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Impact noise in ceramic floors: a statistical analysis of the acoustic performance of bare and covered and covered slabs

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Impact Noise in Ceramic Floors: A Statistical Analysis of the Acoustic Performance of Bare and Covered Slabs

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Introduction / Previous Research

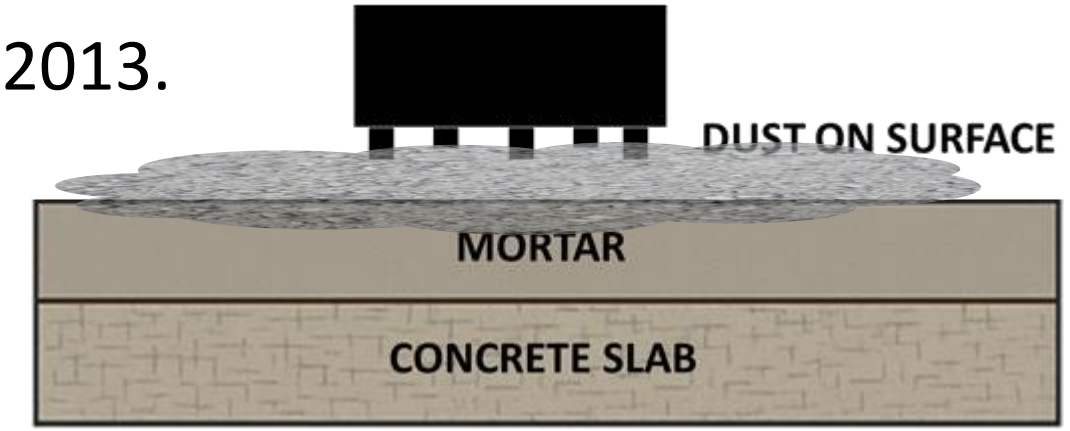
Dust and particles effect

- Residues accumulate on surfaces.
- Dust layers “spring effect,” = errors in high-frequency, from 630 Hz band (Schiavi, Prato and Belli)

Brazilian regulations

- Impact noise performance adopted in 2013.

Minimum field criterion: **LnT,w ≤ 80 dB**.



Introduction / Previous Research

Testing challenges in Brazil

- Tests conducted on buildings as delivered (bare slab + mortar layer).
- Final floor finishes: user's responsibility, not included in tests.
- Mortar layer unsuitable: particles detach, damping occurs, results affected.

Slab thickness and performance

- Inverse relation: thicker slabs → lower impact sound pressure level.
- Requires rigid surface to ensure reliable results (ISO 12354-2).

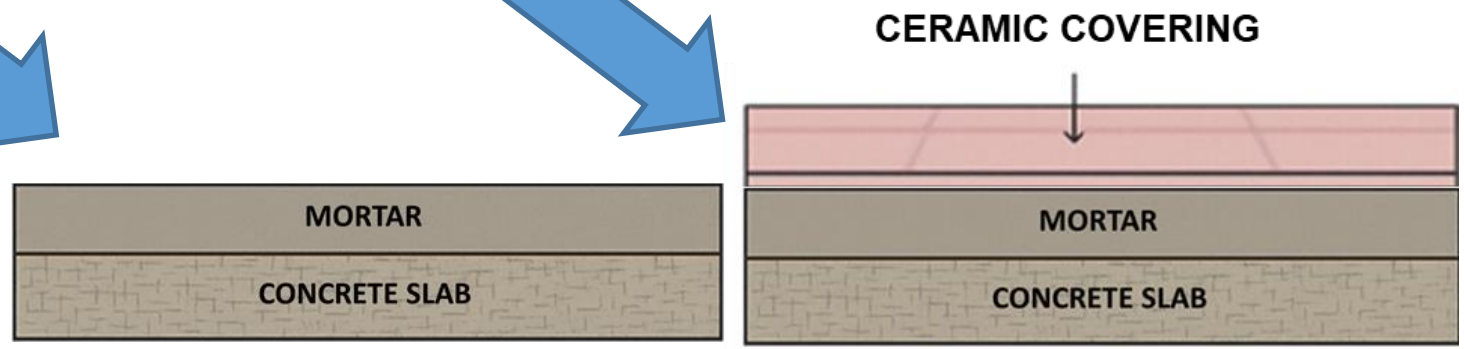
Goals of This Work

- Comparative statistical analysis: bare slabs vs. ceramic-covered slabs.
- Highlights importance of surface rigidity for valid acoustic measurements.

