

CERAMIC TILE QUALITY ASSESSMENT SCHEMES IN BRAZIL

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INTRODUCTION

Brazil is one of the world's leading players in the ceramic tile sector, ranking third in both production and consumption. In 2025, Brazil exported 89.37 million square metres, making it the world's seventh-largest exporter, with sales to more than 110 countries. The main destinations for Brazilian exports are: South America, Central America, North America and the Caribbean.

In 2025, 816.12 million square metres were produced, with an installed capacity of 1,141.05 million square metres. Total sales reached 821.69 million square metres in 2025.

Brazil produces some of the most environmentally friendly ceramics in the world, with lower consumption of gas, energy and water per square metre produced. It pioneered the transition of its energy mix towards natural gas in the 2000s.

The innovation, authentic design and quality of Brazilian products are recognised worldwide.

ANFACER (the Brazilian Association of Manufacturers of Ceramic Tiles, Sanitaryware and Related Products) was founded in 1984 with a view to representing the Brazilian ceramic tile industry at national and international level. The Brazilian ceramic tile sector comprises 80 manufacturing plants, with the highest concentration in the Southeastern and Southern regions and expanding into the Northeast of the country. It is a manufacturing industry with predominantly domestic capital and is also a major employer, providing around 50,000 direct jobs and about 200,000 indirect jobs. A typical feature of Brazilian production is the use of two distinct processes in its industrial base: the dry grinding process and the wet grinding process. Brazilian ceramic tile manufacturers are at the forefront of the best available technology worldwide and comply with international quality standards. The ceramic sector is Brazil's second-largest industrial consumer of natural gas and accounts for 6% of the construction materials industry's GDP.

In Brazil, there are two ceramic tile quality assessment schemes: certification by Inmetro (Brazilian Institute of Metrology, Quality and Technology) and the sectoral quality scheme (PSQ) run by PBQP-H (Brazilian Scheme for Quality and Productivity in Housing).

The Brazilian ceramic tile sector is actively involved in both schemes. Note that ANFACER is the body responsible for the PSQ scheme. The Brazilian Ceramic Centre is the certifying body for products accredited by Inmetro and also acts as the technical management body (EGT) for PBQP-H.

The average monthly certified production during the period analysed in this study was 65.6 million m². Given that average monthly national production during the same period was 68.1 million m², it follows that (96.32 ± 0.25) per cent of national production is certified. Taking non-participating companies into account as well, the sector's Overall Compliance Indicator stands at (98.05 ± 0.25) per cent. Note that the state of São Paulo accounts for around 60% of Brazilian production.

The aim of this paper is to present a summary of some of the results of the analyses carried out under both quality schemes. The standards used are ABNT NBR ISO 13006 and ABNT NBR ISO 10545. It should be noted that work is currently underway to include sustainability indicators in these reports as well.

1. EXPERIMENTAL PROCESS

Currently, the two quality schemes assess ceramic tiles from different water absorption classes (porcelain stoneware/BIa, AI, AII, AIII, BIb, BIIa, BIIb and BIII) produced by 49 participating ceramic manufacturers (each with a different tax registration number), representing 94 commercial brands.

The two quality assessment schemes for ceramic tiles involve quarterly product sampling (which may be carried out either on the market or at the factory gates each quarter). An annual audit is also carried out at factories to verify compliance with management system requirements that may affect the quality of the final product.

The quality assessment of the sampled products is carried out in accordance with ABNT NBR ISO 13.006 and ABNT NBR 16.928 standards.

