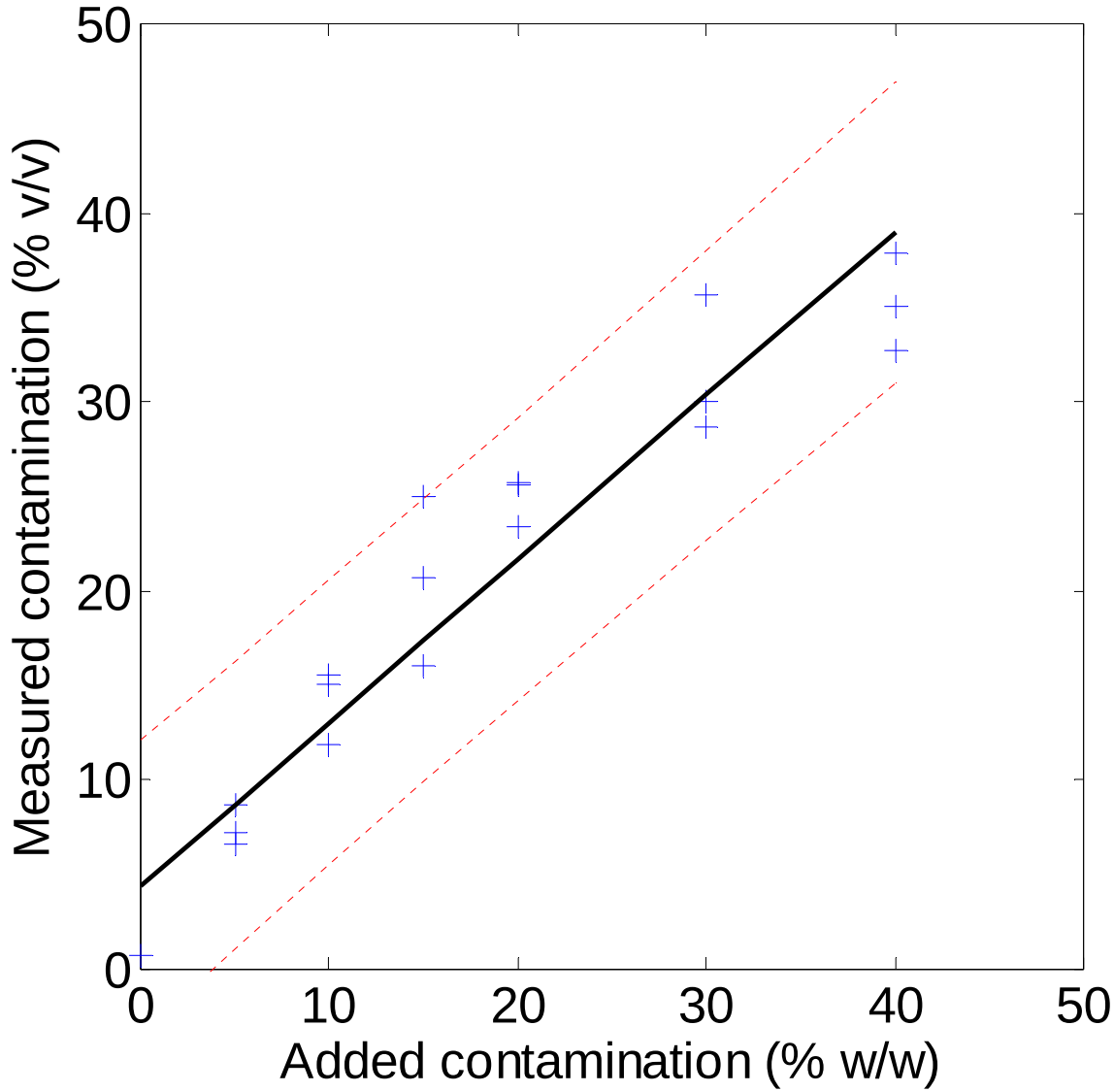
$y = 0.887x + 4.35$

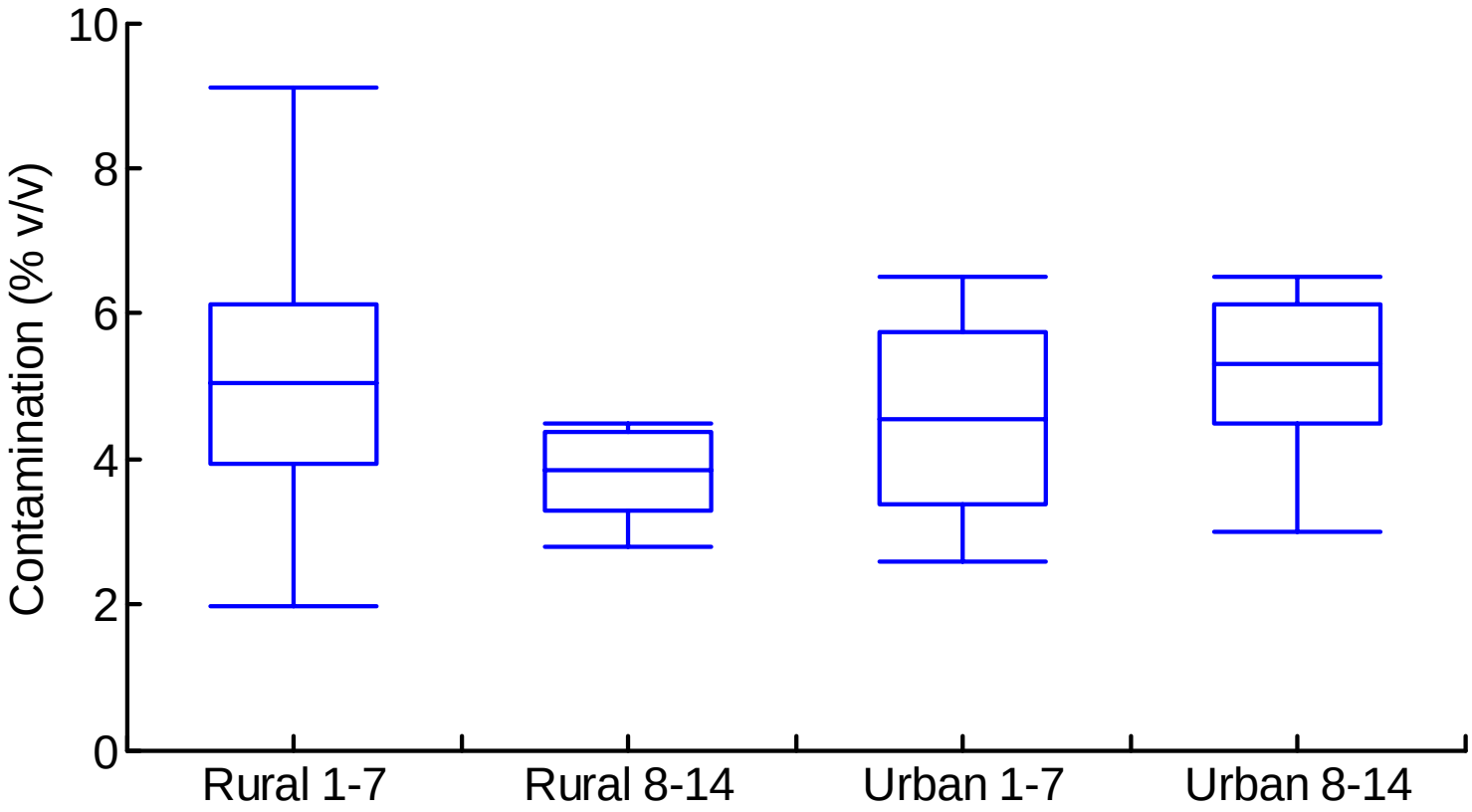
$R^2 = 0.9135$

Infill grade used: 2EW