Method

- **Database and scope**

- Source: IPT database + published Brazilian field test results.
- Floor types: **bare slabs (B)** and **ceramic-covered slabs (C)**.
- Excluded: acoustic tr tments, floating flo s, suspended ceilings.



- **Data collected**
- bare slabs: 73 data points
- Ceramic-covered slabs: 54
- Thickness range: **9–21 cm**, grouped in **1 cm intervals**.

Method

Table 1: Selected Data

Thickness (cm)	Bare slab	Ceramic covering
= 10	34	12
11 - 12	15	15
13 - 14	11	9
15 - 16	11	16
17 - 21	2	1
Total thickness	73	54

Method

- Standard applied: **ISO 16283-2**.

- Field tests conducted in several Brazilian states:
São Paulo, Santa Catarina, Rio Grande do Sul, Paraíba, Alagoas.

Results

Table 2: Statistical results

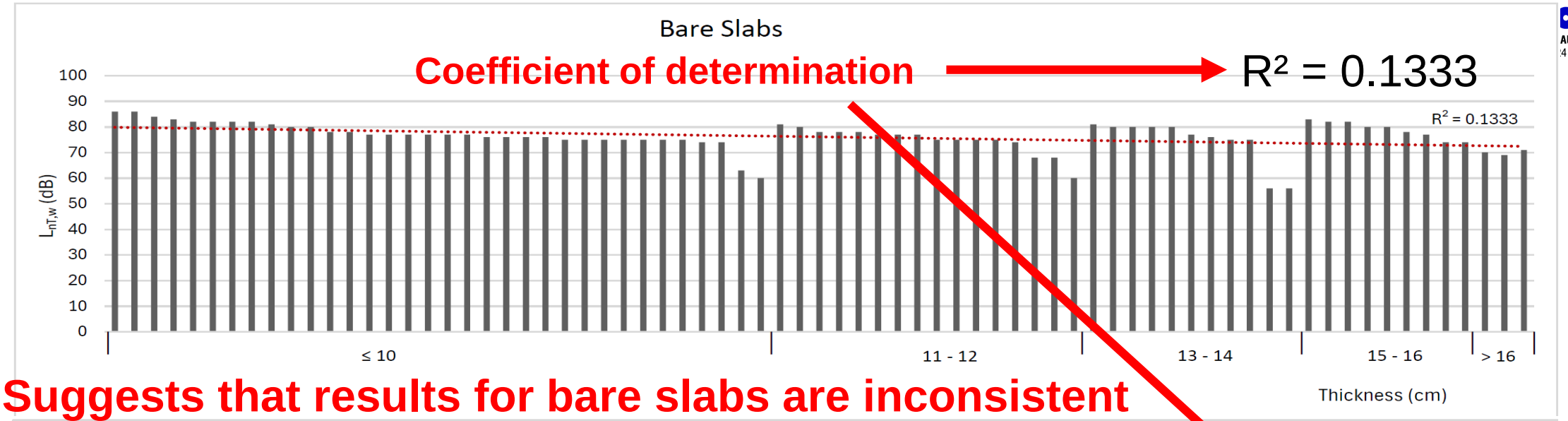
	B				C			
	≤10	11-12	13-14	15-16	≤10	11 12	13 14	15 16
Average	77.24	74.75	74.18	78.89	84.27	80.69	77.44	69.00
Standard deviation	5.27	5.31	9.25	4.85	4.45	3.03	3.09	4.00
Correlation	-0.13				-0.67			

