



**XXIVth World
Road Congress
Mexico 2011**
Mexico City 2011.

Long Lasting Durable Mix as Alternative of Porous asphalt

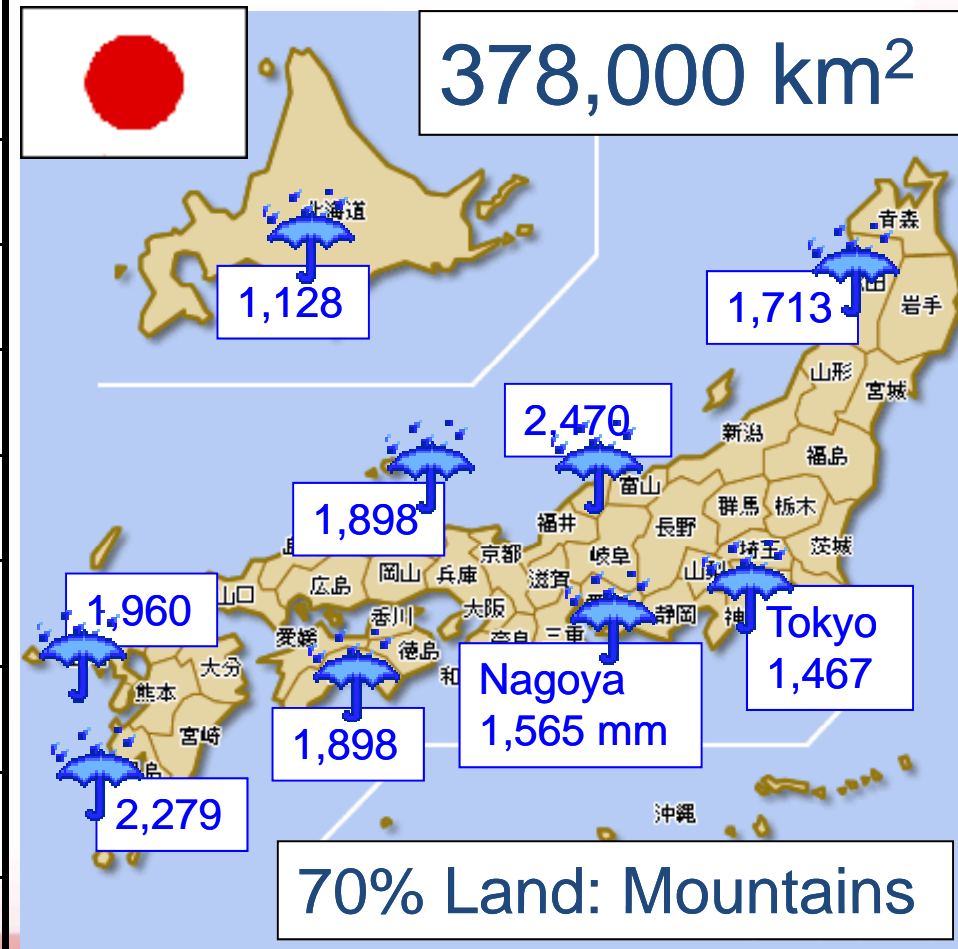
Keizo KAMIYA

- Nippon Expressway Research Institute Company Limited
- Chief Researcher for Pavement
- k.kamiya.ab@ri-nexco.co.jp



Country Information

World City	Annual Rainfall (Average 1970-2000)
Mexico City	1,266 mm
Paris	648 mm
Zurich	1,120 mm
Cape Town	539 mm
New York	1,123 mm
Jakarta	1,903 mm
Bangkok	1,530 mm
Hong Kong	2,360 mm

