1. MONITORING AND CERTIFICATION

1.1 CONSTRUCTION PRODUCTS REGULATION

Scope of application of Regulation (EU) No 305/2011 of the European Parliament and the Council of 9 March 2011 (Construction Products Regulation, CPR)

Assessment system 2+ for verification of constancy of performance and conformity of Factory Production Control (brickwork mortar, aggregates, prefabricated concrete components)

1.1.1 Processing of documents submitted (FPC manual, initial testing)

1.1.2 Monitoring and certification in accordance with the CPR (FEhS monitoring agent commissioned by Güteschutz Beton NRW), incl. documentation (Germany only, other countries on a time and materials basis)

1.1.3 Package prices with simultaneous monitoring/certification according to national regulations

1.1.4 Sampling

1.1.5 Product testing

1.2 TESTING, MONITORING AND CERTIFICATION BODY

Scope of application of the German Standard Building Code (MOB), Section 21 (testing, monitoring and certification body, VV TB)
Conformity verification processes

e.g.: concrete according to properties, concrete according to composition including dry concrete, prefabricated concrete components, etc.)

1.2.1 Processing of documents submitted (FPC manual, initial testing)

1.2.2 Initial monitoring/compliance inspection with factory visit and documentation (Germany only, other countries on a time and materials basis)

1.2.3 Issuing the certification documents

1.2.4 Plausibility assessment (DIN FB 100), incl. certificate

1.2.5 Testing of additive water for concrete according to EN 1008 Table 1 (preliminary test) with sedimentable substances

1.3. BAU O NW/RAP STRA

Scope of application under private law (Construction Regulations of North Rhine-Westphalia – BAU O NW/ Guidelines for the Recognition of Testing Bodies for Building Materials in Road Construction - RAP Stra: third-party monitoring)

e.g. construction site monitoring class 2/3 according to DIN EN 13670/DIN 1045-3, Appendix ND:

e.g. according to the German Technical Supply Conditions 'TL G SoB-StB 2004/ TL BuB E-StB 09': Aggregates

e.g. according to the quality requirements of the RAL German Institute for Quality Assurance and Labelling: Aggregates

1.3.1 (Bau O NW): Construction site monitoring class 2/3

1.3.1.1 Semi-annually with construction site visit and monitoring report

1.3.1.2 Final report after conclusion of the construction site, without construction site visit

1.3.1.3 Monitoring of construction sites with minimal quantities (max. 16 m³, max. 1 day of concreting), incl. monitoring report

1.3.1.4 Consideration of special boundary conditions

1.3.1.5 Additional work for the processing of documents submitted when concretes are used that deviate from a test age of 28 days (application, QA plan, etc.)

1.3.2 RAP Stra:Aggregates
'TL G SoB/TL BuB E' Technical Supply Conditions/RAL
(German Institute for Quality Assurance and Labelling)

1.3.2.1 Processing of documents submitted (FPC manual, initial testing)

1.3.2.2 Initial monitoring/compliance inspection with factory visit and documentation, without sampling (Germany only, other countries on a T&M basis)

1.3.3 Sampling

1.3.4 Product testing

1.4 INTERNAL QUALITY CONTROLS

Performance of internal quality controls (monitoring class 2/3) for construction sites according to DIN EN 13670/DIN 1045-3, Appendix NC1.4.1 Performance of unset concrete tests and manufacture of concrete samples and testing

1.4.1 Performance of unset concrete tests and manufacture of concrete samples and testing

1.4.2 Consulting and documentation within the framework of internal quality control by the permanent concrete testing body

2. CHEMICAL INVESTIGATIONS

2.1 INORGANIC COMPONENTS, SOLIDS

Chemical and physicochemical sample preparation
Chemical and physicochemical samples are prepared in the chemical laboratories with particularly great care and attention. In addition to all conventional solubilisation methods (e.g. complete solubilisation in the microwave), there are also special, matrix-specific solubilisation methods available.

2.1.1	Solubilisation using boric acid	
2.1.2	Solubilisation using aqua regia	DIN 38414-S7 DIN ISO 11466
2.1.3	Maczkowske solubilisation (HCl, NH_4Cl)	
2.1.4	Microwave solubilisation (total solubilisation)	
2.1.5	Solubilisation using peroxide, carbonate	
2.1.6	Simple acid solubilisation (HNO_3)	
2.1.7	Acid solubilisation	DIN 52170-2
2.1.8	Acid solubilisation	DIN 52170-3
2.1.9	Combustion	
2.1.10	Bromine-methanol extraction	Handbuch Eisenhüttenlabor Vol. 1

2.2 INSTRUMENTAL ANALYSIS

Instrumental analysis allows a great number of elements to be identified in a short time and with high precision. Depending on the element, matrix and method, the concentration ranges recorded vary from 100% by weight to ppb (µg/kg). The selection of the analysis method is determined based on the element to be investigated, the matrix, and the degree of precision or detection limit required. Unless otherwise specified, the prices stated do not include any preparation which may be necessary.

2.2.1	X-ray fluorescence screening, semi-quantitative (Na to U)	
2.2.2	X-ray fluorescence analysis, individual elements	
2.2.3	ICP-AES/MS screening, semi-quantitative	
2.2.4	ICP-AES analysis	DIN 38406-E22
2.2.5	ICP-MS analysis	DIN 38406-E22
2.2.6	IR spectrum	DIN EN ISO 17294-2

2.3 PHYSICOCHEMICAL PARAMETERS

2.3.1	ph value	DIN 19684-1
2.3.2	Organoleptic evaluation	

2.4 TRADITIONAL ANALYSIS METHODS

Traditional analysis methods do not only regularly form the basis for the evaluation of materials in accordance with the conventional directives and regulations, but are often the only practical option for determining concentrations in special inquiries or matrices. Depending on the element, matrix and method, the concentration ranges recorded vary from 100% by weight to ppb (µg/kg). Unless otherwise specified, the prices stated do not include any preparation which may be necessary.

2.4.1	Ash content	DIN 51719	gravimetric
2.4.2	Alkaline active substances (as CaO)	EN 12945	AbfKlärV, Appendix 1, 1.3.2
2.4.3	Calcium oxide (CaO), reactive	DIN EN 197-1 Section 3.1	

2.4.4	Chloride (Cl)	DIN EN 196-21	Volhard
2.4.5	Chloride (Cl)	DIN EN 1744-1 (1998)	
2.4.6	Chromate (Cr[VI]) standard	DIN EN 196-10	photometric
2.4.7	Chromate (Cr[VI]) for cement only	DIN EN 196-10	photometric
2.4.8	Cyanide, total (CN_{tot})	DIN 38405-D13	photometric after distillation
2.4.9	Cyanide, easily dissociable ($CN_{l.fr.}$)	DIN 38405-D13	photometric
2.4.10	Iron, total (Fe)	Handbuch Eisenhüttenlabor	titrimetric
2.4.11	Iron, metallic (Fe_{met})	Handbuch Eisenhüttenlabor	titrimetric
2.4.12	Iron-(II)-oxide, in addition to Fe_{met}	Handbuch Eisenhüttenlabor	titrimetric
2.4.13	Iron-(III)-oxide, in addition to Fe_{met} and Iron-(II)-oxide	Handbuch Eisenhüttenlabor	calculated
2.4.14	Fe and V compounds		
2.4.15	Fluoride (F)		photometric after distillation
2.4.16	Free lime (CaO_{free})		Franke method
2.4.17	Free lime (CaO_{free}) (slag only)		conductometric
2.4.18	Fulvic acid	DIN EN 1744-1	
2.4.19	Annealing losses at 550 °C	DIN ISO 11465	gravimetric
2.4.20	Annealing losses at 975 °C	DIN EN 196-2	gravimetric
2.4.21	Annealing losses, calculated as sum CO_2 und H_2O		IR combustion
2.4.22	Annealing losses under nitrogen at 1000 °C		gravimetric
2.4.23	Calorific value	DIN 51900	