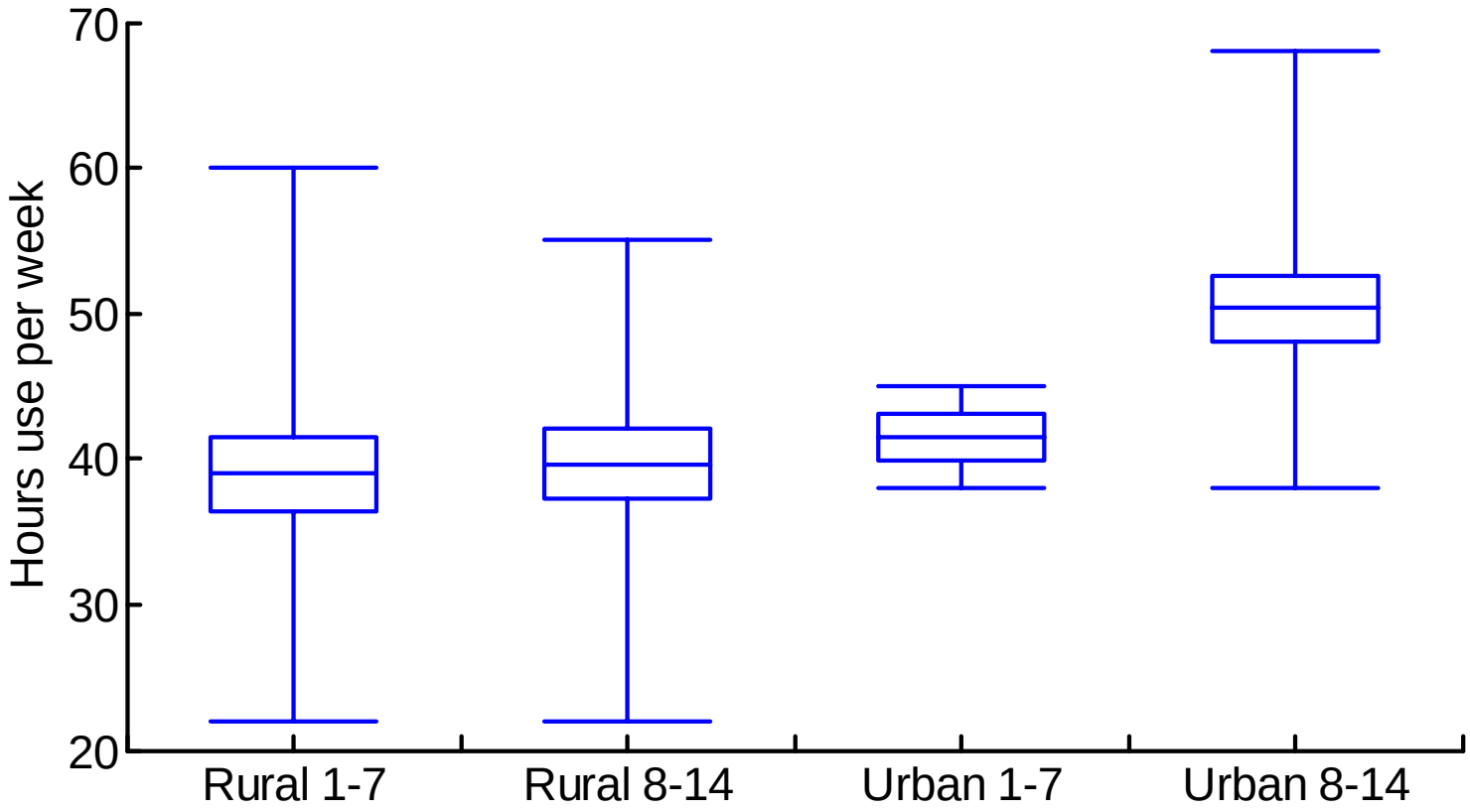


‘Field’ Contamination Data

All sand filled 2G pitches
Used for hockey, football etc.



