Introducing BSM to the Dutch Infra Market:

A bumpy road

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About BAM

Royal BAM Group nv - Corporate centre

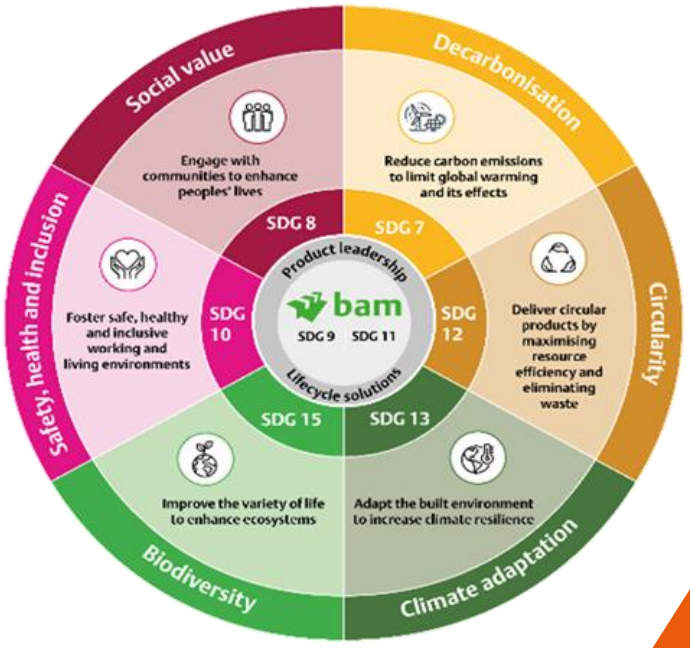
Netherlands division	United Kingdom and Ireland - division	Belgium
BAM Infra Nederland	BAM Nuttall	BAM Interbuild
BAM Bouw en Techniek	BAM Construct UK	Kairos
BAM Residential	BAM Contractors (Ireland)	
BAM Specials	BAM Ventures	

Royal BAM Group nv is a leading construction and property development company listed on Euronext Amsterdam with over 150 years of experience in delivering sustainable buildings, homes and infrastructure for public and private sector clients. With approximately 13,200 employees, BAM realised a revenue of €6.5 billion in 2024.

"Building a sustainable tomorrow"

our ambitions for 2030:

1. We emit less CO2 and other substances
2. We use more circular products and produce less waste
3. We build infrastructure that can adapt to climate change
4. We protect and nurture healthy ecosystems
5. We ensure our projects and workplaces are healthy, safe, and welcoming
6. We improve the lives of everyone



First attempts

< 2014 exploratory research into flexible subbase layers, secondary aggregates with foambitumen

2014: N366 Groningen:
- 250/300 mm foambitumen stabilised subbase;
- Slag/RAP/sand with 1% cement and 3,5% bitumen;
- 2 layers asphalt (90 mm)

2018: Twentekanaal – Inspection paths. Foambitumenstabilisation (SA, Australia)
- subbase layer with surface treatment
- Aim: bound material but more flexible than cement bound
- secondary aggregates, no RAP
- 1,5 – 3 % bitumen, 1 – 3 cement

Focus:
more flexible bound subbase

2019: Technical Seminar Cold Recycling (Wirtgen)
- Based on “South African method” (TG2)

2021: Training modules Loudon International with European participants:
- Recycling / BSM Technology
- Laboratory training
- Design Training

Focus shifting to unbound base / binder layer

Real interest in BSM, but will BSM work with Dutch materials, methods and climate conditions?

BSM Business-case

Strategy:
- Preference: BSM binder layer (100% RAP) with one surface layer; in-situ or in-plant

Mix design:
- Based on TG2;

Structural design:
- Try to combine TG2 with Dutch design methods (ELTS, MR, Transfer Function?);

Construction:
- Mix-in-place: CRi-paver combination or WR (with grader);
- Mix-in-plant: asphalt mixing plant with LEAB foam-bitumen bar (ca. 20 years of experience).