2.4.24	Carbon (CO_2), inorganically bound (TIC)	DIN ISO 10694	IR combustion
2.4.25	Carbon, organically bound (TOC)		IR combustion
2.4.26	Carbon, elemental (C_E)		IR combustion
2.4.27	Carbon, total (C_{tot})	DIN ISO 10694	IR combustion
2.4.28	Lipophilic substances	LAGA-Richtlinie KW/04	
2.4.29	Magnesium sulphate test	EN 1367-2	gravimetric
2.4.30	Sodium sulphate test	JUS B.B8.044	gravimetric
2.4.31	Methylene blue method (fines)	EN 933-9	
2.4.32	P_2O_5 citric acid extraction		photometric
2.4.33	P_2O_5 double extraction		photometric
2.4.34	Phosphorus pentoxide (P_2O_5)		gravimetric/ photometric
2.4.35	Puzzolanicity	DIN 1164	
2.4.36	Reactivity (CaO equivalent)	VDLUFA data sheet II.1, 6.7	titrimetric
2.4.37	Reactive iron sulphide particles	DIN EN 1744-1	
2.4.38	Sulphur, total (S_{tot})		IR combustion
2.4.39	Sulphur, total (S_{tot})		gravimetric after oxidation
2.4.40	Silicon dioxide (SiO_2)	DIN EN 196-2	gravimetric
2.4.41	Silicon dioxide, reactive	DIN EN 197-1 Section 3.2	
2.4.42	Silicon, water-soluble		
2.4.43	Silicon, CAL-soluble		
2.4.44	Nitrogen, nitrate (N)		photometric
2.4.45	Nitrogen, ammonium (N)		photometric after distillation

2.4.46	Nitrogen, total (N_{tot})		Kjeldahl, titrimetric
2.4.47	Nitrogen, total (N_{tot})	DIN 19684-4	IR combustion
2.4.48	Sulphate (SO_3)	DIN EN 1744-1	gravimetric
2.4.49	Sulphate (SO_3)	DIN EN 196-2	gravimetric
2.4.50	Sulphide (S^{2-})	DIN EN 196-2	titrimetric
2.4.51	Sulphide (S^{2-}), qualitative		
2.4.52	Acidity according to Baumann-Gully	DIN 4030-2	
2.4.53	Acid solubility	EN 12902	gravimetric
2.4.54	Clay, silt, sand and gravel content	DIN 18123	
2.4.55	Clay content	DIN 18123	
2.4.56	Loss on drying	DIN 38414-2	gravimetric
2.4.57	Insoluble residue (EDTA)	DINV ENV 196-4	
2.4.58	Insoluble residue (HNO_3)	DINV ENV 196-4	
2.4.59	Insoluble residue	DIN 52170-2	gravimetric
2.4.60	Insoluble residue	DIN 52170-3	gravimetric
2.4.61	Insoluble residue	DIN EN 196-2	gravimetric
2.4.62	Water (H_2O)		IR combustion
2.4.63	Water-soluble alkalis	DIN 1164	
2.4.64	Water-soluble components in aggregate	DIN EN 1744-1	
2.4.65	Sugars (in mortar, including preparation)		qualitative α-naphthol
2.4.66	Volatile components		gravimetric

2.5 ELUTION PROCESSES

2.5.1	Ammonium nitrate extraction		
2.5.2	Availability test	NEN 7371	50 l/kg pH7 and pH4
2.5.3	Calcium chloride extraction		
2.5.4	Filtration		
2.5.5	Percolation column procedure (D)	TP Gestein-StB Part 7.1.3	down-flow
2.5.6	Percolation column procedure (EU) long, thorough characterisation	DIN 19528	4 fractions column elution
2.5.7	Percolation column procedure (EU) short, conformity analysis	DIN 19528	1 fraction column elution
2.5.8	Percolation column procedure (EU)	DIN CEN/TS 14405	
2.5.9	Percolation column procedure (NL) BSB	NEN 7383 BSB	2 fractions column elution
2.5.10	Percolation column procedure (NL)	NEN 7373	7 fractions column elution
2.5.11	S4 batch test (2:1)	DIN 19529	
2.5.12	S4 batch test (10:1)	DIN 38414-4	
2.5.13	S4 batch test (10:1) modified	TP Gestein-StB Part 7.1.1	slag only 8/11 mm
2.5.14	Batch test I	EN 12457-1	2 l/kg < 4 mm
2.5.15	Batch test II	EN 12457-2	10 l/kg < 4 mm
2.5.16	Batch test III	EN 12457-3	2/8 l/kg < 4 mm
2.5.17	Batch test IV	EN 12457-4	10 l/kg < 10 mm
2.5.18	Tank test (NL), 64-day test	NEN 7375	hardened test samples
2.5.19	Tank test	DIN EN 1744-3	

2.5.20	Tank test	TP Gestein-StB Part 7.1.2	
2.5.21	Tank test with synthetic wastewater	NRW data sheet	
2.5.22	Aqueous extraction (stirring of powder samples)	VDZ method	
2.5.23	pH-stat method EU	prEN 14997	per pH value
2.5.24	pH-stat method pH 4/pH 11	LAGA EW98p	
2.5.25	pH-stat method, continuous	DIN EN 14997	8 pH values
2.5.26	Percolation column procedure (EU) (column elution)	DIN CEN/TS 16637-3	7 fractions
2.5.27	Tank test (EU), 64-day, monolithic samples Test/DSLT materials	DIN CEN/TS 16637-2	
2.5.28	Tank test (EU), 64-day, granular samples Test/GLHC Appendix A with low permeability	DIN CEN/TS 16637-2	
2.5.29	Batch test (1:1) for blasting abrasives	DIN EN ISO 11127-6/-7	

2.6 INSTRUMENTAL ANALYSIS

Instrumental analysis allows a great number of elements to be identified in a short time and with high precision. Depending on the element, matrix and method, the concentration ranges recorded vary up to ppt (ng/l). The selection of the analysis method is determined based on the element to be investigated, the matrix, and the degree of precision or detection limit required.

2.6.1	ICP-AES screening, semi-quantitative ((all elements from Li to U excluding N, O, F, Cl, Br, I)		eluate, solutions, water
2.6.2	ICP-AES analysis (all elements from Li to U excluding N, O, F, Cl, Br, I)	DIN 38406-E22	per element
2.6.3	ICP-MS analysis	DIN EN ISO 17294-2	per element

2.7 CHEMICOPHYSICAL PARAMETERS

2.7.1	Colouration SAC 254 nm	DIN 38404-C3
2.7.2	Colouration SAC 436 nm	DIN 38404-C3
2.7.3	Density	DIN 38404-C9
2.7.4	Colouration	EN ISO 7887 (1994-12)
2.7.5	Odour	DBV
2.7.6	Odour (acidulated)	DBV
2.7.7	Conductivity	DIN EN 27 888-C8
2.7.8	Temperature	DIN 38404-C4
2.7.9	pH value	DIN 38404-C5
2.7.10	Redox potential	

2.8 TRADITIONAL ANALYSIS METHODS

Traditional analysis methods do not only regularly form the basis for the evaluation of materials in accordance with conventional directives and regulations, but are often the only practical option for determining concentrations in special inquiries or matrices. Depending on the element, matrix and method, the concentration ranges recorded vary up to ppb (µg/l).

