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Institutul Naţional de Cercetare-Dezvoltare în Construcţii
Urbanism şi Dezvoltare Teritorială Durabilă URBAN-INCERC
S U C U R S A L A   C L U J - N A P O C A

Laboratory INCERC of Applied Research and Construction Testing Cluj Napoca
Address: Str. Calea Floresti, no. 117, code 400524, tel / fax: 0264 425988, 0264 425462;
info@incerc-cluj.ro APPROVES

,   ISC authorization no. 3550 / 11.11.2019

General Manager of INCD "URBAN-INCERC"

associate professor dr. arch. Vasile MEIŢĂ

NOTE: THE FOLLOWING DOCUMENT HAS ADDITIONAL INFORMATION MARKED IN RED THAT WAS ADDED FOR COMPARATIVE PURPOSES ONLY AS INFORMATION FOR THE PURPOSE OF A COMPARATIVE ANALYSYS TOWARD UNDERSTANDING THE DIFFERENCES OF THE MATERIAL PRODUCED.

TEST REPORT no. 1051 of 15.07.2021

1. Customer order / Contract: FN from 25.05.2021 / 21785 from 2021 2.

Object name: Pavement and concrete curb

3.Customer: PFANE SCIENTIFIC SRL, Iaz Village, Plopis Commune, Postei Street no. 43A Salaj County

phone: 0787 635 147

4.Manufacturer: PFANE SCIENTIFIC SRL Working point place. Nusfalau, str. Garii no. 30J, jud. Salaj

5. Identification of the method used:
   Determination of pavilion dimensions - PTE IME-12 / 06.01 / SR EN 1338: 2004
   Determination of water absorption - PTE IME-12 / 06.04 / SR EN 1338: 2004
   Determination of resistance to splitting the pavela - PTE IME-12 / 06.04 / SR EN 1338: 2004
   Determination of the dimensions of the border - PTE IME-12 / 06.01 / SR EN 1340: 2004
   Determination of the resistance to bending at the border - PTE IME 12 / 06.05 / SR EN 1340: 2004
   Determination of the resistance to Bohme wear - PTE IME- 12 / 06.06 / SR EN 1338: 2004

6.Description and identification of the object under test: concrete pavement and concrete curb

Sample code: 340;   **Nr. test pieces:** 10 pieces / type; **Sample dimensions:** 200 x 100 x 55 mm, 495 x 205 x 65 mm

7. Date of receipt of the object under test: according to minutes no. 340 of 21.05.2021

8. Date of test: 24.05. - 06.07.2021

9. Sampling and conditioning data: Sampling was performed by the customer at his own risk and conditioning was performed according to the technical execution procedures mentioned in point 5.
 10. Results obtained

10.1. Checking the dimensions and appearanceappearance
Uniformof surfaces without cracks, exfoliations, delamination, segregation or damaged or broken edges.

Pavela

Nr. test piece	Length (mm)	Width (mm)	Thickness (mm)	Deviations from flatness (mm)	
				Diag.1	Diag.2
1	200	99	55	0.8 concavity	0.4 concavity
2	198	100	51	0.5 concavity	0.5 convexity
3	195	98	50	1.4 concavity	1.6 concavity
4	200	100	54	1.0 convexity	0.5 convexity
5	197	101	52	0.4 convexity	0.5 concavity
6	199	98	55	0.5 convexity	0.5 convexity
7	196	97	51	1.1 convexity	1.4 concavity
8	200	98	50	0.4 concavity	1.3convexity
average	**198**	**99**	**52**		

10.2. Water absorption in pavers and curbs

Principle: Immerse the test tubes in the water vessel at a temperature of 20±5 ° C to a constant mass M_1. Separate the specimens from each other by at least 15 mm and ensure a minimum of 20 mm of water above them.
The minimum immersion period must be 3 days and the constant mass must be considered when 2 weighings performed at an interval of 25 hours show a difference in mass of the sample less than 0.1%.
Dry the test tube at a temperature of 105 ± 5 ° C until the constant mass Mis reached$_2$.

Test tube No.	$M_1(g)$	$M_2(g)$	Water absorption (%)
1	1744	1402	24.4
2	1750	1412	23.9
3	1818	1476	23.2
average			**23.8**

Compared to Results From Concrete (Ready Mix Tests)

10.3 Determination of resistance to splitting of pavers

Principle: Immerse the pavers in water at 20 ± 5 ° C for 24 hours, remove, wipe dry and try immediately. Calculate the load area of the pavement plane tested with the relation:

$$S = l \times t$$

S = load area (mm²)
l = average of 2 measurements of the loading length, one towards the upper and lower part of the pavement (mm)
t = average of 3 measurements of the pavement thickness at load plane (mm)
Calculate the resistance T in MPa of the pavement with the relation

$$T = 0.637 \times k \times \frac{P}{S} \quad \text{where}$$

T - resistance (MPa)
P - breaking load (N)
k - correction factor for the thickness of the pavement 60 mm (k = 0.87)