Usage


70
60
50
40
30
20
Hours use per week
Rural 1-7
Rural 8-14
Urban 1-7
Urban 8-14

Ode#gdwd

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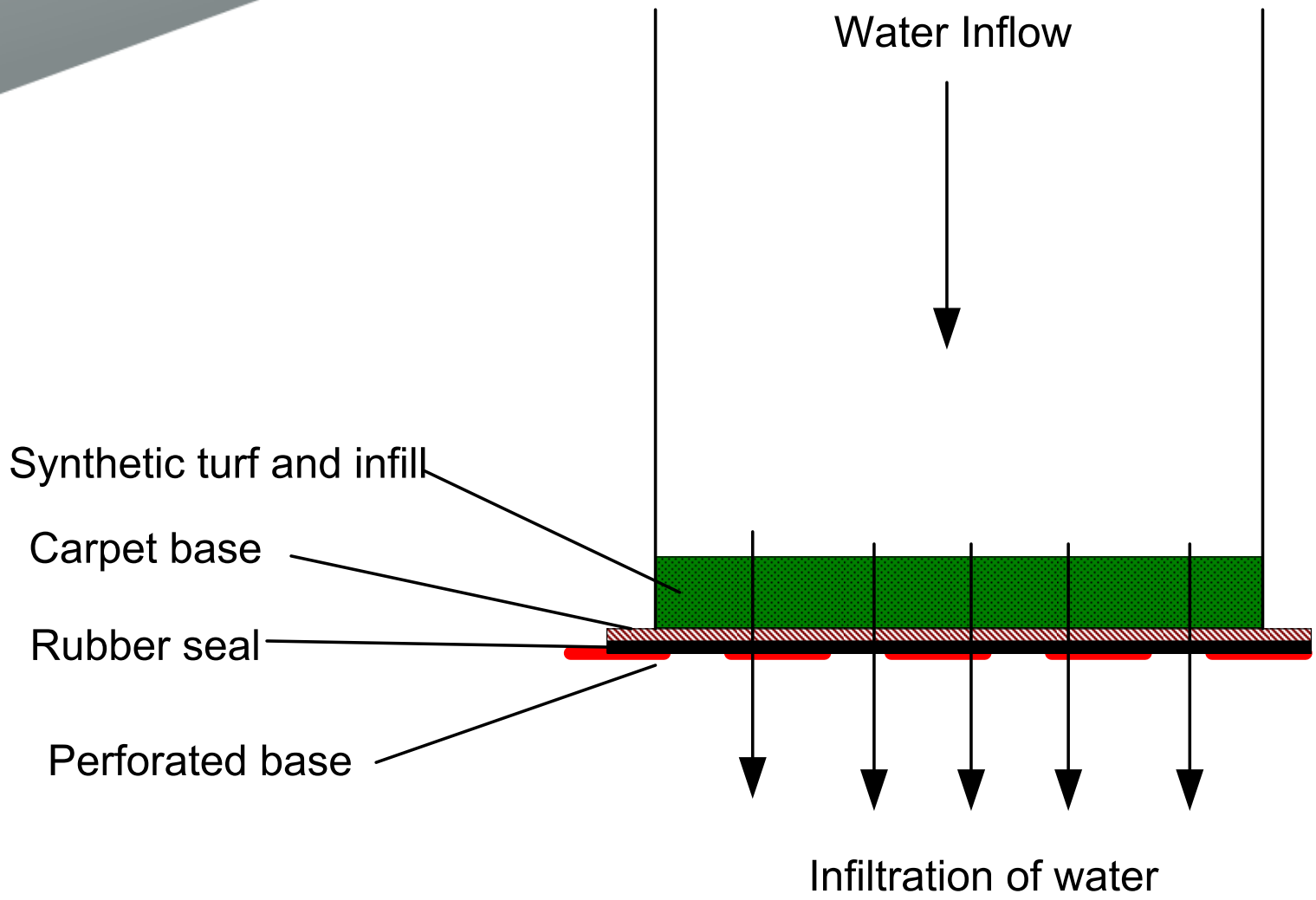
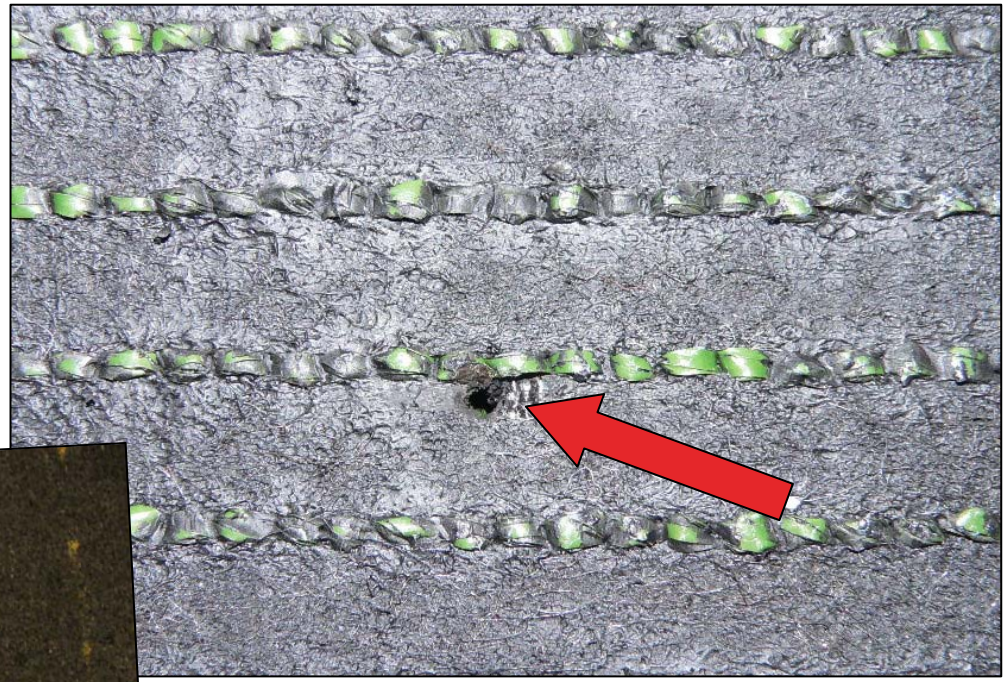
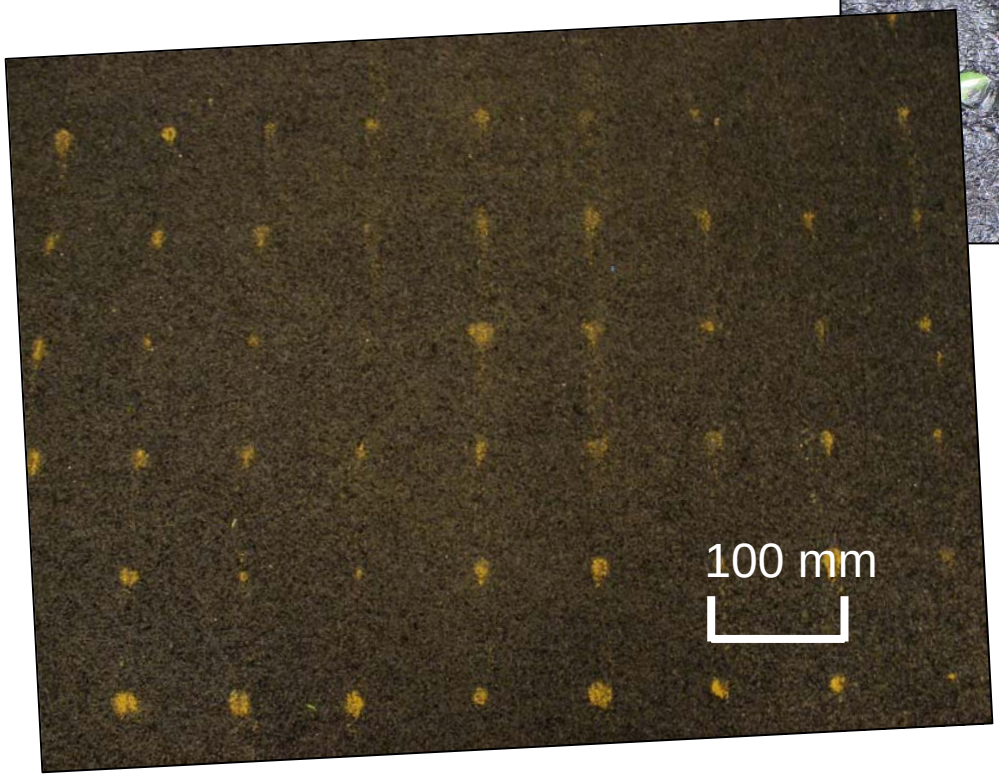
Adapted falling-head permeameter