The requirements assessed under this scheme are as follows:

- ABNT NBR ISO 10.545-1, Ceramic tiles – Part 1: Sampling and basis for acceptance;
- ABNT NBR ISO 10.545-2, Ceramic tiles – Part 2: Determination of dimensions and surface quality;
- ABNT NBR ISO 10.545-3, Ceramic tiles – Part 3: Determination of water absorption;
- ABNT NBR ISO 10.545-4, Ceramic tiles – Part 4: Determination of modulus of rupture and breaking strength;
- ABNT NBR ISO 10.545-6, Ceramic tiles – Part 6: Determination of resistance to deep abrasion for unglazed tiles (not included in this study);
- ABNT NBR ISO 10.545-7, Ceramic tiles – Part 7: Determination of resistance to surface abrasion for glazed tiles (not included in this study);

- ABNT NBR ISO 10.545-10, Ceramic tiles – Part 10: Determination of moisture expansion;
- ABNT NBR ISO 10.545-11, Ceramic tiles – Part 11: Determination of crazing resistance for glazed tiles;
- ABNT NBR ISO 10.545-13, Ceramic tiles – Part 13: Determination of chemical resistance;
- ABNT NBR ISO 10.545-14, Ceramic tiles – Part 14: Determination of resistance to stains (not included in this study);

Product packaging is assessed in accordance with standard ABNT NBR ISO 13.006 and Decree 484/2021.

The acceptance and rejection criteria for the products being tested comply with the provisions of standard ABNT NBR ISO 10545-1.

The sample shall be deemed conforming when it achieves an acceptable score in both types of criteria: attribute inspection and mean value inspection.

The company shall submit corrective measures within a maximum of 15 calendar days from the date of notification of any detected non-conformities. The effectiveness of the corrective measures shall be confirmed by re-testing.

Should there be three (3) consecutive retrials in relation to the same requirement during the period in which the quarterly assessments are carried out, the company shall be excluded from the list of certified companies.

2. RESULTS

The results to be presented are taken from the latest Sectoral Quality Report No. 056/2026, published in March 2026. These quarterly reports are publicly available on the PBQP-H website (<https://pbqp-h.cidades.gov.br/psq/placas-ceramicas-para-revestimento/>).

A total of 404 products from manufacturers were assessed, of which 15 were purchased from retail outlets across Brazil. Figure 1 shows the percentage of products assessed as a function of their surface finish: glazed and unglazed (98% of the assessed products are glazed).

Data	No. of products
Glazed	397
Unglazed	7
Total	404

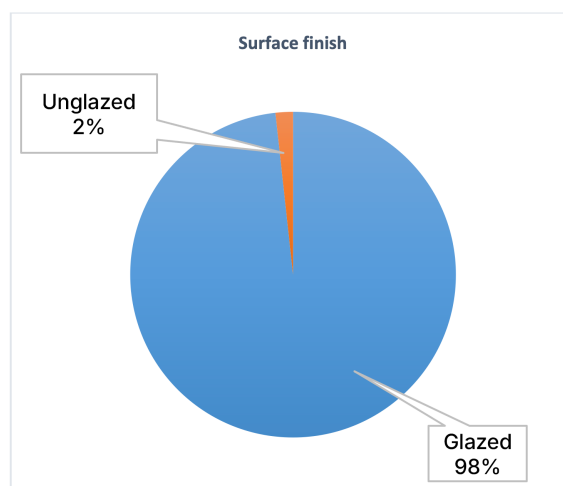


Figure 1. Surface finish of the assessed products.

Figure 2 shows the distribution of the assessed products as a function of their water absorption group. It can be seen that a large number of BIIb products (52%) and porcelain stoneware/Bla products (30.2%) were assessed. These two types of products are the most widely manufactured ceramic tiles in Brazil.

Figure 3 shows the results of the visual analysis of the surface appearance of the 393 assessed products. It may be observed that 15 products (accounting for 4%) did not meet the visual analysis requirement for surface appearance. The 15 products that did not meet the requirement belong to water absorption group BIIb. The manufacturers have since addressed and resolved the non-conformities detected in the products.

