

**Guide to the production  
of asphalt pavements**

**Guidance for ensuring that  
smoothness meets requirements**

**H VAE**

**W 1**

**© 2020 Forschungsgesellschaft für Straßen- und Verkehrswesen e.V., Cologne**

This work is protected by copyright. All rights arising therefrom, in particular with regard to reprinting, translation, presentation, the quotation of illustrations and tables, radio broadcasting, micro-filming, or reproduction by any other means as well as storage on data processing systems, are reserved, even if only extracts from the work are used.

**Guide to the production  
of asphalt pavements**

**Guidance for ensuring that  
smoothness meets requirements**

**H VAE**

**W1**

**Working Group Asphalt Pavements**  
**Committee: Construction Technology**  
**Processing group: Smoothness when paving roller-compacted asphalt**

Lead:

Dr.-Ing. Ronald Utterodt, Minneapolis

Members:

Dipl.-Ing. Thorsten Bode, Wardenburg  
Ralf Böhm, Regensburg  
Martin Bormann, B.Eng., MBA, Bremen  
Wolfgang Brandl, Hennef  
Dipl.-Ing. Wilfried Dohmen, Übach-Palenberg  
André Felchner, Ludwigshafen  
Dipl.-Ing. Axel Fischer, Ludwigshafen  
Dipl.-Ing. (FH) Ramón Gröbke, Magdeburg  
Ralf Hübner, Übach-Palenberg  
Dipl.-Ing. (FH) Stefan Hübner, Halberstadt  
Thomas Kötter, Kirchheim  
Dipl.-Ing. Norbert Mattivi, Raunheim  
Dipl.-Ing. Holger Ohe, Cappel  
Marius Schenker, Bochum  
Stefan Schmolke, Hanover  
Dipl.-Ing. Winfried Schramm, Boppard  
Dr.-Ing. Christian Schulze, Aachen  
Benjamin Seidel, Tirschenreuth  
Univ.-Prof. Dr.-Ing. habil. Bernhard Steinauer, Aachen  
Prof. Dr.-Ing. Alfred Ulrich, Cologne

Preliminary remark

The Guide to the production of asphalt traffic area pavements – Notes for ensuring that smoothness meets requirements (“H VAE”), edition 2019, was prepared by the FGSV German Road and Transportation Research Association’s “Smoothness when paving roller-compacted asphalt” task group and completed by its “Construction Technology” committee (led by Dipl.-Ing. Lars Keller).

# Table of Contents

	Page
<b>1 General</b> .....	7
<b>2 Area of application</b> .....	7
<b>3 Significance and evaluation of smoothness</b> .....	7
<b>3.1 Significance of smoothness</b> .....	7
<b>3.2 Evaluation of smoothness in Germany</b> .....	8
<b>3.3 Constraints on evaluation</b> .....	8
<b>3.4 Economic analysis of smoothness</b> .....	8
<b>4 Asphalt paver terminology</b> .....	10
<b>5 The principle of the “free-floating” screed</b> .....	12
<b>6 Factors influencing smoothness</b> .....	14
<b>6.1 Guidance on planning and drafting work specification</b> .....	14
<b>6.2 Planning paving operations</b> .....	15
6.2.1 Paving and compaction equipment .....	15
6.2.1.1 General .....	15
6.2.1.2 Material transfer vehicles (MTVs) .....	16
6.2.1.3 Asphalt pavers .....	16
6.2.1.4 Rollers .....	17
6.2.2 Equipment selection .....	19
6.2.3 Planning guidance .....	20
6.2.4 Production and paving plan .....	23
<b>6.3 Quality of the base</b> .....	23
6.3.1 Elevation of roadway appurtenances .....	24
6.3.2 Profile improvements on the base .....	25
6.3.3 Milling the base .....	26
6.3.4 Tack coat application .....	28
<b>6.4 Producing asphalt mix</b> .....	30
<b>6.5 Transport logistics and ordering of asphalt mix</b> .....	31
6.5.1 Planning guidance .....	31
6.5.2 Asphalt mix logistics .....	32
6.5.2.1 General .....	32
6.5.2.2 Calculating the hourly asphalt mix rate .....	32
6.5.2.3 Transport logistics .....	32
6.5.2.4 Logistical requirements for the asphalt mixing plant and the construction site .....	34
6.5.3 Ordering asphalt mix .....	35
<b>6.6 Grade and slope control method and reference</b> .....	35
6.6.1 Task of grade and slope control .....	35
6.6.2 Functional principle of automated grade and slope control and references .....	35
6.6.3 Types of sensors and selection of suitable grade and slope controls .....	36
6.6.4 Significance of the base .....	38
6.6.5 Preparatory work .....	38
6.6.6 Paving with automated grade and slope control .....	39