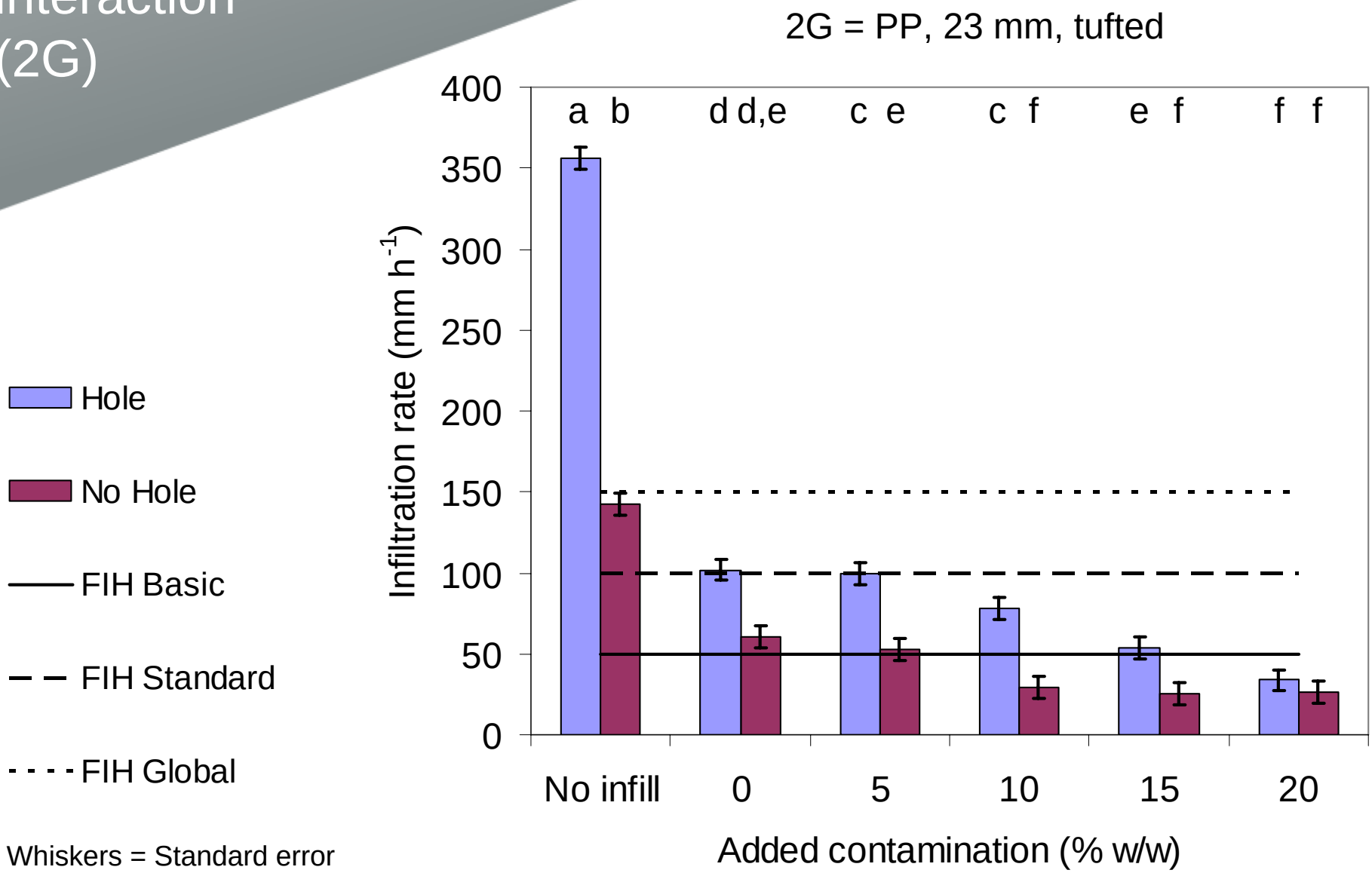
Falling head permeameter

Carpet drainage holes





Hole . Contamination interaction (2G)