2.8.1	ANC/BNC acid/alkali neutralisation capacity		titrimetric
2.8.2	Evaporation residue (R)	DIN 38409-H1	gravimetric
2.8.3	Filterable substances	DIN 38409-H2	gravimetric
2.8.4	Hydrometer analysis	DBV data sheet "Additive water"	volumetric
2.8.5	Ammonium		photometric
2.8.6	Alkalinity pH 8.2 (KB8,2)	DIN 38409-H7-2-2	titrimetric
2.8.7	Bromide (Br^-)	EN ISO 10304-1	HPLC
2.8.8	CSB value	DIN 38409-H41	photometric, titrimetric

2.8.9	Calcite dissolution capacity		
2.8.10	Calcium (Ca)	DIN EN 196-2	potentiometric, titrimetric
2.8.11	Carbonate hardness		calculated
2.8.12	Chloride (Cl^-)	EN ISO 10 304-1	HPLC
2.8.13	Chloride (Cl^-)	EN 196-21	Volhard
2.8.14	Chloride (Cl^-) local		photometric
2.8.15	Chromate (VI)	DIN 38405-D24	photometric
2.8.16	Cyanide, free		fast method
2.8.17	Cyanide, total (CN_{tot})	DIN 38405-D13	photometric after solubilisation
2.8.18	Cyanide, weak acid dissociable (CN_{WAD})	DIN 38405-D13	fast method
2.8.19	Delta pH value		calculated
2.8.20	Detergents		
2.8.21	Iron(II) (Fe^{2+})	DIN 38406-E1	titrimetric
2.8.22	Fluoride (F^-)	DIN 38404 D4-1	potentiometric
2.8.23	Total hardness (°DGH)	DIN 38409-H6	calculated (incl. necessary analysis)
2.8.24	Equilibrium pH value		calculated
2.8.25	Hardness, carbonate hardness (°DKH)	DIN 38409-H6	
2.8.26	Humic substances		
2.8.27	Hydroxyl (OH^-)		titrimetric
2.8.28	Potassium permanganate index	EN ISO 8467 (H5)	titrimetric
2.8.29	Carbon dioxide, aggressive (CO_{2aggr})	DIN 38404-C10	
2.8.30	Carbon dioxide, free (CO_{2free})	DIN 38409-H7-2-2	

2.8.31	Carbon dioxide, associated (CO_{2assoc})	DIN 38409-H7-2	calculated
2.8.32	Lipophilic substances	DIN 38409-H17	
2.8.33	Magnesium (Mg)	DIN EN 196-2	potentiometric
2.8.34	Manganese (Mn)		photometric
2.8.35	MBAS	DIN 38409-H23-1	
2.8.36	Nitrate (NO_3^-)	EN ISO 10304-1	HPLC
2.8.37	Nitrate (NO_3^-)	DIN 38 05-9	photometric
2.8.38	Nitrite (NO_2^-)	DIN 38 05-10	photometric
2.8.39	Nitrite (NO_2^-)	EN ISO 10304-1	HPLC
2.8.40	Phosphate (PO_4^{3-})	DIN 38405-D11-1	photometric
2.8.41	Oxygen (O_2)	EN 25814	O_2 electrode
2.8.42	Acidity pH 4.3 (KS4,3)	DIN 38409-H7-1-2	titrimetric
2.8.43	Sulphur, total (S_{tot})		gravimetric after oxidation
2.8.44	Nitrogen, total (N_{tot})		Kjeldahl, titrimetric
2.8.45	Ammonia nitrogen (NH_4-N)	DIN 38406-E5-2	photometric after distillation
2.8.46	Ammonia nitrogen (NH_4-N)	DIN 38406-E5-1	photometric
2.8.47	Sulphate (SO_4^{2-})	DIN EN 196-2	gravimetric
2.8.48	Sulphate (SO_4^{2-})	EN ISO 10 304-1	HPLC
2.8.49	Sulphide (S^{2-})	DIN 38405-D26	titrimetric
2.8.50	Sulphide (S^{2-})	DIN 38405-D26	photometric
2.8.51	Sulphite (SO_3)	DEV D6	titrimetric
2.8.52	Thiosulphate ($S_2O_3^{2-}$)		titrimetric

2.8.53	Thiosulphate ($S_2O_3^{2-}$)	EN ISO 10304-1	HPLC
2.8.54	Thiocyanate (SCN)	EN ISO 10304-3	
2.8.55	Sugar		qualitative α-naphthol

2.9 ORGANIC COMPONENTS

The methods used in our laboratories for determining organic constituents generally aim to record groups of organic substances, known as sum parameters. The identification of individual substances is likewise possible after consultation with the laboratory. Depending on the element, matrix and method, the concentration ranges recorded vary up to ppb (µg/l).

2.9.1	AOX	DIN 38409 H14	
2.9.2	DOC	DIN EN 1484 H3	
2.9.3	EOX	DIN 38409 H8	
2.9.4	KW	E DIN EN 14039	
2.9.5	PAHs (TVO)	DIN 38407 F8	
2.9.6	PAHs (EPA)	EPA 610	
2.9.7	PCB	DIN 51527 GC-MS	
2.9.8	PCDD/PCDF (dioxins/furans)	17. BImSchV (NATO CCMS)	
2.9.9	Phenol index	DIN 38409 H16-1	
2.9.10	TOC	DIN ISO 10694	
2.9.11	Volatile halogenated hydrocarbons (solids) (eluate)	DIN 38407-F4 DIN 38407-F5	
2.9.12	BTEX (benzene and derivatives)	DIN 38407-F9	GC-FID
2.9.13	Chlorophenols, total	DIN EN 12673-F15	GC-MS

2.10 TEST PACKAGES IN CHEMICALS LABORATORY (EXCLUDING PREPARATION)

2.10.1	German Landfill Ordinance DK0	general solids
2.10.2	German Landfill Ordinance DK1-3	
2.10.3	German Fertiliser Ordinance	
2.10.4	German State Work Group on Soils, Solids (LAGA Boden Feststoff): Table II. 1.2-2	soil
2.10.5	German State Work Group on Soils, Eluate (LAGA Boden Eluat): Table II. 1.2-3	soil
2.10.6	German State Work Group on Household Waste Incineration Ash, Eluate (LAGA HMV-Aschen Eluat): Table II. 2.2-2	household waste incineration ash
2.10.7	German State Work Group on Household Waste Incineration Ash, Solids (LAGA HMV-Aschen Feststoff): Table II. 2.2-1	household waste incineration ash
2.10.8	German State Work Group on Recycling/ Construction Rubble, Eluate (LAGA Recycling/Bauschutt Eluat): Table II. 1.4-6	recycled construction material (RC)
2.10.9	German State Work Group on Recycling/ Construction Rubble, Solids (LAGA Recycling/Bauschutt Feststoff): Table II. 1.4-5	recycled construction material (RC)
2.10.10	North Rhine-Westphalia Decree EOS (NRW-Erlass EOS)	
2.10.11	North Rhine-Westphalia Decree HOS (NRW-Erlass HOS)	
2.10.12	North Rhine-Westphalia Decree HS (NRW-Erlass HS)	
2.10.13	North Rhine-Westphalia Decree LDS (NRW-Erlass LDS)	steel mill slag
2.10.14	North Rhine-Westphalia Decree RCL (NRW-Erlass RCL)	recycled construction material (RC)
2.10.15	North Rhine-Westphalia Decree SFA (NRW-Erlass SFA)	

