

CONSTRUCTION OF HIGHLY LOADED CONCRETE PAVEMENTS IN INDUSTRIAL AREAS

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30 May 2019



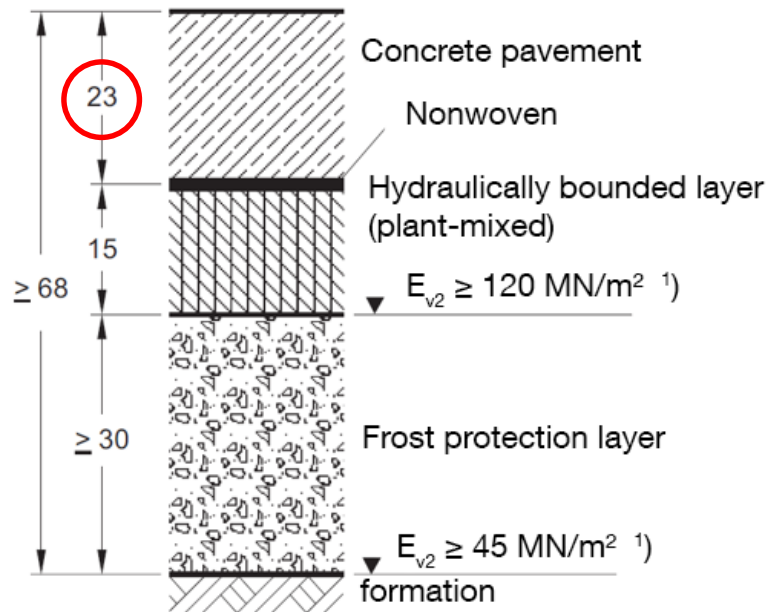
Highly loaded concrete pavements

Highly loaded concrete pavements in industrial areas such as container-terminals require special design and dimensioning of concrete structures.



Proposal in DB RIL 800.0612

Picture 1 Pavement structure for driveways and team tracks

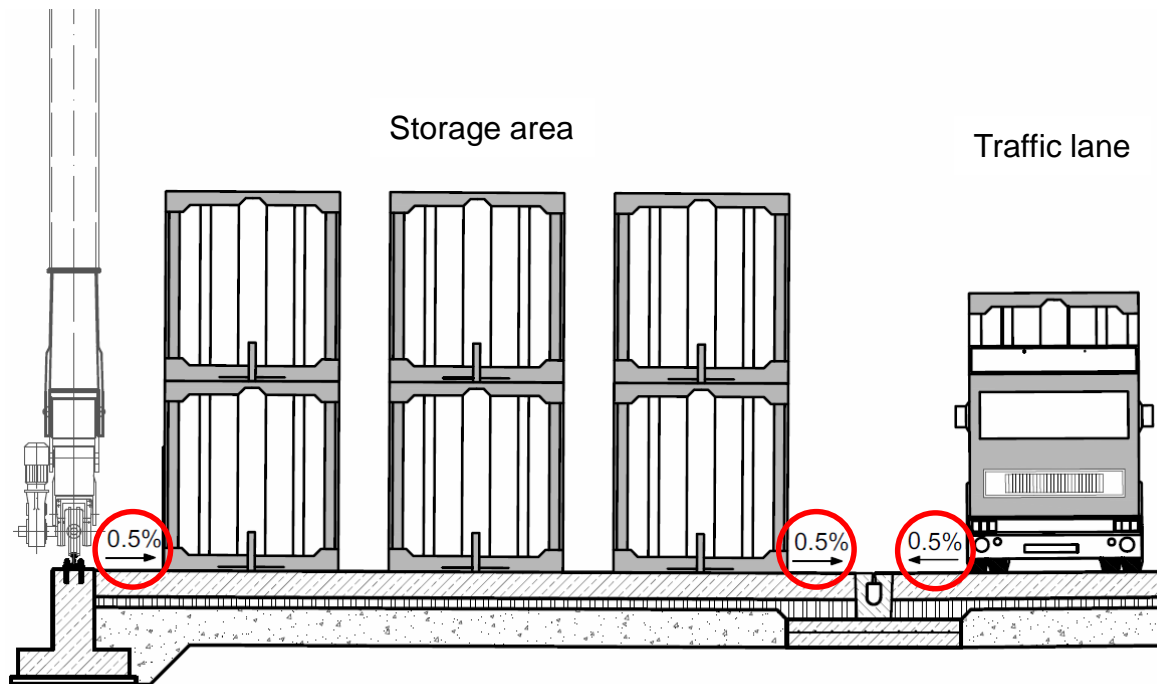


¹⁾ Minimum value of the deformation modulus according to DIN 18134

Main features of highly loaded concrete pavements

1. Limited cross slope (due to operational use)
2. High stresses of the installations (drainage channels, covers, ...)
3. Dimensioning for high static and dynamic loads
(mobile cargo-handling vehicle like a reach stacker, container, ...)
4. Transitions to railway tracks or crane rails
5. Impermeability of the concrete pavement and the joints
6. Supervision of Construction