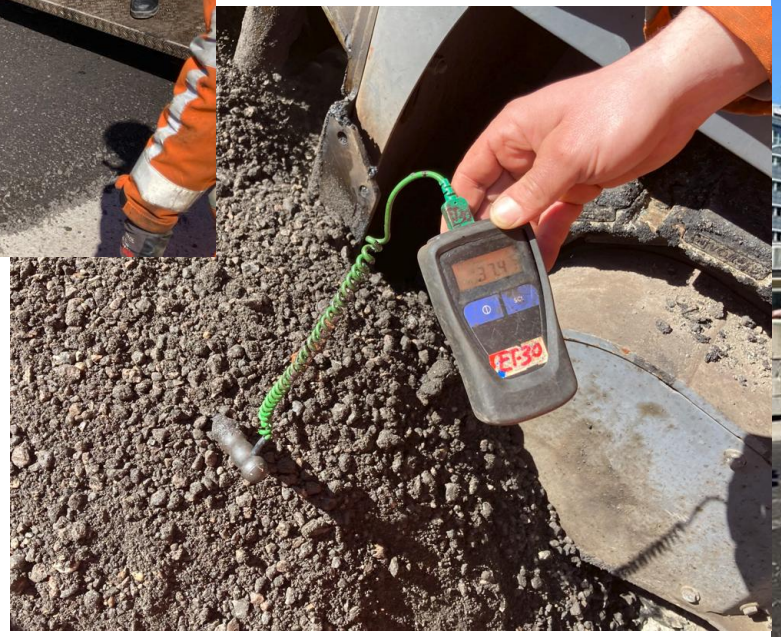
Implementation:
- No time to waste: theoretic research while learning on the job (Job Experience)

Job Experience 2022

several leads but no concrete jobs

Job Experience 2023

- March 2023: trial-production BSM mix-in-plant AsfaltNu Amsterdam paved on BAM construction yard in The Hague
  100 ton BSM 1,8% bit / 1,0% cem, 85% RAP, 100 and 150 mm layer



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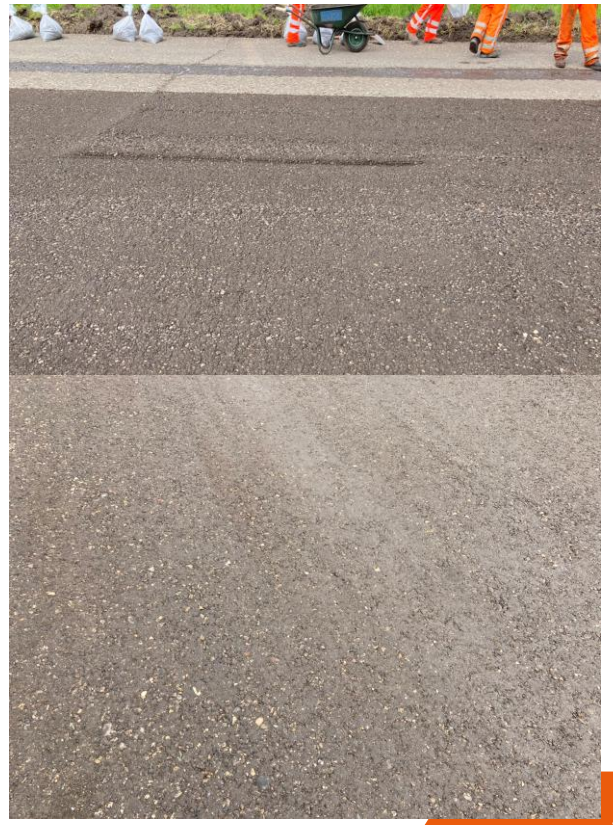
  100 ton BSM 1,8% bit / 1,0% cem, 85% RAP, 100 and 150 mm layer

- May 2023: Oude Heijningseweg Moerdijk, CRi Wirtgen, ZE paving equipment BAM;
  1650 tons BSM 1,8% bit / 1,0% cem, 130 mm BSM binder layer; 40 mm AC 11 surf 50%PR surface layer



Job Experience 2024

- May 2024: Loevesteinse Randweg Schiphol, CRi Arkil, paving equipment BAM
  1530 ton BSM 2,2% bit / 1,0% cem, 155 mm BSM binder layer 100% RAP; 40 mm AC 11 surf 60%PR surface layer

Job Experience 2024

- May 2024: Loevesteinse Randweg Schiphol, CRi Arkil, paving equipment BAM
  1530 ton BSM 2,2% bit / 1,0% cem, 155 mm BSM binder layer 100% RAP; 40 mm AC 11 surf 60%PR surface layer