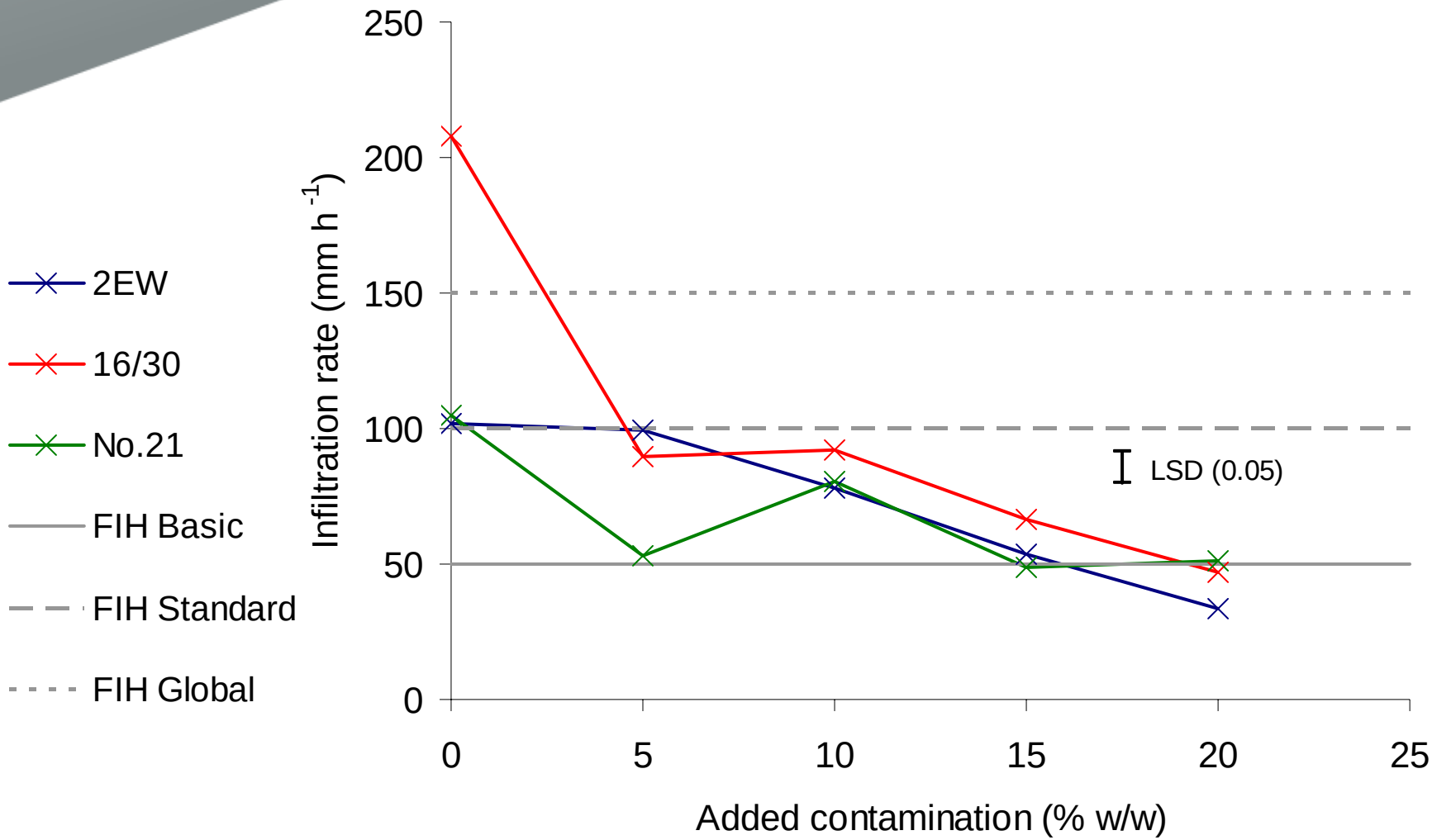


Whiskers = Standard error

Letters = separation by LSD

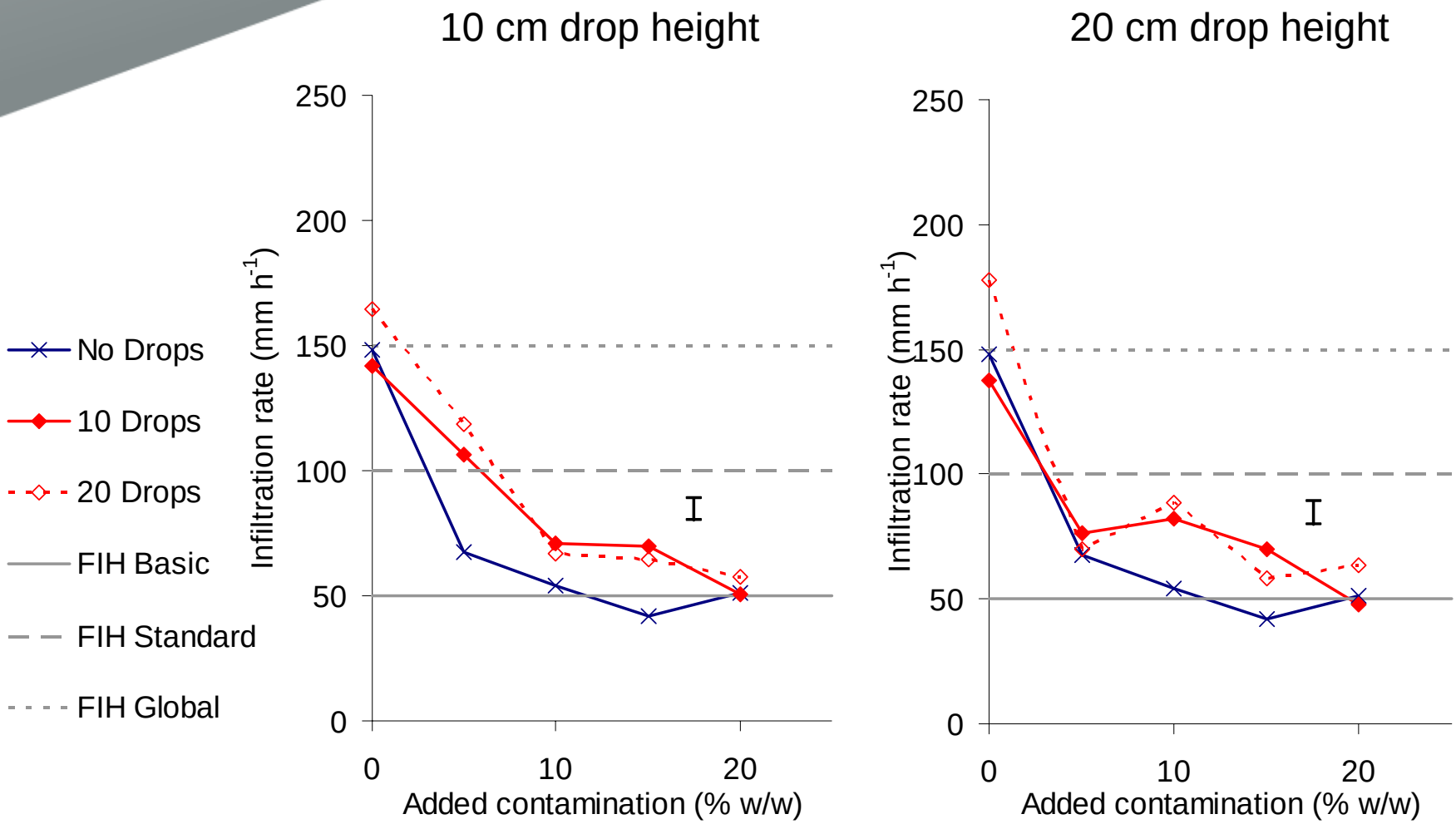
Different infill specifications (2G)