2.10.16	North Rhine-Westphalia Decree SKA (NRW-Erlass SKA)	
2.10.17	North Rhine-Westphalia Decree SKG (NRW-Erlass SKG)	
2.10.18	North Rhine-Westphalia Decree WB (NRW-Erlass WB)	
2.10.19	RAL-GZ 510 EO slag	
2.10.20	RAL-GZ 510 HOS	
2.10.21	RAL-GZ 510 HS	
2.10.22	RAL-GZ 510 LD slag	
2.10.23	RAL-GZ 511 CUG water management features	metal slag
2.10.24	RAL-RG 501/1	recycled construction material (RC)
2.10.25	RoHS (2002/95/EC) excluding organics	
2.10.26	Sachsen-Anhalt-Min.-Blatt (1998), Tab. 10	
2.10.27	Ministerial Play Sand Decree (21.11.2018)	sand
2.10.28	Technical Instructions on Household Waste (TASI) of 14.05.1993, Appendix B	general solids
2.10.29	Technical Supply Conditions for Foundation and Construction Materials for Earthworks in Road Construction (TL BuB E) on the use of HMGM	
2.10.30	Technical Supply Conditions for Aggregates in Road Construction (TL Gestein-StB) for blast furnace slag	blast furnace slag BFS
2.10.31	Technical Supply Conditions for Aggregates in Road Construction (TL Gestein-StB) for ground granulated blast furnace slag	blast furnace slag BFS

2.10.32	Technical Supply Conditions for Aggregates in Road Construction (TL Gestein-StB) for RC construction materials	recycled construction material (RC)
2.10.33	Technical Supply Conditions for Aggregates in Road Construction (TL Gestein-StB) for steel mill slag	steel mill slag
2.10.34	Technical Supply Conditions for Armourstone (TL Wasserbausteine 2003) for CUS	general solids
2.10.35	Technical Supply Conditions for Armourstone (TL Wasserbausteine 2003) for steel mill slag	general solids
2.10.36	Technical Supply Conditions for Grit (TL-Streu)	general solids
2.10.37	German Waste Stowing Ordinance (VersatzV) Appendix 1 Table 1 and 1a – Solids	general solids
2.10.38	German Waste Stowing Ordinance (VersatzV) Appendix 1 Table 2 – Eluates	
2.10.39	Additive water for concrete according to EN 1008	general liquids (water, eluate etc.)
2.10.40	Additive water for concrete according to EN 1008 Table 1 (preliminary test) with sedimentable substances	general liquids (water, eluate etc.)
2.10.41	Water, solids and gases aggressive to concrete DIN 4030	water
2.10.42	Water, solids and gases aggressive to concrete DIN 4030 fast method	water

3. MINERALOGICAL / PHYSICAL INVESTIGATIONS

3.1 X-RAY DIFFRACTION ANALYSIS

3.1.1	Sample preparation (incl. quantitative sample division, drying,crushing)	grain sizes < 2 mm material pieces for quantitative assessment
3.1.2	Standard analysis (5-75° 2Theta) incl. preparation, equipment costs	plus preparation
3.1.3	Standard analysis (5-75° 2Theta), incl. installation, equipment costs, semi-quantitative assessment	grain sizes < 2 mm material pieces
3.1.4	Quantitative Analysis (Rietveld Method) (5-92° 2Theta), installation, preparation incl. internal standard, equipment costs, quantitative assessment (Rietveld)	

3.2 MICROSCOPIC INVESTIGATIONS

3.2.1	Determining glass content of ground granulated blast furnace slag in grain fraction 40/60 µm (incl. preparation, preparation creation and count)	ZKG, 1994 No.11, S. 658
3.2.2	Determining glass content of cement in grain fraction 40/60 µm (incl. preparation, preparation creation and count)	DIN EN 196-4
3.2.3	Qualitative evaluation of a material sample or microscopic preparation (transmitted and incident light) incl. image analysis	
3.2.4	Determining melting behaviour using hot stage microscope (incl. manufacturing test sample, up to 1.600 °C, neutral or reducing atmosphere)	DIN 51730

3.3 PHYSICAL/GEOSCIENTIFIC INVESTIGATIONS

3.3.1	Petrographic appraisal of aggregate (visual appraisal, weighing)	DIN 321-3 DAfStB Alkali-Richtlinie
3.3.2	Determining reactive flint, chalk flint or opaline sandstone in aggregate (visual appraisal, weighing, determining density or boiling test)	DAfStB Alkali-Richtlinie
3.3.3	Determining particle size distribution using laser granulometry	ISO 13310
3.3.4	Determining pore content and distribution using Hg pressure porosimeter (up to 400 MPa, incl. preparation and Hg distillation)	
3.3.5	Determining thermal capacity and conductivity using TPS method (incl. preparation)	ISO 22007-2
3.3.6	Air jet screening	

4. METALLURGICAL TREAMENTS AND INVESTIGATIONS

4.1 MELTING IN THE TAMMANN FURNACE AND OPERATIONAL EXPERIMENTS

4.1.1	Melting in the Tammann furnace (up to 1,680 °C) for reduced slag in graphite crucible	higher temperature after agreement
4.1.2	Melting in the Tammann furnace (up to 1,680 °C) for non-reduced slag in graphite crucible	higher temperature after agreement
4.1.3	Melting in the Tammann furnace (up to 1,680 °C) for oxidised slag under neutral conditions (ceramic crucible)	higher temperature after agreement

4.1.4	Variation of cooling conditions Pouring for air cooling, water granulation, indirectly cooled plates, etc.	also possible on site
4.1.5	Determining the electrical conductivity of liquid slag in the Tammann furnace (up to 1,680 °C)	
4.1.6	Manufacturing synthetic slag	
4.1.7	Supervision/implementation of operational experiments (e.g. hot sampling)	

4.2 THERMODYNAMIC CALCULATIONS

4.2.1	Calculation of viscosity for blast furnace slag	
4.2.2	Calculation of thermal capacity	
4.2.3	Calculation of thermal conductivity of slag	only in conjunction with hot stage microscopy (3.2.4)

4.3 TEMPERING IN THE MUFFLE FURNACE

4.3.1	Tempering in the muffle furnace up to 1,400 °C, furnace chamber 500 x 500 x 500 mm (FF products, glass, ceramic, ash, slag etc.)	oxidising/neutral/ reducing atmosphere
4.3.2	Tempering in the muffle furnace up to 1,750 °C, furnace chamber 200 x 300 x 250 mm (FF products, glass, ceramic, ash, slag etc.)	Oxidierende/Neutrale Atmosphäre

5. FERTILISER, SOIL AND PLANT INVESTIGATIONS

5.1 FERTILISER INVESTIGATIONS

5.1.1	P_2O_5 water extraction	VDLUFA data sheet II. 1, 4.1.7	photometric
5.1.2	P_2O_5 citric acid extraction	VDLUFA data sheet II. 1, 4.1.3	photometric
5.1.3	P_2O_5 double extraction		photometric
5.1.4	P_2O_5 neutral ammonium citrate extraction	EN 15957:2011-09	photometric
5.1.5	Fertilisers containing lime – determining the alkaline-effective components (neutralisation value)	EN 12945:2014	titrimetric
5.1.6	Reactivity (CaO equivalent) in carbonatic and silicate lime fertilisers	EN 13971:2011	titrimetric
5.1.7	Reactivity (CaO equivalent) in carbonatic and silicate lime fertilisers	EN 16357:2013-07	potentiometric
5.1.8	Fertilisers containing lime – determining the lime effect in the soil (soil incubation method)	EN 14984:2016-07	potentiometric

