



a patented system for
**sand mitigation
around railway tracks**

PCT international application WO 2016/181417 A1



Graphic design: M. Lo Turco - Politecnico di Torino



**POLITECNICO
DI TORINO**

Commercial Reference:
Research Support
and Technology Transfer Department

Technical Reference:
Windblown Sand Modeling
and Mitigation Research Group

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What it solves

A growing number of railways are being designed and built in arid regions worldwide (e.g. MENA region: 40,000 km of tracks, USD 259 billion up to 2030). Shield for Sand solves undesired effects of windblown sand on such railway infrastructures



It fixes safety issues (Sand Ultimate Limit State, SULS)



Moving sand dunes



Sand covering tracks



Trapping of stationary trains



Derailment

It mitigates serviceability issues (Sand Serviceability Limit State, SSLS)



Ballast contamination



Dust lifting



Asymmetric rail grinding



Balise sand covering

What it is

Conceptual design principles

- | | | |
|---------------------------------|----|--|
| Works with Mother Nature | 1. | it exploits wind energy |
| Controls the cause | 2. | it controls wind flow, mitigates the effect, i.e. sand transport |
| Highly efficient | 3. | it traps the incoming windblown sand |
| Robust | 4. | aerodynamic behaviour insensitive to incoming wind features |
| Easy to maintain | 5. | fully compliant with a high-performing sand removal machine |
| Flexible | 6. | constant shape, varying size |
| Durable | 7. | versus ambient and maintenance actions |
| Simple | 8. | components and building process |

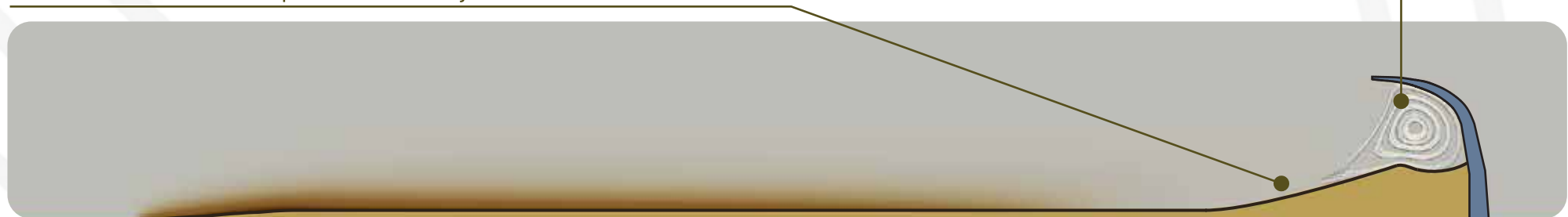
→ **Cheaper** than ditches, **more efficient** than solid/porous walls, **more durable** than fences.

Working principles

Clockwise trapping vortex

- + flow close to the ground reversed
- + wind velocity decreased
- + sand sedimentation promoted away from the rail track

