expo 2012 vial Argentina
XVI CONGRESO ARGENTINO DE VIALIDAD Y TRÁNSITO
7ma EXPOVIAL ARGENTINA
Congreso Argentino de Vialidad y Tránsito
22 al 26 de OCTUBRE 2012
COMPLEJO FERIAL CÓRDOBA - CIUDAD DE CÓRDOBA . ARGENTINA

Concrete Pavement Design and Construction in Germany

– State of the Art –

Stefan Höller

IX CONGRESO INTERNACIONAL ITS
XXXVII REUNIÓN DEL ASFALTO
SEMINARIO INTERNACIONAL DE PAVIMENTOS DE HORMIGÓN
XXXVII REUNIÓN DEL ASFALTO
ICPA
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2. Standard Construction for Concrete Pavement
3. Maintenance of Concrete Pavement
4. Outlook and Innovation

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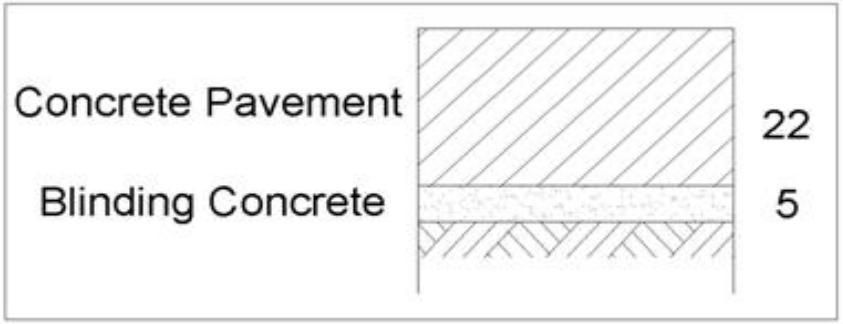
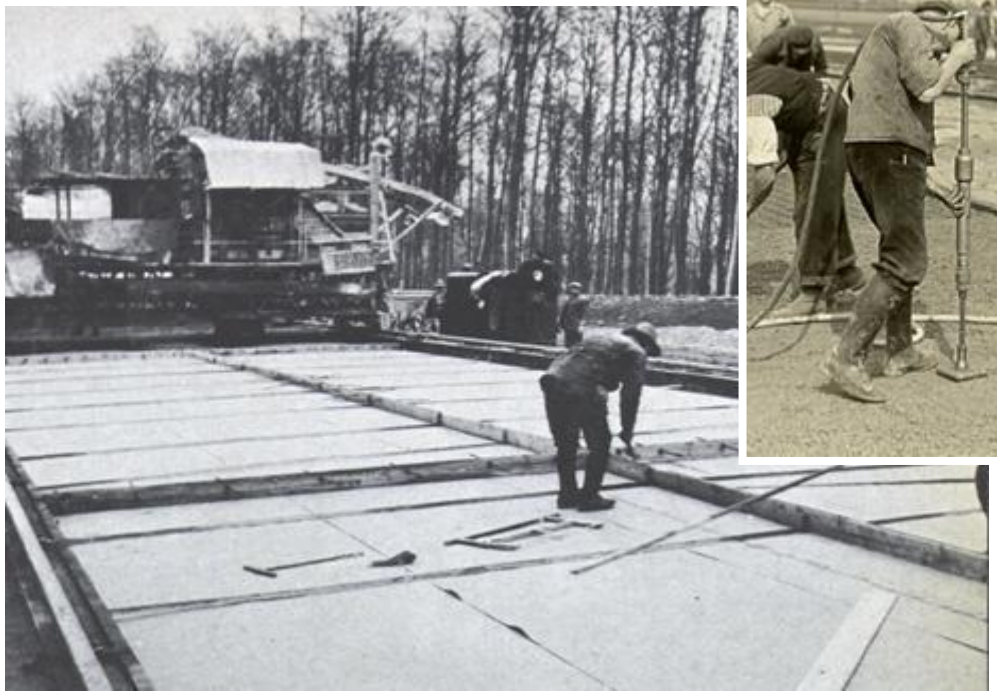
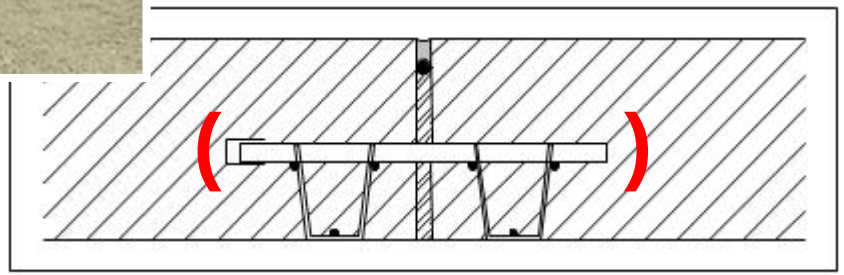
Concrete Pavement Surfaces in the 1930s







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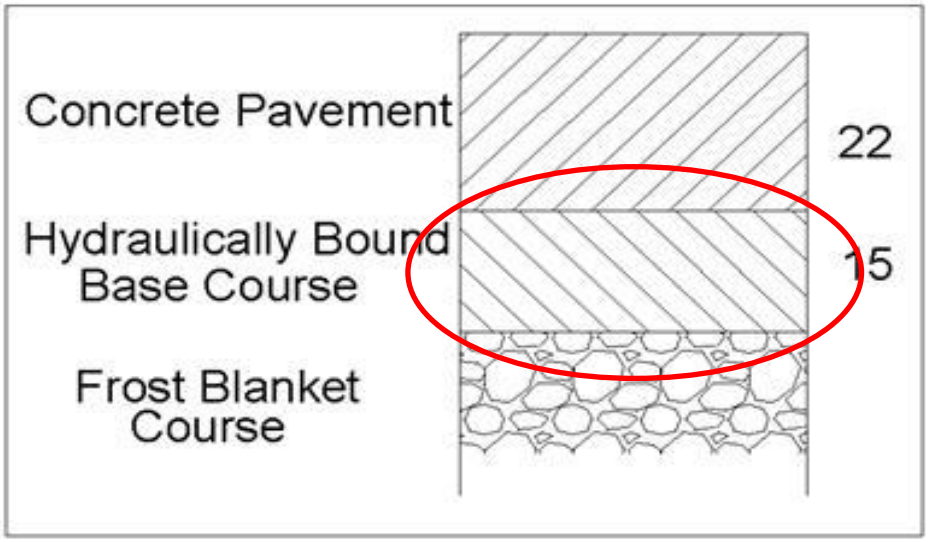
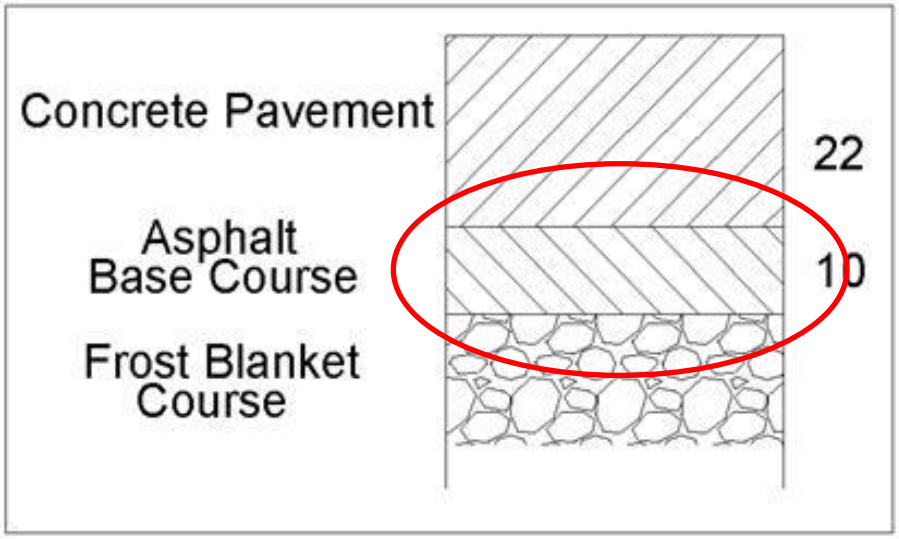
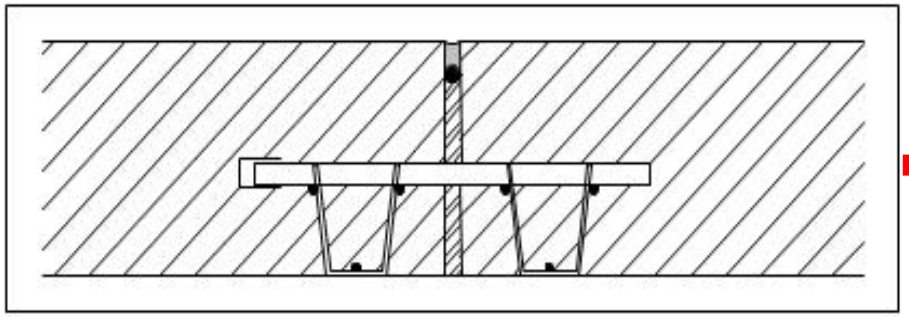
Concrete Pavement Surfaces in the 1930s