5.2 SOIL INVESTIGATIONS

5.2.1	Determining the pH value	VDLUFA data sheet I, A 5.1.1
5.2.2	Determining the lime requirements of arable land and grassland soil based on pH value	VDLUFA data sheet I, A 5.2.2
5.2.3	Determining phosphorus and potassium content using calcium acetate lactate (CAL) extraction	VDLUFA data sheet I, A 6.2.1.1
5.2.4	Determining water-soluble phosphorus content by volume	VDLUFA data sheet I, A 6.2.4.1
5.2.5	Determining plant-available magnesium in calcium chloride extraction	VDLUFA data sheet I A 6.2.3.2

5.2.6	Determining content of magnesium, sodium and the trace nutrients copper, manganese, zinc and boron in calcium chloride/DTPA extraction	VDLUFA data sheet I, A 6.4.1
5.2.7	Determining the soluble sulphur in calcium chloride extraction (Smin)	VDLUFA data sheet I, A 6.3.1
5.2.8.1	Determining the elements in the soil that are soluble in aqua regia at atmospheric pressure in a reflux system	EN 13657
5.2.8.2	Determining the elements in the soil that are soluble in aqua regia using microwave pressure solubilisation	EN 13657

5.3 PLANT INVESTIGATIONS

5.3.1	Determining phosphorus, potassium, magnesium, sulphur and trace elements in plants using microwave-assisted nitric acid solubilisation

6. CEMENT AND MORTAR INVESTIGATIONS

6.1 LABORATORY CEMENT MANUFACTURING

6.1.1	Preparation of a raw material ≤ 700 g in oscillating disc mill
6.1.2	Preparation of a raw material > 700 g and ≤ 10 kg in ball mill
6.1.3	Manufacturing of test cements
6.1.4	Drying of raw material ≤ 10 kg

6.2 PHYSICAL PROPERTIES

6.2.1	Density	
6.2.1.1	True density (pycnometer method)	Journal series of the cement industry, issue 33
6.2.1.2	Gross density (gas pycnometer)	Journal series of the cement industry, issue 33
6.2.1.3	Gross density (pycnometer)	DIN EN 1097-6, Appendix G (e.g. filler)
6.2.1.4	Bulk density (according to Böhme)	DIN EN 459-2
6.2.2	Particle size analysis	
6.2.2.1	Screen analysis (dry screening)	DIN EN 933-1
6.2.2.2	Screen analysis (air jet screening) up to screens of 2 mm	DIN EN 196-6 DIN EN 933-10
6.2.2.3	Screen analysis (wet screening)	DIN EN 450-1 ASTM C 430
6.2.2.4	Grain size distribution of ground granulated blast furnace slag (dry screening, 6 screens)	DIN EN 933-1
6.2.2.5	Grain size distribution of filler according to DIN EN 12620 air jet screening	DIN EN 933-10
6.2.2.6	Grain size distribution (laser granulometer)	ISO 13320
6.2.2.7	Specific surface area (according to Blaine)	DIN EN 196-6
6.2.2.8	Specific surface area (according to Blaine), incl. true density	DIN EN 196-6

6.2.2.9	Specific surface area (according to BET, 5-point measurement)	DIN ISO 9277
6.2.2.10	Flow capacity according to IMSE	in-house PA
6.2.3	Porosity	
6.2.3.1	Porosity calculated from true and gross density	
6.2.3.2	Hg porosity & pore size distribution – in relation to sample – in relation to mortar mix – plus preparation from soil (min. € 100.00)	
6.2.4	Moisture	
6.2.4.1	Moisture (drying)	in-house PA
6.2.4.2	Moisture (drying scale)	in-house PA
6.2.5	Grindability	
6.2.5.1	Grindability according to Zeisel (original grain size) incl. true density; without grain size distribution	Journal series of the cement industry, issue 14
6.2.5.2	Grindability according to Zeisel (fraction 0.5–1.0 mm) incl. preparation and true density; without grain size distribution	Journal series of the cement industry, issue 14
6.2.6	Hydration heat	
6.2.6.1	Isothermal heat flow calorimeter (TAM Air)	DIN EN 196-11
6.2.6.2	Solution heat	DIN EN 196-8
6.2.6.3	Wet slaking curve t60	DIN EN 459-2

6.2.7	Additional tests	
6.2.7.1	Angle of repose	in-house PA
6.2.7.2	Vickers micro-hardness – Standard: HV0,1 with 100 g imposed load – HV with free imposed load selection	

6.3 DETERMINING CEMENT CONSTITUENTS

6.3.1	Ground granulated blast furnace slag content, microscopic/chemical	DIN 1164-31
6.3.2	X-ray analysis with Rietveld refinement	in-house PA

6.4 UNSET MORTAR INVESTIGATIONS

6.4.1	Manufacturing and storage of mortar	
6.4.1.1	Manufacturing and storage of prisms at 20 °C, at 5 °C/8 °C	DIN EN 196-1 DIN EN 1015-2
6.4.1.2	Manufacturing and storage of prisms at 5 °C/8 °C	DIN EN 196-1 DIN EN 1015-2
6.4.1.3	Manufacturing and storage of cubes at 20 °C	ASTM C109
6.4.2	Water demand	DIN EN 196-3
6.4.3	Setting times + water demand	DIN EN 196-3
6.4.4	Volume stability according to Le Chatelier	DIN EN 196-3
6.4.5	Consistency – slump	DIN EN 1015-3 DIN EN 413-2 DIN EN 459-2

6.4.6	Air content + gross density (litre jug)	DIN EN 1015-7 DIN EN 413-2 DIN EN 459-2
6.4.7	Gross density (litre jug)	DIN EN 1015-6 DIN 18555-3
6.4.8	Cr(VI) content, incl. manufacturing the mortar	DIN EN 196-10

6.5 HARDENED MORTAR INVESTIGATIONS

6.5.1	Strengths	
6.5.1.1	Flexural and compressive strength, incl. manufacturing	DIN EN 196-1
6.5.1.2	Flexural strength (individual)	DIN EN 196-1
6.5.1.3	Flexural and compressive strength of supplied mortar prisms incl. storage, gross density	DIN EN 1015-10 DIN EN 1015-11
6.5.1.4	Compressive strength of cube, incl. manufacturing	ASTM C 109
6.5.1.5	Compressive strength in the interstice	DIN 18555-9
6.5.1.6	Bond strength	DIN EN 1052-3
6.5.2	Young’s modulus	
6.5.2.1	Dynamic Young’s modulus (pulse excitation)	in-house PA
6.5.2.2	Static Young’s modulus or transversal strain modulus, incl. manufacturing	DIN EN 13412
6.5.3	Density	
6.5.3.1	Gross density (set mortar)	DIN EN 1015-10
6.5.3.2	Dry gross density	DIN EN 1015-10

6.5.4	Additional hardened mortar tests	
6.5.4.1	Water absorption coefficient	DIN EN 1015-18
6.5.4.2	C value (incl. report)	NEN 5970
6.5.4.3	Sources/shrinkage – basic test with 5 measurements – further appointments	DIN EN 12617-4
6.5.4.4	Air void characteristic values	DIN EN 480-11

6.6 DURABILITY

6.6.1	Sulphate resistance	
6.6.1.1	Wittekindt method – at 20 °C – at 8 °C	in-house PA
6.6.1.2	Small prism method according to Koch/Steinegger at 20 °C	in-house PA
6.6.1.3	SVA method – at 20 °C – at 8 °C	in-house PA
6.6.2	Alkali-silica reaction quick test – incl. preparation for single determination – incl. preparation for double determination	DAfStB Alkali Guideline
6.6.3	Air void characteristic values	DIN EN 480-11

