GENERAL WORK SPECIFICATION

BASE COURSE OF GRAVEL – GWS

TENDER SPECIFICATION

NOVEMBER 2003
Replaces March 1998

DISCLAIMER

The translation into English of Road Standards (Vejregler) and Tender Specifications is to be regarded entirely as a service. In the event of any discrepancy or shortcomings in the translation, the Danish version will prevail. At any time the Danish versions of Road Standards (Vejregler) and Tender Specifications are those in force.

VEJREGLER

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1 GENERAL

"General work specification (GWS) for base course of gravel" comprises construction of base course of gravel. GWS contains functional requirements for the finished layer and requirements for materials, execution and inspection. The material requirements and characteristics specified are consistent with:

DS/EN 13285 Unbound mixtures – Specifications
DS/EN 13242 Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction.

with related test methods:

DS/EN 933-1 Tests for geometrical properties of aggregates – Part 1: Determination of particle size distribution – Sieving method
DS/EN 933-5 Tests for geometrical properties of aggregates – Part 5: Determination of percentage of crushed and broken surfaces in coarse aggregate particles
DS/EN 933-8 Tests for geometrical properties of aggregates – Part 8: Assessment of fines - Sand equivalent test, Annex A
DS/EN 13286-5 Unbound and hydraulically bound mixtures – Part 5: Test methods for laboratory reference density and water content – Vibrating table.

as well as the Danish Road Institute's test method:

SV LP 16 Compaction control according to the isotope method.

2 MATERIALS

The gravel materials shall be strong and weather-proof and consist of natural materials.

The material shall under reasonable conditions be able to be laid in a layer with adequate load-carrying capacity, frost-proofing and frost resistance and wearing resistance.

The material shall not contain contaminant volumes of plant residue, top soil or lumps of clay or silt.

Addition of fines that do not come from stone dust shall only be carried out subject to agreement.

Base course of gravel is specified in two qualities:

Quality I (SG I 0/31.5)

- Throughout, the grading shall be within the values stated for SG I in the following table (see DS/EN 13285, category Gc, OC75, UF9 and LF2)
- The sand equivalent shall be at least 34
- The content of uncrushed particles (round grains) shall not exceed 50% (see DS/EN 13242, category CNR/50).

SG I					
	Passing fraction %				
Sieve mm	Min.	Max.	Declaration values		Tolerance[1)]
			Min.	Max.	
63	100	-			
31.5	75	99			
16	50	90	61	79	± 11
8	30	75	41	64	± 11
4	20	60	31	49	± 11
2	13	45	22	36	± 9
1	8	35	13	30	± 5
0.5	5	25	10	20	± 5
0.063	2	9	2	9	
1) Permitted deviation from selected declaration value					

Fraction content in %		
Sieve	Min.	Max.
8 – 16	7	30
4 – 8	7	30
2 – 4	7	20
1 – 2	4	15

Quality II (SG II 0/31.5)

- Throughout, the grading shall be within the values stated for SG II in the following table (see DS/EN 13285, category G_E, OC_{75}, UF_9 and LF_2)
- The sand equivalent shall be at least 30
- The content of uncrushed particles (round grains) shall not exceed 70% (see DS/EN 13242, category $C_{NR/70}$).

SG II			
	Passing fraction %		
Sieve mm	Min.	Max.	Declaration values
63	100	-	No requirements, but mean values between min. and max. requirement for passing fraction
31.5	75	99	
16	50	90	
8	30	75	
4	15	60	
1	2	35	
0.063	2	9	

Fraction content in %		
Sieve	Min.	Max.
8 – 16	5	35
4 – 8	5	35

3 EXECUTION

3.1 Delivery

Simultaneous delivery from more than one production site is only allowed subject to prior agreement with the Employer.

The materials shall be loaded, transported and unloaded in such a way that contamination and harmful segregation are avoided.

3.2 Laying

Laying shall be conducted using methods that prevent harmful segregation and ensure a uniform distribution of the materials.