Joint Spacing too far

Concrete Pavement Surfaces in the 1960s







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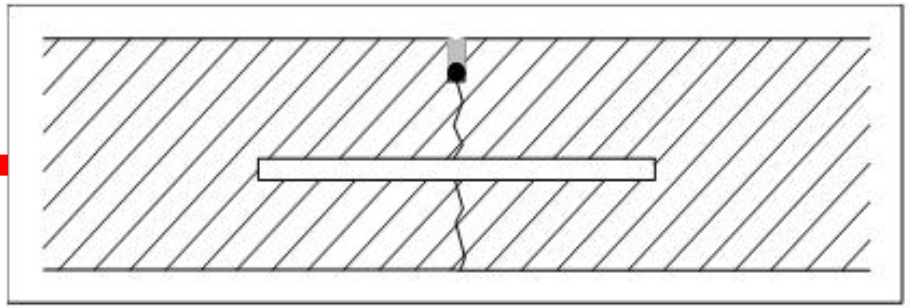
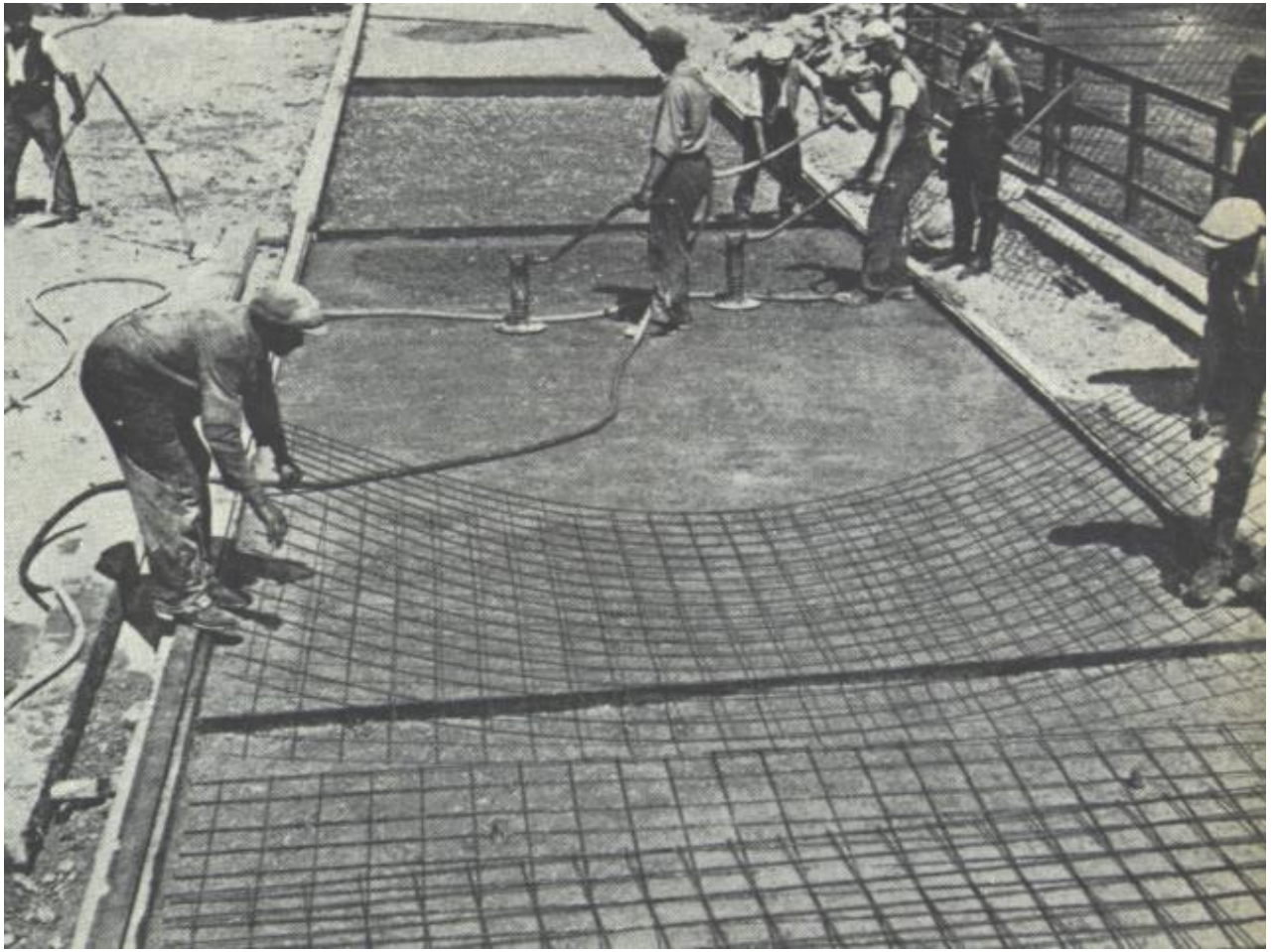
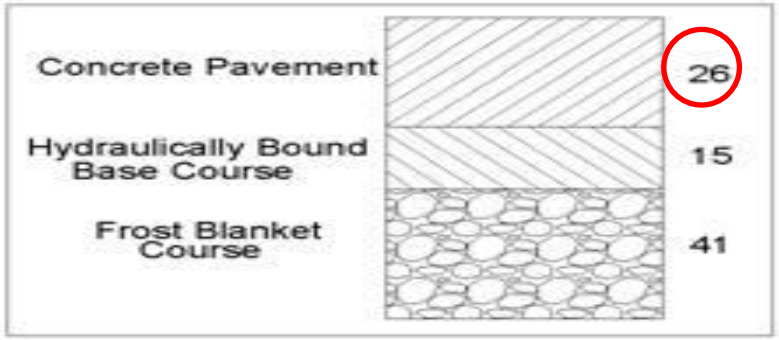