6.7 SUMMARISED INVESTIGATIONS

6.7.1 Testing supplied cement

6.7.1.1	Manufacturing and storage of mortar prisms, true density, spec. surface area (Blaine), grain size distribution, water demand, setting times (Vicat), volume stability (Le Chatelier), compressive and flexural strength for 2 inspection appointments	DIN EN 197-1
6.7.1.2	Additional inspection appointments	DIN EN 197-1

6.7.2 Mortar method to classify ground granulated blast furnace slag according to DIN EN 15167

6.7.2.1	Preparing the ground granulated blast furnace slag in the ball mill, fineness according to Blaine, grain size distribution
6.7.2.2	Manufacturing, storage and testing the test mortar
6.7.2.3	Manufacturing, storage and testing the reference mortar

6.7.3 Mortar method to classify ground granulated blast furnace slag according to ASTM C989

6.7.3.1	Preparing the ground granulated blast furnace slag in the ball mill, fineness according to Blaine, PSD, gross density
6.7.3.2	Manufacturing, storage and testing the test mortar
6.7.3.3	Manufacturing, storage and testing the reference mortar

6.7.4 Mortar method to classify mineral fly ash according to DIN EN 450-1

6.7.4.1	Moisture, fineness according to Blaine, grain size distribution, wet screening 45 µm, optional BET

6.7.4.2	Manufacturing, storage and testing the test mortar	
6.7.4.3	Manufacturing, storage and testing the reference mortar	
6.7.5	Mortar method to classify mineral fly ash according to ASTM C618	
6.7.5.1	Moisture, fineness according to Blaine, wet screening 45 µm	
6.7.5.2	Manufacturing, storage and testing the test mortar	
6.7.5.3	Manufacturing, storage and testing the reference mortar	

7. CONCRETE TESTS

7.1 AGGREGATES

7.1.1	Sampling	DIN EN 932-1
7.1.2	Grain size distribution	DIN EN 933-1
7.1.2.1	Dry screening (up to maximum aggregate size of 32 mm)	
7.1.2.2	Dry screening (maximum aggregate size >32 mm, ≤ 63 mm)	
7.1.2.3	Wet screening	
7.1.2.4	Air jet screening	
7.1.2.5	Fines content (< 0.125 mm), incl. sample preparation	
7.1.3	Intrinsic moisture (water content by kiln drying)	

7.1.4.	Bulk density	DIN EN 1097-3
7.1.5	Gross density and water absorption	DIN EN 1097-6
7.1.5.1	Pycnometer method for aggregates with a maximum aggregate size up to 32 mm	DIN EN 1097-6
7.1.5.2	Method for aggregates with a maximum aggregate size over 32 mm	DIN EN 1097-6
7.1.6	Resistance to frost (10 freeze-thaw cycles)	DIN EN 1367-1
7.1.7	Magnesium sulphate test	EN 1367-2
7.1.8	Harmful components	
7.1.8.1	Determining fines content	DIN EN 933-1
7.1.9	Determining organic components	
7.1.9.1	Humus content	DIN EN 1744-1/ NEN 5919
7.1.9.2	Fulvic acid content	DIN EN 1744-1
7.1.9.3	Floating contaminants	DIN EN 1744-1
7.1.9.4	Fe and Va compounds	NEN 5923
7.1.9.5	Seashell content	DIN EN 933-7/ NEN 5922
7.1.10	Acid-soluble sulphates, incl. sample preparation	DIN EN 1744-1, Abschn. 12
7.1.11	Total sulphur content, incl. sample preparation	DIN EN 1744-1, Abschn. 11
7.1.12	Chloride (double testing, incl. sample preparation)	DIN EN 1744-1, Abschn. 7
7.1.13	Determining grain geometry	

7.1.13.1	Flakiness index for each grain class	DIN EN 933-3
7.1.13.2	Grain geometry index for each grain class	DIN EN 933-4
7.1.14	Determining the flow coefficient for fine aggregates (incl. gross density measurement)	DIN EN 933-6

7.2 ADDITIVES (FLY ASH/ROCK FLOUR)

7.2.1	Suitability testing for mineral fly ash	DIN EN 450

7.3 UNSET CONCRETE

7.3.1	Sampling	DIN EN 12350-1
7.3.2	Designing a concrete mixture for known properties of starting materials	
7.3.3	Manufacturing a laboratory mixture	
7.3.4	Manufacturing and storage of samples	DIN EN 12390-2
7.3.5.1	Consistency with a compaction test	DIN EN 12350-4
7.3.5.2	Consistency with the flow table	DIN EN 12350-5
7.3.5.3	Consistency with the slump test	DIN EN 12350-2
7.3.6	Gross density	DIN EN 12350-6
7.3.7	Concrete composition	DIN 52171

7.3.8	Water-cement ratio (w/c ratio) by drying unset concrete in a drying vessel	DIN 1048-1
7.3.9	Air content using the pressure equalisation method	DIN EN 12350-7
7.3.10	Pore size distribution and air void characteristic values using DBT device	

7.4 HARDENED CONCRETE

7.4.1	Moisture content of hardened concrete	DIN 1048-5
7.4.2	Gross density measurement by weighing underwater	DIN EN 12390-7
7.4.3	Dry gross density of hardened concrete pieces	
7.4.4	Manufacturing a test sample from hardened concrete (sawing work)	
7.4.5	Comparison of test samples with cement paste	
7.4.6	Compressive strength of a test sample supplied ready for testing, incl. storage, geometry, dimensions and hardened concrete gross density	DIN EN 12390-3
7.4.7	Flexural strength of a bar supplied ready for testing, incl. storage, geometry, dimensions and hardened concrete gross density	DIN EN 12390-5
7.4.8	Splitting tensile strength of a concrete body supplied ready for testing, incl. storage, geometry, dimensions and shardened concrete gross density	DIN EN 12390-6
7.4.9	Water impermeability of a slab supplied ready for testing 12 x 20 x 20 mm	DIN EN 12390-8
7.4.10	Water absorption	DAfStb, issue 422

7.4.10.1	Water absorption at atmospheric pressure	
7.4.11	Porosity	
7.4.11.1	Total porosity via the ratio of gross density/density	DAfStb, issue 422
7.4.11.2	Pore content and pore distribution relative to the binding agent, incl. preparation	mercury pressure porosimeter
7.4.11.3	Pore content and pore distribution relative to the mortar, incl. preparation	mercury pressure porosimeter
7.4.12	Depth of carbonation	phenolphthalein solution DIN EN 14630
7.4.13	Young's modulus	
7.4.13.1	static	DIN 1048-5
7.4.13.2	dynamic (prismatic test sample)	impulse excitation
7.4.13.3	dynamic (other geometry)	impulse excitation
7.4.14	Resistance to freeze-thaw loading, with and without simultaneous de-icing agent loading	
7.4.14.1	Weathering on 2 cubes up to 100 freeze-thaw cycles	cube method DIN/TS 12390-9
7.4.14.2	Weathering on 5 test samples up to 56 freeze-thaw cycles, incl. ultrasound measurement	CIF test DIN/TS 12390-9/ BAW data sheet (MFB)
7.4.14.3	Weathering on 5 test samples up to 28 freeze-thaw cycles, incl. ultrasound measurement	CDF test DIN/TS 12390-9/ BAW data sheet (MFB)
7.4.15	Chloride migration	DIN EN 12390-11 BAW data sheet (MDCC)
7.4.16	Removal of concrete cores	
7.4.17	Time expended and km travelled	

