Load Securing of Prefabricated Concrete Elements in Accordance with VDI 2700, Part 10

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Klettwitz, 23. Oktober 2013

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Preface

The Guideline VDI 2700, part 10 consists of 3 sections.

- Part 10.1 Plan (two-dimensional) concrete elements
- Part 10.2 Prefabricated concrete manhole elements, fittings, concrete tubes
- Part 10.3 Packetized concrete products

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Part 10.1 Plan concrete elements

Plan concrete elements in terms of Part 10.1 are

- Prefabricated ceiling elements
- Prefabricated wall elements,
- Prefabricated elements for roofs and facades
- Prefabricated elements for flights of stairs

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Alternatives of transportation

- Horizontal transportation

The cargo consists normally on multiple prefabricated elements, laying one above each other and can be stapled with or without interlayer, for example timber beams. The prefabricated elements normally are not laying directly on the loading platform but usually on a steel frame or timber beams.

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Alternatives of transportation

- Horizontal transportation

Homogeneous staples have to be assembled which enables a friction-locked securing of the cargo and a homogeneous distribution of forces due to the use of lashing devices.

When assembling the staples it has to be considered that the height of the cargo respectively the resulting centre of gravity is as low as possible.

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Horizontal transportation

Combination of form locking (at front wall) and friction locking

Horizontal transportation


Origin: Goldbeck Betonelemente, Hamm


Origin: Goldbeck Betonelemente, Hamm

Combination of form locking (at stanchions) and friction locking

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Horizontal transportation

Combination of form locking (by spring lashing) and friction locking

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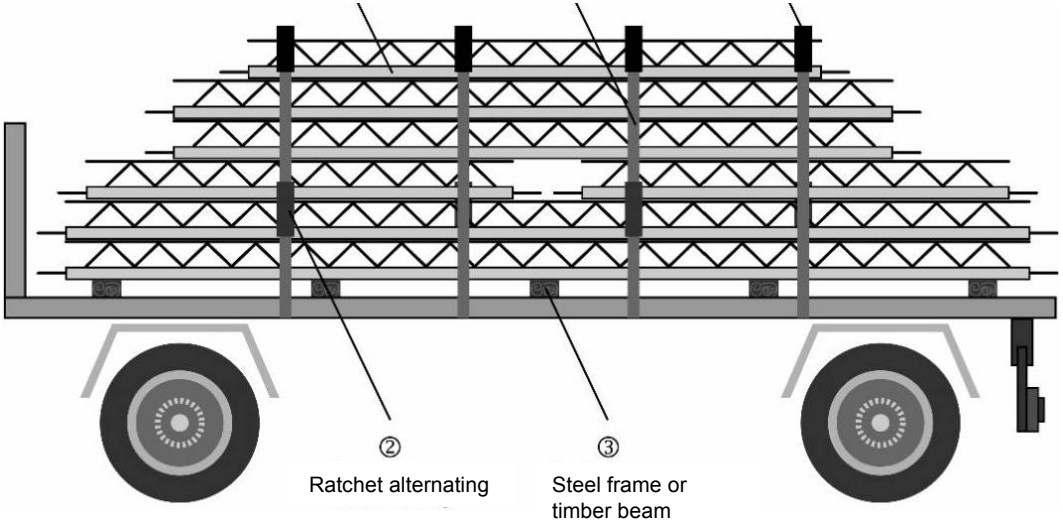
Horizontal transportation



Origin: Syspro Gruppe, Erlensee

Ceilings elements friction locked (no possibility for form locking).