Ceramic-covered slabs generally perform worse in tests

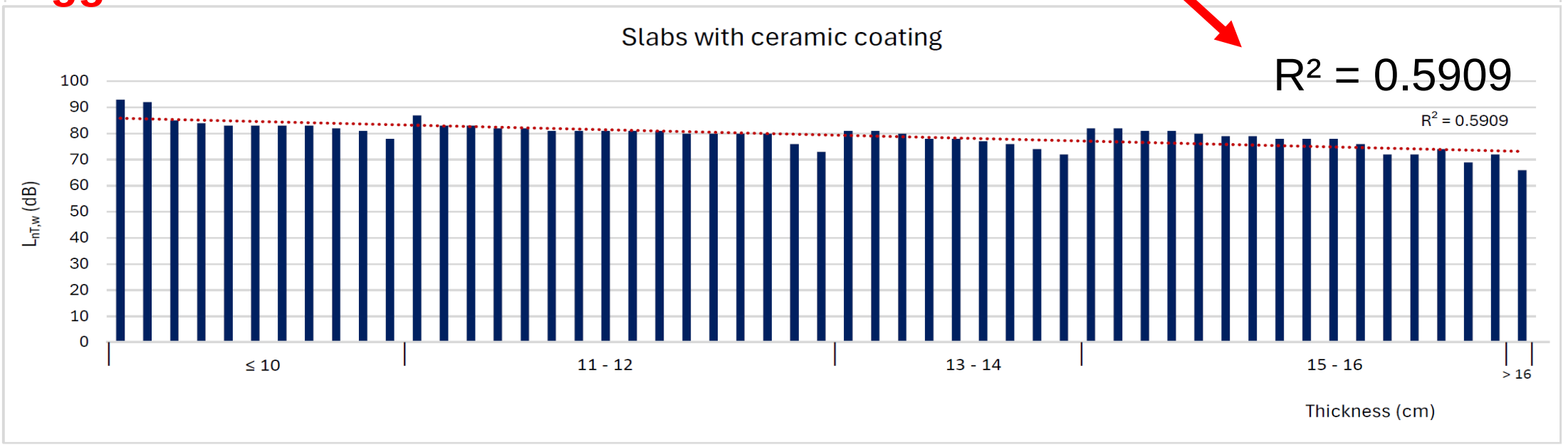
Ceramic-covered slabs generally exhibit a lower standard deviation

Significantly difference in correlation between thickness and impact noise level. Weak correlation for type B

