



Quality Control Measures, State of Practice

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Outline

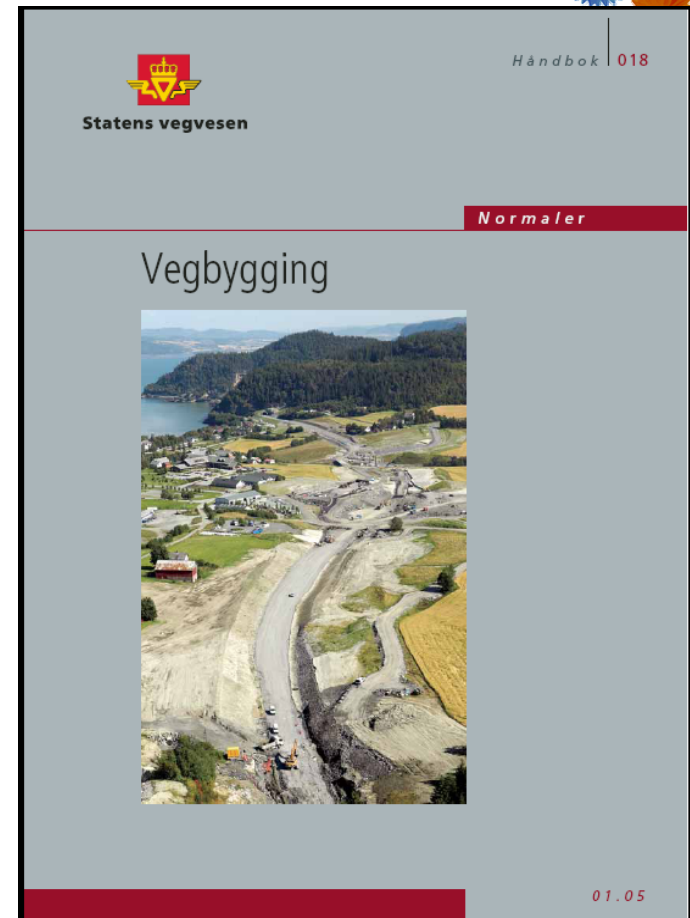


- The Norwegian Design Guide
- What materials do we use, and why?
- Quality control measures



The Norwegian design guide

- Pavement design according to the Norwegian design guide, "Håndbok 018"
- Specification of layer thicknesses and materials
- Quality requirements for each layer and material are given in "Håndbok 018"
- Norwegian quality requirements are adapted to EU-standards



What type of materials
do we normally choose
for Norwegian pavement
constructions?



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Sub-base layer



- Unbound, coarse crushed rock materials are normally used
- $D_{\max} < 2/3$ of the layer thickness
- Fraction 0-120 mm up to 0-600 mm
- Gravel and recycled materials (asphalt, concrete, brick) may also be used



Base layer



- Lower layer
 - Unbound materials
 - Crushed and well graded
- Upper layer
 - Bituminous or unbound materials, depending on the traffic volume







Pavement



Normally hot mixed asphalt



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Reasons for choice of materials



- Unbound materials
 - Crushed and well graded to ensure good stiffness and stability
 - Low fines content to avoid frost susceptibility
 - High mechanical strength to reduce crushing and generation of fines
- Bituminous materials
 - Durability (economy)
 - Properties of the mixture adjusted to traffic, climatic loads and sub-grade condition
 - Good friction properties
 - Easy to maintain (compared to concrete)



Construction



- The construction job is allocated to a contractor after an ordinary tender procedure
- The quality control is mainly based on the contractors documentation
- In addition: Spot checking, varying number and extent



Quality control - what do we emphasize?



		Sub-base			Base, unbound			Base, bituminous							Recycled concrete	
		Forsterkningslag ¹⁾			Mek. stab. bærelag			Bærelag av bitumenstabiliserte materialer							Gjb I Gjb II	
Kontroll av		S/G	P/K	SS	Gk	Fk	Fp	Ag	As	Ap	Pp	Eg	Ep	Sg	Bg	Ak
Material quality	Materialegenskaper															
	• Los Angeles-verdi	X	X	X	X	X	X	X	X	X	X	X	X	X		X
	• flisighetsindeks				X	X	X	X	X	X	X	X	X	X		X
	• mølleverdi ²⁾	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	• micro-Deval-koeffisient	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	• andel knuste korn				X			X	X	X	X	X	X	X		
	• bindemiddelkvalitet							X	X	X	X	X	X	X		
Water sensitivity, frost susceptibility	• massesammensetning															X
	Korngradering															
	• kornfordeling	X	X		X	X	X	X	X	X	X	X	X	X	X	X
Binder content, temperature	• maks. steinstørrelse	X	X	X												
	Vannømfintlighet	X	X	X	X	X	X									X
	Telefarlighet	X	X	X	X	X	X									X
Compaction, quantity	Bindemiddelmengde							X	X	X	X	X	X	X	X	
	Asfalttemperatur															
	• materialproduksjon							X	X	X						
Purity	• utlagt materiale							X	X	X	X					
	Komprimering	X	X	X	X	X	X	X	X	X						X
	Forbruk							X	X	X	X	X	X	X	X	
	Indirekte strekkstyrke											X	X	X	X	
	Sammensetning (renhet)														X	X