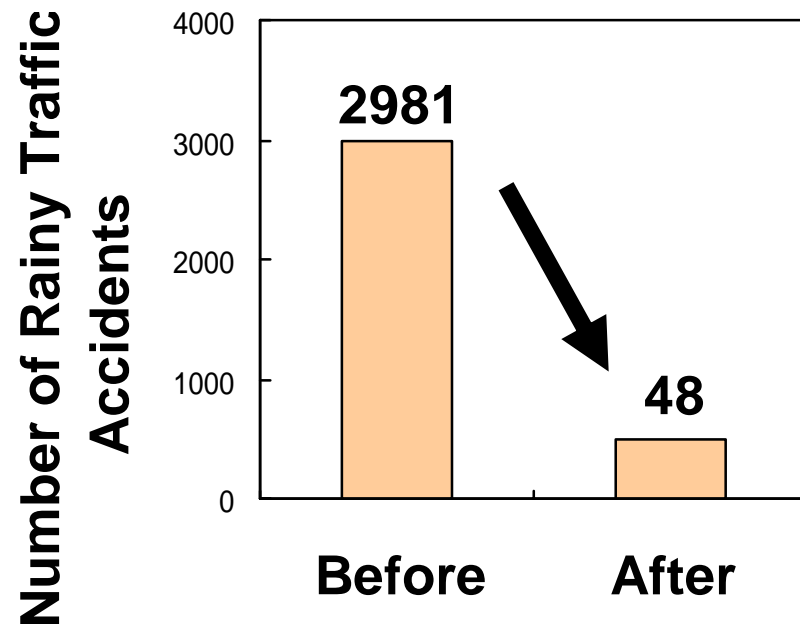


Source: Japanese Ministry of International Affairs Communications

Profile of Japanese PA

70% share in Motorway

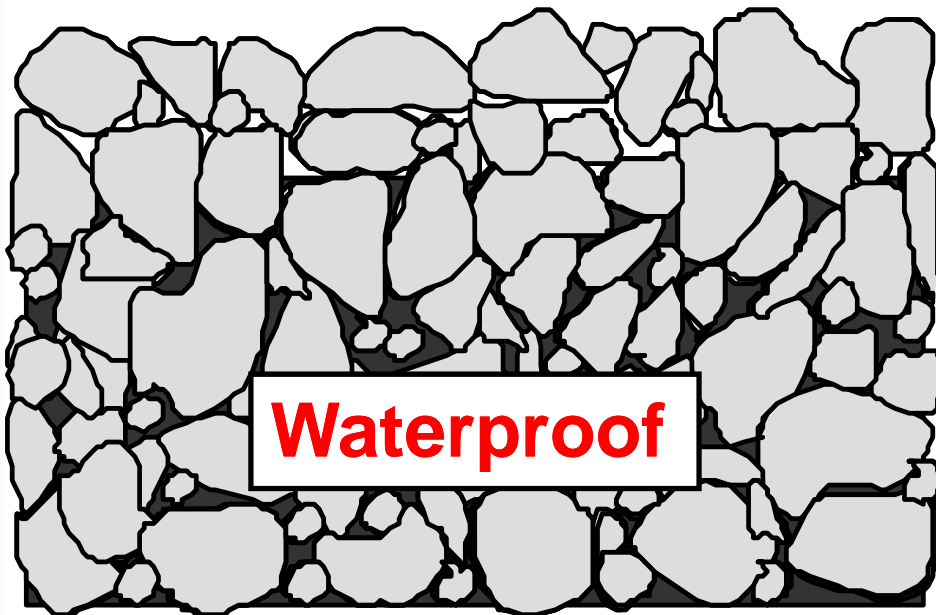
Highly Viscous Modified Bitumen



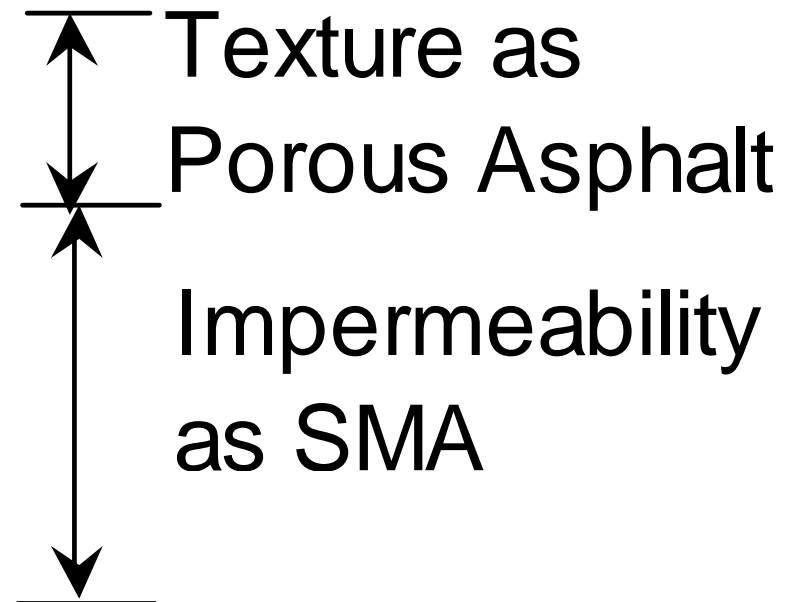
Long Lasting Mix Needed!