Water absorption group	No. of products
AI _a	0
AI _b	0
AII _{a1}	1
AII _{a2}	0
AII _{b1}	0
AII _{b2}	0
AIII	0
BI _a	122
BI _b	13
BII _a	26
BII _b	210
BIII	32
Total	404

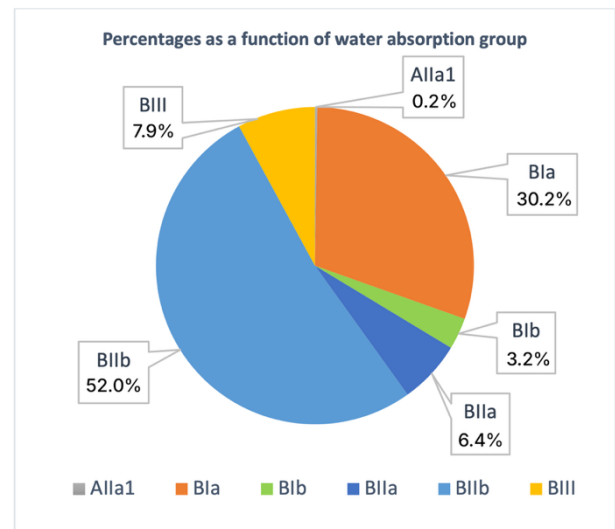


Figure 2. Product breakdown as a function of water absorption group.

Water absorption	Conforming	Non-conforming	Total	%C	%NC
Al _a	0	0	0	-	-
Al _b	0	0	0	-	-
All _{a1}	0	0	0	-	-
All _{a2}	0	0	0	-	-
All _{b1}	0	0	0	-	-
All _{b2}	0	0	0	-	-
All	0	0	0	-	-
Bl _a	120	0	120	100%	0%
Bl _b	13	0	13	100%	0%
Bll _a	25	0	25	100%	0%
Bll _b	188	15	203	93%	7%
Blll	32	0	32	100%	0%
Total	378	15	393	96%	4%

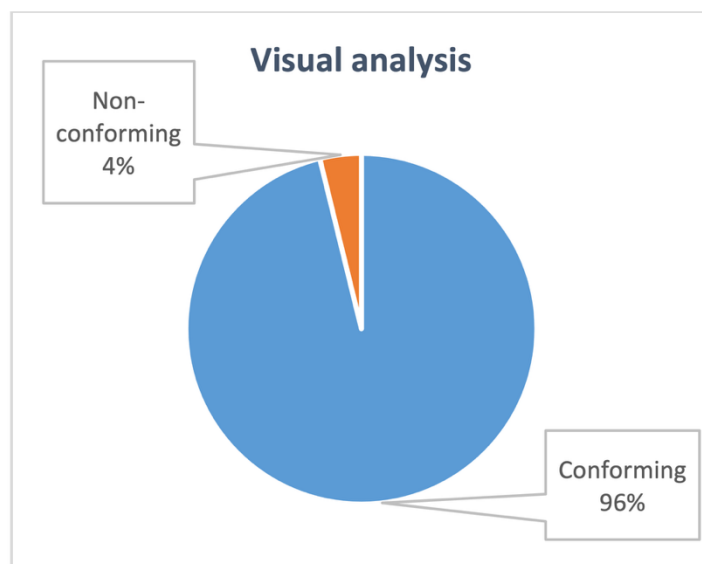
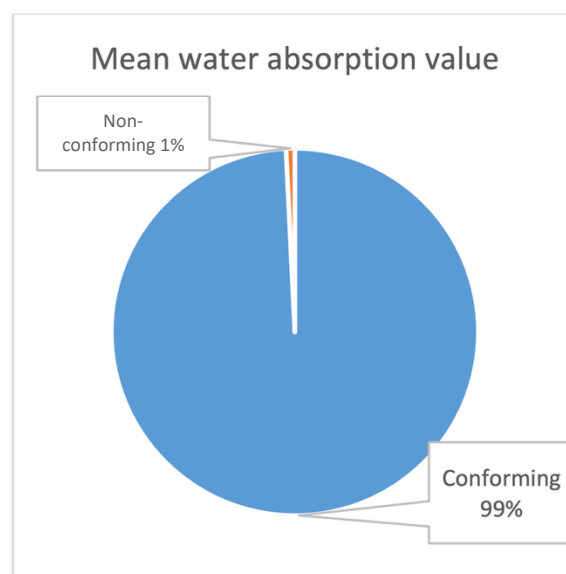


Figure 3. Results of the visual surface appearance analysis of the assessed products.