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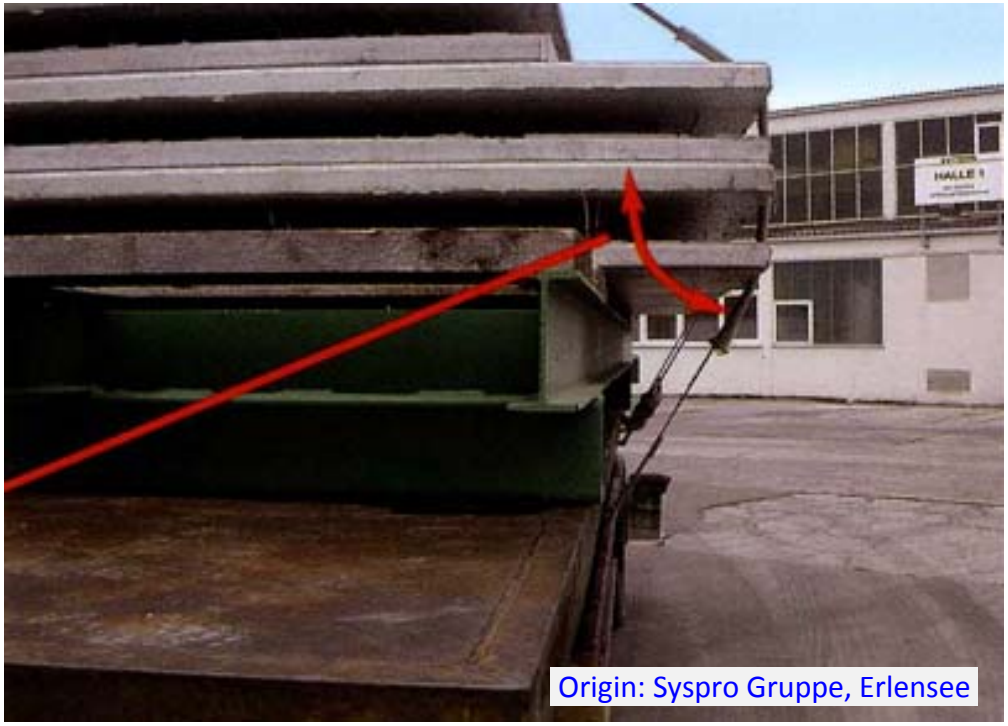
Horizontal transportation



- Load width 3.0 m max.
- Approval required
- Overhang equal on both sides
- pay attention on turn-around angle
- pay attention on impaired capacity of belt lashings

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Alternatives of transportation

- Vertical transportation

The cargo consists of multiple prefabricated elements staying one next to each other.

The prefabricated elements may be positioned vertical or inclined.

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Alternatives of transportation

- Vertical transportation

The prefabricated elements are positioned on a special horse not directly on the loading platform.

In doing so the position of the centre of gravity has to be considered (safety against tilting).

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Alternatives of transportation

- Vertical transportation

Horses are usually form locked against shifting and tilting by blocking or anchoring on the lading platform. Then the pre fabricated concrete elements will be positioned on it and secured as well.

If the pre fabricated parts are seeded on the horse outside of the loading platform (pre commissioned for example) the horse is part of the cargo unit created this way and has to be secured as such.

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Alternatives of transportation

- Vertical transportation

Usual horses are:

- Internal loading stage
- A rack
- U rack
- Transversal rack

Transportation horses have to meet the requirements regarding static loads.

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Vertical transportation

… using internal loading stage

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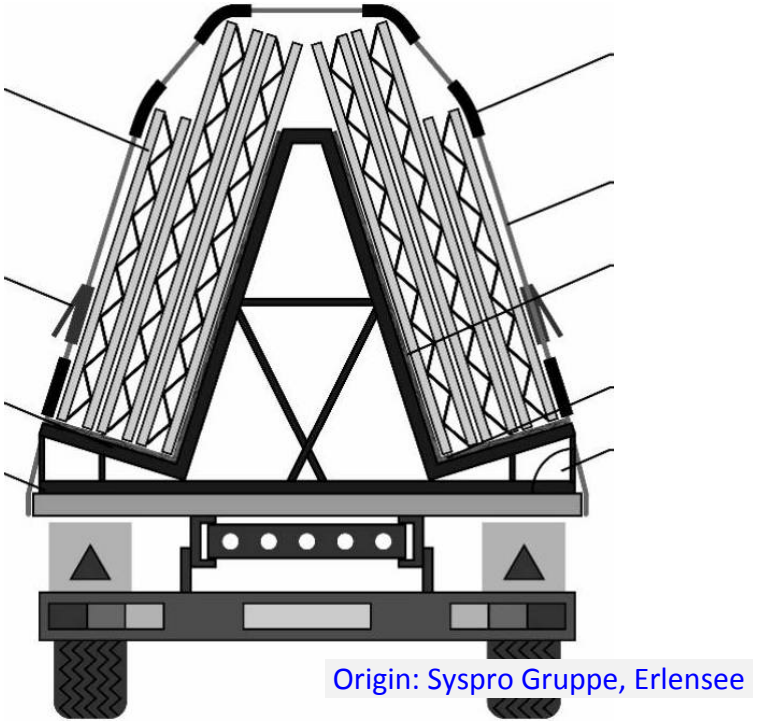
Vertical transportation