Concept of Hybrid Mix

Skid Resistance



Waterproof

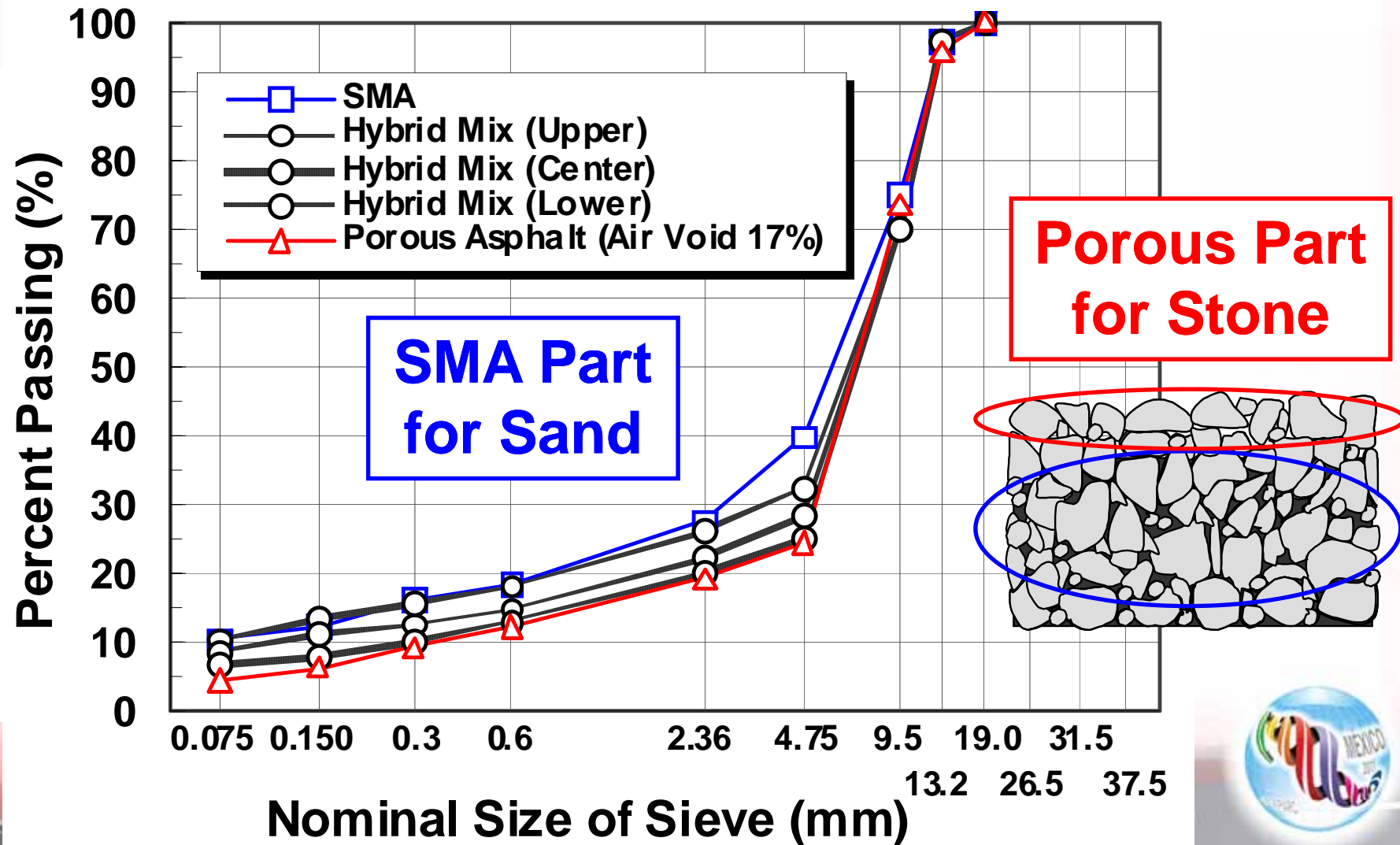


Intentionally not Uniformed Mix

One Mix with Two Functions

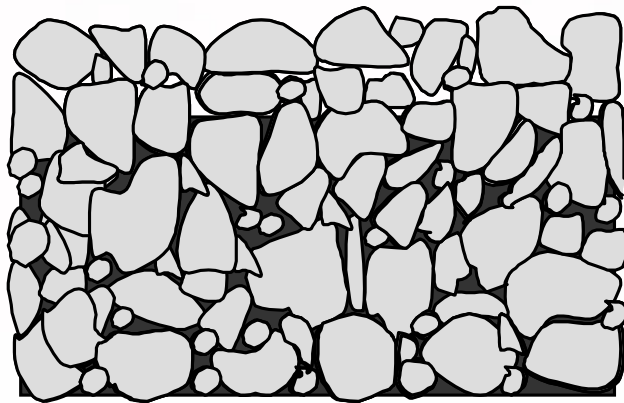


Aggregate Gradation Design

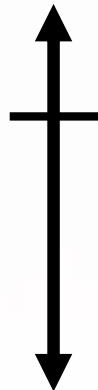


Air Void Evaluation

Porous Part



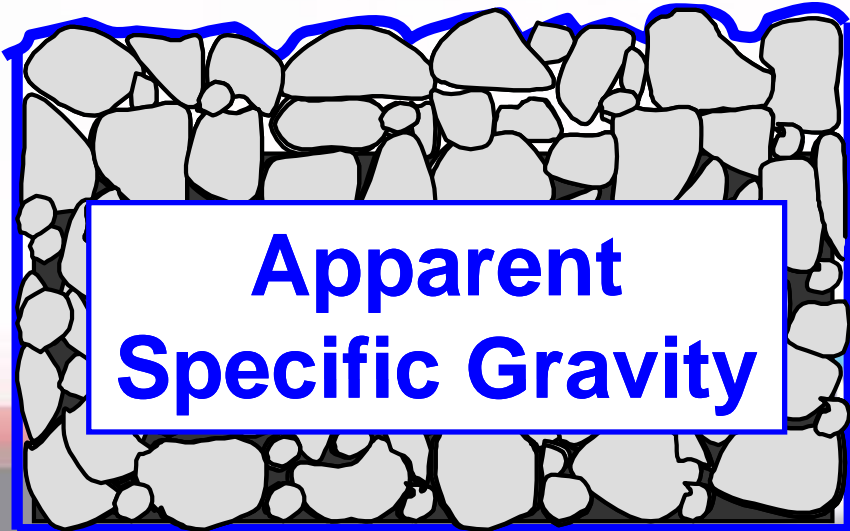