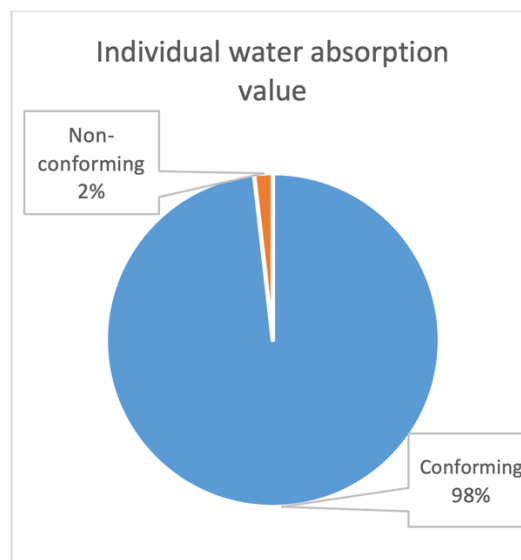
Figure 4 shows the conformance rates of the mean and maximum individual water absorption values of all assessed products. It can be seen that, of the 391 assessed products, only three in the Bl_a absorption group failed to meet the requirement relating to mean water absorption. As regards maximum individual water absorption, seven products in the Bl_a absorption group also failed to meet the requirement. All identified non-conformities have now been addressed and resolved by the respective manufacturers.

Mean value					
Water absorption	Conforming	Non-conforming	Total	%C	%NC
Al _a	0	0	0	-	-
Al _b	0	0	0	-	-
All _{a1}	0	0	0	-	-
All _{a2}	0	0	0	-	-
All _{b1}	0	0	0	-	-
All _{b2}	0	0	0	-	-
All	0	0	0	-	-
Bl _a	118	3	121	98%	2%
Bl _b	13	0	13	100%	0%
BII _a	25	0	25	100%	0%
BII _b	200	0	200	100%	0%
BIII	32	0	32	100%	0%
Total	388	3	391	99%	1%



(a) Conformance of mean water absorption value of all assessed products.

Individual value					
Water absorption	Conforming	Non-conforming	Total	%C	%NC
AI _a	0	0	0	-	-
AI _b	0	0	0	-	-
AI _{a1}	0	0	0	-	-
AI _{a2}	0	0	0	-	-
AI _{b1}	0	0	0	-	-
AI _{b2}	0	0	0	-	-
AII	0	0	0	-	-
BI _a	114	7	121	94%	6%
BI _b	13	0	13	100%	0%
BII _a	25	0	25	100%	0%
BII _b	200	0	200	100%	0%
BIII	32	0	32	100%	0%
Total	384	7	391	98%	2%



(b) Conformance of maximum individual water absorption value of all assessed products.

Figure 4. Conformance rates of mean and maximum individual water absorption values of all assessed products.

Figure 5 shows the results of breaking strength conformance in all assessed water absorption groups. It may be observed that, of the 390 assessed products, four failed to meet the breaking strength requirement (one from group BIIa and three from group BIIb). The manufacturers have since addressed and resolved these non-conformities.

Figure 6 shows conformance as a function of water absorption group of the mean and individual minimum values for the modulus of rupture. All assessed products met the requirement for the mean value of the modulus of rupture. At the individual level, three products failed to meet the requirement: one from the BIa water absorption group and two from the BIII water absorption group. The manufacturers have since addressed and resolved these non-conformities.

