BRNO UNIVERSITY OF TECHNOLOGY

FACULTY OF CIVIL ENGINEERING
institute of building testing

ilac-MRA

Z 7008

FINAL REPORT ON THE RESULTS OF PRECISION EXPERIMENT

Proficiency Testing Program
Strenght and Elasticity of Hardened Concrete
ZZB 2020/2

Brno University of Technology
Proficiency testing provider at the SZK FAST
Veveří 95, Brno 602 00
Czech Republic

www.szk.fce.vutbr.cz
www.ptprovider.cz

Date: January 18, 2021

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Contents

1 Introduction and Important Contacts

In the year 2019, the Proficiency Testing Provider at the SZK FAST (PT Provider) initiated the Proficiency Testing Program (PTP) designated ZZB 2020/2 whose aim was to verify and assess the conformity of test results across laboratories when testing hardened concrete.

The assessment of the results of the Proficiency Testing Program was carried out by a committee consisting of the following PT Provider employees:

Head of the PT Provider, PTP coordinator

Assoc. Prof. Ing. Tomáš Vymazal, Ph.D.
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Coordinator of PTP result assessment PrZZ

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The subjects of proficiency testing were the following testing procedures:

1. **EN 12390-3** – Compressive strength of test specimens [1].
2. **EN 12390-5** – Flexural strength of test specimens [2].
3. **EN 12390-6** – Tensile splitting strength of test specimens [3].
4. **EN 12390-7** – Density of hardened concrete [4].
5. **ISO 1920-10** – Determination of static modulus of elasticity in compression [5].
6. **EN 12390-13** – method A – Determination of secant modulus of elasticity in compression [6].
7. **EN 12390-13** – method B – Determination of secant modulus of elasticity in compression [6].
8. **EN 12504-4, ČSN 731371** – Non-destructive testing of concrete [7], [8].
9. **ČSN 731373, EN 12504-2** – Determination of rebound number [9], [10].
10. **EN 1542, ČSN 736242** – Appendix B – Measurement of bond strength by pull-off [11], [12].

Testing procedures No 6 – 8 were not open due to the low number of participants.

The supplier, BETOTECH s. r. o., was responsible for the preparation of hardened concrete for the PTP. Fresh concrete for the preparation of test samples was taken from one production batch prepared in accordance with methods stipulated in EN 206 [13]. Fresh concrete was poured into test molds, which were always of the same type, and after removal from the molds the test specimens were placed under identical conditions in storage rooms complying with the requirements for individual specifications.

The specimens were taken from the same production with the same production date. The test results from individual PTP participants were compared via a method involving the statistical analysis of all their results in a manner complying with ISO 5725-2 [14] and with EN ISO/IEC 17043 [15]. The outcome is the present final report summarizing the results of the interlaboratory comparison, including statistical evaluation.

52 laboratories took part in the program. In order to maintain the anonymity of the PTP, each laboratory was given an identification number that will be used henceforth in this document. An integral part of the present final report is a Certificate of Participation in the Proficiency Testing Program. It is unique for each participant and includes the participant's ID used in this report. The following chart shows the participation of laboratories in individual parts of the PTP.