SMA Part



**Bulk
Specific Gravity
(Vacuum Pack)**



**Apparent
Specific Gravity**

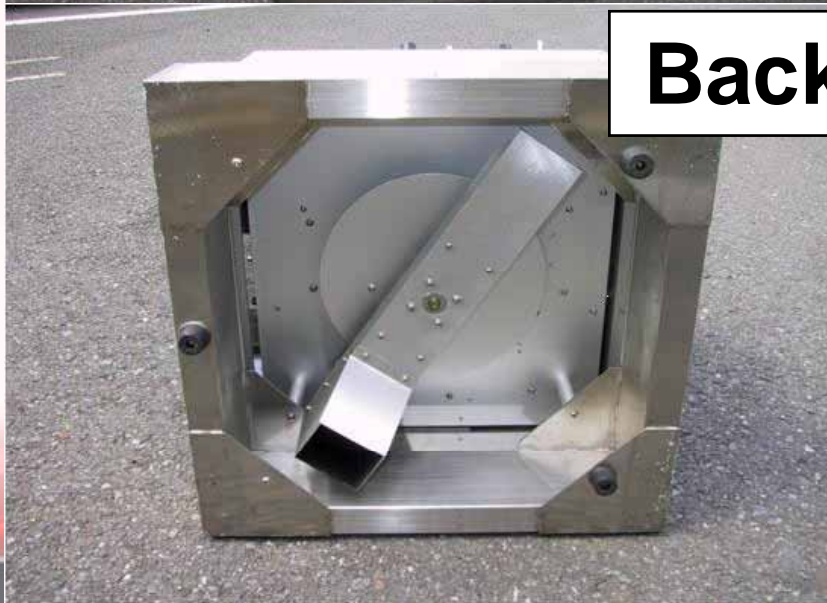


Texture Measurement

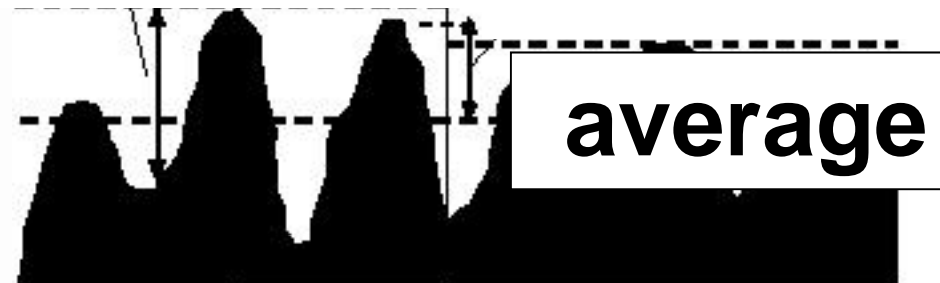
Circular Track Meter



Back



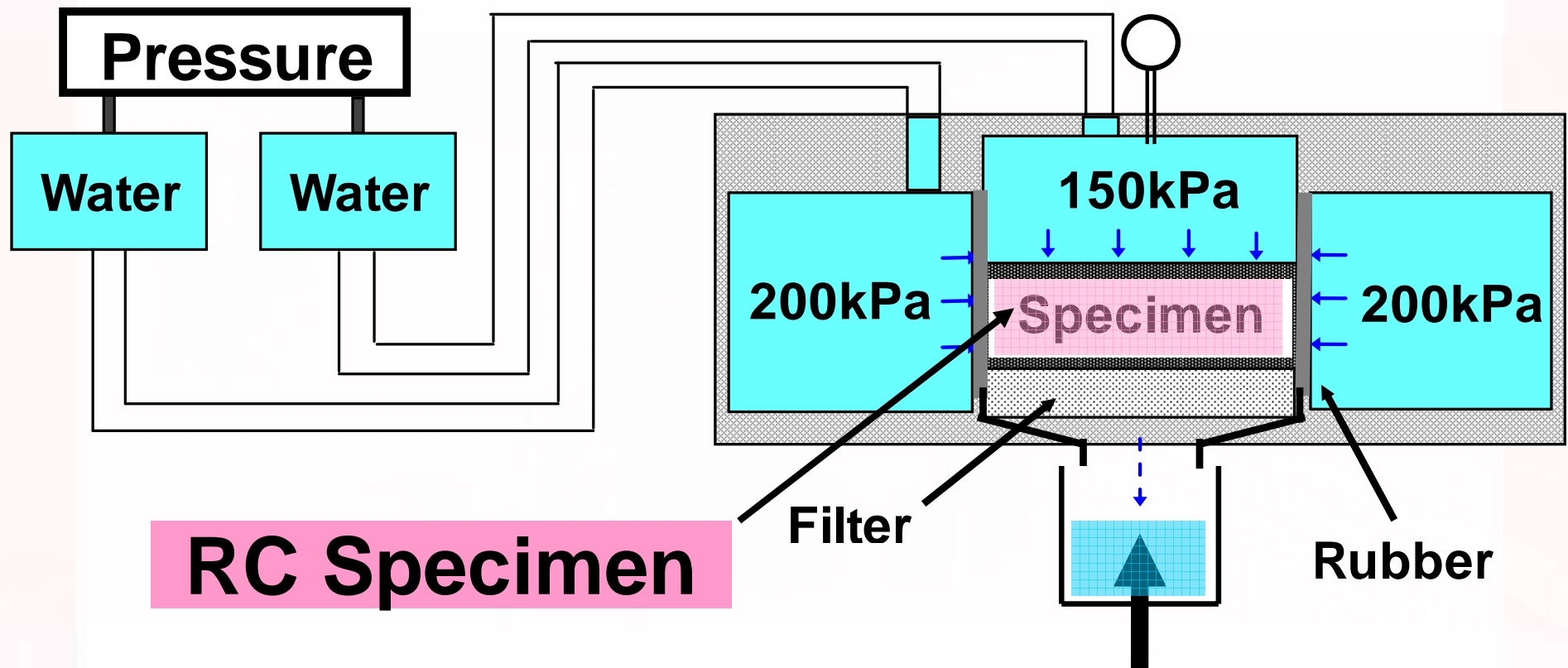
Mean Profile Depth



**Roller Compacted
Specimen**



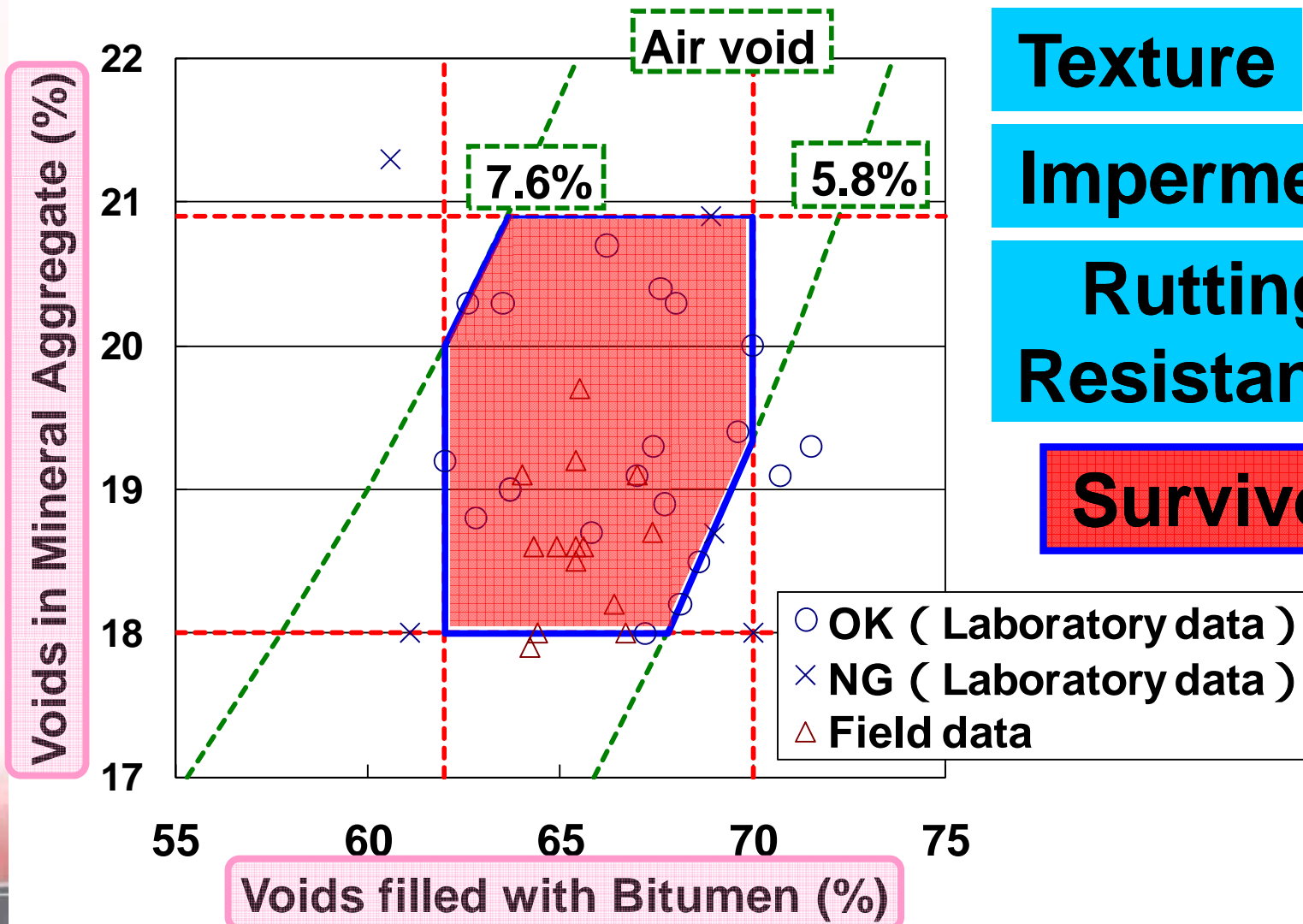