Water absorption	Conforming	Non-conforming	Total	%C	%NC
AI _a	0	0	0	-	-
AI _b	0	0	0	-	-
AII _{a1}	0	0	0	-	-
AII _{a2}	0	0	0	-	-
AII _{b1}	0	0	0	-	-
AII _{b2}	0	0	0	-	-
AIII	0	0	0	-	-
BI _a	120	0	120	100%	0%
BI _b	13	0	13	100%	0%
BII _a	24	1	25	96%	4%
BII _b	197	3	200	99%	2%
BIII	32	0	32	100%	0%
Total	386	4	390	99%	1%

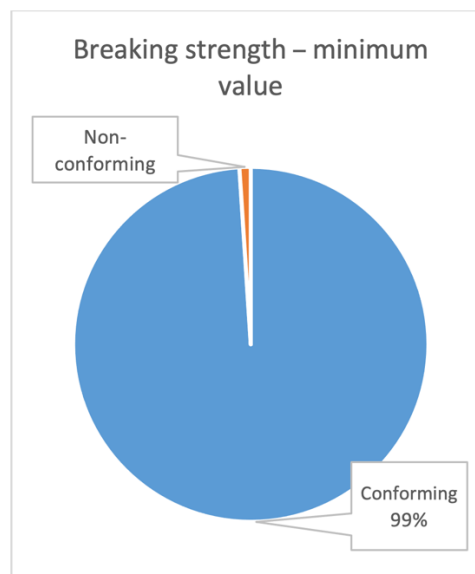


Figure 5. Breaking strength conformance of all assessed water absorption groups.

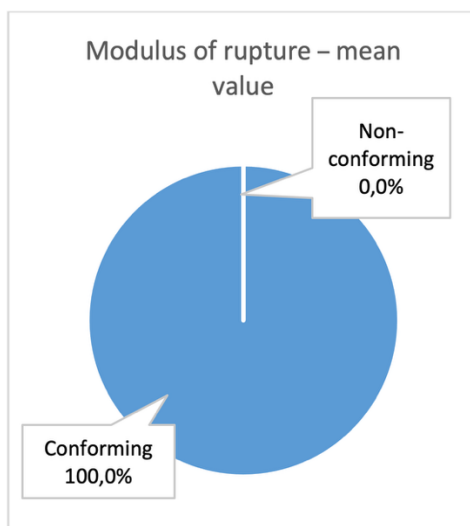
Figure 7 shows the results of the tests carried out to determine crazing resistance of the assessed glazed tiles. It can be seen that all 389 assessed products met this requirement.

Figure 8 shows the results of the moisture expansion tests carried out on the assessed products. All 369 assessed products met the moisture expansion requirement. Note that the majority of the assessed products exhibited a moisture expansion of 0.3 mm/m or less. The value of 0.6 mm/m is not a mandatory requirement in the ABNT NBR ISO 13.006 standard (Annex P), but it is a value suggested in a note in that standard and adopted for certification purposes.

Figure 9 shows the results of chemical resistance of glazed tiles when exposed to household chemicals and swimming pool salts. All 390 assessed products met the declared chemical resistance class.

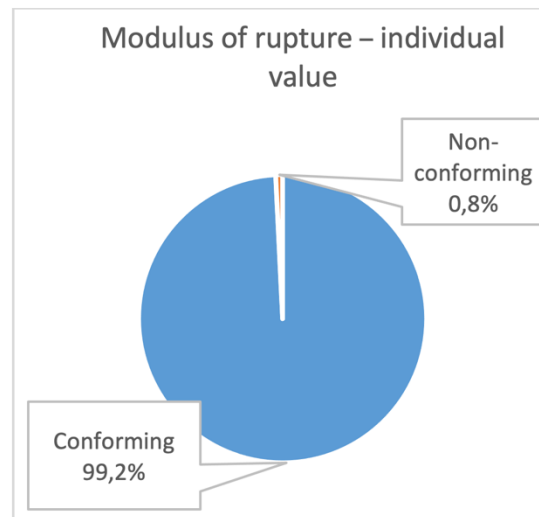
Figure 10 shows the results of the chemical resistance tests carried out on the 390 assessed products against low-concentration acids and alkalis. Of the 390 assessed products, one product from the BIa absorption group and three products from the BIb absorption group failed to meet this requirement. These non-conformities have since been addressed and resolved by the manufacturers.