2G = PP, 23 mm, tufted



Compaction
(2G, in cylinders)

2G = PP, 23 mm, tufted
Infiltration cylinders, 10 kg mass

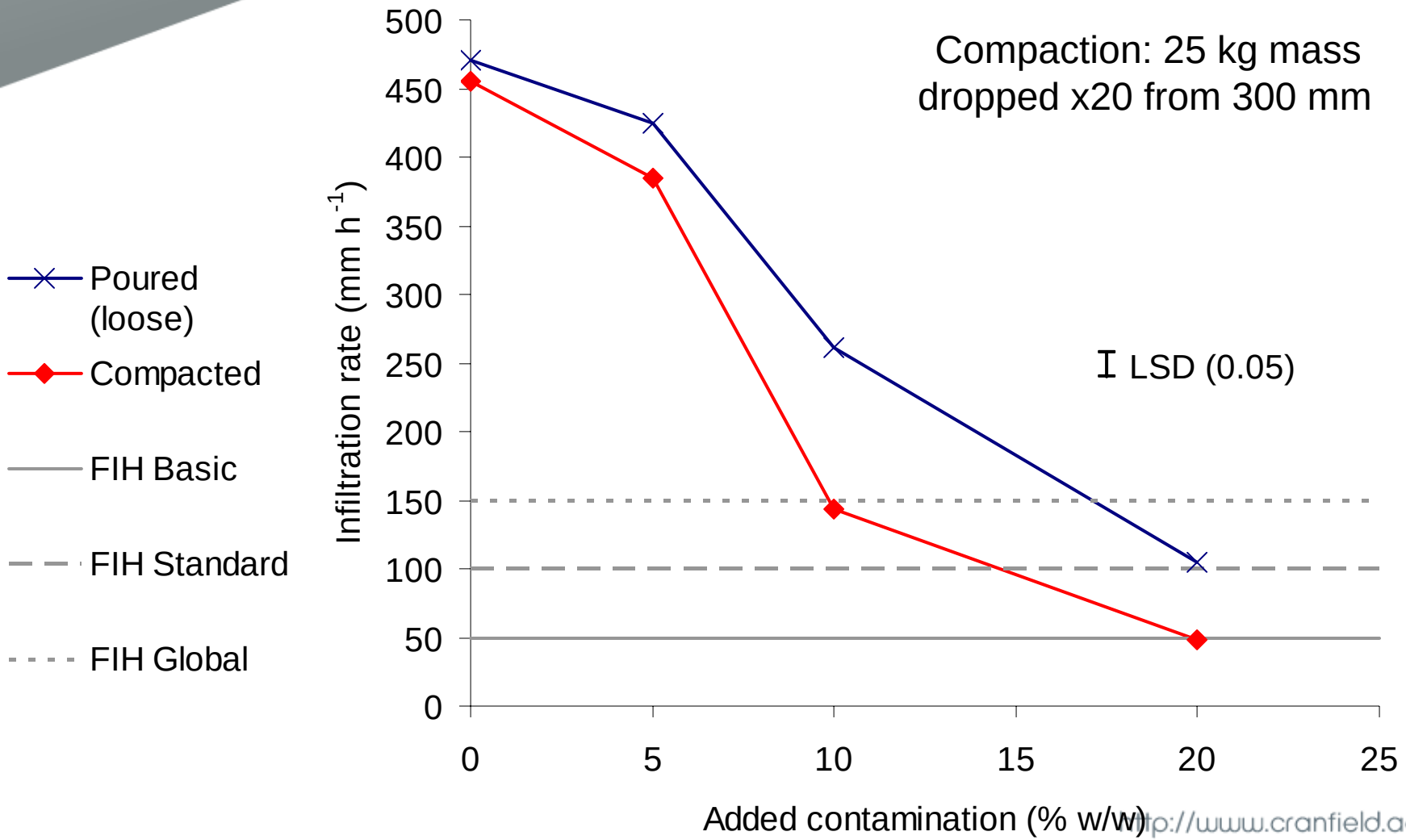


Whiskers = LSD (0.05)

Compaction
(2G, in 1 m^2 plots)