Test tube	1	2	3	4	5	6	7	8	average
Resistance to cracking, T (mPa)	1.36	1.57	1.67	1.55	1.58	1.50	1.51	1.54	**1.5**
Load load, F (N / mm)	134	156	165	154	157	149	149	152	**152**

152 n/mm2 = 152 mPa = ~ 22045.74 psi

Compared To Results From Concrete Pavers

Test tube	Without Fibers	With 1.5% Fibers	With 2.5% Fibers	average
Resistance T(mPa)	~1.8	~2.0	~2.1	~1.9
Compression (mPa)	~32	~36	~37	~35

35 mPa = 35 n/mm2 = ~ 5076.32 psi

10.4 Checking the dimensions and appearance of the edge

Uniform appearance of surfaces without cracks, exfoliations, delamination, segregation or damaged or broken edges.

Border

No. test piece	Length (mm)	Width (mm)	Height (mm)	Deviations from flatness (mm)	
				Diag. 1	Diag.2
1	490	75/65	210/200	0.8 concavity	0.4 concavity
2	494	74/64	208/200	0.5 concavity	0.5 convexity
3	495	75/64	210/201	1.4 concavity	1.6 concavity
4	491	74/65	209/200	1.0 convexity	0.5 convexity
5	490	75/63	210/200	0, 4 convexity	0.5 concavity
6	494	74/64	210/200	0.5 convexity	0.5 convexity
7	493	75/65	209/200	1.1 convexity	1.4 concavity
8	492	75/65	210/199	0.4 concavity	1.3convexity
average	**492**	**75/64**	**210/200curvature**		

10.5 Determination of resistance of curb edges of the edging

Principle: The distance from the end supports must be 100 mm, but if the opening is less than 4 times the vertical dimension of the edging, placed In the test machine, the distance between the supports and the end of the edging must be reduced by half the vertical dimension of the edging in the test position. $T = \dfrac{3xPxL}{2xbxt^2}$

    T is the resistance, Mpa
    P breaking load, N
    L distance between supports, mm
    b width of the slab in the breaking plane, mm
    t height of the slab in the breaking plane, mm

No. of specimen	L (mm)	b (mm)	t (mm)	P (N)	Bending strength T (MPa)	
					Individual values	average
1	290	205	70	3708	1.6	
2	290	205	70	3575	1.5	
3	290	205	70	3650	1.6	
4	290	205	70	4290	1.8	**1.7**
5	290	205	70	4300	1,9	
6	290	205	70	4280	1,8	
7	290	205	70	4180	1,8	
8	290	205	70	4250	1,8	

10.6 Determination of wear according to Bohme's test on pavers and curbs

Principle: Place the cubes on the disk Böhme abrasive, on the test track on which a standard abrasive is sprayed, the disc being rotated and the specimens subjected to an abrasive load of (294 ± 3) N for a specified number of cycles. Wear is determined as a loss of test tube volume.

$$\Delta V = \frac{\Delta m}{\rho_R}$$ where

ΔV - volume loss after 16 cycles (mm3)

Δm - loss of mass after 16 cycles (g)

ρ_R - the density of the specimen (g /mm3)

Wear is reported to the nearest whole number of 1000 mm^3 / 5000 mm^2

No. of test tube	Δm (g)	ρ_R (g / mm³)	ΔV (mm³)
1	11.7	0.001204	9700
2	11.9	0.001245	9600
3	12.0	0.001248	9600
average			**9600**

Comparison to Concrete Study Source: https://etd.lib.metu.edu.tr/upload/12605709/index.pdf

15cm3 loss from 50cm2 material was reported

Converted: Pfane results would compare as
0.12cm3 loss from 97cm2

10.7 Determination of frost-thaw resistance

Principle: The test piece is preconditioned and then subjected to 28 freeze-thaw cycles with the surface covered with 3% NaCl solution. The exfoliated material, which comes off by brushing, is collected and weighed, then the result is expressed in kg / m^2. L = M / A

M - mass of the total quantity of peeled material after 28 cycles

A - surface area to be tested

L - mass lost per unit area No. test

tube	M (kg)	A (m^2)	L (kg / m^2)
1	0.003	0.005	0.6
2	0.003	0.005	0.6
3	0.003	0.005	0.6
average			**0.6**

Compared to results from concrete pavers Study Source:https://etd.lib.metu.edu.tr/upload/12605709/index.pdf

Results show little difference between the two materials.

11. Measurement uncertainty: - no

12. Opinions and interpretations: -

NOTES:

The test results refer only to the object to be tested.

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Targeted

Director of INCD "URBAN-INCERC" Cluj-Napoca Branch

Dr. Eng. Henriette SZILAGYI

Verified / Head of LaboratoryManager   Prepared / Contract

Eng. Carmen DICOEng   Dr.. Gabriela CALATAN

Conclusion of the testTest