Permeability Measurement



**Vol. for 10 min. after 24hr
under Pressure**



VMA, VFB & Functions



Texture

Impermeability

Rutting Resistance

Survived Mix



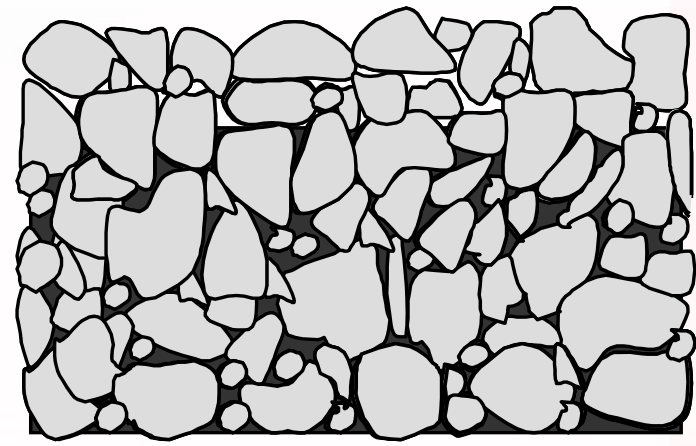
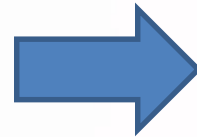
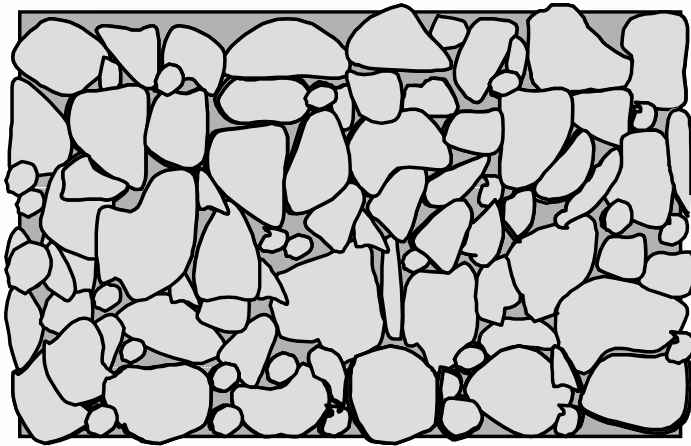
Paving Hybrid mix in the field



Not a special machine needed!