	Page
<b>6.7 Preparing the asphalt paver and rollers for operation</b> . . . . .	39
6.7.1 Basic equipment of a paving crew . . . . .	39
6.7.2 Preparing the asphalt paver for operation . . . . .	40
6.7.3 Preparing the rollers for operation . . . . .	43
<b>6.8 Paving with an asphalt paver</b> . . . . .	43
6.8.1 General instructions . . . . .	43
6.8.2 Positioning of the screed . . . . .	44
6.8.3 Transferring the asphalt mix from the truck to the asphalt paver . . . . .	44
6.8.4 Flow of material in the asphalt paver . . . . .	45
6.8.5 Adjusting the compaction performance of the screed . . . . .	46
6.8.6 Corrections during the paving process . . . . .	48
6.8.7 Localized bumps and roughness after paver stop . . . . .	48
6.8.8 Paving “hot to cold” . . . . .	48
6.8.9 Paving “hot to hot” with two or more pavers working in echelon . . . . .	49
6.8.10 Transverse joints . . . . .	49
<b>6.9 Roller compaction</b> . . . . .	50
6.9.1 General rolling rules to achieve required smoothness . . . . .	50
6.9.2 Influence of weather . . . . .	52
6.9.2.1 Warm weather . . . . .	52
6.9.2.2 Cool weather . . . . .	52
6.9.2.3 Wet conditions . . . . .	53
6.9.2.4 Wind . . . . .	53
6.9.3 Rolling patterns . . . . .	53
6.9.3.1 Rolling transverse joints . . . . .	54
6.9.3.2 Rolling longitudinal joints . . . . .	54
6.9.3.3 Compacting the edge of the road . . . . .	56
6.9.3.4 Lane changing . . . . .	57
6.9.3.5 Finishing main compaction and transition to final compaction . . . . .	57
6.9.4 Inadequate smoothness due to roller damage . . . . .	57
6.9.4.1 Adhesion of the asphalt mix to the roller drum . . . . .	58
6.9.4.2 Tender mix . . . . .	58
6.9.4.3 Bulging adjacent to the drum . . . . .	58
6.9.4.4 Roller cracking . . . . .	59
<b>6.10 Acceptance</b> . . . . .	59
<b>7 Special construction methods</b> . . . . .	60
<b>7.1 Thin asphalt surface courses applied hot on spray seal</b> . . . . .	60
<b>7.2 Rubber-modified asphalt</b> . . . . .	60
<b>7.3 Noise-optimised asphalt surface courses</b> . . . . .	60
<b>7.4 Reduced-temperature roller-compacted asphalt</b> . . . . .	60
<b>7.5 Asphalt surface courses made of porous asphalts</b> . . . . .	60
<b>7.6 Asphalt courses made of mastic asphalt with porous         surface</b> . . . . .	60
<b>8 Need for training and further education</b> . . . . .	61
<b>9 Literature references</b> . . . . .	62
<b>10 List of images</b> . . . . .	63
<b>11 List of tables</b> . . . . .	66

	Page
<b>Appendix A: Terms, abbreviations and symbols</b> .....	67
Appendix A 1 Terminology .....	67
Appendix A 2 Abbreviations & Acronyms .....	68
Appendix A 3 Symbols .....	69
<b>Appendix B: Interaction between paving and compaction performance</b> .....	70
<b>Appendix C: Sample breakdown of a paving concept</b> .....	72
<b>Appendix D: Order form</b> .....	73
<b>Appendix E: Asphalt paving check lists</b> .....	74
Appendix E 1 Tendering check list (client) .....	74
Appendix E 2 Bill of quantities check list (bidder) .....	75
Appendix E 3 Construction planning check list .....	76
Appendix E 4 Base check list .....	78
Appendix E 5 Paving and compaction check list .....	79
<b>Appendix F: Selected paving and compaction defects</b> .....	84
<b>Appendix G: Technical regulations</b> .....	85

## **Remarks on the system of technical publications of the FGSV**

### **R stands for regulations:**

These publications either specify the technical design or realization (R1) or give recommendations on the technical design or realization (R2).

### **W stands for information documents:**

These publications represent the current state-of-the-art knowledge and define how a technical issue shall be practicably dealt with or has already been successfully dealt with.

#### Category R1 indicates 1<sup>st</sup> category regulations:

R1-publications contain the contractual basis (Additional Technical Conditions of Contract and Guidelines, Technical Conditions of Delivery and Technical Test Specifications) as well as guidelines. They are always coordinated within the FGSV. R1-publications – in particular if agreed on as integral part of the contract – have a high binding force.

#### Category R2 indicates 2<sup>nd</sup> category regulations:

R2-publications contain information sheets and recommendations. They are always coordinated within the FGSV. Their application as state-of-the-art technology is recommended by the FGSV.

#### Category W1 indicates 1<sup>st</sup> category documents of knowledge:

W1-publications contain references. They are always coordinated within the FGSV but not with external parties. They represent current state-of-the-art knowledge within the respective responsible boards of the FGSV.

#### Category W2 indicates 2<sup>nd</sup> category documents of knowledge:

W2-publications contain working papers. These may include preliminary results, supplementary information and guidance. They are not coordinated within the FGSV and represent the conception of an individual board of the FGSV.



Production and sales:

**FGSV Verlag GmbH**

Wesselinger Strasse 15-17, 50999 Köln, Germany

Phone: +49 (0) 22 36 / 38 46 30

Fax: +49 (0) 22 36 / 38 46 40

E-Mail: [info@fgsv-verlag.de](mailto:info@fgsv-verlag.de)

Internet: [www.fgsv-verlag.de](http://www.fgsv-verlag.de)



**W 1**