



Kiacrete: A puddle-free pavement surface

Background and problem addressed

Concrete is a widely used pavement material, however it is both a significant contributor to carbon emissions, through cement production, and is impermeable, leading to urban flooding. Flooding currently costs the UK £2.2 billion annually and is projected to increase to £27 billion by 2080, without significant flood resilient infrastructure investment.

Permeable pavements rapidly drain stormwater, providing a solution to urban flooding, although they are currently unsuited to many applications, with insufficient strength, durability and long-term permeability, and require frequent maintenance.

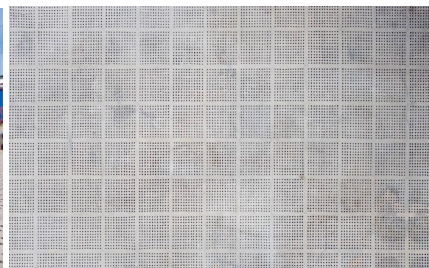
Technology overview

A novel high-strength clogging resistant permeable pavement called Kiacrete has been developed at Imperial College London. The key innovations of this pavement are:

- (i) a new engineered pore structure with low tortuosity, which increases the permeability, reducing the probability of sediment clogging, improves freeze-thaw resistance and increases the strength.
- (ii) it utilises a higher strength self-compacting cementitious mix, which also improves the freeze-thaw durability.

Rigorous lab testing confirmed the superior performance of this new material when compared with conventional permeable pavements. It has high strength (> 50 MPa) and high permeability (> 2 cm/s) yet does not clog despite extensive cyclic exposure to sand and clay. It is at least twice as strong and ten times more permeable than conventional systems of equal porosity, which completely clogged after just a few cycles of sediment exposure. Therefore, this new pavement can be used in a wide range of applications. It is more durable, requires less maintenance and its superior performance will deliver material, carbon and cost savings for infrastructure operators and clients.

Kiacrete can be delivered as an in-situ or precast system, depending upon contractor and client requirements. Both delivery methods are quick, simple and versatile, resulting in a high quality, safe, resilient and puddle-free pavement surface. Kiacrete was successfully deployed at Imperial College's White City Campus (pictures below) and showed excellent long-term durability and permeability performance.



Benefits

- Puddle-free surface
- Safe, high slip and skid resistant surface
- Long service life with low maintenance requirements
- Reduced emissions from material savings
- Opportunities for water reuse and groundwater recharge
- Decreased urban heat island effect

Advantages

Comparing to conventional permeable concrete:

- Kiacrete is twice as strong and ten times more permeable
- It is clogging resistant and has reduced maintenance requirements
- Enhanced long-term durability, leading to a long service-life
- Easily installed on site by any competent contractor
- Can be delivered as an in-situ or precast system

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Technology reference: **8859**

Intellectual property information

The International patent application is now published under the number WO2020/099868. The patent application is pending in Europe, the US, India, Singapore, Malaysia and Thailand.

Link to published paper(s)

Kia, A. (2023) Freeze-thaw durability of air-entrained high-strength clogging resistant permeable pavements, *Construction and Building Materials*, 400, 132767

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Kia, A., Wong, H. S., Cheeseman, C. R. (2022) Freeze-thaw durability of conventional and a novel permeable pavement replacement, *Journal of Transportation Engineering: Part B, Pavements*, 148 (4), 04022051

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Inventor information

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