Mechanism of Hybrid structure

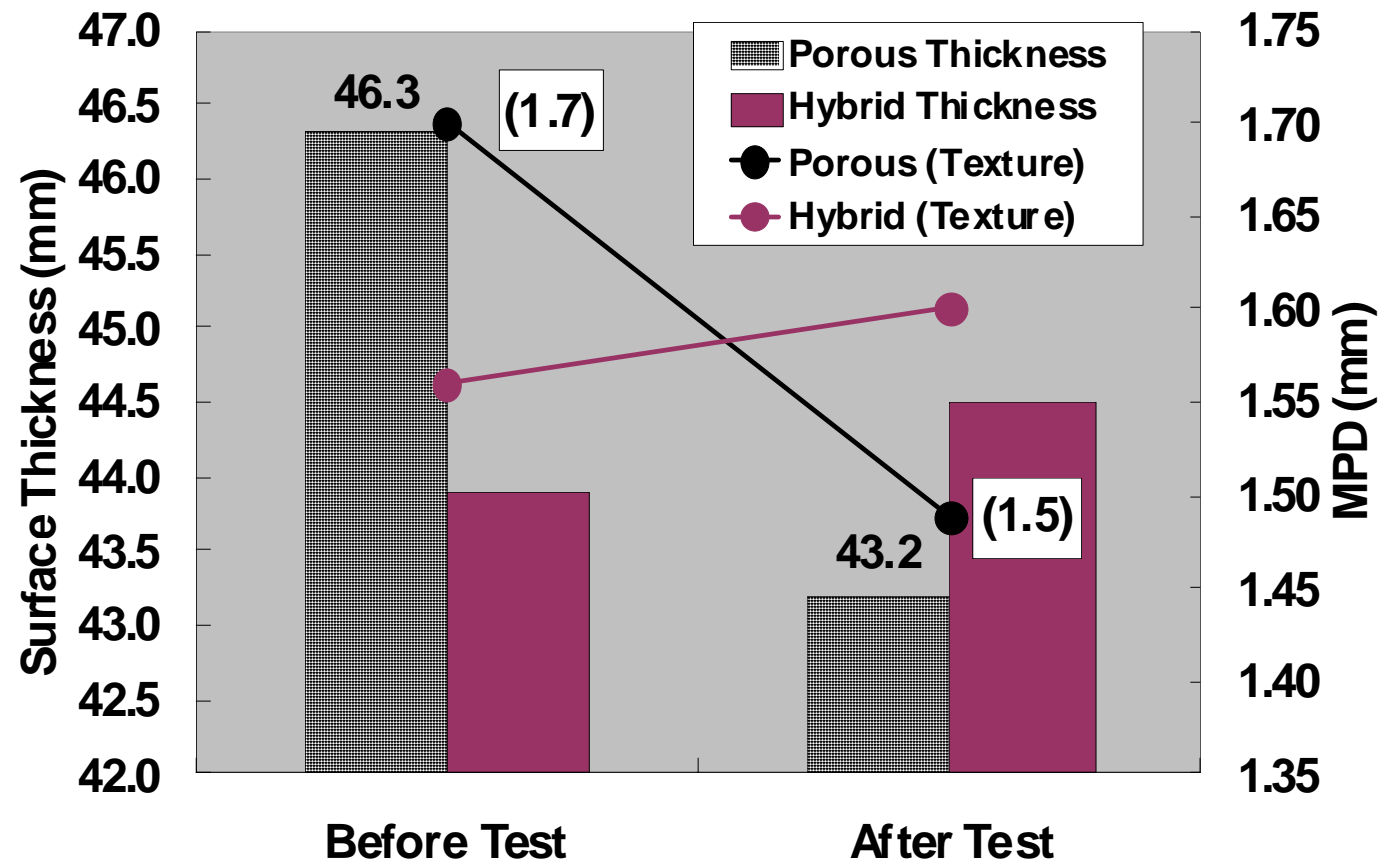


Just after finishing the mix, bituminous mortar is up to surface. The mortar is falling down to bottom while compaction, since bitumen content is designed as higher for gradation.

After paving, surface can be porous alike and inside SMA alike.



