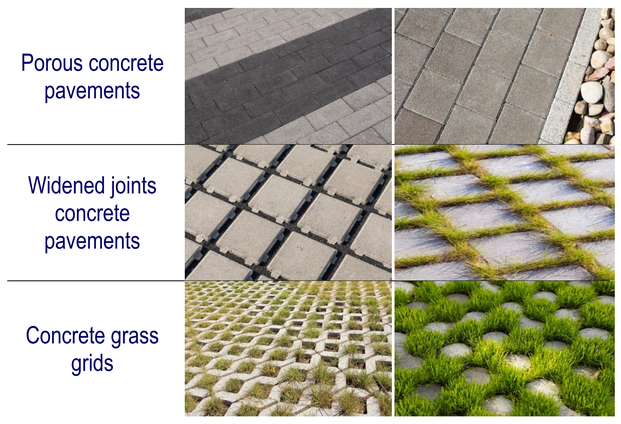
CONCRETE PERMEABLE PAVEMENTS: TECHNICAL SPECIFICATIONS

Revêtements perméables en éléments modulaires en béton : vers un référentiel technique

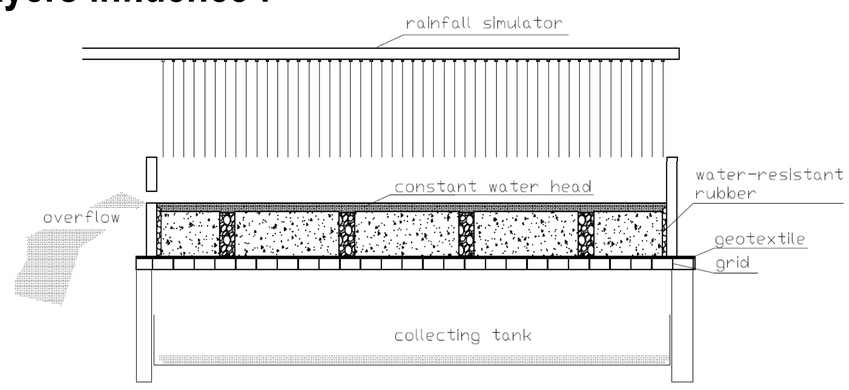
1. Context

- In France, contrary to other countries (Belgium, Germany), there are no guidelines about concrete permeable pavements. Neither EN 1338 (concrete paving block) nor EN 1339 (concrete paving flags) apply entirely.
- The CERIB wrote technical specifications (mechanical behavior, permeability, abrasion…) and a permeability test protocol applicable on these products :



2. Permeability test protocol

- This developed test protocol enables to characterize the permeability of the set "pavers and joint materials" without the bedding and foundation layers influence :



- Tests are carried out :
  - on an horizontal reconstituted pavement area of $S = 1\ m^2$, under a constant water head $h_w = 1\ cm$ above the pavement of height h.
  - the water which drains vertically through the pavement area in a duration t is collected and weighted (m)
  - the permeability coefficient K is : $K = \frac{m}{\rho S t}\frac{h}{h+h_w}\left[\frac{m}{s}\right]$

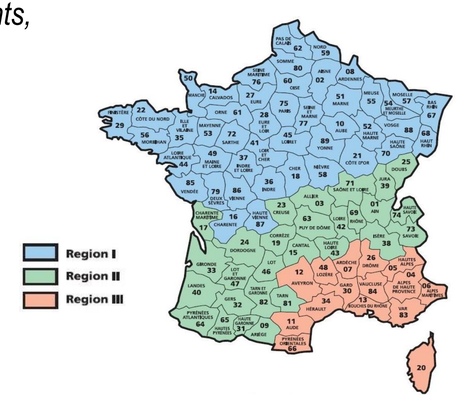
3. Link with French rainfall

- Pluviometry is usually defined by Montana's equations and coefficients. Interministerial Circular n°77284/INT defines them for 3 specific regions :

$$I(D,T) = a(D,T) * d^{b(D,T)}$$

Where a(D,T) and b(D,T) are Montana coefficients, I(D,T) is the rainfall intensity (mm/min) for a rain duration D(min) and a return period T(years)

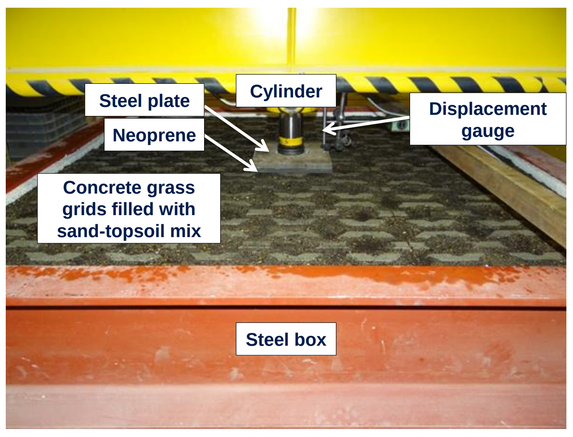
Area	Montana coefficient a	Montana coefficient b	Rainfall duration (min)	Return period (years)	Rainfall intensity (*10-4 m/s)
I	5,9	-0,59	5	10	0,38
II	6,7	-0,55	5	10	0,46
III	6,1	-0,44	5	10	0,50



- To obtain the required pavement permeability, a coefficient of 10 is taken into account (clogging, safety, climate change…)

4. Grass grids mechanical behavior

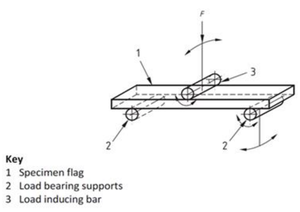
- Concrete grass grids' mechanical resistance cannot be determined using the same approach as the one for whole concrete paving flags, due to large vertical holes, and the filling, laying bed and subbase contribution.
- This method links laboratory tests results on the products themselves (and not just on the constitutive material) to in-situ performance : an initial type test according to the full-scale experiment allows to determine the appropriate use of the concrete grass grids (light vehicles traffic, heavy traffic…).

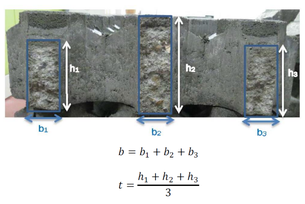


  - To be representative of actual installation conditions and simulate the continuity of the flag pavement, the test is carried out on a reconstructed pavement area of 1,5 m * 1,5 m. The concrete grass grid are filled with a volume mix of 1/3 of sand and 2/3 of topsoil, laid on a 3 cm laying bed of sand and a 15 cm subbase of crushed gravel. Both the surface load and dynamic amplification factor depend on the targeted scope of use for the concrete grass grid,
  - The equivalent real expected breaking load in situ P_S is calculated from the average breaking load obtained from the test representative of actual installation conditions P_C, safety factors $a = 0,75$ *and* $b = 1,25$ *(worst case load, possible imperfections and inaccuracies)*, and a dynamic amplification factor λ :

$$P_S = \frac{a}{b} * \frac{P_C}{\lambda}$$

- The manufacturers can then perform tests with the same methods and machines as for concrete flags, i.e. bending tests according to EN 1339 :





$$T = \frac{3 * P * L}{b * t^2}$$

Where T(MPa) is the strength, P(N) is the breaking load, L(mm) is the distance apart of the supports, b(mm) is the width at the failure plane (= the total sum of the failure sections widths), t(mm) is the height of at the failure plane (= the failure sections mean height).

More info in the technical specifications document (353.E) on : www.cerib.com

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