… using transversal rack

Vertical transportation

… using U rack



… using A rack

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Part 10.3 Packetized concrete products

Packetized concrete products in terms of part 10.3 are for example

- paving blocks
- paving flags
- kerb units, edging units
- stair elements, solidblocks for example
- garden products, palisades for example
- roofing tiles, building bricks

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Prerequisites for the use of part 10.3

- Similar surface conditions (equal friction characteristics)
- Cargo units stable by itself, pressure resistant and dimensionally stable
- palletized on customary euro pallets or industry-standard pallets or not palletized

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Characteristics of concrete products

- The loading platforms of vehicles, which are mostly or often used for the transportation of concrete products, are stressed strongly due to the loading and unloading practice.
- Therefore these platforms show adequate traces of use and abrasion.
- Extensive measurements according to VDI 2700 Part 14 (draft) did indicate, that a used loading platform influences the friction coefficient favourable.

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Part 10.3 Packetized concrete products
Dynamic friction coefficient as of recent draft status

Row	Friction paring	Loading platform condition	Dynamic friction coefficient μ_D
1	Concrete products (except roofing tiles) **not palletized** on loading platform made of steel or porous printed	Used; dry or wet [b)]	0.45
2	Concrete products (except roofing tiles) **palletized** on euro pallets or industry-standard pool pallets [c)] on porous printed loading platform	Used; dry or wet [b)]	0.55
3	Concrete products (except roofing tiles) **palletized** on euro pallets or industry-standard pool pallets on loading platform made of steel	Used or not used; dry or wet	0.40
4a	Concrete roofing tiles **not palletized** on porous printed loading platform	Used / dry	0.40
4b		Unused /dry or used / wet	0.25
5a	Concrete roofing tiles **not palletized** on loading platform made of steel	Used / dry	0.34
5b		Unused / dry	0.24
5c		Unused or used/ wet	0.11

[a)] for friction parings not indicated here dynamic friction coefficients have to be taken separately, if applicable using appropriate measurements.
[b)] for a loading platform in "unused" condition the dynamic friction coefficient given for the "used" condition has to be reduced by 0.1.
[c)] industry-standard pool pallets are returnable pallets with end-to-end timber beams as shown in figure 2.