Dry Plowing Experiment



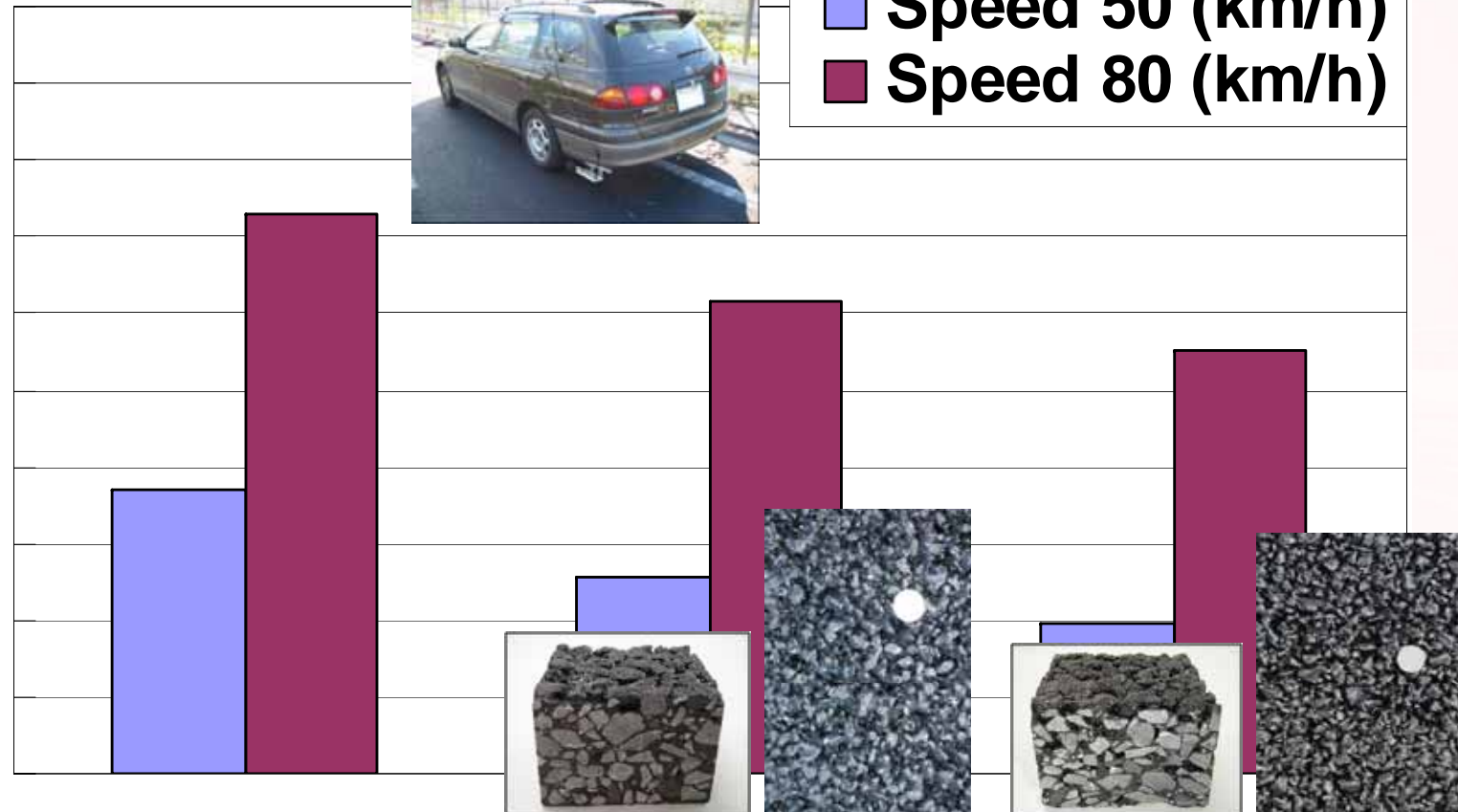
Noise Reduction Levels

tyre/road noise (dB)

108
106
104
102
100
98
96
94
92
90
88



Speed 50 (km/h)
Speed 80 (km/h)