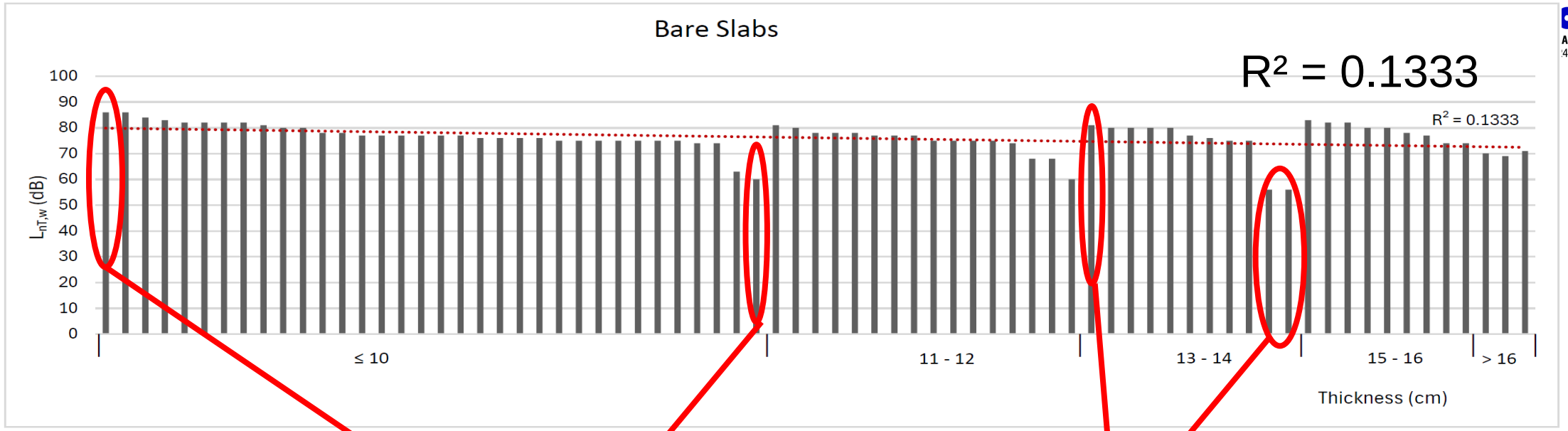
Results



Suggests that results for bare slabs are inconsistent



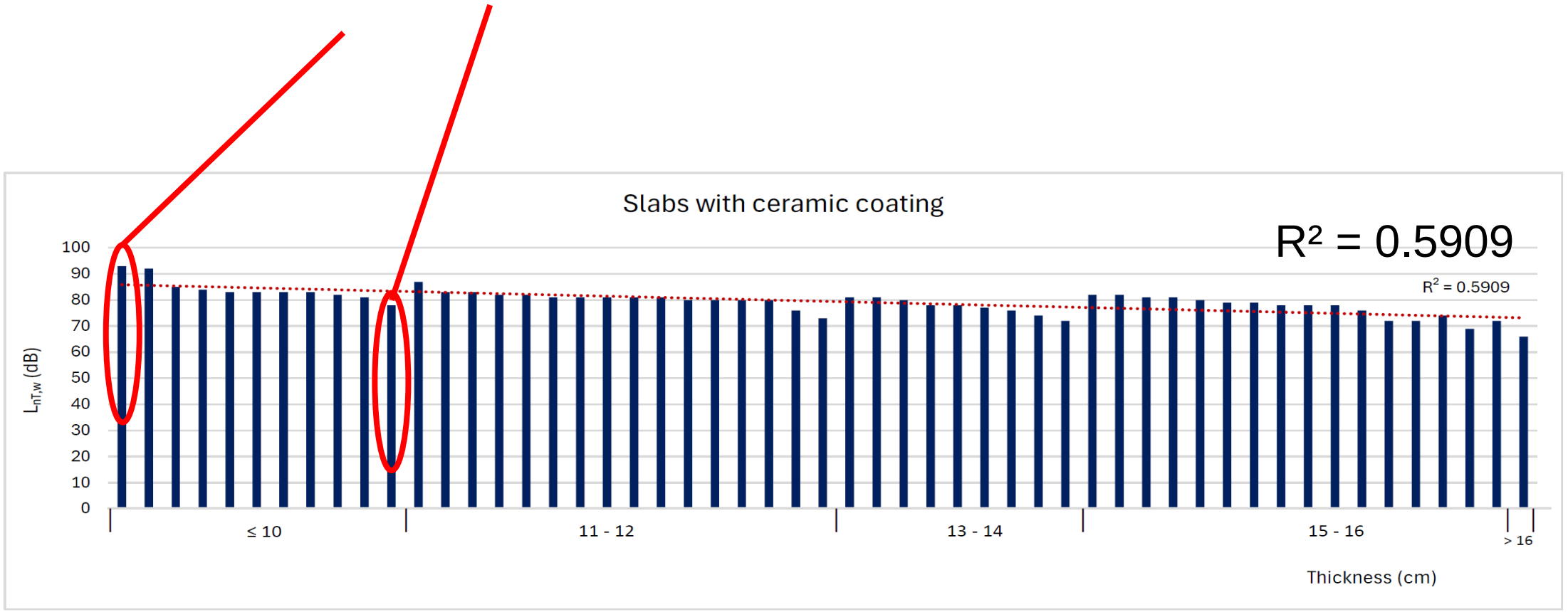
Results



Variations were identified in slabs up to 10 cm thick, where LnT,w ranged from 86 dB to 60 dB, and in the 13–14 cm group, with values between 81 dB and 56 dB
This is 25 and 26 dB of difference, respectively.

Results

Highest variation in thickness up to 10 cm, ranging from 93 dB to 78 dB. This is 15 dB of difference.



Conclusions

Study findings

- **Bare slabs (≤10 cm):** LnT,w variation up to **26 dB** → high data dispersion.
- **Ceramic-covered slabs:** more consistent results due to **rigid surface**.

Recommendation

- Adopt an **additional criterion**: impact noise tests should be conducted only on **rigid surfaces**.
- Ensures reliable measurements while maintaining delivery without floor coverings.

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