wind flow
deflected downwards



How it performs

Experimental performance assessment

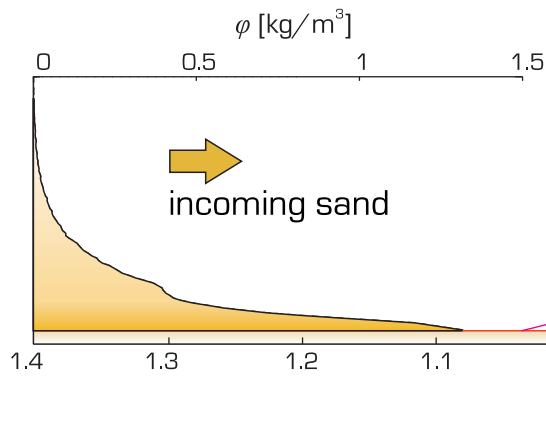
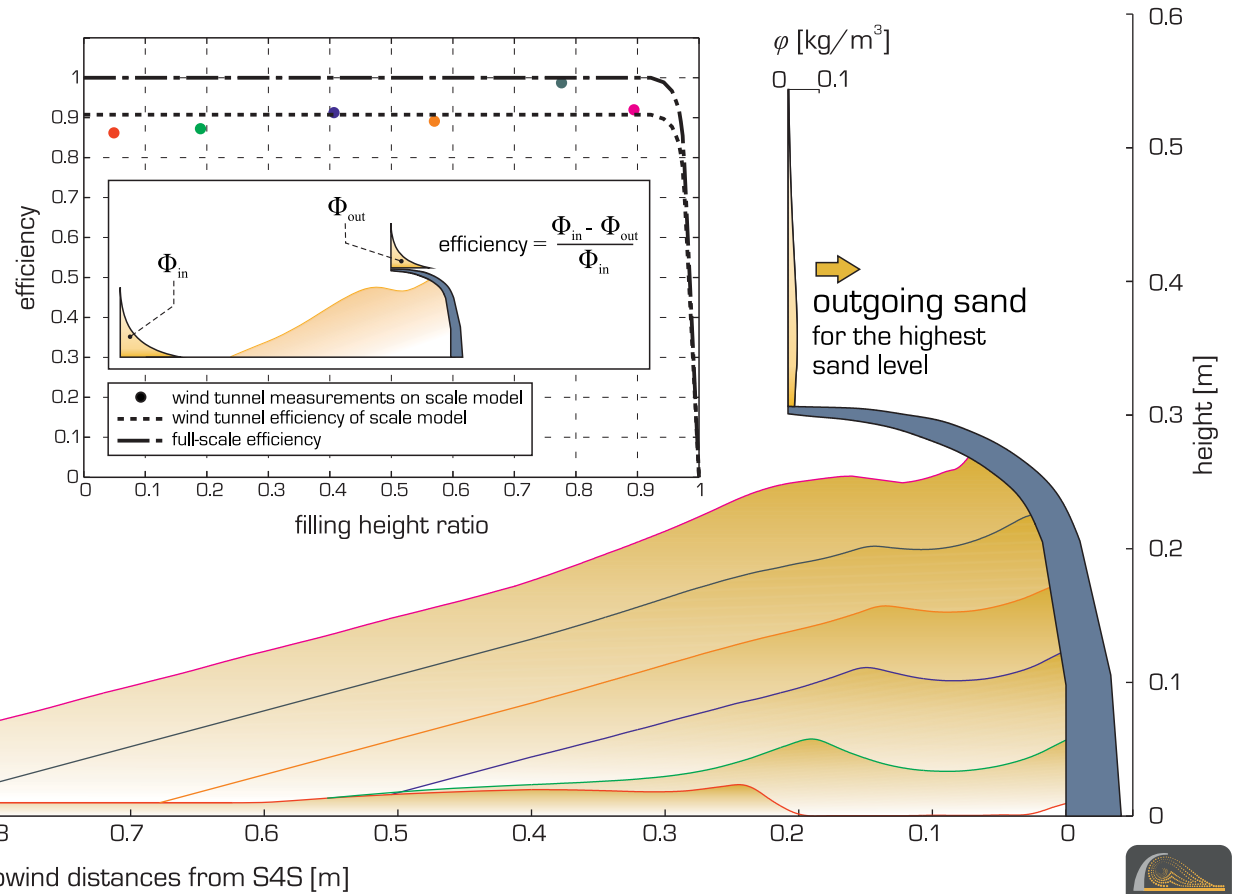
Wind tunnel tests at



Shield for Sand scale model and sand fetch



Particle Track Velocimetry: laser sheet for sand grain counting



How much you gain

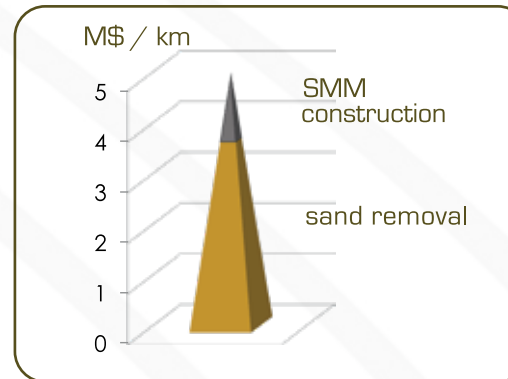
Sand maintenance

“fit and forget” Sand Mitigation Measures?