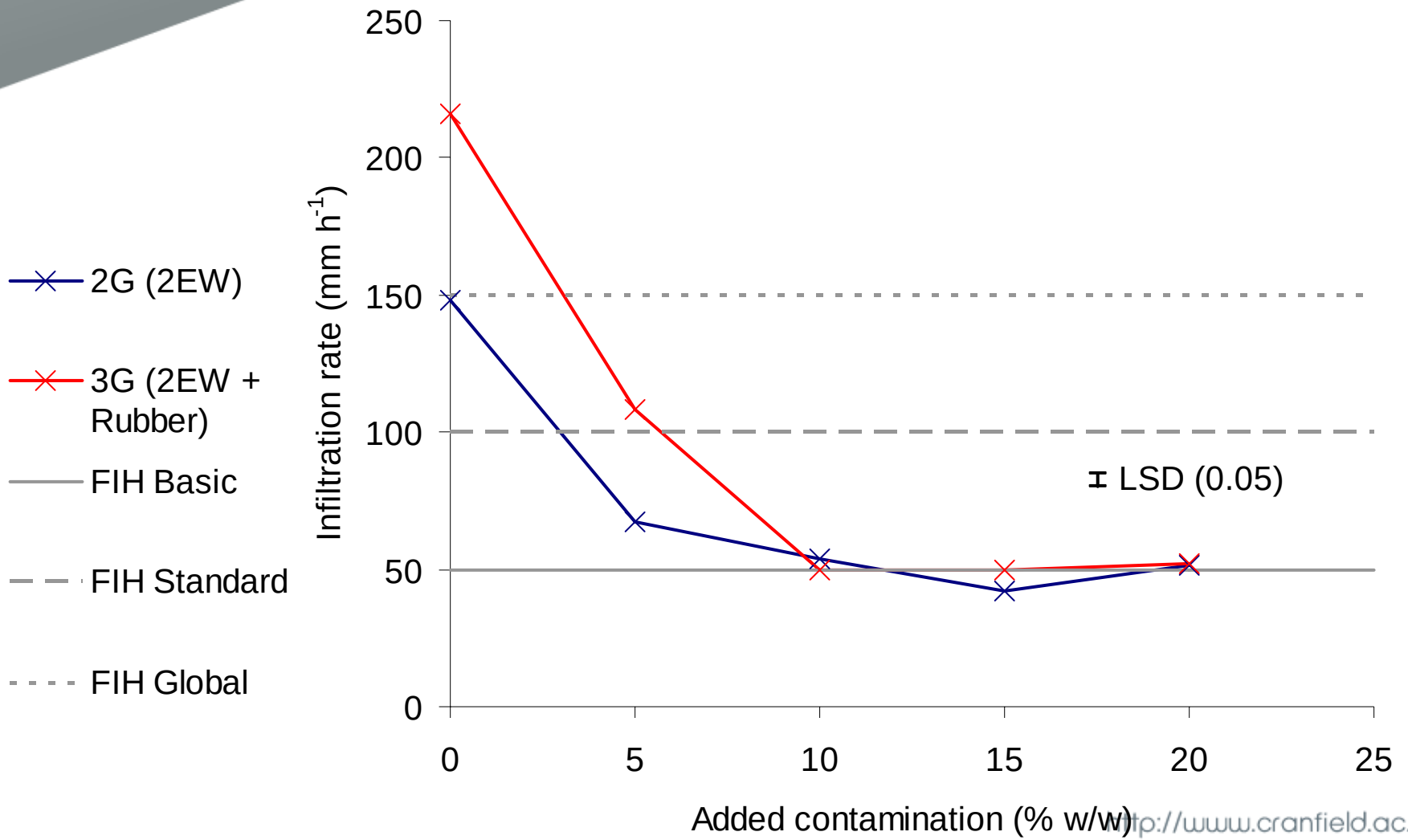
2G = PP, 23 mm, tufted
Double ring infiltrometer

Compaction: 25 kg mass dropped x20 from 300 mm



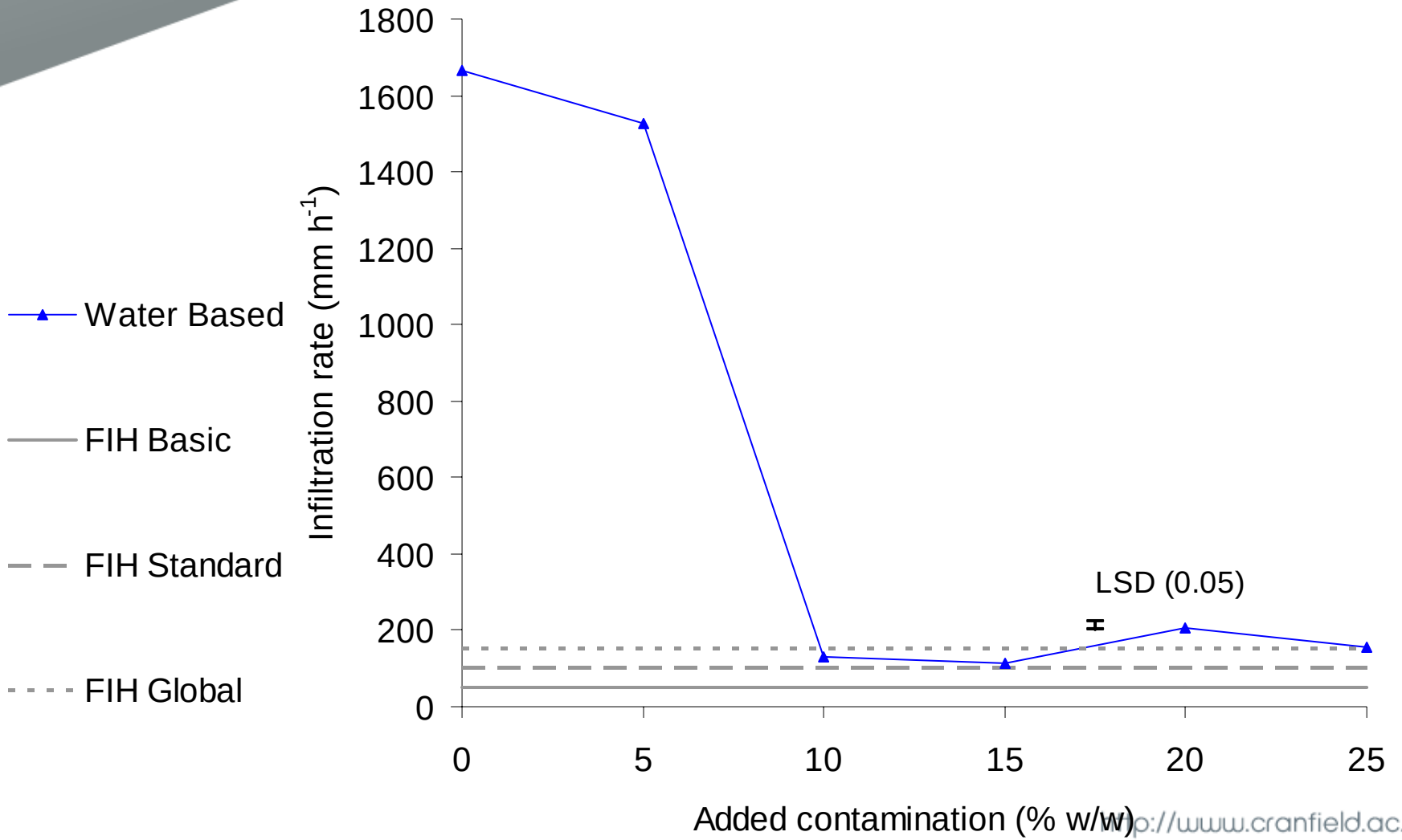
Rubber/sand infill (3G, cylinders)