- Subsections with extra BSM-layer: mix-in-plant Amsterdam Asphalt mixing plant AsfaltNu
  200 ton BSM 1,8% bit / 1,0% cem, 96% RAP 4% crusher sand

Job Experience 2024

- May 2024: Loevesteinse Randweg Schiphol, CRi Arkil, paving equipment BAM
  1530 ton BSM 2,2% bit / 1,0% cem, 155 mm BSM binder layer 100% RAP; 40 mm AC 11 surf 60%PR surface layer

- June 2024: Kiekweg Venray, WR Freesmij, grader, padfoot/drum/pneumatic-tyred rollers
  2300 ton BSM 2,2% bit / 1,0% cem, 200 mm BSM base layer (85-90% RAP + sand)
  3 sections different asphalt buildup (60 mm LEAB 22 bin/base 60%PR and 35/50 mm AC 11 surf 30%PR surface layer)

Job Experience 2025

- May 2025: Teunis Spekbaan Someren: CRi Arkil, paving equipment BAM;
  720 ton BSM 2,2% bit / 1,0% cem, 200 mm BSM base layer 100% RAP; 50 mm LEAB bin/base 60%PR (wearing course client)
- May 2025: Jaegerhofweg Venray, CRi Arkil, paving equipment BAM;
  2300 ton BSM 2,3% bit / 1,0% cem, 200 mm BSM base layer, 100% RAP; 40 mm AC 11 surf 30%PR surface layer;
- May 2025: Ontginningsweg Venray, CRi Arkil, paving equipment BAM;
  380 ton BSM 2,3% bit/ 1,0% cem, 150 mm base layer, 100% RAP; 40 mm AC 11 surf 30%PR surface layer;

Lessons (to be) Learned from Job Experience

Finding suitable trialsections:

- Looking for ideal job-site with no tar-contaminated pavements

Replacing tar-contaminated RAP with external RAP:

- mixing-plant stockpile: well-graded, more active bitumen;
- Project / recycling industry: medium-graded, handling/transport segregation

Lessons (to be) Learned

Mix-in-plant:

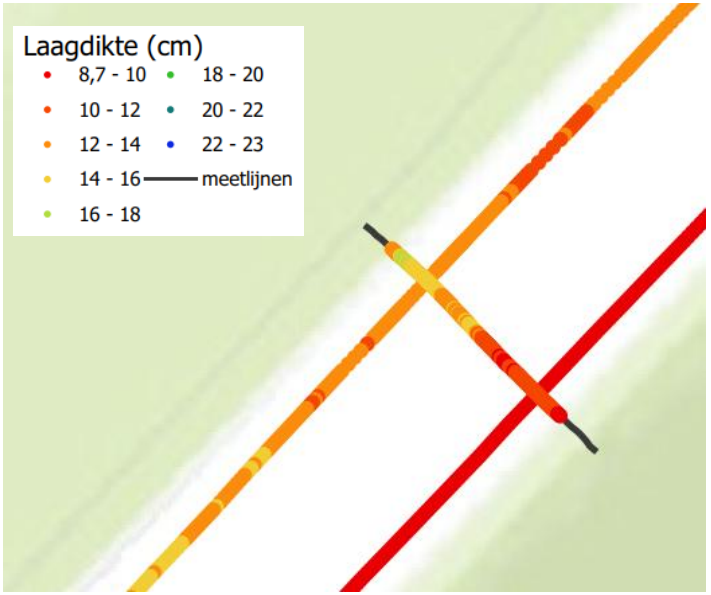
- Well-graded RAP from stockpile;
- Homogenous aggregate, with manageable grading (sieves);
- High-quality BSM mixture with LEAB foambar (16 nozzles);
- No mixing shortly after HMA/WMA production!
- Don’t store in silo’s!