Table 1: Participation of individual laboratories in the PTP

ID/Method	1	2	3	4	5	6	7	8	9	10
76bfd8	X	-	-	-	-	-	-	-	-	-
0f0db2	X	-	-	X	X	-	-	-	-	-
76e1de	-	-	X	-	-	-	-	-	-	-
1e1eec	X	-	-	-	-	-	-	-	X	X
8b7ed8	-	-	-	-	-	-	-	-	X	-
9c2e92	X	-	-	-	-	-	-	-	-	-
86bdde	-	-	-	-	-	-	-	-	-	X
d48859	-	-	X	X	-	-	-	-	X	-
aaf2c2	X	-	-	X	-	-	-	-	-	-
f73b2c	X	-	-	X	-	-	-	-	-	-
accaa8	-	-	X	-	X	-	-	-	-	-
a83fcd	X	X	X	X	-	-	-	-	X	X
10984f	-	-	-	-	-	-	-	-	-	X
68d869	-	-	-	-	-	-	-	-	-	X
1165f2	-	-	-	-	-	-	-	-	-	X
7bb808	-	-	-	-	-	-	-	-	-	X
33033a	X	-	-	X	-	-	-	-	X	-
695bf7	-	-	-	-	-	-	-	-	-	X
d38b83	X	-	-	X	-	-	-	-	-	-
64c7e3	X	-	-	X	-	-	-	-	-	-
78d877	X	-	-	X	-	-	-	-	-	-
f1c786	X	-	-	X	-	-	-	-	-	-
c44c48	X	-	-	X	-	-	-	-	-	-
9d1087	X	-	-	X	-	-	-	-	-	-
e0fba4	X	-	-	X	-	-	-	-	-	-
dd036d	X	-	-	X	-	-	-	-	-	-
ac6b0d	X	-	-	X	X	-	-	-	-	-
51c294	X	-	-	X	-	-	-	-	-	-
4b9070	X	X	-	-	X	-	-	-	-	-
73eaf6	X	X	X	X	-	-	-	-	-	-
f47e64	X	-	-	-	-	-	-	-	X	X
14bad1	-	-	-	-	X	-	-	-	-	-
a9a27b	-	X	-	-	-	-	-	-	-	-
c91d8a	-	X	-	-	-	-	-	-	-	-
ae9208	-	-	-	-	-	-	-	-	X	X
3b59a5	-	X	-	-	-	-	-	-	X	-
abe715	X	-	-	-	-	-	-	-	-	-
9b5cad	-	X	-	-	-	-	-	-	-	X
271d81	X	-	-	-	-	-	-	-	-	-
84db56	X	-	-	-	-	-	-	-	-	-
ec4d76	X	X	X	X	-	-	-	-	-	-
c03a46	X	-	-	X	-	-	-	-	-	X
8699f5	X	-	-	X	-	-	-	-	-	X
b8975c	-	-	X	-	-	-	-	-	-	-

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ID/Method	1	2	3	4	5	6	7	8	9	10
3539c7	-	-	-	-	X	-	-	-	-	-
362e18	X	X	X	X	-	-	-	-	-	-
e1bfb8	X	X	-	X	-	-	-	-	-	-
a191ba	X	-	-	X	-	-	-	-	-	-
68d36b	X	-	-	X	-	-	-	-	-	-
658f36	X	-	-	-	-	-	-	-	-	-
23af1e	-	-	-	-	-	-	-	-	-	X
c36d82	X	X	-	X	-	-	-	-	-	-

Table 2: List of participants (laboratories) – the order in the table does not correspond to the identification number in previous table

Laboratory	Address	Accreditation number
BETOTECH, s.r.o. - Pracoviště Most	Beroun 660, Beroun, 26601, Česká republika	AZL 1195
BETOTECH, s.r.o. - pracoviště Brno	Beroun 660, Beroun, 266 01, Česká republika	1195.3
BETOTECH, s.r.o. - pracoviště Ostrava	Beroun 660, 26601 Beroun, Ostrava, 70300, Česká republika	1195.2
BP INSTITUT D.O.O VELIKO BLAŠKO, LAKTAŠI, COUNTRY BIH	TURJANICA 31, LAKTAŠI, 78250, BOSNIA AND HERZEGOVI	LI-146-01
BetónRacio, s.r.o., Skúšobné laboratórium, Pracovisko Lietavská Lúčka	Skladová 2, Trnava, 917 00, Slovenská republika	S-320
BetónRacio, s.r.o., Skúšobné laboratórium, Pracovisko Trnava	Skladová 2, Trnava, 917 00, Slovenská republika	S-320
BetónRacio, s.r.o., Skúšobné laboratórium, Pracovisko Veľký Šariš	Skladová 2, Trnava, 917 00, Slovenská republika	S-320
Building Research Institute	86 Nikola Petkov Blvd., Sofia, 1618, Bulgaria	88 ЛИ
CEMEX Czech Republic, s.r.o.	Semtín 102, Pardubice, 53354, Česká republika	1302
Cement Hranice, akciová společnost	Bělotínská 288, Hranice I - Město, 75301, Česká republika	1284
Central Regional Lab	Canna Road, Tabuan Jaya, Kuching, 93350, Sarawak	nan
Centrum dopravního výzkumu v.v.i.	Líšeňská 33a, Brno, 63600, Česká republika	1506
Disoma	Krommewege 319, Maldegem, 9990, Belgium	-
Domo+LysisLAB	DISTOMOU 97, ATHENS, 10443, GREECE	-
EPE/SPA LABORATOIRE DES TRAVAUX PUBLICS DE L'EST	ZONE INDUSTRIELLE 24 FEVRIER 1956 CONSTANTINE, ZONE INDUSTRIELLE 24 FEVRIER 1956 CONSTANTINE, 25000, ALGERIA	-