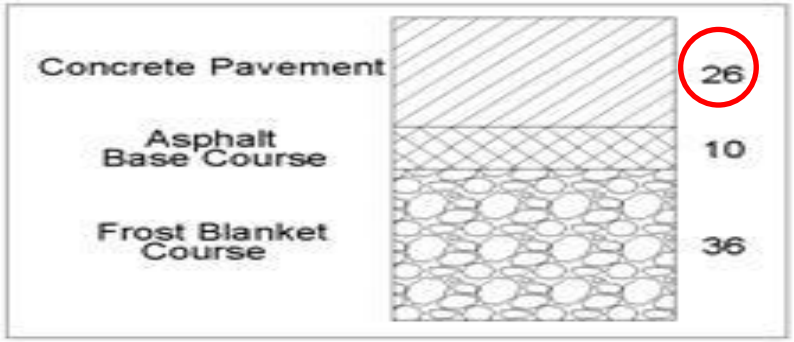
Concrete Pavement Surfaces in the 1960s

Reinforcement of the individual Slabs by Steel Fabrics



Concrete Pavement Surfaces from 1980 to 2001






Mixed in plant


Mixed in place

Concrete Pavement Surfaces vom 1980 to 2001

Problems with Dowels in 1-Lift Concrete Pavement Surfaces

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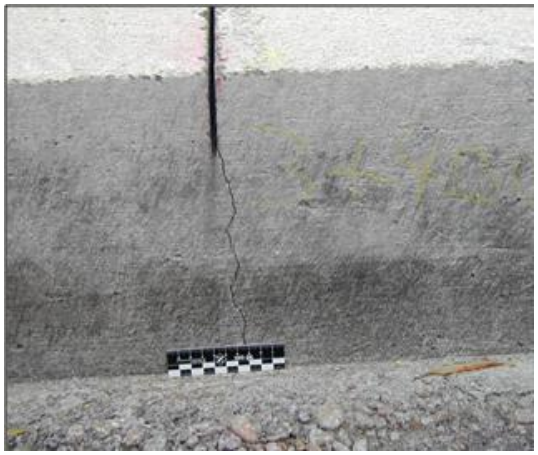
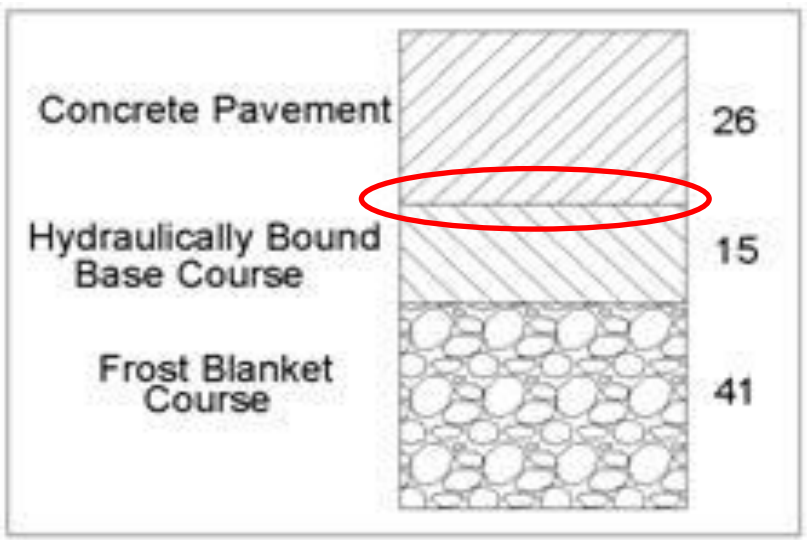
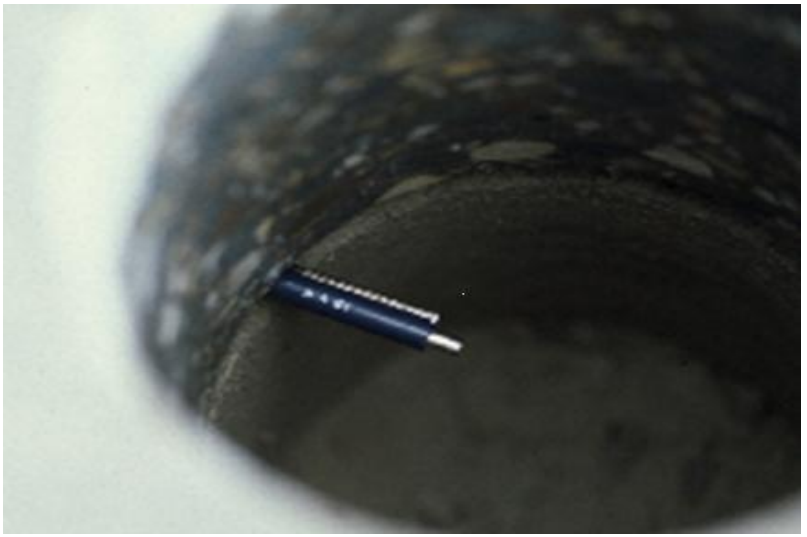
Concrete Pavement Surfaces vom 1980 to 2001

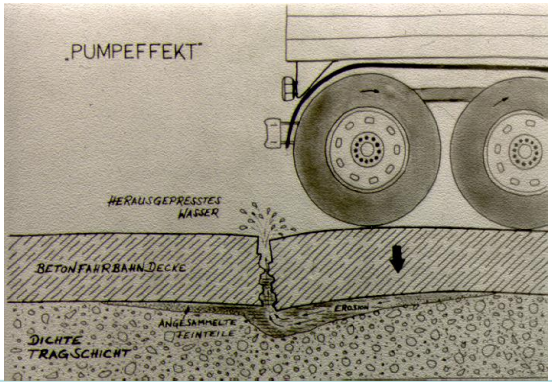


Concrete Pavement Surfaces from 1980 to 2001

Problems of Erosion and Water Pumping







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Federal Republic of Germany

Population, Road-Network, Traffic

Inhabitants:	**82,5 Mio.**
Size:	357.046 km²
Density of population:	231 Inhab./km²
Motorways:	13,077 km
Concrete Pavement:	**~3,500 km or 26,7 %**
Federal Highways:	41,000 km

Traffic volume:

Motor vehicles:	55 Mio
on Motorways	49.000 vehicles/day
peak volume:	189.000 vehicles/day

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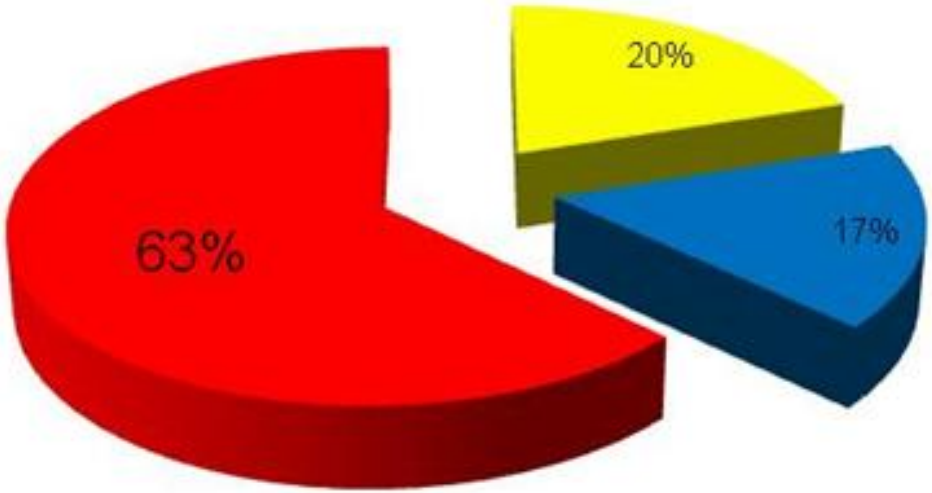
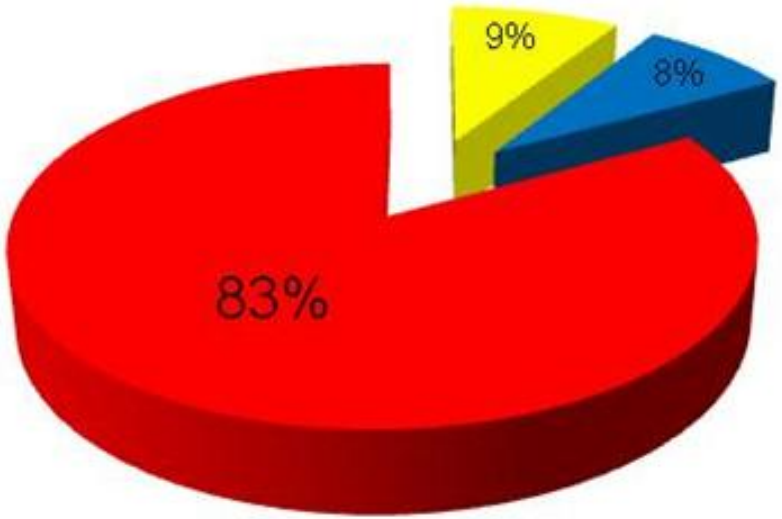
Federal Republic of Germany

Freight Transport

1997



2015 (Forecast)



railway waterway transport road

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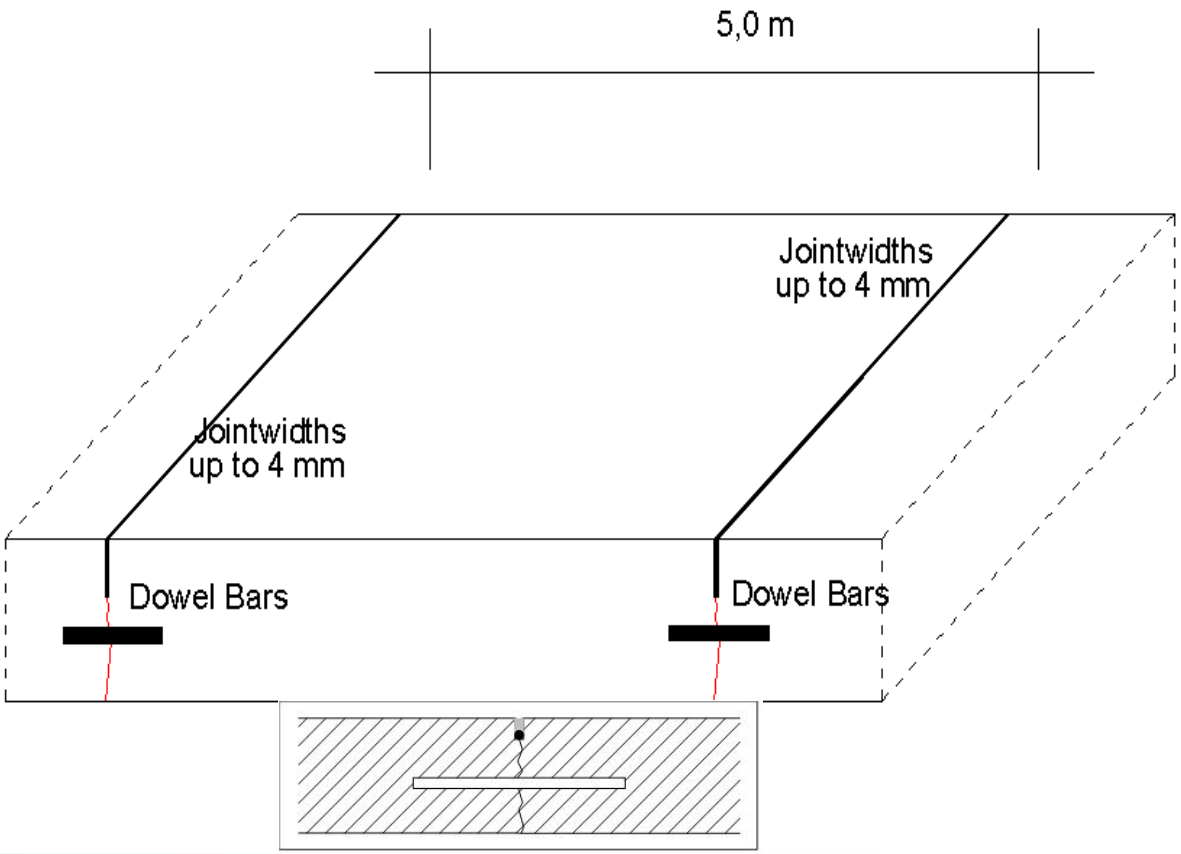
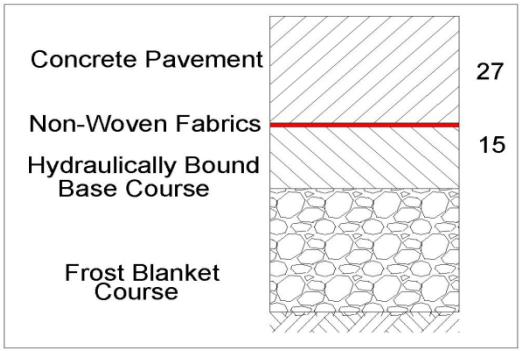
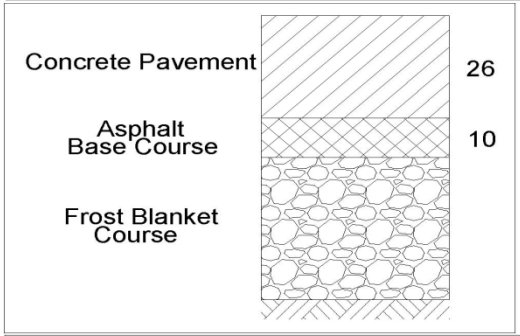
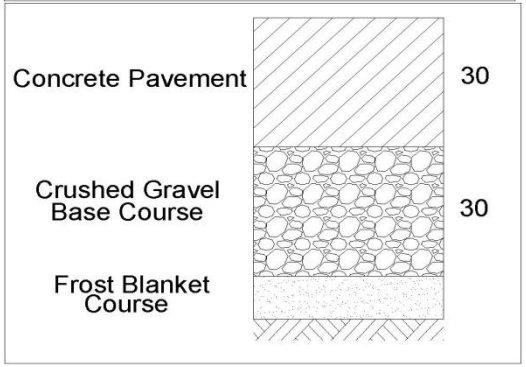
Standard Constructions

Jointed Plain Concrete Pavement, (unreinforced slabs) JPCP









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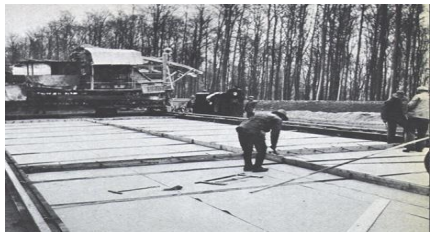
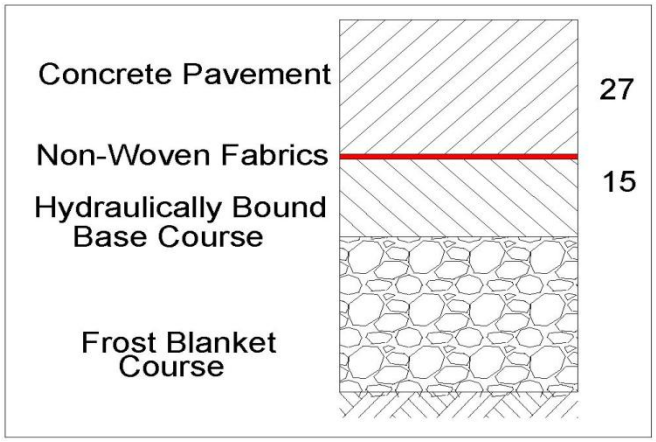
Concrete Pavement Surfaces

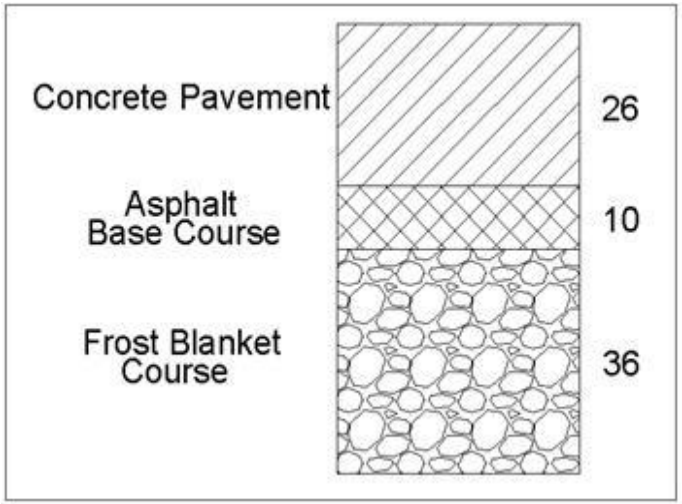
on Hydraulically Bond Base Course
With an Interlayer of Non-Woven Fabrics





Concrete Pavement Surfaces

on Asphalt Base Course



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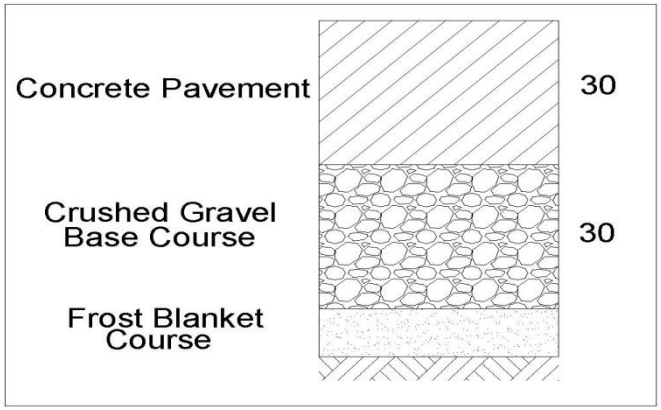
Concrete Pavement Surface

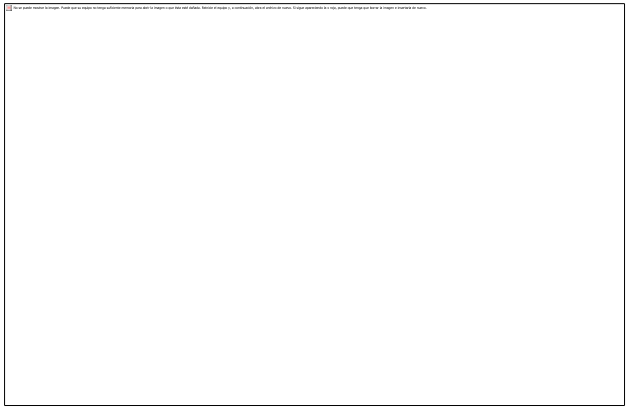
on Crushed Gravel Base Course



Placement with Finisher or Grader

Drainage

Recycling



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German Guidelines for Pavement Design („Standard Catalogue“)

For

Asphalt Pavement, Concrete Pavement and Block Pavement

current version: 2001

revised version: 2013


Forschungsgesellschaft·für·Straßen-·und·Verkehrswesen'

Arbeitsgruppe·Infrastrukturmanagement¶

Richtlinien

für·die·Standardisierung·des·Oberbaues

von·Verkehrsflächen¶

RStO·01

Ausgabe·2001¶

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Traffic Load

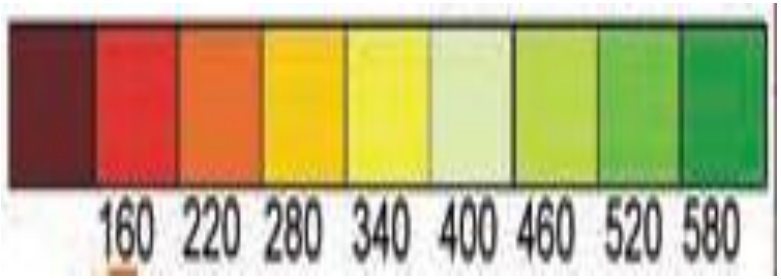
Construction Class	Equvalent 10to. axle load [Mio.]
SV	> 32
I	10 – 32
II	3 – 10
III	0,8 – 3
IV	0,1 – 0,8
V	0,1-0,3
VI	< 0,1

Service Life: 30 Years

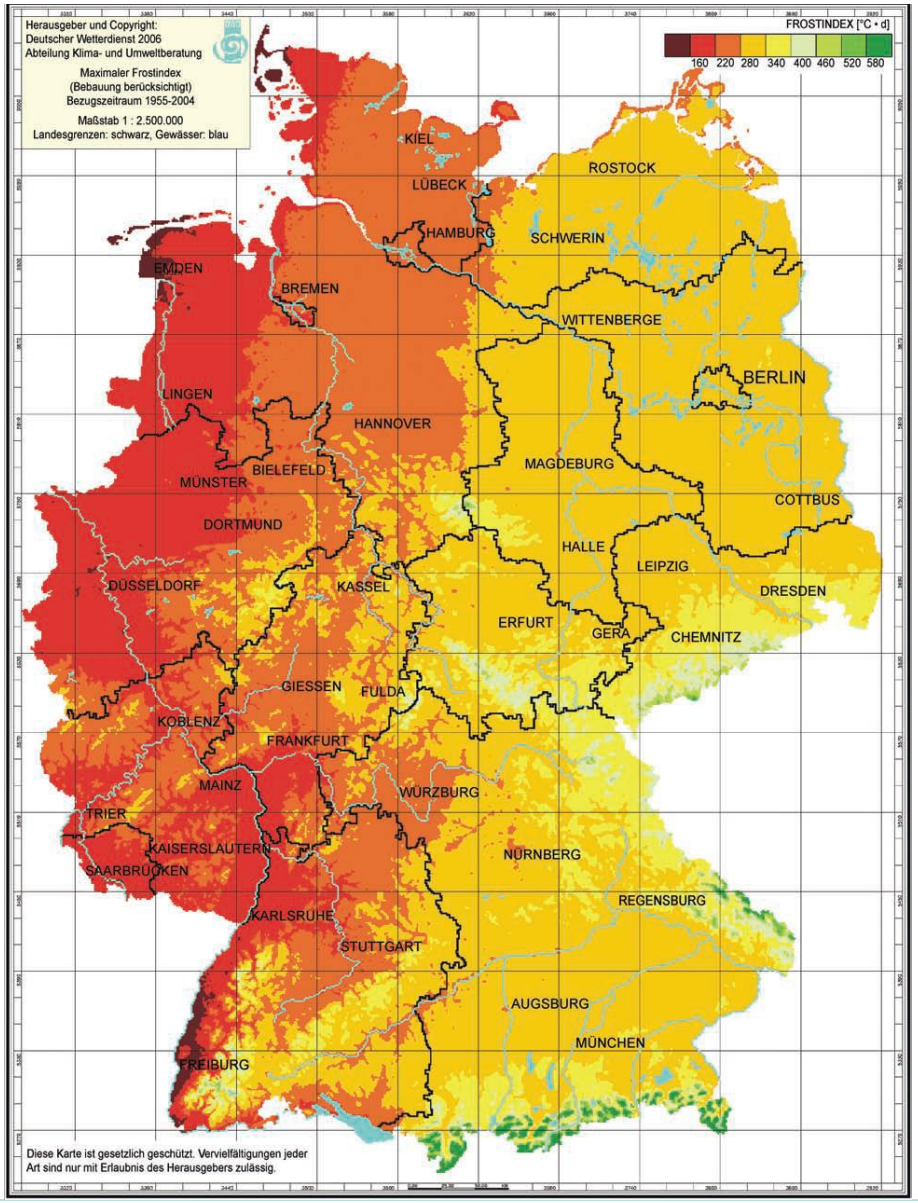
Climate of Region

(Frost Zones I – III)

warm → cold



[- degree Celsius * days]



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Classification of Sub Soil

Classifikation of Sub Soil		
Class	**Frost Sensitivity**	**Sub Soil Class according DIN 18196**
F1	not Frost sensitive	GW, GI, GE, SW, SI, SE
F2	minor to medium Frost Sensitive	TA, OT, OH, OK, (ST, GT, SU, GU)1
F3	very Frost sensitive	TL, TM, UL, UM, UA, OU, ST*, GT*, SU*, GU*

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„The Catalogue“

Table 2: Concrete Pavement

1.) **Traffic Load**
(equivalent 10 t Axle Loads)

2.) **Climate of the Region**
(Frost Zone I – III)

3.) **Frost Sensitivity of Sub Soil**
(F1-F3 Sub Soil)

Tafel 2: Bauweisen mit Betondecke für Fahrbahnen auf F2- und F3-Untergrund/Unterbau
(Bauweisen auf F1-Böden s. Abschnitt 3.1.2)
(Dickenangaben in cm; ▼ E_{v2}-Mindestwerte in MN/m²)

Zeile	Bauklasse		SV				I				II				III				IV				V				VI			
	Äquivalente 10-t-Achsübergänge in Mio.	B	> 32				> 10 - 32				> 3 - 10				> 0,8 - 3				> 0,3 - 0,8				> 0,1 - 0,3				≤ 0,1			
	Dicke des frostsich.Oberbaues[1]		55	65	75	85	55	65	75	85	55	65	75	85	45	55	65	75	45	55	65	75	35	45	55	65	35	45	55	65
	Vliesstoff auf Tragschicht mit hydraulischem Bindemittel auf Frostschutzschicht bzw. Schicht aus frostunempfindlichem Material																													
1.1	Betondecke Vliesstoff Hydraulisch gebundene Tragschicht (HGT) Frostschutzschicht																													
	Dicke der Frostschutzschicht		-	-	32[2]	43	-	25[3]	35	45	-	26[3]	36	46	-	-	27[3]	37												
1.2	Betondecke Vliesstoff Verfestigung Schicht aus frostunempfindlichem Material –weit- oder intermittierend gestuft gemäß DIN 18196–																													
	Dicke der Schicht aus frostunempfindlichem Material		8[4]	18[4]	28	38	15[4]	25	35	45	16[4]	26	36	46	7[4]	17[4]	27	37												
1.3	Betondecke Vliesstoff Verfestigung Schicht aus frostunempfindlichem Material –enggestuft gemäß DIN 18196–																													
	Dicke der Schicht aus frostunempfindlichem Material		3[4]	13[4]	23	33	10[4]	20	30	40	11[4]	21	31	41	2[4]	12[4]	22	32												
	Asphalttragschicht auf Frostschutzschicht																													
2	Betondecke Asphalttragschicht Frostschutzschicht																													
	Dicke der Frostschutzschicht		-	29[3]	39	49	-	31[2]	41	51	-	32[2]	42	52	-	-	33[2]	43	-	29[3]	39	49	-	21[2]	31	41	-	21[2]	31	41
	Schottertragschicht auf Schicht aus frostunempfindlichem Material																													
3	Betondecke Schottertragschicht [7] Schicht aus frostunempfindlichem Material																													
	Dicke der Schicht aus frostunempfindlichem Material		Ab 12 cm aus frostunempfindlichem Material, geringere Restdicke ist mit dem darüber liegenden Material auszugleichen																											
	Frostschutzschicht																													
4	Betondecke Frostschutzschicht																													
	Dicke der Frostschutzschicht																		-	33[2]	43	53	-	25[3]	35	45	-	27[3]	37	47

1) Bei abweichenden Werten sind die Dicken der Frostschutzschicht bzw. des frostunempfindlichen Materials durch Differenzbildung zu bestimmen, siehe auch Tabelle 8
2) Mit rundkörnigen Gesteinskörnungen nur bei örtlicher Bewährung anwendbar
3) Nur mit gebrochenen Gesteinskörnungen und bei örtlicher Bewährung anwendbar
4) Nur auszuführen, wenn das frostunempfindliche Material und das zu verfestigende Material als eine Schicht eingebaut werden
7) Mit Anforderungen gemäß ARS 37/1997 des BMV vom 6. Oktober 1997

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Regulations for Concrete Pavement Surfaces

Material Requirements

Construction Requirements

Testing Requirements

Compressive Strength

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Guidelines

for Individual Design of Concrete Pavement Surfaces

RDO - Beton 2008

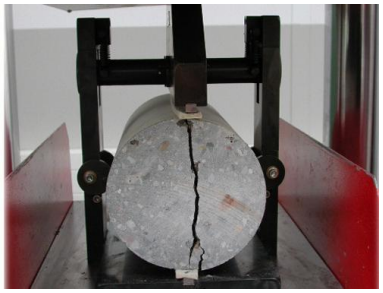
FORSCHUNGSGESELLSCHAFT FÜR STRASSEN- UND VERKEHRSWESEN

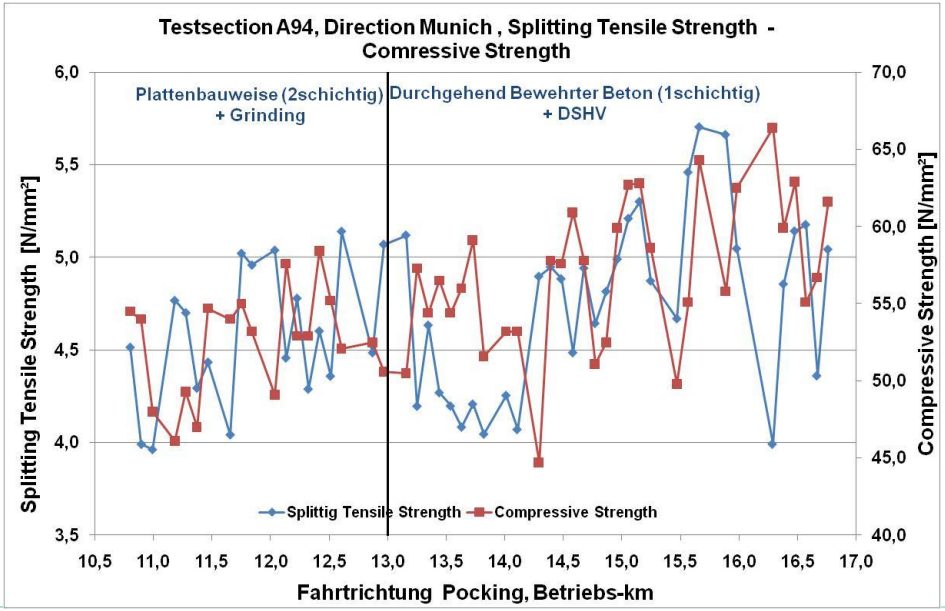
Richtlinien
für die rechnerische Dimensionierung von Betondecken
im Oberbau von Verkehrsflächen

RDO - Beton 08

Ausgabe 2008

Splitting Tensile Strength





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Repair and Renewal of Joints

Removing old Joint Sealant

Cleaning of the Joints

Re-cutting of Joints

Installation of backer rod

Re-Sealing of Joints

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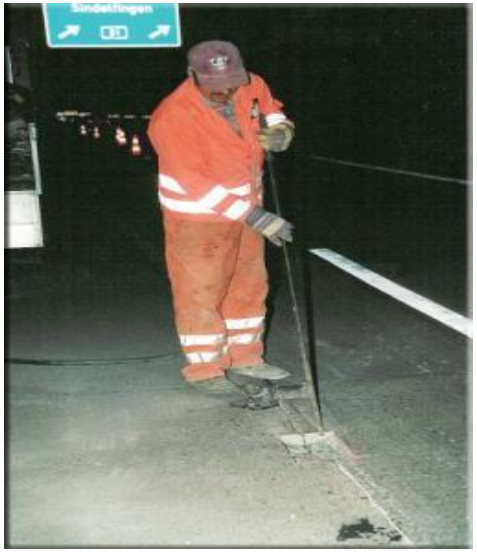
Repair of Broken-Off-Corner with Polymer Concrete



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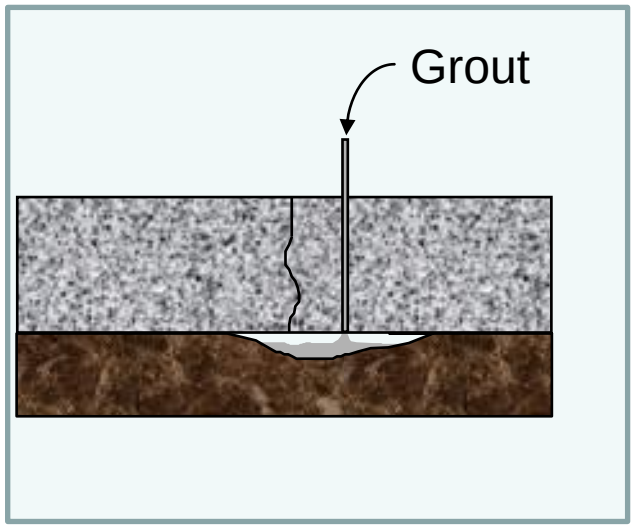
Lifting and Securing of Slabs with Hydraulic Binder

Drilling of injection holes



Injection of Expansion Resin

Seperating of slabs by means of compressed air

Replacement of Slabs and Slab Sections

Seperating cuts

Drilling machine for installation of tie-bars and dowels

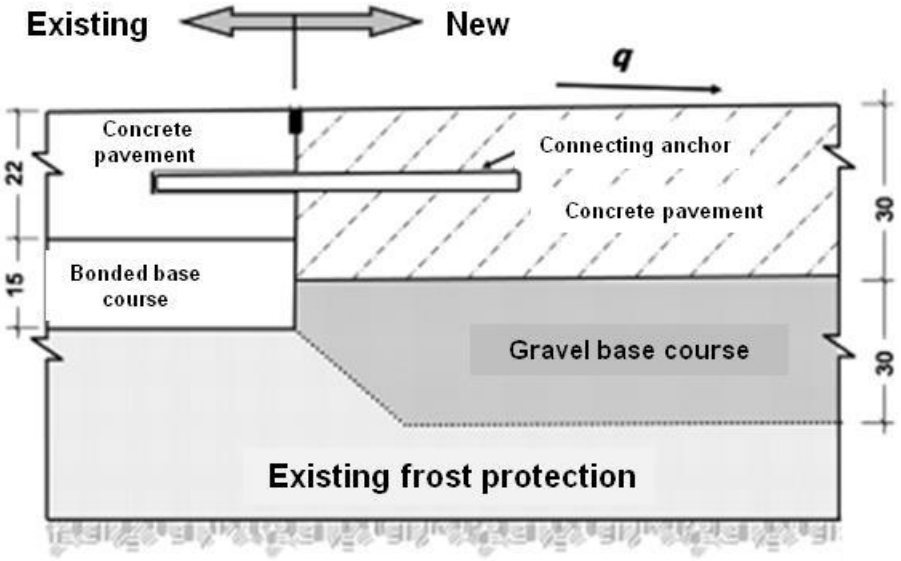
Prepared panel section

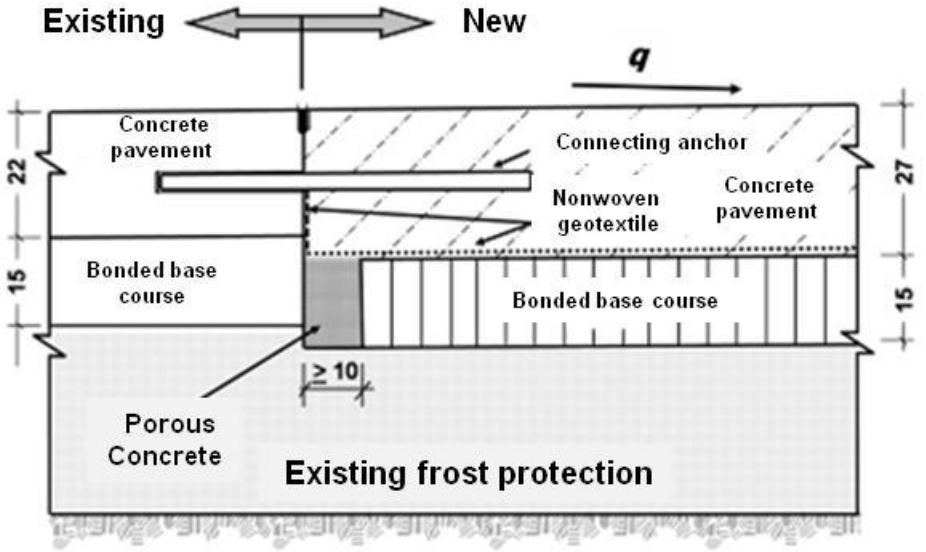
Placing concrete

Finishing

Finished and well done

Renewal of (single) Lanes





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Complete Renewal (Full-depth)

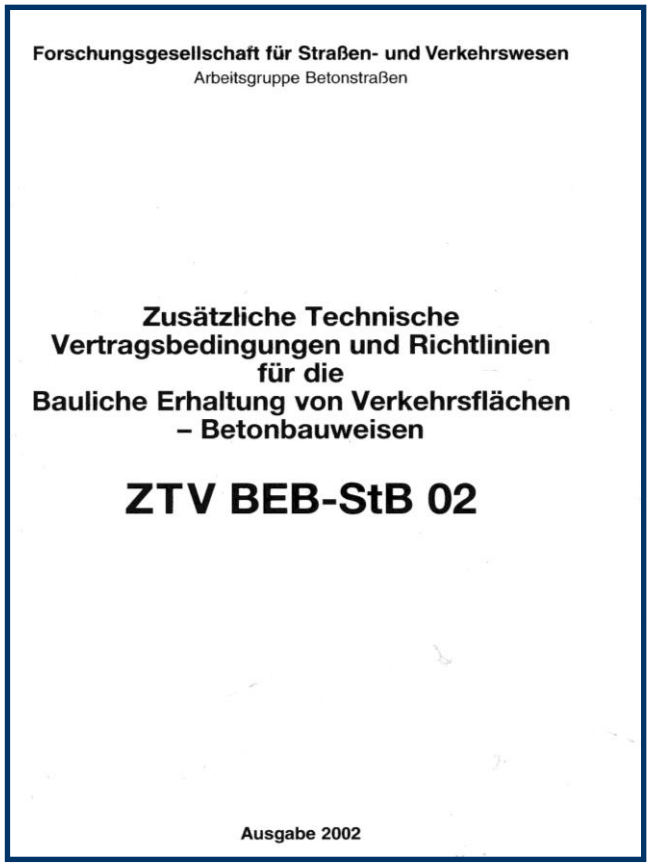
Placement of Dowel Bars

Regulations

for Maintenance and Rehabilitation of Concrete Pavement

„Manual“

„Requirements“



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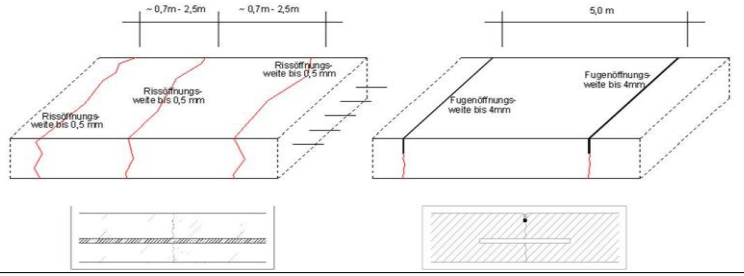
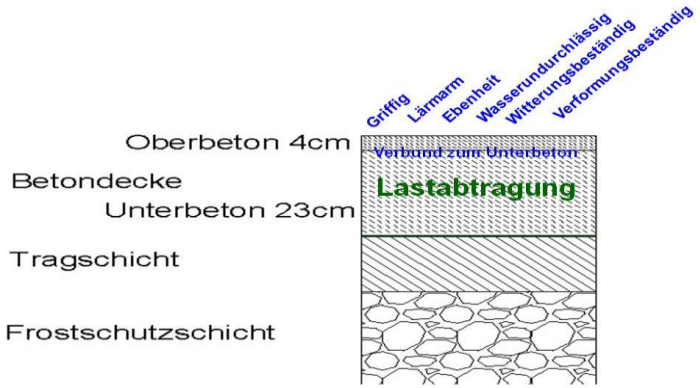
Conctinuously Reinforced Concrete Pavement (CRCP)

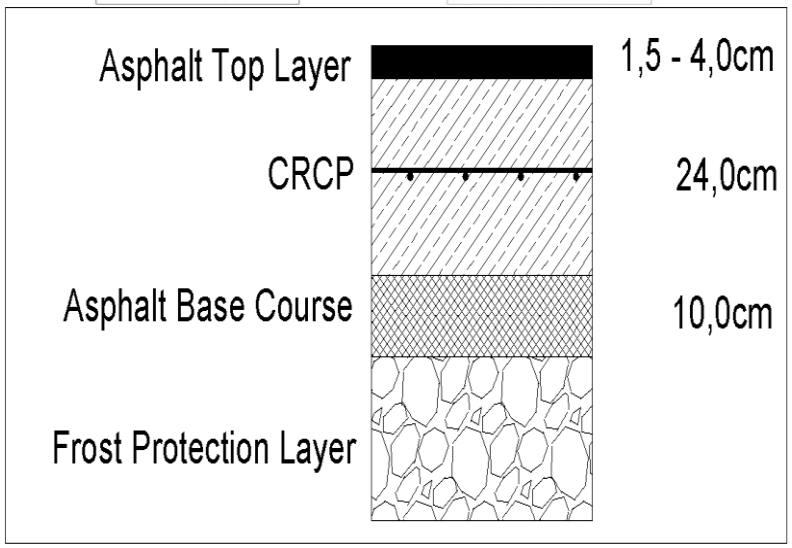
with Asphalt Top Layer – (Composite Structure)

Continuously Reinforced Concrete Pavement CRCP

Jointed Plain Concrete Pavement (unreinforced slabs) JPCP







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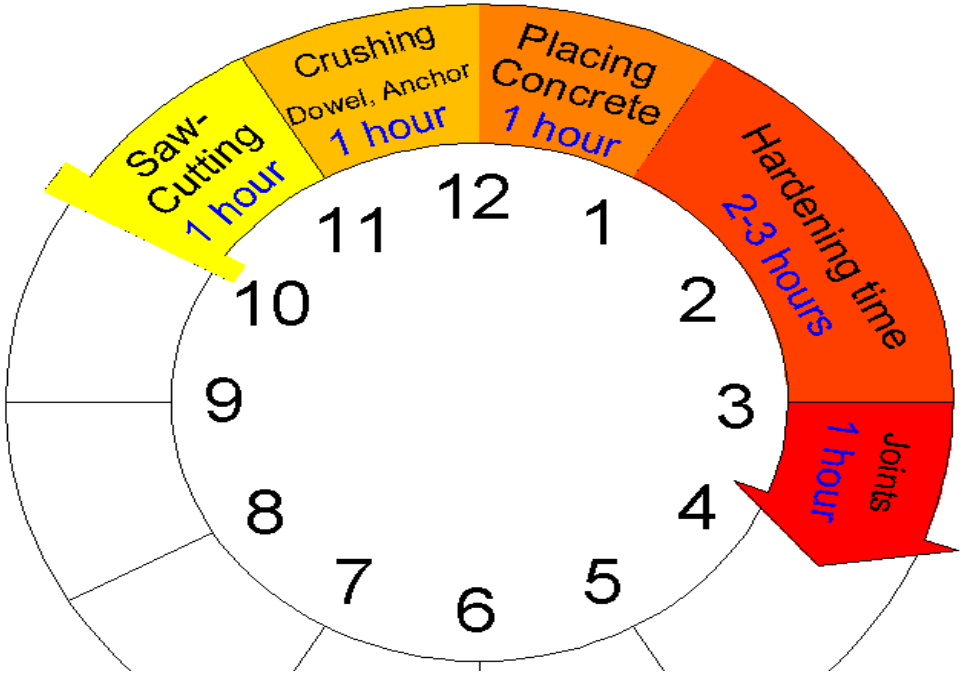
Concrete Pavement

„not only on Highways“

Fast Track Slab Replacement



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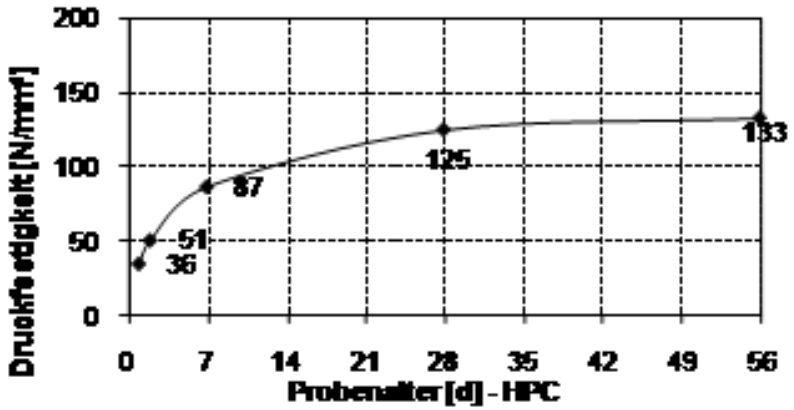
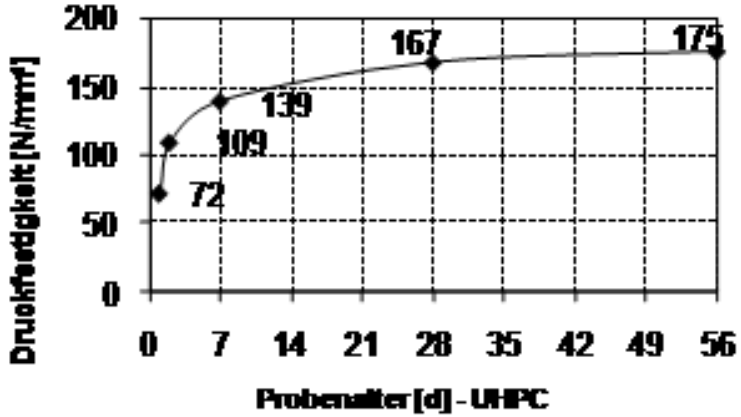
Ultra-High-Performance Concrete

Overlay for fatigued and worn pavement (White Topping)





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Recycling

of damaged Concrete Slabs on Site and Reuse as RC-Aggregates

Thank You for Your Kind Attention!

Questions?

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