2G = PP, 23 mm, tufted
3G = PE, 50 mm, tufted



Water-based (cylinders)

Water based = PP, 14 mm, tufted
No infill



Conclusions (1)

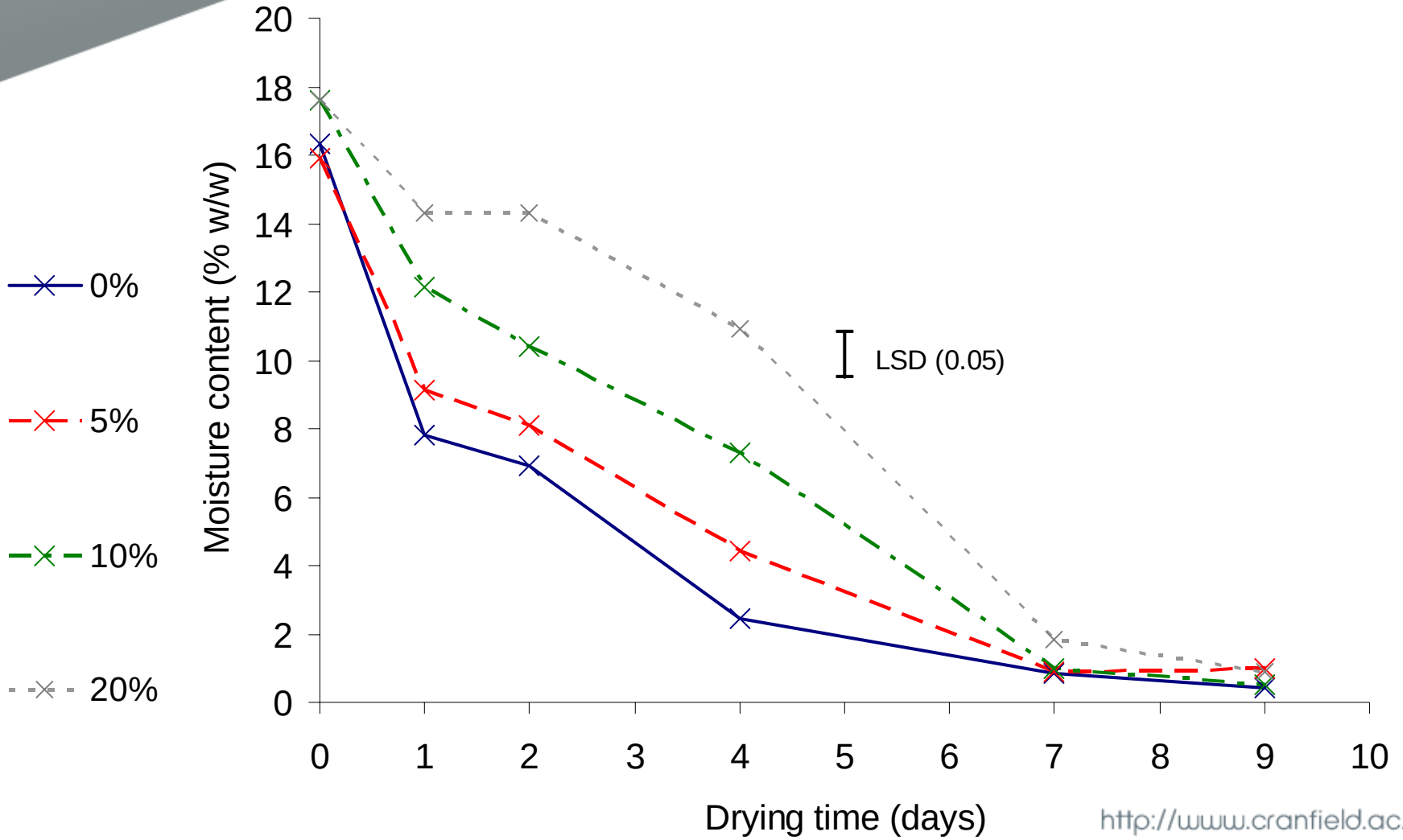
- Development of a volumetric quantification method for infill contamination
- Infill contamination ↑ - Infiltration rate ↓
  (for all carpet types)
- Critical value of 10%* contamination (by volume)
  *determined in lab tests
- Quantification allows planning of pro-active maintenance programmes

Conclusions (2)

- No significant separation of rural and urban environments in terms of contamination
- Field values ranged from 2.1 to 9.1 %v/v
- ‘Noisy’ system – differing management practices
  - Usage patterns different
  - Maintenance patterns different?

Applications (1)
Infill drying
(in 1 m^2 plots)

2G = PP, 23 mm, tufted
Infill: 2EW at 30 kg m^{-2}
Mean air T = 20°C



Applications (2) Field operation effectiveness

- Compressed air renovation
  - Air blown into carpet to loosen pile and infill
  - Infill removed by brushing, cleaned and replaced

17 mm pile: 9-2% (72% removal)

19 mm pile: 4.9-0.9 (83% removal)

- Pressurised water renovation
  - High pressure water (17.2 MPa / 2500 psi) blown to loosen pile and infill
  - Infill removed by brushing and shovelling

11 mm pile: 18-2% (89% removal)

20 mm pile: 10-9% (13% removal)

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Thank you.