Lessons (to be) Learned

Applying BSM:

- Compaction (roller sequence, weight, strategy)

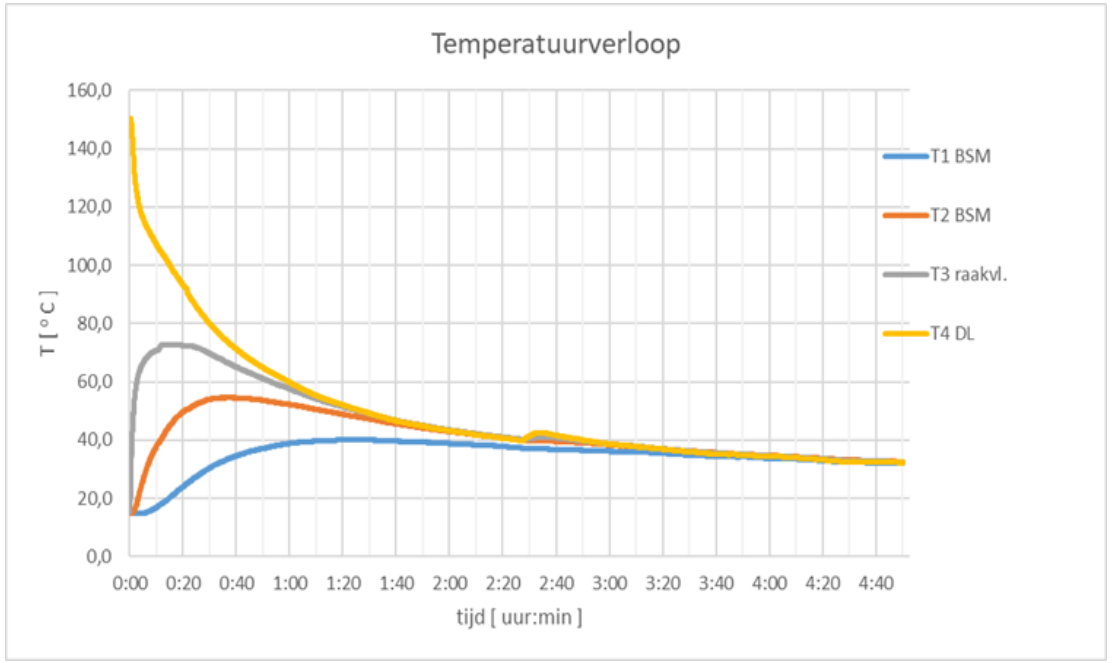
- Edge-locking (+30 cm width both sides)

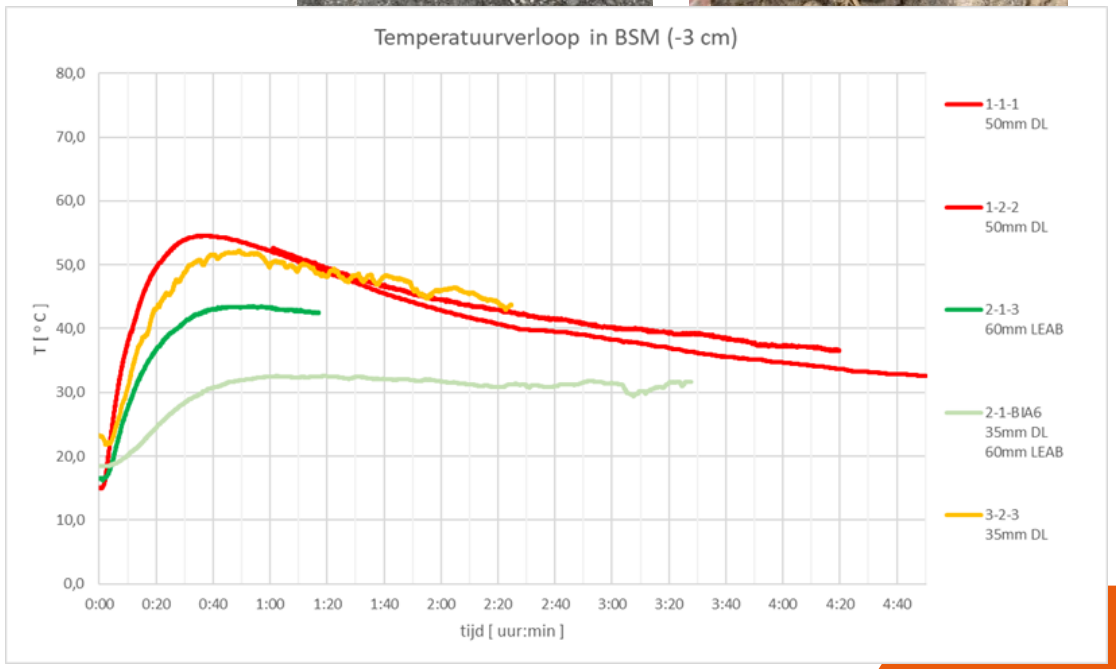


Lessons (to be) Learned

HMA/WMA asphalt surface layer:

- (re)heating BSM when applying HMA/WMA surface layer;
- app. 72 ^{o}C in interface layer with HMA;
- 15-20 ^{o}C less only cm's below interface layer;
- less heating with LEAB (WMA);

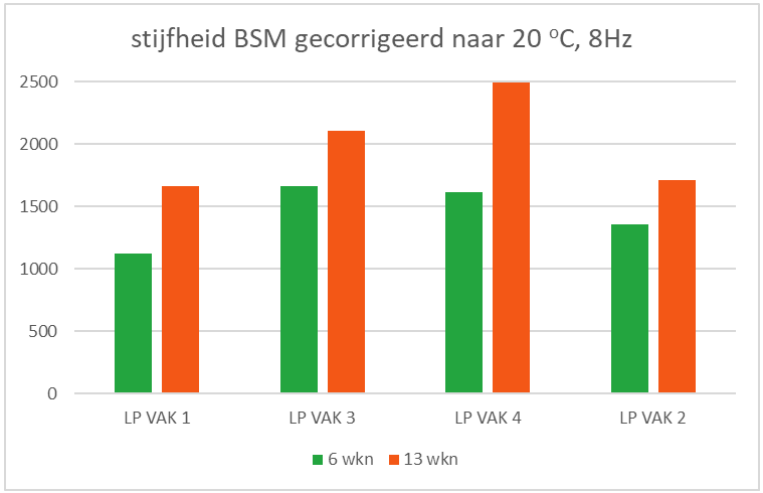


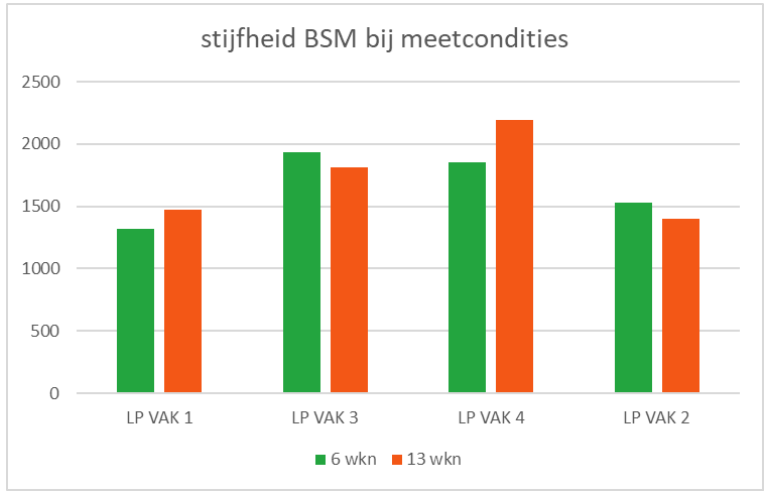


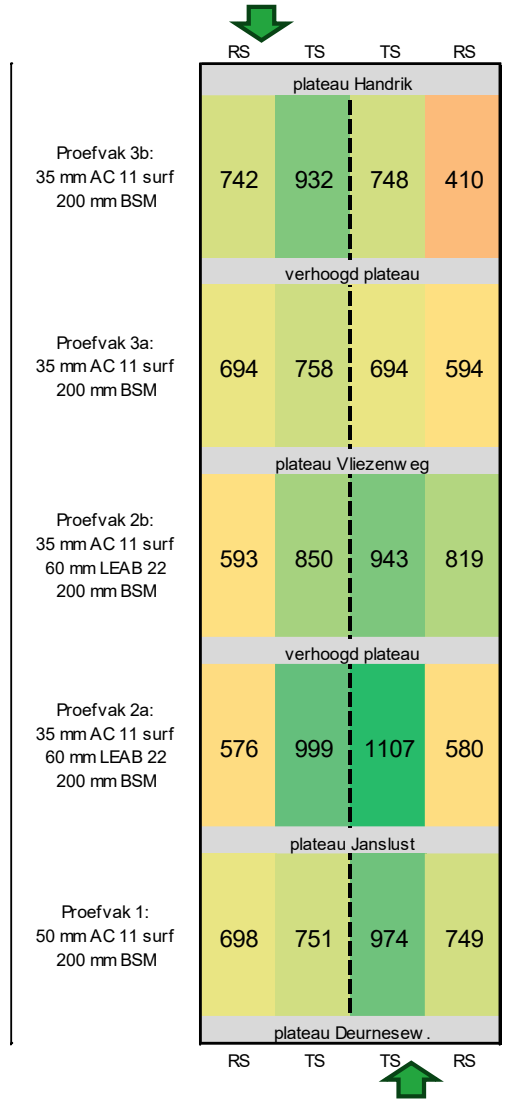
Lessons (to be) Learned

Stiffness ($E_{dynamic}$):

- BMS binder layers on asphalt/base layers: 1000 – 2000 Mpa;
- BMS base layers on subgrade: 600 – 1000 Mpa;
- Lower stiffness at edges: edge-locking;
- Temperature dependency







Lessons (to be) Learned

Rutting: no issues so far

Moerdijk 2 years 3 months

Schiphol 1 year 3 months

Venray 1 year 2 months

Venray / Someren 3 months

Lessons (to be) Learned

- Flexible in operation (shorter train)
- Fixed width
- Availability (in NL)
- Attention for compaction/evenness

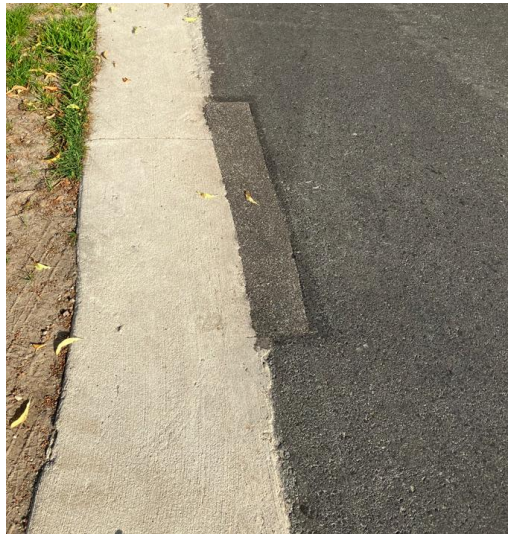
- Better mixing (downcut and crossmixing)
- Advantage of asphalt paver: flexible widths, good evenness
- Less flexible in operation (longer train, limited angle conveyor)
- Attention for material flow

Lessons (to be) Learned

Projects with BSM recycling:

- Material sampling;
- Safety: sufficient work space start/end of jobsite;
- Logistics: sufficient bitumen, water available (resupplyment);
- Quality: tapwater or ‘swampwater’;
- External material (grading RAP);
- Curing time / other work related activities






Publicity Strategy: spreading the word

What is ‘the word’?

