

GENERAL WORK SPECIFICATION

# SUBBASE OF SAND AND 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**

## TABLE OF CONTENTS

1	GENERAL	3
2	MATERIALS	3
3	EXECUTION	4
3.1	Delivery	4
3.2	Laying	4
3.3	Compaction	4
3.4	Surface	4
3.5	Works traffic	4
4	VERIFICATION	5
4.1	General	5
4.2	Materials	5
4.3	Compaction	5
4.3.1	Control rule for average/minimum value	6
4.3.2	Control rule for statistical assessment	6
4.4	Surface	6

# 1 GENERAL

General Work Specification (GWS) for Subbase of Sand and Gravel comprises the laying of subbase layer. 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 933-8 Annex A Procedure for the determination of the sand equivalent value  
 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 Checking compaction according to the isotope method.

# 2 MATERIALS

The material shall under reasonable conditions be able to be laid in a layer with adequate load-bearing capacity, drainage capacity, frost-proofing and frost resistance and serve as a filter towards fine-grained subgrade.

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

Subgrade materials are specified in two qualities:

## Quality I (BL I)

- |          |   |          |
|----------|---|----------|
| Grading: | No grain size greater than  | 90 mm    |
|          | No more than 15% can be greater than                              | 63 mm    |
|          | No more than 5% can be less than                                  | 0.063 mm |
|          | Sand equivalent at least  | 40       |
|          | (cf. DS/EN 13285, category OC <sub>85</sub> and UF <sub>5</sub> ) |          |

## Quality II (BL II)

- |          |   |          |
|----------|---|----------|
| Grading: | No grain size greater than  | 90 mm    |
|          | No more than 15% can be greater than                              | 63 mm    |
|          | No more than 9% can be less than                                  | 0.063 mm |
|          | Sand equivalent at least  | 30       |
|          | (cf. DS/EN 13285, category OC <sub>85</sub> and UF <sub>9</sub> ) |          |

### 3 EXECUTION

#### 3.1 Delivery

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

#### 3.2 Laying

The subbase layer shall be laid out as soon as possible after the road prism has been checked and approved.

#### 3.3 Compaction

Compaction shall be carried out using equipment which gives a uniform compaction of the entire layer. Compaction shall be made immediately after laying and with appropriate water content, possibly provided by watering the uncompacted material.

The compaction requirement is that the subbase layer shall be compacted in such a way that the degree of compaction is greater than 92% vibration in at least 90% of the layer. The probability of approving compaction work that does not meet the requirement shall not exceed 25%.

The compaction is deemed satisfactory when regulatory control in section 4.3 has been met.

#### 3.4 Surface

The profile shall be regulated, so that the final surface becomes as prescribed with a tolerance of  $\pm 20$  mm. Deviations shall not be consistently too high.

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

#### 3.5 Works traffic

Traffic that may damage the subbase layer or cause rutting in the road prism is not allowed.

## 4 VERIFICATION

### 4.1 General

The Contractor is responsible for checking the supplied materials, the compaction of the subbase layer 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 particle size analysis and a determination of the sand equivalent for each 1,000 m<sup>3</sup> or fraction thereof.

In the course of the work, a new test shall be made if

- a) Sand or gravel from new production area 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 in the same way as the check of the original supply.

Samples shall be taken 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 5,000 m<sup>3</sup> or fraction thereof. Product certificates and results of analyses of the inspection of finished goods 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 subbasing from the same production appears homogeneously and uniformly compacted. Each layer and each daily production constitutes a control section, however, max 1,000 m<sup>3</sup>.

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 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 taken 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 2,500 m<sup>3</sup> and fraction thereof.

The compaction degree shall be calculated for each measurement as the proportion 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.

The choice of control rule is made either by the Employer in connection with invitation to tender, or by the Contractor prior to commencement of the works.

#### 4.3.1 Control rule for average/minimum value

The compaction requirement is considered met in a control section when the average and minimum values for 5 randomly extracted samples observe the following:

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

#### 4.3.2 Control rule for statistical assessment

The compaction requirement is considered met in a control section when the following disparity is achieved:

$$g - k \times s \geq K$$

$$K = 92\%$$

$$g = \text{the average, } \Sigma x / n$$

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

x = individual measurements

n = number of measurements, at least 5

k = a constant which is found from 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 finished surface of the subbase layer shall be checked by levelling (mm reading) the cross section in all 20 m stations and assessing the course between them. If the profile requirement specified in section 3.4 has not been observed, the surface of the subbase layer shall be regulated again and compacted.





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