Water absorption	Mean value				
	Conforming	Non-conforming	Total	%C	%NC
AI _a	0	0	0	-	-
AI _b	0	0	0	-	-
AI _{a1}	0	0	0	-	-
AI _{a2}	0	0	0	-	-
AI _{b1}	0	0	0	-	-
AI _{b2}	0	0	0	-	-
AIII	0	0	0	-	-
BI _a	120	0	120	100%	0%
BI _b	13	0	13	100%	0%
BII _a	25	0	25	100%	0%
BII _b	200	0	200	100%	0%
BIII	32	0	32	100%	0%
Total	390	0	390	100%	0%



(a) Conformance of mean modulus of rupture as a function of water absorption groups

Individual value					
Water absorption	Conforming	Non-conforming	Total	%C	%NC
AI _a	0	0	0	-	-
AI _b	0	0	0	-	-
AI _{a1}	0	0	0	-	-
AI _{a2}	0	0	0	-	-
AI _{b1}	0	0	0	-	-
AI _{b2}	0	0	0	-	-
AII	0	0	0	-	-
BI _a	119	1	120	99%	1%
BI _b	13	0	13	100%	0%
BII _a	25	0	25	100%	0%
BII _b	200	0	200	100%	0%
BIII	30	2	32	94%	6%
Total	387	3	390	99.2%	0.8%



(b) Conformance of individual modulus of rupture as a function of water absorption groups.

Figure 6. Conformities based on water absorption group as a function of mean and minimum individual modulus of rupture.

Water absorption	Conforming	Non-conforming	Total	%C	%NC
AI _a	0	0	0	-	-
AI _b	0	0	0	-	-
AI _{a1}	0	0	0	-	-
AI _{a2}	0	0	0	-	-
AI _{b1}	0	0	0	-	-
AI _{b2}	0	0	0	-	-
AI _{II}	0	0	0	-	-
BI _a	114	0	114	100%	0%
BI _b	13	0	13	100%	0%
BII _a	25	0	25	100%	0%
BII _b	205	0	205	100%	0%
BIII	32	0	32	100%	0%
Total	389	0	389	100%	0%



Figure 7. Resistance to crazing of the assessed glazed products.

Water absorption	Conforming	Non-conforming	Total	%C	%NC
AI _a	0	0	0	-	-
AI _b	0	0	0	-	-
AI _{a1}	0	0	0	-	-
AI _{a2}	0	0	0	-	-
AI _{b1}	0	0	0	-	-
AI _{b2}	0	0	0	-	-
AII	0	0	0	-	-
BI _a	99	0	99	100%	0%
BI _b	13	0	13	100%	0%
BII _a	25	0	25	100%	0%
BII _b	200	0	200	100%	0%
BIII	32	0	32	100%	0%
Total	369	0	369	100%	0%

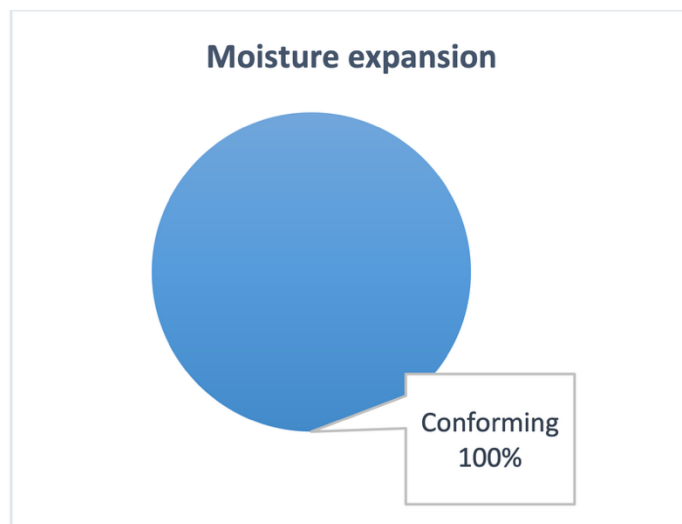


Figure 8. Moisture expansion of the assessed products.