7.4.18	Core bit wear	
7.4.19	Sealing bore holes	
7.4.20	Visual evaluation of core samples, specifying dimensions, aggregate microstructure, position and diameter of reinforcement, incl. photo	
7.4.21	Preparation (sawing and grinding) and testing of core samples for compressive strengths, incl. gross density	DIN EN 12390-3
7.4.21.1	Ø 50 mm	
7.4.21.2	Ø 80 mm	
7.4.21.3	Ø 100 mm	
7.4.21.4	Ø 150 mm	
7.4.21.5	Ø 200 mm	
7.4.22	Binding agents containing ground granulated blast furnace slag, qualitative	sulphide test
7.4.23	Composition of hardened cement mortar (insoluble residue, CO_2, H_2O, dry gross density, grading curve)	
7.4.23.1	Cement content with grain crushing of aggregates	DIN 52170-2
7.4.23.2	Cement content without grain crushing of aggregates	DIN 52170-3
7.4.23.3	Grading curve of eluted aggregates	DIN EN 933-1
7.4.24	Composition of hardened concrete insoluble residue, CO_2, H_2O, dry gross density, grading curve)	
7.4.24.1	Cement content with grain crushing of aggregates	DIN 52170-2

7.4.24.2	Cement content without grain crushing of aggregates	DIN 52170-3
7.4.24.3	Grading curve of eluted aggregates	DIN EN 933-1
7.4.25	Elution of steel fibres, determining steel fibre content	
7.4.26.1	SO_3 in concrete, absolute, incl. sample preparation	
7.4.26.2	SO_3 in concrete, calculated for binding agents, incl. sample preparation	
7.4.26.3	SO_3 in concrete, absolute, for analytically pure samples	
7.4.26.4	SO_3 in concrete, calculated for binding agents, in analytically pure samples	
7.4.27.1	Cl^- in concrete, absolute, incl. sample preparation	
7.4.27.2	Cl^- in concrete, calculated for binding agents, incl. sample preparation	
7.4.27.3	Cl^- in concrete, absolute, for analytically pure samples	
7.4.27.4	Cl^- in concrete, calculated for binding agents, in analytically pure samples	
7.4.28	Fly ash, qualitative	
7.4.29	Strength testing with the rebound hammer, incl. preparation of the test surface	DIN EN 12504-2
7.4.30	Surface/adhesive/ pull strength	DAfStb Guideline/ZTV-Ing.
7.4.30.1	without drilling a circular groove	
7.4.30.2	with drilling a circular groove	
7.4.31	Crack survey, setting of gypsum marks, shrinkage measurements with extensometer, reinforcement coverage using profometer etc.	

7.4.32	Concrete engineering and handling water-polluting substances	
7.4.32.1	Penetration of test liquid into uncracked concrete	DAfStb Guideline
7.4.32.2	Determining the damage depth of liquids that are aggressive to concrete	DAfStb Guideline

8. AGGREGATES FOR EARTHWORKS, ROAD CONSTRUCTION AND HYDRAULIC ENGINEERING

8.1 SAMPLE PREPARATION

8.1.1	Sample preparation (crushing, grinding)	
8.1.2	Sample division	DIN EN 932-2
8.1.3	Intrinsic moisture (water content by oven drying)	DIN EN 1097-5

8.2 GENERAL MATERIAL PROPERTIES

8.2.1	Visual evaluation of aggregate samples	DIN EN 932-3
8.2.2	Petrographic and mineralogical investigation	
8.2.3	Substance composition of RC construction materials	TP Gestein-StB 3.1.5, DIN EN 933-11
8.2.4	Particle density of aggregates ≤ 31.5 mm (pycnometer method)	DIN EN 1097-6, Appendix A.4

8.2.5	Particle density of aggregates > 31.5 mm (wire basket method)	TP Gestein-StB 3.2.2/ DIN EN 1097-6, Appendix A.3
8.2.6	Water absorption of aggregates	DIN EN 1097-6, Appendix B
8.2.7	Particle density and water absorption of armour stones/track ballast (wire basket method)	TP Gestein-StB 3.2.2/ DIN EN 1097-6, Appendix B/ DIN EN 13383-2, 13450

8.3 GRANULOMETRIC PROPERTIES

8.3.1	Grain size distribution	
8.3.1.1	Dry sieving (maximum grain size ≤ 31.5 mm)	TP Gestein-StB 4.1.2/ DIN EN 933-1
8.3.1.2	Dry sieving (maximum grain size > 31.5 mm)	TP Gestein-StB 4.1.2/ DIN EN 933-1
8.3.1.3	Determining fines content of grains as delivered (washing)	TP Gestein-StB 4.1.2/ DIN EN 933-1
8.3.1.4	Determining fines content of a construction material mixture (washing)	TP Gestein-StB 4.1.2/ DIN EN 933-1
8.3.1.5	Grain size distribution of fine aggregates (air jet screening.)	TP Gestein-StB 4.1.3/ DIN EN 933-10
8.3.1.6	Grain size distribution of filler (air jet screening)	TP Gestein-StB 4.1.4/ DIN EN 933-10
8.3.1.7	Grain size distribution (laser granulometer)	
8.3.1.8	Rock size distribution of armour stones, incl. rock geometry	DIN EN 13383-2
8.3.1.9	Mass distribution of armour stones	DIN EN 13383-2

8.3.2	Determining grain geometry	
8.3.2.1	Flakiness index	TP Gestein-StB 4.3.1/ DIN EN 933-3
8.3.2.2	Shape index	TP Gestein-StB 4.3.2 DIN EN 933-4
8.3.3	Angularity	TP Gestein-StB 4.4 DIN EN 933-5
8.3.4	Determining the flow coefficient for fine aggregates, incl. gross density measurement	TP Gestein-StB 4.7.3 DIN EN 933-6
8.3.5	Bulk density	TP Gestein-StB 3.2.1, 4.5/DIN EN 1097-3
8.3.6	Humus content	DIN EN 1744-1
8.3.7	Fulvic acid content	DIN EN 1744-1
8.3.8	Floating contaminants	DIN EN 1744-1
8.3.9	Acid-soluble sulphates	DIN EN 1744-1
8.3.10	Total sulphur content	DIN EN 1744-1
8.3.11	Chloride	DIN EN 1744-1

8.4 RESISTANCE TO WEATHERING

8.4.1	Volume stability	
8.4.1.1	Steam test on steel mill slag (24 h), incl. sample preparation	TP Gestein-StB 6.7.3/ DIN EN 1744-1
8.4.1.2	Steam test on steel mill slag (24 h) on prepared aggregate sample	TP Gestein-StB 6.7.3/ DIN EN 1744-1
8.4.1.3	Steam test on steel mill slag (168 h), incl. sample preparation	TP Gestein-StB 6.7.3/ DIN EN 1744-1
8.4.1.4	Steam test on steel mill slag (168 h) on prepared aggregate sample	TP Gestein-StB 6.7.3/ DIN EN 1744-1
8.4.1.5	Sample cell test, incl. sample preparation	TP Gestein-StB 6.7.4

8.4.1.6	Sample cell test on prepared aggregate sample	TP Gestein-StB 6.7.4	
8.4.1.7	Sample cell test on finished test samples	TP Gestein-StB 6.7.4	
8.4.1.8	Free lime content CaO_{free}, incl. sample preparation		conductometric
8.4.1.9	Lime decomposition of blast furnace slag	TP Gestein-StB 6.7.5/ DIN EN 1744-1	
8.4.1.10	Iron decomposition of blast furnace slag	TP Gestein-StB 6.7.6/ DIN EN 1744-1	
8.4.1.11	Boiling test on armour stones	DIN EN 13383-2	
8.4.2	Resistance to frost loading		
8.4.2.1	Freeze-thaw cycle trial on coarse aggregates (grain size 4–63 mm)	TP Gestein-StB 6.3.1/ DIN EN 1367-1	
8.4.2.2	Freeze-thaw cycle trial on coarse aggregates (grain size 4–63 mm)	TP Gestein-StB 6.3.4/ DIN EN 1367-6	
8.4.2.3	Freeze-thaw cycle trial on fine aggregates (sand)	TP Gestein-StB 6.3.3	
8.4.2.4	Freeze-thaw cycle trial on armour stones	DIN EN 13383-2	
8.4.3	Magnesium sulphate test	TP Gestein-StB 6.4/ DIN EN 1367-2	
8.4.4	Resistance to heat loading (plus impact and Los Angeles abrasion test)	TP Gestein-StB 6.5/ DIN EN 1367-5	
8.4.5	Water sensitivity of fine aggregates (batch abrasion method)	TP Gestein-StB 6.6.3	