A mere illusion

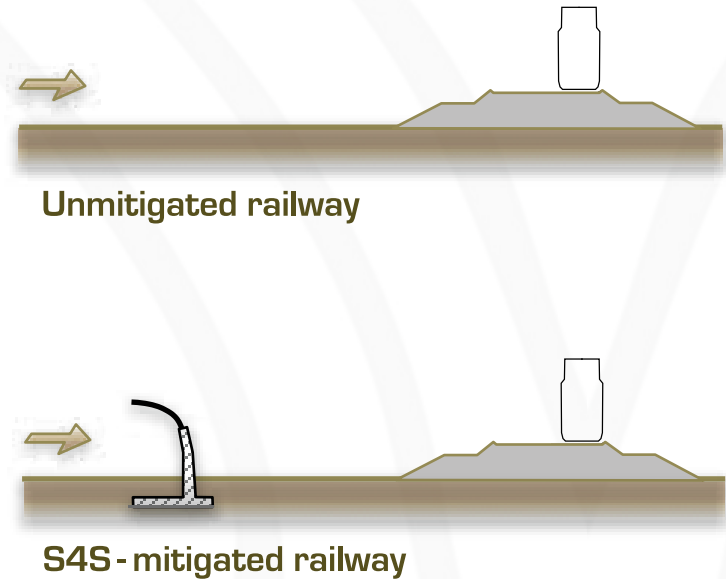
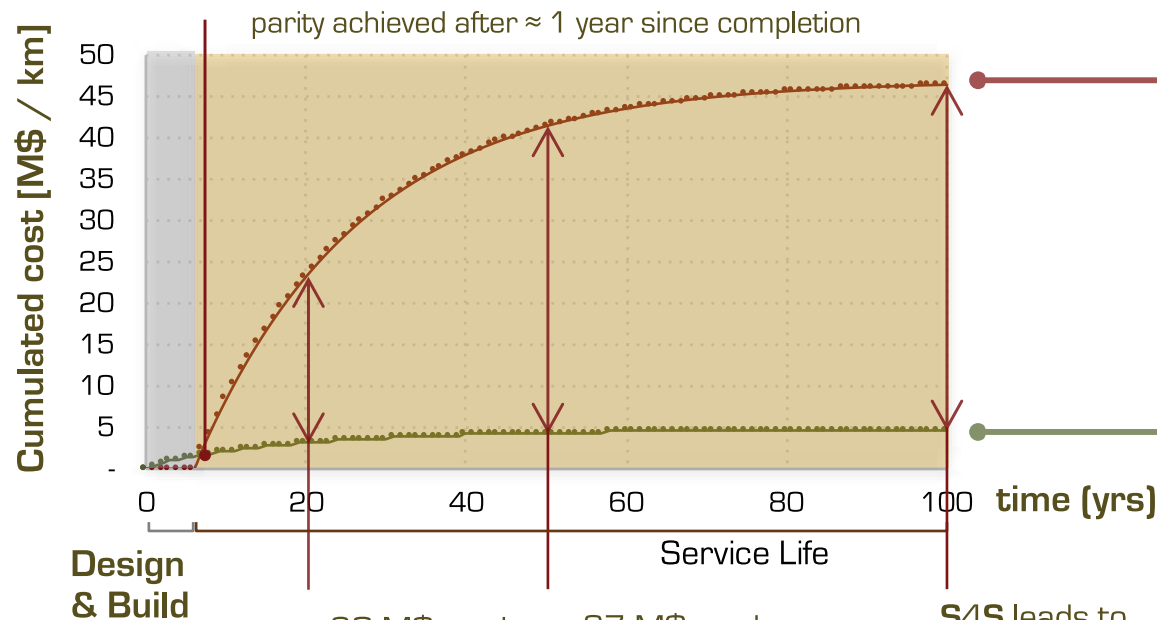
Periodic sand removal?

A mandatory need



Sand maintenance cost: the hidden part of the iceberg
(up to 5 times the construction cost)

Sand Life Cycle Cost Analysis



S4S performs better than other SMMs, see the scientific papers
[Bruno et al, *Journal of Wind Eng. Ind. Aerodyn.*, 2018]
[Bruno et al, *Recent Patents on Engineering*, 2018]



Who we are

Shield for **S**and is a patent of Politecnico di Torino, www.polito.it.

Shield for **S**and has been conceived and is currently developed by **W**indblown **S**and **M**odelling and **M**itigation group www.polito.it/wsmm.

WSMM is an intersectoral, multidisciplinary, joint Research, Development & Consulting group composed by:

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Shield for **S**and commercialization is in charge of the Research Support and Technology Transfer Department

www.polito.it/impres/brevetti/?lang=en



Other applications

A number of other human activities are prone to hazards from windblown sand. Shield for Sand shelters them.



Transport infrastructures



Road - Egypt



Berkine airport - Algeria



Industrial facilities



Murzuq refinery - Libia



Oil pipeline - Central Sahara



Built environment



Nouakchott town - Mauritania



In - Salah village - Algeria



Historical sites



Begrawiya Pyramids - Sudan



Farms



Palm plantation In - Salah - Algeria