Water absorption	Conforming	Non-conforming	Total	%C	%NC
AI _a	0	0	0	-	-
AI _b	0	0	0	-	-
AII _{a1}	0	0	0	-	-
AII _{a2}	0	0	0	-	-
AII _{b1}	0	0	0	-	-
AII _{b2}	0	0	0	-	-
AIII	0	0	0	-	-
BI _a	120	0	120	100%	0%
BI _b	13	0	13	100%	0%
BII _a	25	0	25	100%	0%
BII _b	200	0	200	100%	0%
BIII	32	0	32	100%	0%
Total	390	0	390	100%	0%

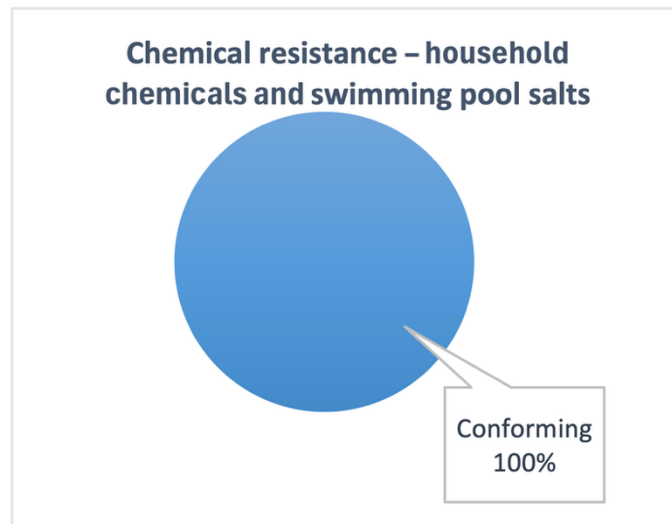


Figure 9. Chemical resistance of the assessed products on exposure to household chemicals and swimming pool salts.

Water absorption	Conforming	Non-conforming	Total	%C	%NC
AI _a	0	0	0	-	-
AI _b	0	0	0	-	-
AI _{a1}	0	0	0	-	-
AI _{a2}	0	0	0	-	-
AI _{b1}	0	0	0	-	-
AI _{b2}	0	0	0	-	-
AII	0	0	0	-	-
BI _a	119	1	120	99%	1%
BI _b	13	0	13	100%	0%
BII _a	25	0	25	100%	0%
BII _b	197	3	200	99%	2%
BIII	32	0	32	100%	0%
Total	386	4	390	99%	1%

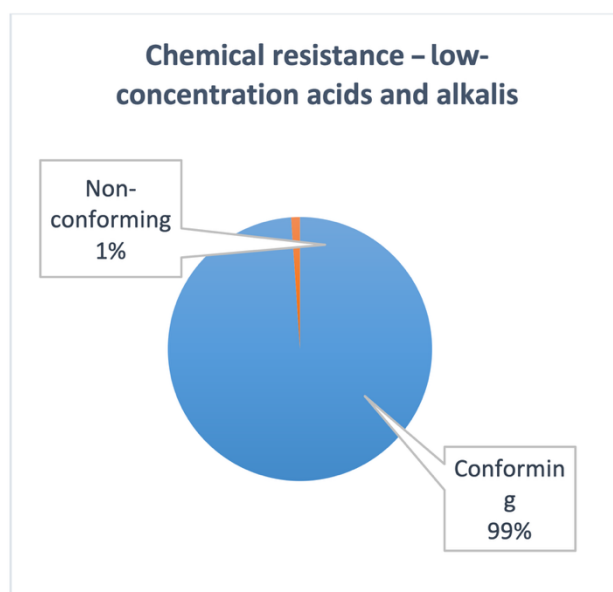


Figure 10. Chemical resistance to low-concentration acids and alkalis of the assessed products.

Table 1 details the conformance of the dimensional characteristics of the assessed products.