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Laboratory	Address	Accreditation number
Egidijus Urbonas	P.Puzino 1, Panevezys, 35173, Lithuania	LA.01.022
Grean Consult BV	Winkelomseheide 223 A, Geel, 2440, België	575-TEST
Institut za ispitivanje materijala a.d.	Bulevar vojvode Mišića 43, Belgrade, 11000, Serbia	-
JKV TEST s.r.o.	Holvekova 164/25, Ostrava-Kunčičky, 718 00, Česká republika	1294
LABIS EOOD - Independent construction laboratory LABIS	Doiran str. 9A, Sofia, 1680, Bulgaria	6 LI
Laboratoire des Travaux Publics de l'Ouest LTP-Ouest	Rond point des Castors, Oran, 31014, ALGERIA	-
Lafarge Cement, a.s.	Lafarge Cement, a.s., Čížkovice čp. 27, 411 12, Česká republika	1426
Magnel-Vandepitte Laboratory for Structural Engineering and Building Materials	Technologiepark - Zwijnaarde 60, Zwijnaarde (Ghent), 9052, Belgium	220-TEST
Materialprüfinstitut Nord	Raiffeisenstraße 8, Großburgwedel, 30938, Germany	-
QCONTROL s.r.o. - odštěpný závod	Lesní 693, Bílovice nad Svitavou, 66401, Česká republika	1737
SQZ, s.r.o. - organizačná zložka Bratislava	U místní dráhy 939/5, Olomouc, 77900, Česká republika	566/S-376
SQZ, s.r.o. - organizačná zložka Bratislava	U místní dráhy 939/5, Olomouc, 77900, Česká republika	566/S-376
STACHEMA CZ s.r.o.	Hasičská 1, Zibohlavy, Kolín, 28002, Česká republika	L 1433
Setsco Services Pte Ltd	18 Teban Gardens Crescent, Singapore, 608925, Singapore	-
Slovenská správa ciest, Investičná výstavba a správa ciest Žilina, Oblastné laboratórium	Martina Rázusa 104/A, Žilina, 010 01, Slovenská republika	181/S-322
Slovenská správa ciest, Miletičova 19, 826 19 Bratislava, Investičná výstavba a správa ciest Košice, OKKS Kasárenské námestie 4 040 01Košice	Kasárenské námestie 4, Košice, 040 01, Slovenská republika	S-175
Stavební fakulta, ČVUT v Praze	Thákurova 7, Praha 6, 16629, Česká republika	1048
TPA Spoločnosť pre zabezpečenie kvality a inovácie s.r.o - pracovisko Geča	Neresnická cesta 3, Zvolen, 960 01, Slovensko	211/S-176
TPA Spoločnosť pre zabezpečenie kvality a inovácie s.r.o - pracovisko K2	Neresnická cesta 3, Zvolen, 960 01, Slovensko	211/S-176
TPA Spoločnosť pre zabezpečenie kvality a inovácie s.r.o - pracovisko Podunajské Biskupice	Neresnická cesta 3, Zvolen, 960 01, Slovensko	211/S-176