1) S/G betyr sand/grus; P/K betyr pukk/kult; SS betyr sprengt stein

2) Kullemløleverdien tillates brukt i produksjonskontrollen som et alternativ til kontroll av micro Dev



Compaction of unbound layers



Compaction program including type of compactor and requirements for min. and max. passages shall be worked out



Compaction control, unbound layers



- $D_{\max} < 32 \text{ mm}$
 - Troxler measurements, required density according to Modified Proctor
- $D_{\max} > 32 \text{ mm}$
 - Levelling: average settlement for the last passage of the compactor must be less than 10% of the total settlement
 - 10 measure points over the road cross section
 - Minimum 5 controlled cross sections per "uniform road section"
 - Plate loading test



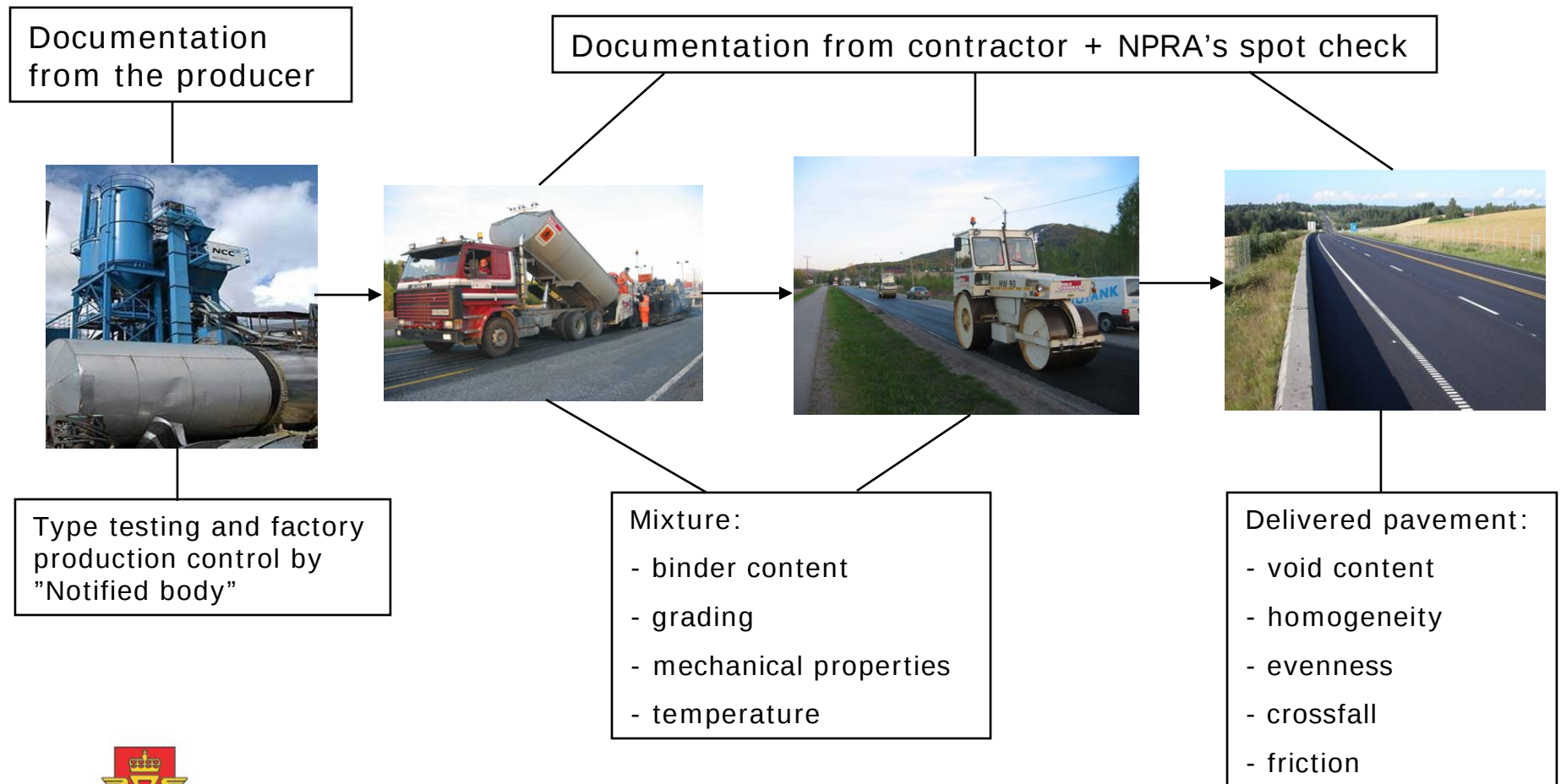
Layer thicknesses



- Geometric control on top of every layer
 - Use of total station and GPS
- Bituminous layers
 - contractors documentation of quantity paved mix (kg/m^2)



Pavement quality control





Thanks for your attention!



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