Dimensions	Length/ width	Thickness	Orthogon ality	Straightn ess of sides	Centre curvature	Side curvature	Edge warpage
Conforming	332	332	339	337	329	336	336
Non- conforming	6	6	1	0	9	1	2
Total	338	338	340	337	338	337	338
% Conformity	98.2	98.2	99.7	100	97.3	99.7	99.4
% Non- conformity	1.8	1.8	0.3	0	2.7	0.3	0.6

Table 1. Conforming and non-conforming products as a function of their dimensional characteristics.

Table 1 shows that few products failed to meet the dimensional requirements, with a conformity rate consistently above 95%. The detected non-conformities were addressed and resolved by the respective manufacturers.

3. CONCLUSIONS

Brazil is the only country in the world to have two ceramic tile conformity assessment schemes. These schemes are rigorous and demonstrate that isolated instances of non-conformities may occur, which need to be addressed and resolved by manufacturers. Ninety-eight percent of

Brazil's ceramic tile production is voluntarily certified. Note that construction companies and social housing programmes require products to be certified by Inmetro or by PBQP-H.

The analyses and results obtained in this study provide an overview of the conformity of ceramic wall tiles with regard to the requirements for visual surface appearance analysis, water absorption, breaking strength, modulus of rupture, resistance to chemical attack, resistance to crazing, moisture expansion and dimensional characteristics in accordance with standards ABNT NBR ISO 13.006 and ABNT NBR ISO 10.545. The resulting conformity status is presented in Table 2.

These quality schemes have an acceptable quality limit (AQL) of 95%. In the quarterly sampling carried out, this AQL was met for all assessed requirements.

Furthermore, the PBQP-H Sectoral Quality Scheme intends to introduce sustainability requirements related to greenhouse gas emissions, circularity, and water consumption, among others.

Requirement	Water absorption groups										General		
	AI _a	AI _b	AI _{a1}	AI _{a2}	AI _{b1}	AI _{b2}	AI _{III}	BI _a	BI _b	BI _a	BI _b	BI _{III}	
Visual analysis of surface appearance	-	-	-	-	-	-	-	100%	100%	100%	93%	100%	96%
Water absorption													
Mean value	-	-	-	-	-	-	-	98%	100%	100%	100%	100%	99%
Max. individual value	-	-	-	-	-	-	-	94%	100%	100%	100%	100%	98%
Minimum breaking strength	-	-	-	-	-	-	-	100%	100%	96%	99%	100%	99%
Modulus of rupture													
Mean value	-	-	-	-	-	-	-	100%	100%	100%	100%	100%	100%
Min. individual value	-	-	-	-	-	-	-	99%	100%	100%	100%	94%	99%
Resistance to crazing	-	-	-	-	-	-	-	100%	100%	100%	100%	100%	100%
Chemical resistance													
Household chemicals and swimming pool salts	-	-	-	-	-	-	-	100%	100%	100%	100%	100%	100%
Low-concentration	-	-	-	-	-	-	-	99%	100%	100%	99%	100%	99%

acids and alkalis														
Mean moisture expansion	-	-	-	-	-	-	-	100%	100%	100%	100%	100%	100%	100%
Dimensional characteristics														
Length and width (deviation from W)	-	-	-	-	-	-	-	96%	100%	100%	99%	97%	98%	
Thickness (deviation from ew)	-	-	-	-	-	-	-	99%	100%	100%	98%	94%	98%	
Straightness of sides	-	-	-	-	-	-	-	100%	100%	100%	100%	100%	100%	
Orthogonality	-	-	100%	-	-	-	-	100%	100%	96%	100%	100%	99.7%	
Centre curvature	-	-	-	-	-	-	-	94%	100%	100%	98%	100%	97%	
Side curvature	-	-	-	-	-	-	-	99%	100%	100%	100%	100%	100%	
Edge warpage	-	-	-	-	-	-	-	100%	100%	100%	99%	100%	99.4%	

Table 2. Summary of conformance of the assessed requirements.
Conformance rate as a function of water absorption group

4. REFERENCES

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