3.3 Compaction

Compaction shall be carried out using equipment which gives a uniform compaction of the entire base course. Compaction shall be performed immediately after laying and with targeted optimum water content.

The compaction requirement is that the base course shall be compacted so that the degree of compaction is greater than 92% vibration in at least 90% of the layer. The probability that compaction work not meeting the requirement is approved shall not exceed 25%.

The compaction is deemed satisfactory when the control provisions in section 4.3 have been met.

3.4 Surface

The profile shall be regulated, so that the final surface becomes as prescribed with a tolerance of ± 10 mm.

Regulation in a firmly compacted base course may only take place subject to prior scarifying. When depressions are regulated using bituminous materials, scarifying can be omitted.

The surface of the final base course shall be uniform, even and firm. Where these requirements are not met, a request can be made to replace the materials.

4 CONTROL

4.1 General

The Contractor is responsible for controlling the supplied materials, the compaction of the base course as well as its final surface.

Applicable test methods are specified in section 1.

Copies of all checklists shall be submitted to the Employer immediately after the results are available.

4.2 Materials

The quality of the materials shall be checked regularly. At least one material analysis shall be made, comprising a determination of the particle size distribution via the sieving method for each 500 m^3 (approximately) or fraction thereof.

The degree of fragmentation shall be documented at the beginning of the delivery.

In the course of the work, a new test shall be made if
a) Gravel from a new production site is used
b) Great variation is seen in the materials used or in the composition of the materials which might affect the material properties.

The result of the new test shall be documented as the check of the original supply.

Samples shall be extracted at the time of delivery to the workplace, before the materials are built into the project.

By using materials from companies that have been certified by an accredited certification body, the frequency of the above handover inspection can be reduced to 1 set of analyses for each 2500 m^3 or fraction thereof. Product certificates and results of analyses of the samples shall be handed over to the Employer on an ongoing basis.

4.3 Compaction

Compaction work shall be checked by determining the degree of compaction in control sections, which may be of varying sizes. A control section is defined as a section in which base course of gravel from the same production appears homogeneously and uniformly compacted. Each layer, but no more than 500 m^3, constitutes a control section.

The compaction check is based on a sample consisting of several individual measurements of the dry density. The measurements are distributed randomly in the control section.

The measurements are identified by control section, station, lateral location and, in connection with laying in several layers also by layer number.

The dry density in the field is determined by the isotope method.

Reference values for dry density are determined by vibration tests in the laboratory on a representative sample of material extracted before filling.

The reference value may apply to several control sections if the material analyses show that the material is uniform. However, as a minimum a reference value shall be determined for each 2500 m^3 or fraction thereof.

The compaction degree shall be calculated for each measurement as the relationship between dry density in the field and the reference value. The compaction degree shall be expressed in percent and is termed %-vibration.

As a control rule, either average/minimum value or statistically formulated criteria can be used.

Choice of control rule is made either by the Employer in connection with invitation to tender, or by the Contractor prior to commencing the work.

4.3.1 Control rule for average/minimum value

The compaction requirement is deemed to be met in a control section when the average and minimum value for five randomly extracted samples observe the following:

- Average > 95%
- Minimum value $\geq$ 92%

4.3.2 Control rule for statistical assessment

The compaction requirement is deemed to be met in a control section when the following disparity is achieved:

$g - k \times s \geq K$

K = 92%

g = the average, Σ x/n

s = standard deviation, $\sqrt{\Sigma(x - g)^2 / (n - 1)}$

x = individual measurements

n = number of measurements, at least five

k = a constant, which is found in the following table:

n	5	6	7	8	9	10	15	20	25	30	40	50
k	1.96	1.86	1.79	1.74	1.70	1.67	1.58	1.53	1.50	1.47	1.44	1.43

4.4 Surface

The surface of the base course shall be checked by levelling (mm reading) the cross section in all 20 m stations and assessing their mutual progression. If the profile requirement specified in section 3.4 has not been observed, the surface of the base course shall be regulated again and compacted.

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