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Laboratory	Address	Accreditation number
TPA spoločnosť pre zabezpečenie kvality a inovácie s.r.o. - pracovisko Zvolen	Neresnická cesta 3, Zvolen, 960 01, Slovensko	211/S-176
TPA za obezbeđenje kvaliteta i inovacije d.o.o. Beograd (lokacija Čačak)	Milutina Milankovića 3b, Novi Beograd, 11070, Srbija	01-280
TPA ČR, s.r.o.	Vrbenská 1821/31, České Budějovice, 370 06, Česká republika	1181
Technický a skúšobný stavebný, n.o. (SP BA)	Studená 967/3, Bratislava, 821 04, Slovenská republika	S-045
Technický a skúšobný stavebný, n.o. (SP KE)	Studená 967/3, Bratislava, 821 04, Slovenská republika	S-045
Technický a skúšobný stavebný, n.o. (SP NM)	Studená 967/3, Bratislava, 821 04, Slovenskárepublika	S-045
Technický a skúšobný stavebný, n.o. (SP NR)	Studená 967/3, Bratislava, 81 04, Česká republika	S-045
Technický a skúšobný stavebný, n.o. (SP PO)	Studená 967/3, Bratislava, 821 04, Slovenská republika	S-045
Technický a skúšobný stavebný, n.o. (SP ZA)	Studená 967/3, Bratislava, 821 04, Slovenská republika	S-045
Technický a skúšobný stavebný, n.o. (SP ZV)	Studená 967/3, Bratislava, 821 04, Slovenská republika	S-045
Technický a zkušební ústav stavební Praha, s.p., pobočka Praha	Prosecká 76a/811, Praha 9, 190 00, Česká republika	1018.3
University of Natural Resources and Life Sciences, Vienna	Peter-Jordan-Str. 82, Vienna, 1190, Austria	P0252
Vysoké učení technické v Brně, Fakulta stavební, Akreditovaná zkušební laboratoř při ÚTHD FAST VUT v Brně	Veveří 331/95, Brno, 60200, Česká republika	L1396
Z7008	Veveří 95, Brno, 60200, Česká republika	Z7008
ÉMI Építésügyi Minőségellenőrző Innovációs Nonprofit Korlátolt Felelősségű Társaság	Dózsa György, Szentendre, 2000, 26	-
Ředitelství silnic a dálnic ČR	Rebešovická 40, Brno-Chrlice, 643 00, Česká republika	1072
"ЦЕНТЪР ЗА ИЗПИТВАНЕ И ЕВРОПЕЙСКА СЕРТИФИКАЦИЯ" ЕООД/Center for Testing and European Certification Ltd.	2, Industrialna str., Stara Zagora, 6000, Bulgaria, Stara Zagora, 6000, Bulgaria	No 252 ЛИ

2 Procedures used in the Statistical Analysis of Laboratory Results

The statistical analysis is based on the following steps:

1. Evaluation of intralaboratory variabilities by Cochran's C test: If 5% or 1% critical value is exceeded, the effect of the individual observations is first considered. If the results indicate that high participant variability is caused by a single observation, this value is excluded from the experiment, but the participant is not excluded as outlying. By overcoming 1% of the critical value, the participant's results can be marked as outlying and excluded from the experiment (symbol **X**).

2. The numerical critical evaluation of the test results using Grubbs' test: By overcoming 1% critical value, the participant's results can be marked as outlying and excluded from the experiment (symbol X).
3. Graphical determination of the consistency of laboratories (Mandel's statistics): The exceedance of the critical values of Mandel's statistics does not indicate that the results of the laboratories concerned are wrong; it only suggests minor inconsistencies.
4. Evaluation of descriptive statistics and, if possible, taking into account the number of observations, the repeatability and reproducibility.
5. Evaluation of the assigned value.
6. The performance evaluation: The most significant outcome of the PT Program is the so-called z-score and ζ-score (zeta-score). These characteristics assess the performance of individual participants by comparing it with the assigned value and measurement uncertainties. z-score and ζ-score are compared with limit values. The resulting ζ-score values are not taken into account during the final evaluation of the performance of participants as they are to a considerable degree dependent on the values of the measurement uncertainties of the assessed institutions. The following scales are applied for the z-score values:
   - $|z\text{-score}| < 2 \Rightarrow$ shows that the laboratory performance is **satisfactory** and generates no signal – ✓.
   - $2 \leq |z\text{-score}| < 3 \Rightarrow$ shows that the laboratory performance is **questionable** and generates an action signal – ?.
   - $|z\text{-score}| \geq 3 \Rightarrow$ shows that the laboratory performance is **unsatisfactory** and generates an action signal – !.

Procedures used in the statistical analysis of proficiency testing programs can be found here: http://ptprovider.cz/?lang=en.