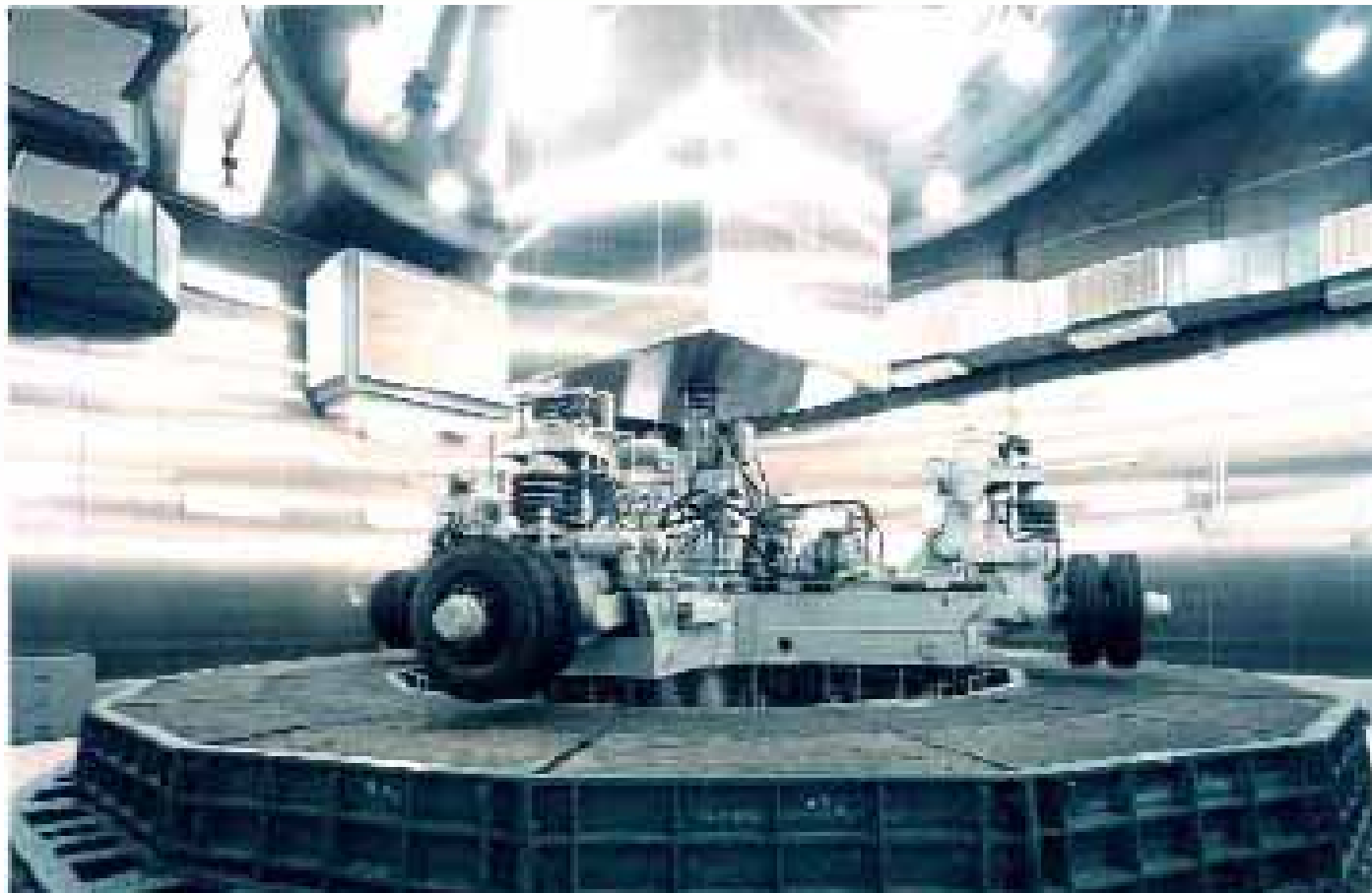


Dense-graded
asphalt

Hybrid
pavement

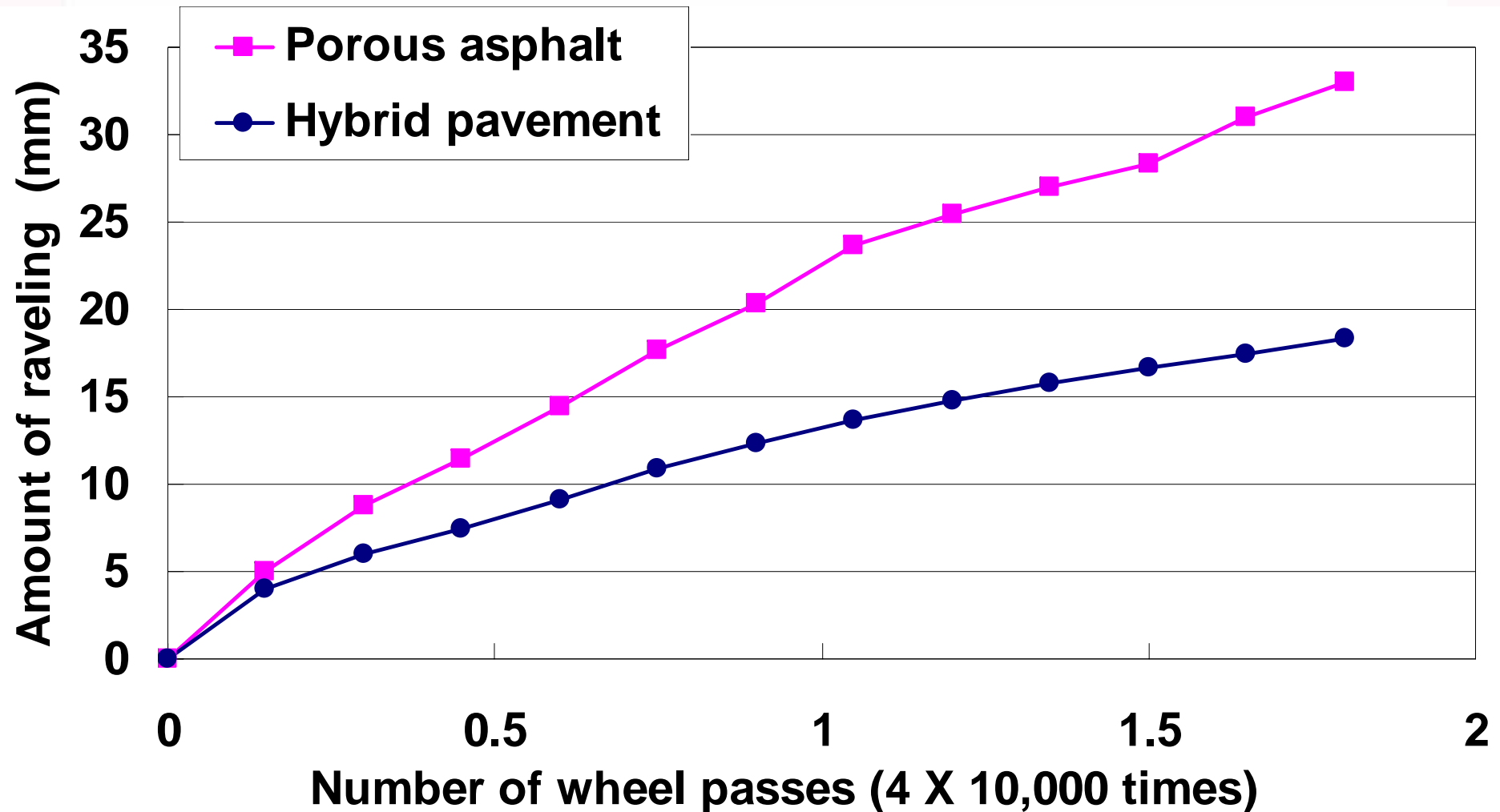
Porous
asphalt

Accelerated Pavement Test



Accelerated Loading and Environmental Simulator

Raveling Resistance by ALES



CONCLUSION

- By controlling aggregate gradation, VMA and VFB, the concept of Hybrid mix is achievable in the field.
- Hybrid mix is durable against raveling.
- Noise reduction of Hybrid is between porous and dense graded mixes.



Thank you for your attention!

Keizo KAMIYA

NEXCO RI



k.kamiya.ab@ri-nexco.co.jp