1. Limited cross slope



- Handling with gantry crane
- Multiple stackings

⚡ Drainage

2. High stresses of the installations

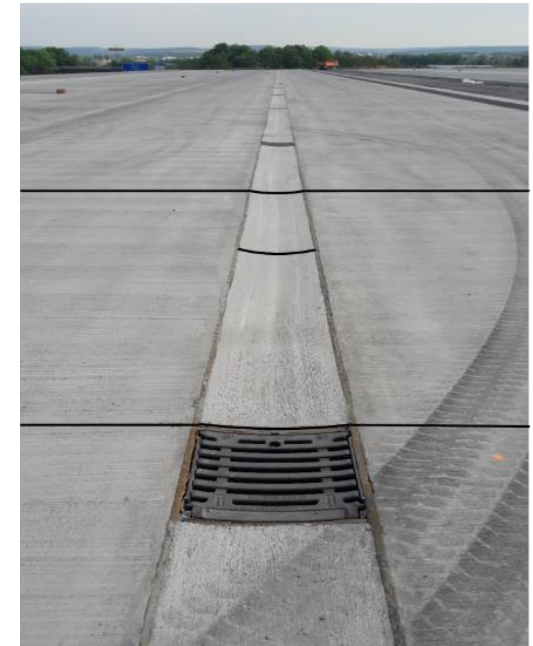
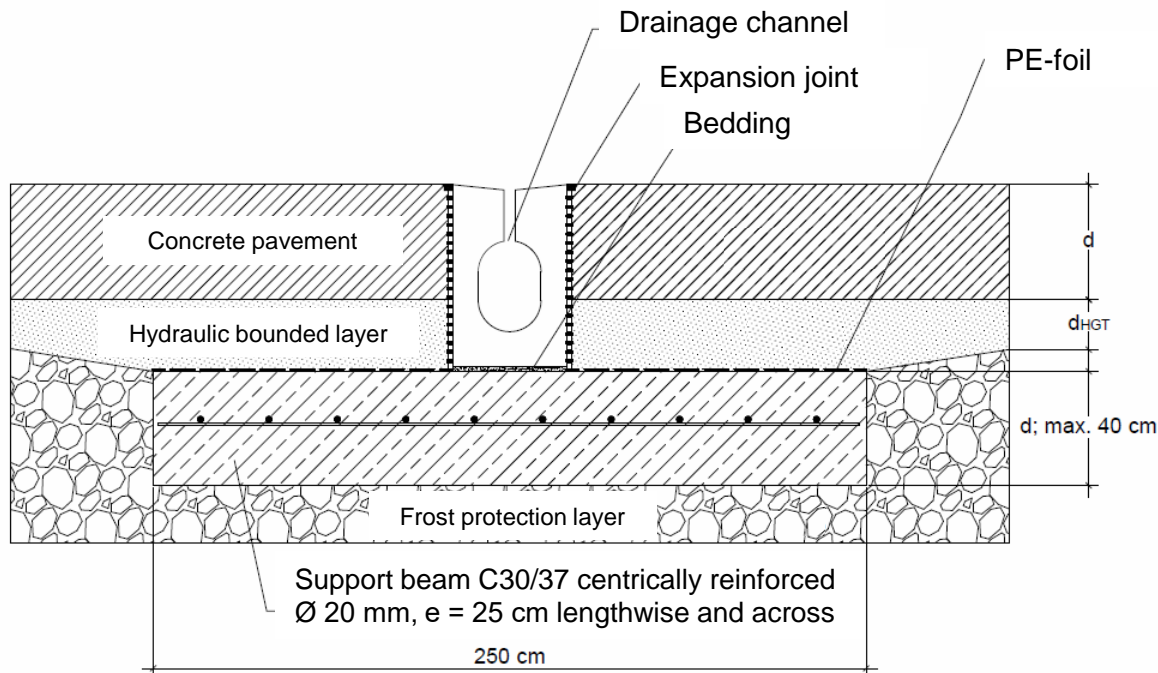


High stresses due to:

- Trucks
- Mobile cargo-handling vehicle

Arrangement of the containers

2. High stresses of the installations



3. Static and dynamic loads



1. Mobile cargo-handling vehicle

Load per axle: **108 t**

3. Static and dynamic loads



2. Container

Total weight of a 40-ft-
Container: **33 t**

High concentrated load

- Corner at corner
- Multiple stacking







3. Dimensioning

Determination of the **load category** for loads of **mobile cargo-handling vehicle / truck**:

Maximum Axle Load [Ton]	< 40	40 - 80	80 - 120	120 - 140
Load Category	A	C	E	F

Determination of the load category for loads of **container arrangement**:

	Stacking Height					
Series Lineup			*	*	**	**
			1-fold	2-fold	3-fold	4-fold
One Lineup	Container 1	Container 2	A	C	D	G
Several Lineup	Container 1	Container 2	B	E	G	H
	Container 3	Container 4				
	Container 5	Container 6				

Top View

Container 1	Container 2
Container 3	Container 4
Container 5	Container 6

Load Point

* Load Approach 33 t/Container

** Load Approach 80% out of 33 t/Container

3. Dimensioning

Required concrete layer thickness depending on load category (bonded base layer)

		Load Category	A	B	C	D	E	F	G	H
<p>Concrete Pavement</p> <p>Asphalt Base course 10</p> <p>Frost Protection Layer 45 [MPa]</p> <p>Frost Protection Layer 45 [MPa]</p> <p>120</p>	<p>Thickness of concrete layer [cm] on bonded base layer</p>	26	31	36	42	45	48	52	60	
		<p>Concrete Pavement</p> <p>Base Courses with Hydraulic Binders 12</p> <p>Frost Protection Layer 45 [MPa]</p> <p>Frost Protection Layer 45 [MPa]</p> <p>120</p>								

3. Dimensioning

Required concrete layer thickness depending on load category (unbound base layer)

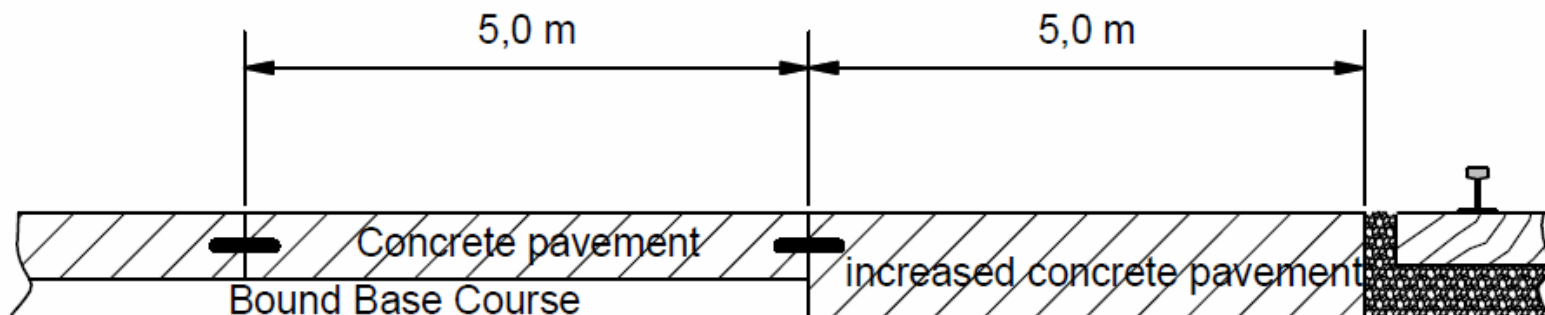
	Load Category	A	B	C	D	E	F	G	H
<p>Concrete Pavement</p> <p>150</p> <p>Crushed Stone Base Course</p> <p>120</p> <p>Frost Protection Layer</p> <p>45</p> <p>[MPa]</p> <p>30</p> <p>[cm]</p>	<p>Thickness of concrete layer [cm] on unbound base layer</p>	29	33	38	44	47	50	55	64

4. Constraints

Connections to the existing structures, concrete and asphalt pavements

High stresses at the slab edge next to the railway track

→ strengthened concrete pavement of the border slabs



5. Impermeability

Handling of water-polluting substances on areas with intermodal traffic:

→ Requirements concerning the impermeability according to guideline
AwSV

- Special requirements to the concrete (acc. to TL Beton-StB)
- Concrete without structural cracks
- Scheduled joint width: 20 mm
- High frequent visual inspections during service

6. Supervision of Construction

Concrete according to TL Beton-StB 07

- concrete strength C35/45 self-monitoring tests for each delivery, control tests at least every 500 m
- tensile bending strength $\geq 5,5$ MPa, acc. to EN 12390-5
- cement content ≥ 340 kg/m³
- water-/cement ratio of fresh concrete, control tests every 3000 m²
- minimum thickness of concrete layer, control tests every 100 m

Thank you for your attention

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