8.5 RESISTANCE TO MECHANICAL LOADING

8.5.1	Aggregate crushing value for grit (8/12.5 mm), plus gross density calculation	TP Gestein-StB 5.1.2/ DIN EN 1097-2
8.5.2	Aggregate crushing value for crushed aggregate (> 31.5 mm), plus gross density calculation	TP Gestein-StB 5.1.3/ DIN 52115-2/ DIN EN 13450
8.5.3	Los Angeles abrasion test on grit (10/14 mm)	TP Gestein-StB 5.3.1.1 DIN EN 1097-2
8.5.4	Los Angeles abrasion test on gravel (> 31.5 mm)	TP Gestein-StB 5.3.1.2
8.5.5	Pressure test, incl. drilling, cutting, grinding	TP Gestein-StB 5.2/ DIN EN 1926
8.5.6	Polished stone value (PSV)	TP Gestein-StB 7.4.1/ DIN EN 1097-8
8.5.7	Micro-Deval test (resistance to abrasion)	TP Gestein-StB 5.5.2/ DIN EN 1097-1
8.5.8	Nordic abrasion test (resistance to wear from spiked tyres), incl. sample preparation	DIN EN 1097-9
8.5.9	Nordic abrasion test on prepared aggregate sample	DIN EN 1097-9

8.6 COMPACTION AND LOAD-BEARING CAPACITY

8.6.1	Proctor test Cylinder diameter Ø = 100 mm Ø = 150 mm Ø = 250 mm	TP Gestein-StB 3.2.3/ DIN EN 13286-2
8.6.2	Static CBR test	DIN EN 13286-47
8.6.3	Dynamic CBR test	TP Gestein-StB 5.6
8.6.4	Plate-loading test where a counterweight is provided by the client	DIN 18134

8.6.5	Self-hardening of steel slag	RuA-StB
8.6.6	Density calculation for soil	
8.6.6.1	Cutter cylinder method	DIN 18125-2
8.6.6.2	Sand replacement method	DIN 18125-2
8.6.6.3	Balloon method	DIN 18125-2

8.7 OTHER TESTS

8.7.1	Skid resistance test (SRT and outflow meter)	TP Griff-StB
8.7.2	Macro-texture depth (sand patch method)	DIN EN 13036-1
8.7.3	Water permeability coefficient when optimal water content is present	DIN 18130-1
8.7.4	Permeability test (double-ring infiltrometer, field test)	
8.7.5	Consistency limits	
8.7.5.1	Flow limits	
8.7.5.2	Roll-out limit	DIN 18122
8.7.5.3	Shrinkage limit	DIN 18122
8.7.6	Load-bearing capacity of a road structure, deflection measurements (Benkelman beam)	

9. BITUMEN AND ASPHALT

9.1 BITUMEN AND BINDING AGENTS CONTAINING BITUMEN

9.1.1	External structure	DIN EN 1425
9.1.2	Needle penetration	DIN EN 1426
9.1.3	Ring-and-ball softening point	DIN EN 1427
9.1.4	Fraaß breaking point	DIN EN 12593
9.1.5	Elastic recovery	DIN EN 13398
9.1.6	Density	DIN EN 15326
9.1.7	Ash content	DIN 52005
9.1.8	Resistance to hardening under the influence of heat and air (RFT method)	DIN EN 12607-3

9.2 ASPHALT, INDIVIDUAL TESTING

9.2.1	External structure	
9.2.2	Binding agent content	
9.2.2.1	Recovery process	TP Asphalt-StB, Parts 1 & 3
9.2.2.2	Differential method	TP Asphalt-StB, Part 1
9.2.3	Determining grain size composition through dry screening	TP Asphalt-StB, Part 2
9.2.4	Determining the gross density of asphalt	TP Asphalt-StB, Part 5
9.2.5	Determining the density by volume of asphalt	TP Asphalt-StB, Part 6
9.2.6	Determining the adhesion between rock and bitumen (affinity)	TP Asphalt-StB, Part 11

9.2.7	Manufacturing asphalt test samples from mixed materials supplied, using the Marshall compaction device	TP Asphalt-StB, Part 30
9.2.8	Determining Marshall stability and flow value	TP Asphalt-StB, Part 34
9.2.9	Manufacturing cast asphalt cubes from mixed materials supplied	TP Asphalt-StB, Part 20
9.2.10	Penetration depth in cast asphalt cubes	TP Asphalt-StB Part 20
9.2.11	Coating thickness on core sample	
9.2.12	Layer separation in core sample	
9.2.13	Layer bond according to Leutner	TP Asphalt-StB, Part 80
9.2.14	Additional asphalt test on request	

LIST OF ABBREVIATIONS

AbfKlärV	German Sewage Sludge Ordinance
BAU O NW	Construction Regulations of North Rhine-Westphalia
BAW	Federal Waterways Engineering and Research Institute
BImSchV	German Emissions Control Ordinance
BÜV	Building Materials Monitoring and Certification Association
DAfStb	German Reinforced Concrete Committee
DAfStb Alkali-Richtlinie	German Reinforced Concrete Committee Alkali Guidelines
DBV	German Concrete Association
EOS	Electric Arc Furnace slag
Handbuch für das Eisenhüttenlaboratorium	Ironworks Laboratory Manual
HOS	Blast furnace slag
HS	Granulated blast furnace slag
HV	Vickers hardness
KW	Hydrocarbons
LAGA	Working Group of the Federal States on Waste
LAGA-Richtlinie	Guidelines of the Working Group of the Federal States on Waste
LDS	Basic Oxygen Furnace slag
PA	Inhouse method
RAL	German Institute for Quality Assurance and Labelling
RAP Stra	Guidelines for the Recognition of Testing Bodies for Building Materials in Road Construction

RCL	Recycled aggregate
RuA-StB	Guidelines for the Environmentally Compatible Use of Industrial By-Products and Recycled Building aggregates in Road Construction
Schriftenreihe der Zementindustrie	Journal series of the cement industry
SFA	Hard coal fly ash
SKA	Hard coal boiler ash
SKG	Slag tap granulate
SVA	Committee of experts
TL BuB E-StB 20	Technical Supply Conditions for Ground and Construction Materials for Earthworks in Road Construction
TL G SoB-StB 2020	Technical Supply Conditions for Aggregate Mixtures for the Production of unbound Layers in Road Construction, Part Quality control
TP Asphalt-StB	Technical testing regulations for Asphalt in Road Construction
TP Gestein-StB	Technical testing regulations for Aggregates in Road Construction
TP Griff-StB	Technical testing regulations for Grip in Road Construction
VDLUFA	Association of German Agricultural Analytic and Research Institutes
VDZ	Research Institute of the Cement Industry
VV TB	Administrative Regulation on Technical Construction Requirements
WB	Armour stone
ZKG	Cement Lime Gypsum
ZTV-Ing.	Additional Technical Contract Conditions for Civil Engineering Structures