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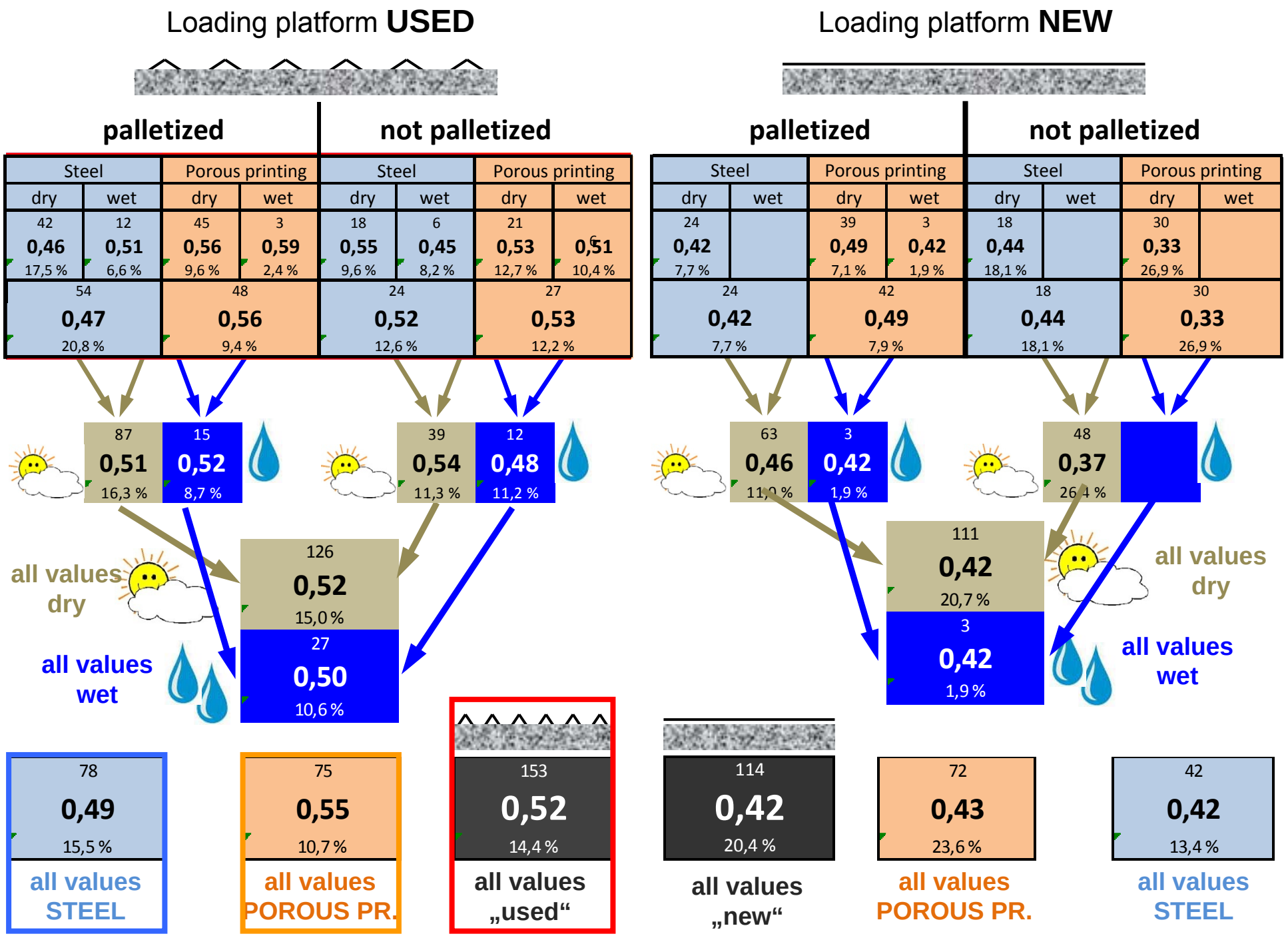
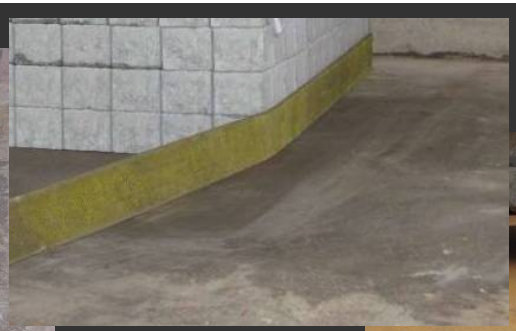

Loading platform USED
palletized
not palletized
Steel
Porous printing
Steel
Porous printing
dry
wet
dry
wet
dry
wet
dry
wet
42
0,46
17,5 %
12
0,51
6,6 %
45
0,56
9,6 %
3
0,59
2,4 %
18
0,55
9,6 %
6
0,45
8,2 %
21
0,53
12,7 %
0,51
10,4 %
54
0,47
20,8 %
48
0,56
9,4 %
24
0,52
12,6 %
27
0,53
12,2 %
87
0,51
16,3 %
15
0,52
8,7 %
39
0,54
11,3 %
12
0,48
11,2 %
all values dry
all values wet
126
0,52
15,0 %
27
0,50
10,6 %
78
0,49
15,5 %
all values STEEL
75
0,55
10,7 %
all values POROUS PR.
153
0,52
14,4 %
all values „used“
Loading platform NEW
palletized
not palletized
Steel
Porous printing
Steel
Porous printing
dry
wet
dry
wet
dry
wet
dry
wet
24
0,42
7,7 %
39
0,49
7,1 %
3
0,42
1,9 %
18
0,44
18,1 %
30
0,33
26,9 %
24
0,42
7,7 %
42
0,49
7,9 %
18
0,44
18,1 %
30
0,33
26,9 %
63
0,46
11,0 %
3
0,42
1,9 %
48
0,37
26,4 %
all values dry
all values wet
111
0,42
20,7 %
3
0,42
1,9 %
114
0,42
20,4 %
all values „new“
72
0,43
23,6 %
all values POROUS PR.
42
0,42
13,4 %
all values STEEL

Proposal:

$\mu_{D,\,used}$ = 0.5

$\mu_{D,\,new}$ = 0.4



Packetized concrete products

With the exception on packets which are totally covered by stretched foil, roofing tiles packages for example

Thank you very much for your attention

Photos and sketches used are provided by the members of the working group „VDI 2700 Part 10“.

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