2022: one contractor offering an ‘innovative’ product that is better than what other contractors offer

➡ **“buy our BAM product!”**

2025: a solution for (the infrastructural) society as a whole to reach our sustainability goals

➡ **“contractors have a solution for our mutual challenge”**

- Clear substantiated definition
- Unified message between contractors
- Contractors, (defining) clients and research institutes working together

Publicity Strategy: spreading the word

External publicity:

- Exposure at trade & knowledge fairs (emphasizing on sustainability): banners, flyers, etc.
- Presentations at symposia;
- (social) media-exposure;
- Events at (trial) job-sites;
- emphasizing success: Groene Doener Award

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- emphasizing success: Groene Doener Award Schiphol

Internal publicity:

- Identifying opportunities for trial sections / job sites with clients, in tenders and projects;
- People at the frontline:
  - Commercial managers;
  - Sustainability managers;
  - Tender / projectteams:

Conclusion

The first BSM attempts are very promising and we learned a lot, but there is still room for more improvement

BSM is not asphalt ➡ BSM projects are not asphalt projects

- Mix design / structural design;
- Materials (quality, handling);
- Equipment / logistics;
- Project planning;
- Paving / compacting;
- Aftercare;
- Client approach;
- …

But if we can keep learning and improving, BSM pavements will even get better than what we have achieved thus far: