

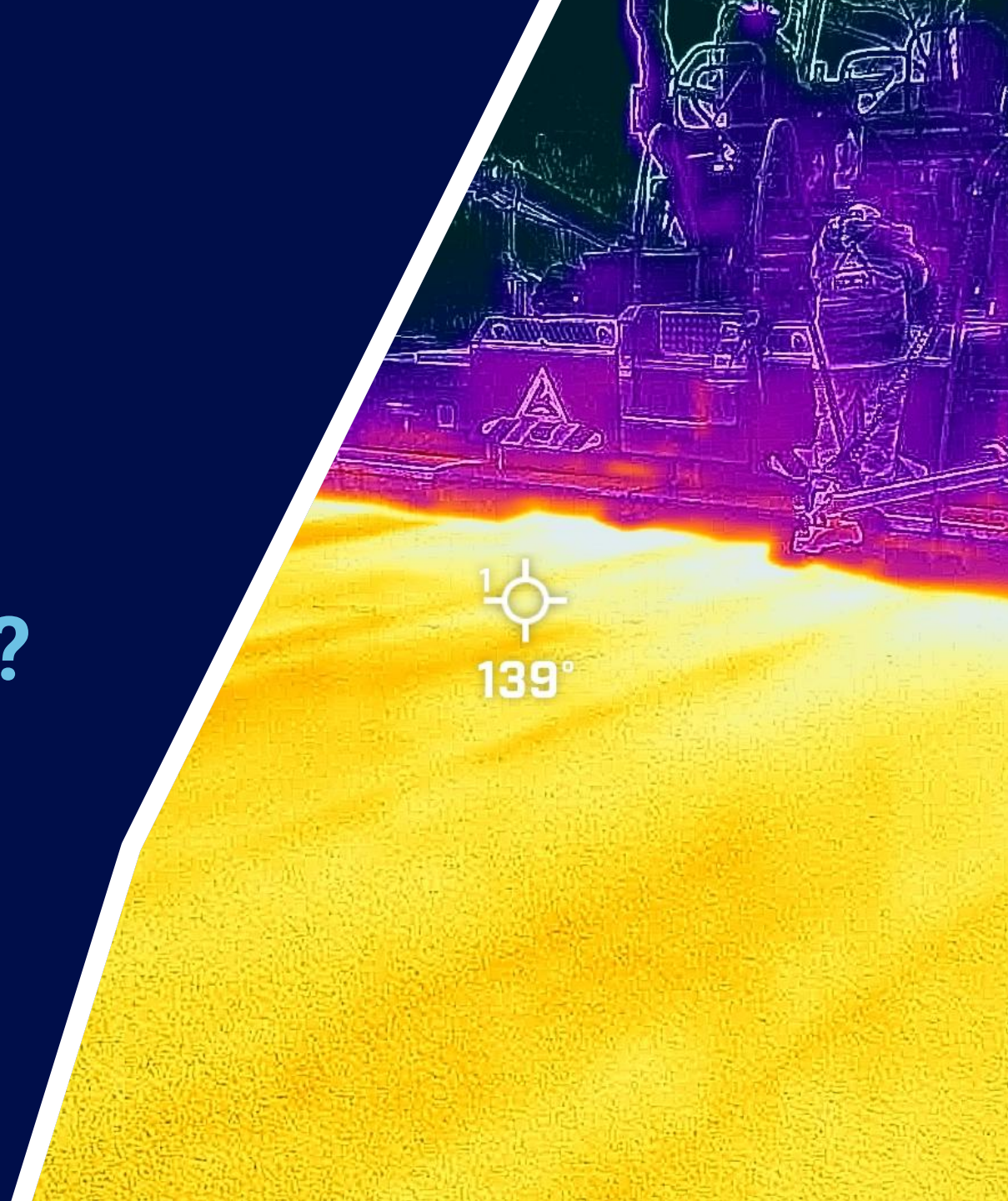


aspha-min[®]

WARM MIX ASPHALT: IS WARM THE NEW HOT?

Practical Implications of Warm Mix Asphalt

Stephan Harnischfeger | MHI



AGENDA



- **Definition**
- **Key Benefits**
- **WMA in Germany - Technical Guidelines**
- **Technologies at a Glance**
- **In Practice**
- **Outlook**

WARM MIX ASPHALT:

DEFINITION

DEFINITION



“Warm Mix Asphalt” (WMA): Technology for reducing the mixing and/or compaction temperature of asphalt mixtures by approximately **30 K**.

The reduction is achieved by temporarily lowering the viscosity of the asphalt binder through production processes or the use of additives.

As a result, the asphalt mixture can be manufactured, laid and compacted at a lower temperature while maintaining the required performance and quality characteristics.

Where additives are incorporated without a deliberate reduction in the production temperature, the result is commonly referred to as “low-viscosity asphalt”.



WARM MIX ASPHALT: **KEY BENEFITS**

KEY BENEFITS



Key Benefits of WMA:

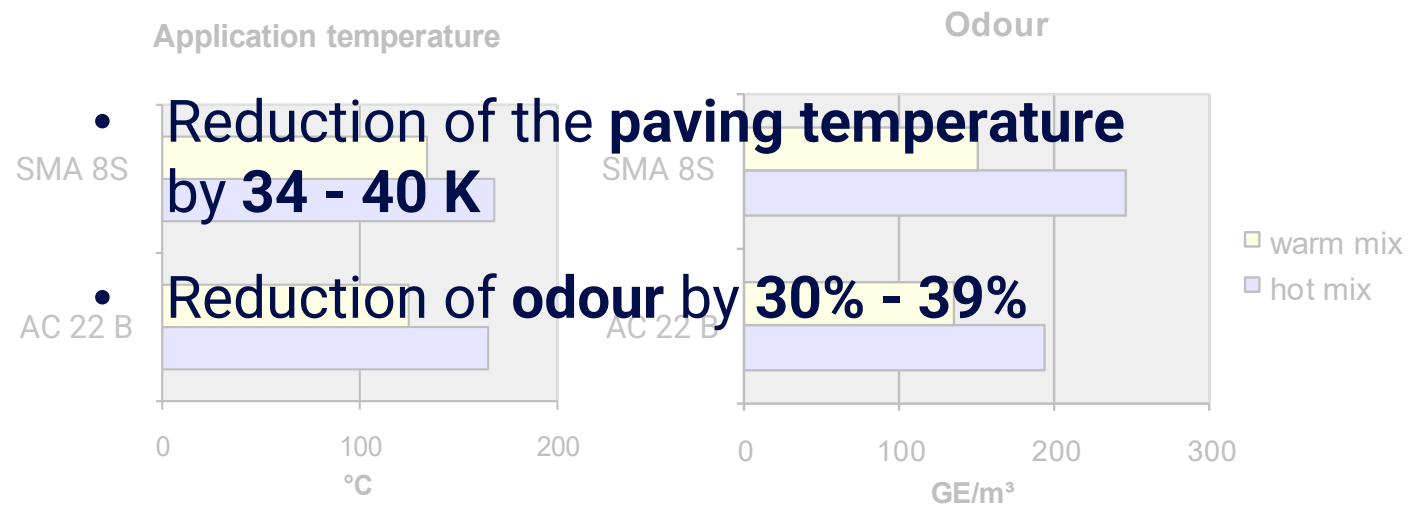
- Energy savings
- Emission reduction
(vapours, aerosols, CO₂, NO_x, VOC)



KEY BENEFITS



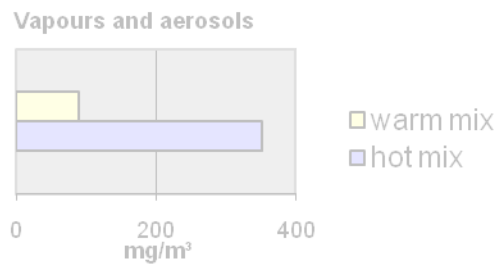
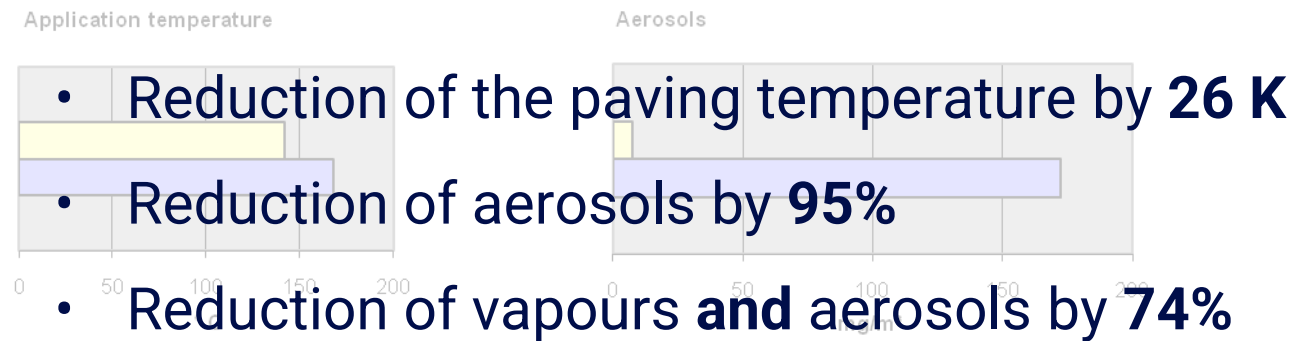
Case study (here: aspha-min)



KEY BENEFITS



Case study (here: aspha-min)



KEY BENEFITS



Warm Mix „Under Construction“

KEY BENEFITS



„Hotter is better“ - Is it really?

KEY BENEFITS



Key Benefits of WMA:

- Energy savings
- Emission reduction
(vapours, aerosols, CO₂, NO_x, VOC)
- Faster opening for traffic
- Reduced thermal stress on binder, aggregate, additives and mixing plant
- Enhanced / improved workability
(**without** temperature reduction at the plant!)



KEY BENEFITS



Key Benefits of WMA:

- Energy savings
- Emission reduction
(vapours, aerosols, CO₂, NO_x, VOC)
- Faster opening for traffic
- Reduced thermal stress on binder
aggregate, additives and moving part
- Enhanced / improved workability
(without temperature reduction at the plant)

01.01.2027:

**OEL for vapours and aerosols:
1.5 mg/m³**



KEY BENEFITS



Key Benefits of WMA:

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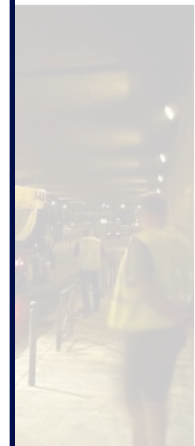
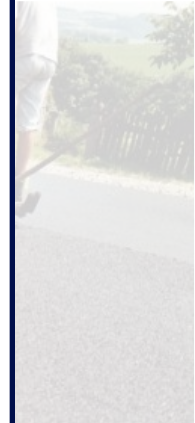
The combination of WMA and vapour extraction on site will become mandatory in order to avoid...

KEY BENEFITS



Key Benefits

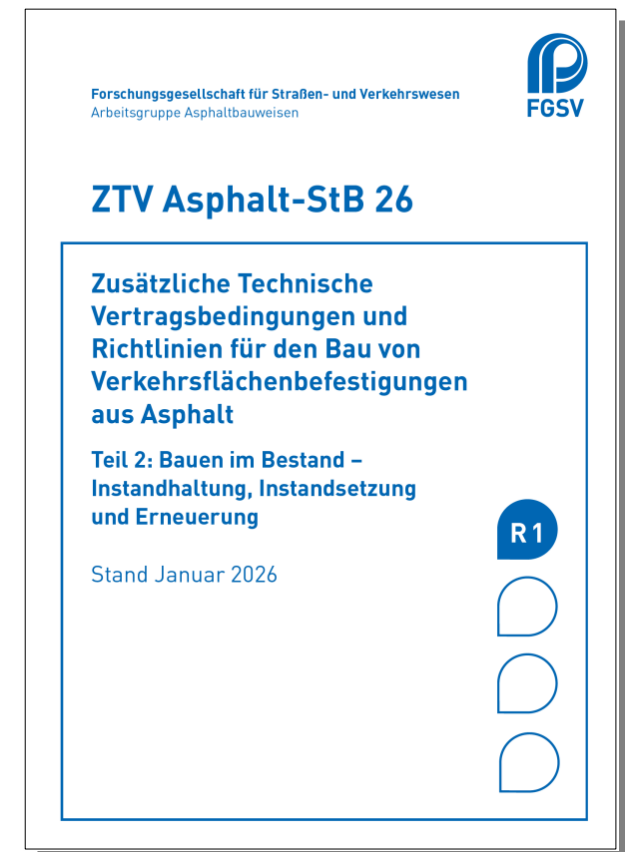
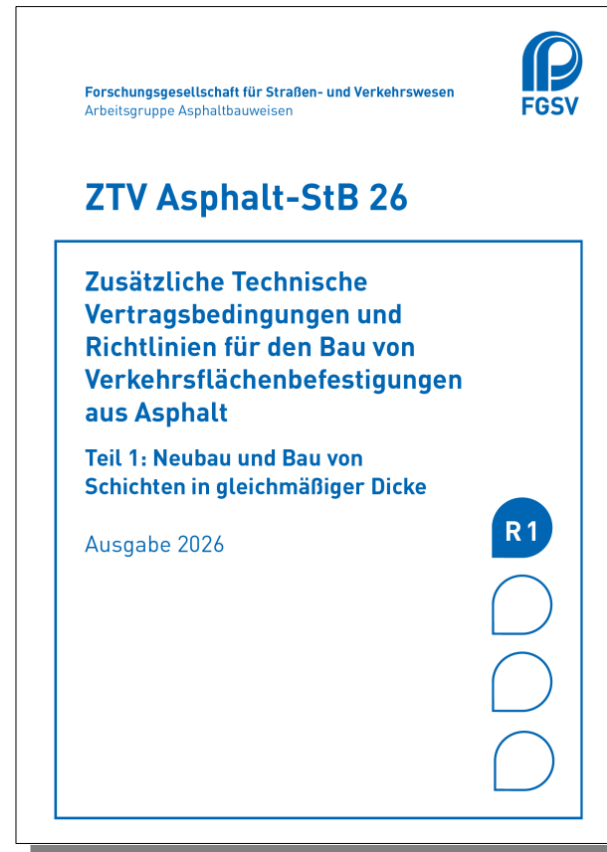
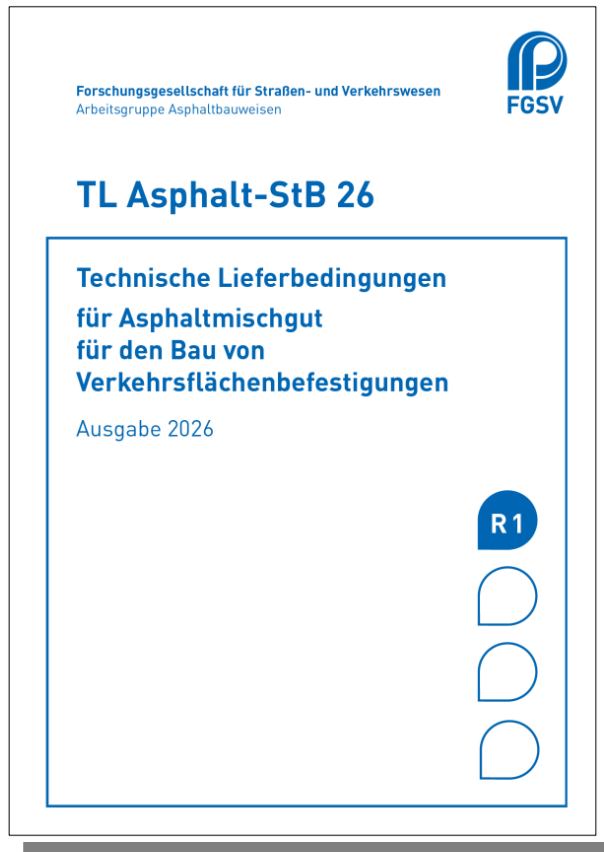
- Energy savings
- Emission reduction (vapour)
- Faster completion
- Reduced aggregate
- Enhanced safety (without)





WARM MIX ASPHALT: WMA IN GERMANY - TECHNICAL GUIDELINES

WMA IN GERMANY - TECHNICAL GUIDELINES



Source: Prof. Dr.-Ing. Weßelborg, FH Münster

WMA IN GERMANY - TECHNICAL GUIDELINES



With the introduction of the new Technical Guidelines in Germany, there is no more „hot mix“ or „warm mix asphalt“.

From now on, it is just „**asphalt**“...

... being produced and paved in a lower temperature range.

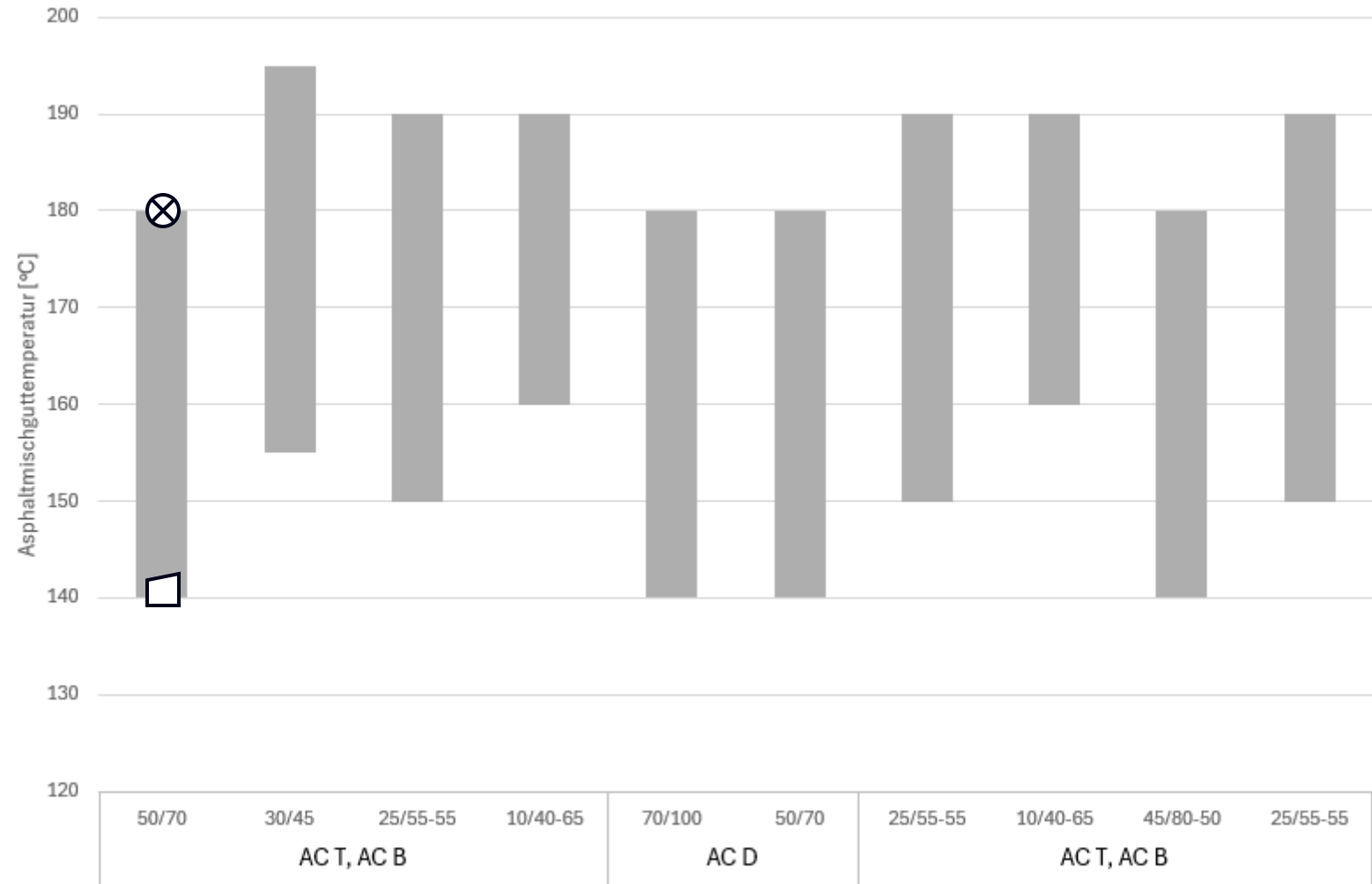


WMA IN GERMANY - TECHNICAL GUIDELINES



Former temperature ranges
for asphalt mixtures, based
on layer and pen grade:

- ⊗ max. at mixer discharge
- min. at the paver



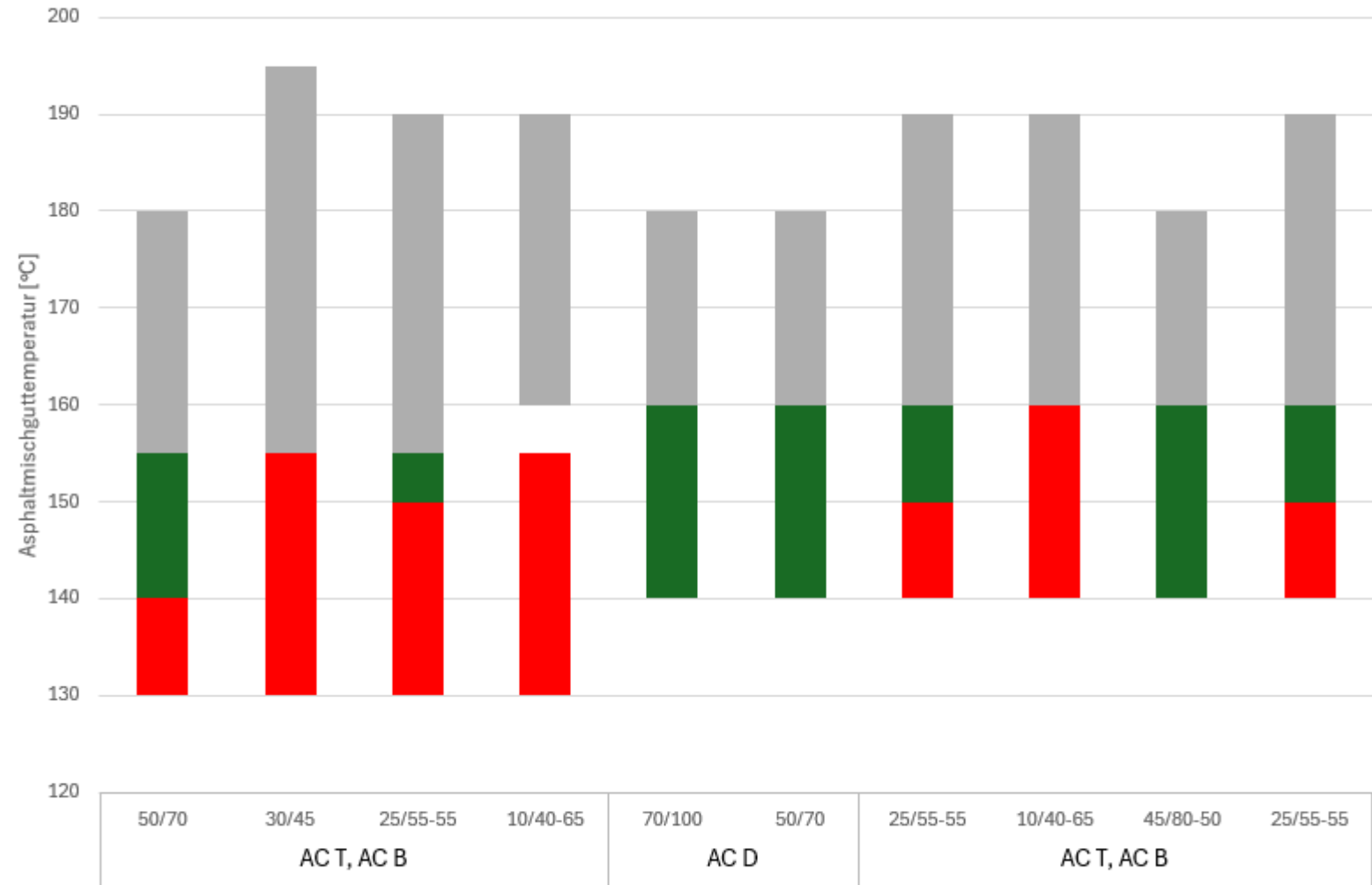
Source: Dr. Knut Johannsen, EUROVIA

WMA IN GERMANY - TECHNICAL GUIDELINES



Applied changes:

- To be eliminated
- Remaining
- To be Added



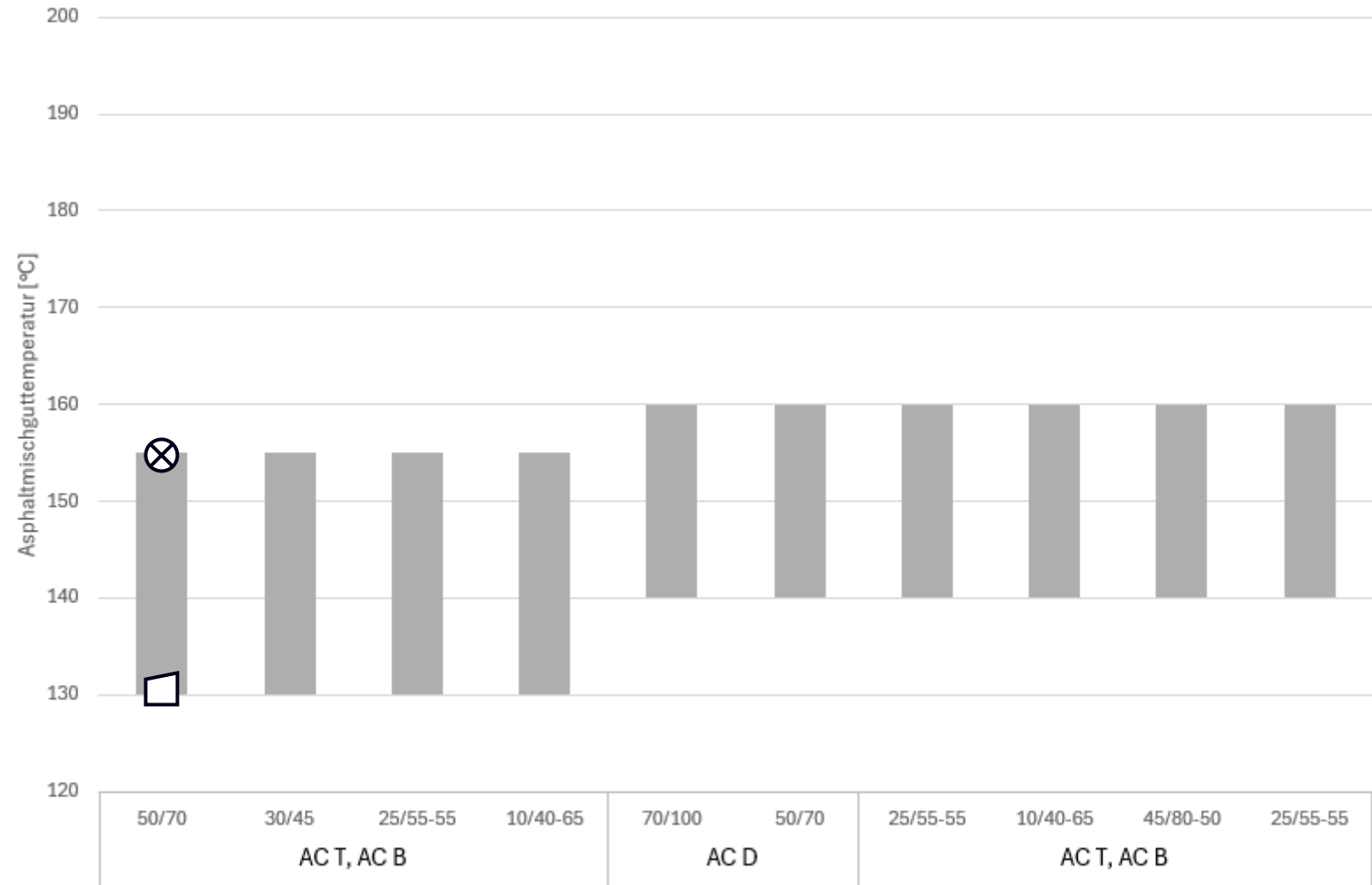
Source: Dr. Knut Johannsen, EUROVIA

WMA IN GERMANY - TECHNICAL GUIDELINES



Revised temperature ranges
for asphalt mixtures, based
on layer and pen grade:

- ⊗ max. at mixer discharge
- min. at the paver



Source: Dr. Knut Johannsen, EUROVIA



WARM MIX ASPHALT TECHNOLOGIES AT A GLANCE

TECHNOLOGIES AT A GLANCE



ORGANIC

Organic Additives
(„Waxes“)

Reduced viscosity of the binder

- Available as solid or pre-mix binder
- **Commonly** changing the performance of binder and mix

CHEMICAL

Surface-active or reactive additives

Mainly reducing the surface tension of the binder

- Available as liquid or pre-mix binder
- **With and without** changing the performance of binder and mix

DIRECT FOAMING

Foamed Bitumen

Increasing the binder volume by foam

- Modification of the plant (foaming nozzle)
- **Not** changing the performance of binder and mix

INDIRECT FOAMING

Zeolite

Increasing the binder volume by micro pores

- Available as solid
- **Not** changing the performance of binder and mix

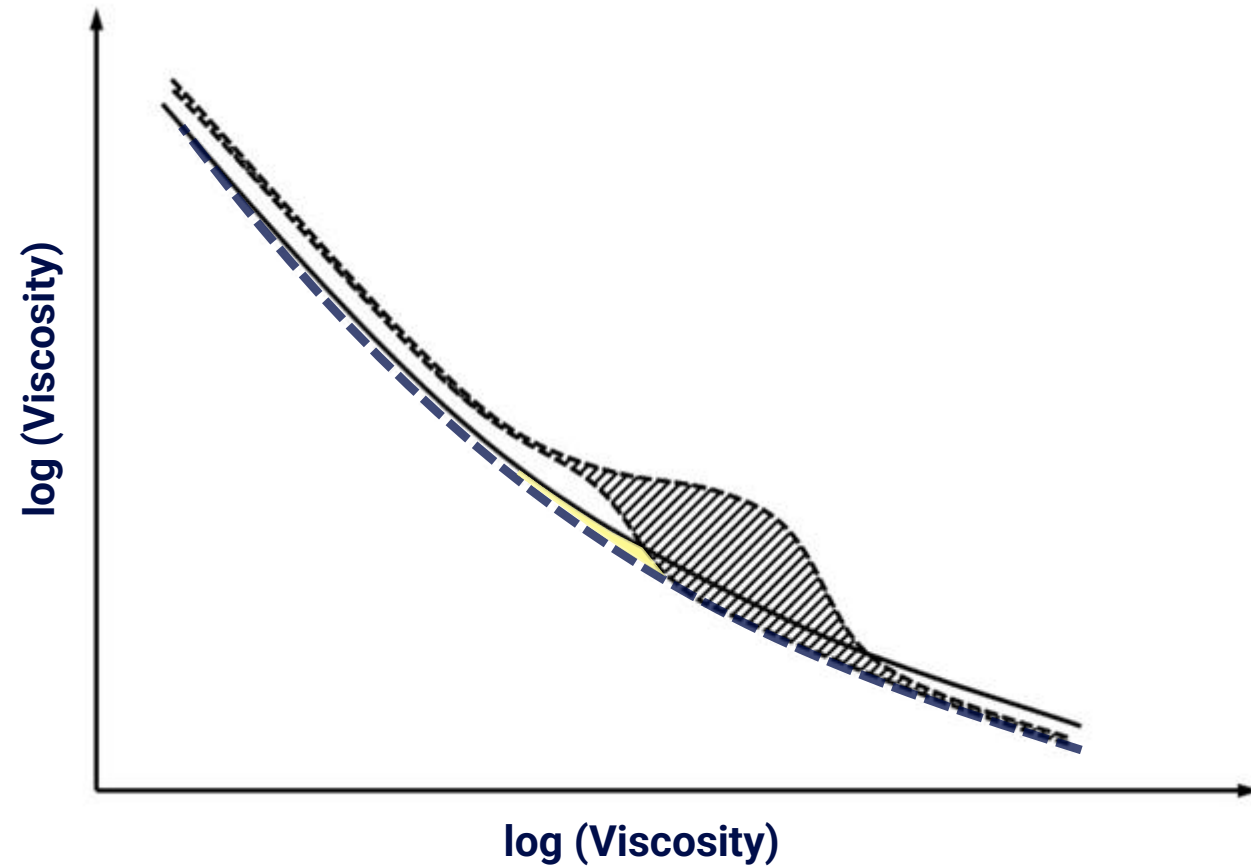
TECHNOLOGIES AT A GLANCE



Indirect foaming (here: zeolite „aspha-min[®]“):

- Recommended **dosage rate** of
 - 0,2% (2 kg / 1000 kg of mix) with base courses
 - 0,3% (3 kg / 1000 kg of mix) with binder and wearing coursesequally replacing **natural** filler with **synthetic** filler (zeolite)
- The controlled water release causes **finely dispersed water vapour**, creating micro pores in the bitumen (> „micro foaming“)
- The **micro foaming** enhances the **binder volume**, causing a **temporarily** reduced viscosity of the mix
- The **steady water release** (in a range between 85 °C and 180 °C over the course of 6 to 8 hours) allows sufficient time for hauling, laying and compacting
- Maintaining **workability** of the mix until under 100 °C

TECHNOLOGIES AT A GLANCE



- Viscosity curve of a PG 50/70; unmodified
-  Viscosity curves of a PG 50/70; modified with a range of standard wax type additives
- - Viscosity curve of a PG 50/70; indirectly foamed (zeolite)
-  „Extra compaction capacity“



WARM MIX ASPHALT: IN PRACTICE

IN PRACTICE



Producing WMA (at the plant)

- Ensure close **coordination** with site operations
 - Clarify project **requirements** (weather, distance, paving devices)
 - Jointly agree accordingly on key decisions
- Temperature reduction... how warm is **warm enough**?
 - What is technically feasible under **project requirements** (see above)?
 - What is technically feasible under **plant restrictions**?
 - Do ensure an **exhaust temperature** above dew point at all times!
- Follow manufacturer's **instructions**!
 - **Storage** and **handling** of additives (hazard information, possible water hazards?)
 - **Dosing** instructions (facilities, precautions, timing etc.)
 - Pre-mixing and **silos storage** of asphalt mixtures
 - Wanted / unwanted **side effects**

Applying WMA (on site):

- Consider possible additional on-site **loss of temperature** (use of material transfer vehicles, hauling distance, weather etc.) with preparation and planning
- Successful compaction depends on the (target) mix temperature at the **screed**
- Early clarification of **framework conditions** enhances process reliability
- Adapt the selected **technology** to the specific framework – where appropriate and possible
- Avoid residual **moisture** on the underlying asphalt surface
- **Preheat** paving equipment, possibly provide standby equipment
- No time wasting, please! Do unload, pave and compact **swiftly**
- While gaining experience, ensure non-destructive **compaction measurement**, do monitor initial compaction and progress
- Adjust the **rolling regime** if necessary and as recommended by laboratory support

Challenges using WMA

- Any **coexistence** of „Hot“ and „Warm“ is very demanding for the plants
- Frequent **switching** may turn out difficult, can cause loss of production performance or even damage to some installations
- Process **planning** needs to „level up“ on both ends (buyer **and** supplier)
- Small and medium sized construction teams might be the last to get in touch with WMA
- Different technologies may cause **workability** to vary during construction



WARM MIX ASPHALT: **OUTLOOK**

OUTLOOK



On sustainability:

- The most sustainable infrastructure is the one that lasts the longest:
Good quality and a lack of repair are paramount!
- Less thermal stress to the system can be a bonus on the durability of asphalt surfaces
- Asphalt is possibly one of the most sustainable construction materials – it is fully recyclable!
- Energy savings and reduced emissions **add** to that!

Therefore...:

- Choose your technology objectively and forward looking
- Cheapest is not always best: Which technologies are safest, field-proven, process-reliable and „tick all the boxes“?
- And most of all: Which technologies continue to allow fullest **recyclability** without any drawbacks or adverse effects?
- Do not wait! Try it yourself. Gain your own experience!

OUTLOOK





**JUST WARM MIX ASPHALT.
THANK YOU VERY MUCH.**

