Nanostructured Bitumen, better mechanical performance and for extreme climates

Source: Ferrovial Highways – 407 ETR, Toronto, Canada

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Improve a property

No higher price

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What could be an agent which mainly damage pavements?
• When snow and salt had been spreaded, the pavement is plenty of detached aggregates.
  ❌ ICE
  ❌ High salt concentration
  ❌ Snowplows which have blades.
  ❌ Water resistance

• It is demonstrated that the effect of spread salt on the pavements is very negative.
How is it possible to improve this situation?
• The water effect and more if the effect is made by water with salt, produce the lack of cohesion between bitumen and aggregates.

❌ Result: aggregates stripped around the pavements.

Source: Ferrovial Highways, Burgos, Spain.
• It is necessary to improve the bitumen-aggregate bonds

• A physical mix achieved by temperature and mechanic energy, due to bitumen and aggregates do not work well.

Source: Ferrovial, London, UK.
• Amines are currently used.
• They link by ionic bonding which is not strong enough.

Solution: Modification with nanomaterials and special polymers.
How can we see this interaction?
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Submit deeply by the water action pavement specimens

Conventional Bitumen

Nanostructured Bitumen

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What have we improved?
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✅ Salt attack  ✅ Water attack  ✅ Ice attack

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• The better interaction between aggregate – bitumen, the better compaction.

✔ Higher density
✔ Lower period of time, to achieve the optimum density

Source: Ferrovial – Amey, UK
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Nanostructured Bitumen

Source: Ferrovial Highways – M4-M6, Kilcock, Ireland

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Nanostructured Bitumen

• Helps compacting in cold weather conditions and improving asphalt properties.
• Same quality and way of working as with conventional bitumen.

• Improved properties:
  ✓ Cohesion
  ✓ Adhesion
  ✓ Better workability
  ✓ Better Immersion – Compresion Test results (ASTM D1075)
  ✓ Better Boiling Water Test results (ASTM D3625)
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Nanostructured Bitumen

✓ Boiling test (ASTM D3625)
• AC16Surf 50/70S

Conventional Bitumen
Nanostructured Bitumen

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Nanostructured Bitumen

✅ Boiling test (ASTM D3625)
  • BBTM11B PMB 45/80-60

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Nanostructured Bitumen

• Help in Challenges:

✓ Transport to projects: Distances are very important, with this bitumen is possible to cover longer distances or manufacture at lower temperatures with same distances.
✓ Compaction: It is easier to compact with this bitumen due to the compaction will be fine in less time. Are only needed less passes to compact as with a conventional bitumen.
✓ Salt/Ice/Water resistance: pavements life become longer, due to the better envolve bitumen-aggregate.
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31.08.2017  Project
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Navacerrada Project

• M-601 Road - Navacerrada Mountain Ski port. (1880 m) 26 Octobre ´16.

• Project carry out with Nanostructured Bitumen.

• Area in Green with big slope.
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Nanostructured Bitumen

✓ Immersion – Compression Test (ASTM D1075) – Navacerrada Ski Port

COMPRESSIVE STRENGTH (MPa)

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Ribadesella Project

• North of Spain Road, Asturias, between mountains and near the Cantabric Sea.

• Carried out under Winter conditions (22 January ´17)
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Nanostructured Bitumen

✓ Immersion – Compression Test (ASTM D1075)

• AC16 Surf 50/70S
Ribadesella Project

- Compaction test:
  - Grey: Conventional
  - Yellow: Nanostructured Bitumen

- AC 16 Asphalt Mix
A2-Highway Project

- A2 Highway, Zaragoza, (Spain).
- Applied June´17
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Nanostructured Bitumen

✓ Immersion – Compression Test (ASTM D1075) – A2 Highway
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Canadian tests

• Developed on August, 2017, to Projects in Canada.
• Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture-Induced Damage – AASHTO T 283-07 (2011)
Conclusions

✓ Specific Bitumen for extreme climate
✓ Improved properties, big resistance at salt chemical attack.
✓ Increase box flow return.
✓ Reinforcement could be delayed in time.
✓ Compaction design ir reached before.
✓ Reduction of laying times.
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Worldhighways

BITUMEN TECHNOLOGY

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Many thanks
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