3 Conclusions of the Statistical Analysis

The present report summarizes the results of the Proficiency Testing Program Strenght and Elasticity of Hardened Concrete (PT Program) organized by the PT Provider at the SZK FAST. 52 participants (laboratories) took part in the PT Program. The program focused on ordinary standardized testing of hardened concrete with emphasis on its strength and elasticity. The test results are evaluated separately for each testing procedure examined. An evaluation of statistical characteristics is included in the Appendix, as well as test results and graphic presentations. Testing methods can be found in part 1 of this report.

In the case of test No. 1 (compressive strength according to EN 12390-3 [1]), the outputs may be affected by significant time differences in the supply of test specimens to laboratories, which were caused by the situation around the COVID-19. There was a significant delay in the supply of test specimens, which was not caused by the proficiency testing provider, mainly for participants outside the Czech Republic. We therefore ask the supervisory authorities for leniency in assessing the performance of laboratories.

Table 4: Evaluation of overall performance and outliers.
✓ – satisfactory performance; ? – questionable performance; ! – unsatisfactory performance; X – outlier;

ID / Method	1	2	3	4	5	6	7	8	9	10
76bfd8	✓	-	-	-	-	-	-	-	-	-
0f0db2	✓	-	-	✓	✓	-	-	-	-	-
76e1de	-	-	✓	-	-	-	-	-	-	-

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ID / Method	1	2	3	4	5	6	7	8	9	10
1e1eec	✓	-	-	-	-	-	-	-	✓	✓
8b7ed8	-	-	-	-	-	-	-	-	✓	-
9c2e92	✓	-	-	-	-	-	-	-	-	-
86bdde	-	-	-	-	-	-	-	-	-	✓
d48859	-	-	✓	✓	-	-	-	-	✓	-
aaf2c2	✓	-	-	✓	-	-	-	-	-	-
f73b2c	✓	-	-	✓	-	-	-	-	-	-
accaa8	-	-	✓	-	✓	-	-	-	-	-
a83fcd	✓	✓	✓	✓	-	-	-	-	✓	✓
10984f	-	-	-	-	-	-	-	-	-	!
68d869	-	-	-	-	-	-	-	-	-	!
1165f2	-	-	-	-	-	-	-	-	-	!
7bb808	-	-	-	-	-	-	-	-	-	!
33033a	✓	-	-	✓	-	-	-	-	✓	-
695bf7	-	-	-	-	-	-	-	-	-	✓
d38b83	✓	-	-	✓	-	-	-	-	-	-
64c7e3	✓	-	-	✓	-	-	-	-	-	-
78d877	✓	-	-	✓	-	-	-	-	-	-
f1c786	✓	-	-	✓	-	-	-	-	-	-
c44c48	✓	-	-	✓	-	-	-	-	-	-
9d1087	✓	-	-	✓	-	-	-	-	-	-
e0fba4	✓	-	-	✓	-	-	-	-	-	-
dd036d	✓	-	-	✓	-	-	-	-	-	-
ac6b0d	✓	-	-	✓	✓	-	-	-	-	-
51c294	!	-	-	✓	-	-	-	-	-	-
4b9070	✓	✓	-	-	✓	-	-	-	-	-
73eaf6	✓	✓	✓	✓	-	-	-	-	-	-
f47e64	!	-	-	-	-	-	-	-	✓	✓
14bad1	-	-	-	-	✓	-	-	-	-	-
a9a27b	-	✓	-	-	-	-	-	-	-	-
c91d8a	-	✓	-	-	-	-	-	-	-	-
ae9208	-	-	-	-	-	-	-	-	✓	✓
3b59a5	-	✓	-	-	-	-	-	-	✓	-
abe715	?	-	-	-	-	-	-	-	-	-
9b5cad	-	✓	-	-	-	-	-	-	-	✓
271d81	✓	-	-	-	-	-	-	-	-	-
84db56	✓	-	-	-	-	-	-	-	-	-

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ID / Method	1	2	3	4	5	6	7	8	9	10
ec4d76	✓	✓	✓	✓	-	-	-	-	-	-
c03a46	✓	-	-	✓	-	-	-	-	-	?
8699f5	✓	-	-	✓	-	-	-	-	-	✓
b8975c	-	-	✓	-	-	-	-	-	-	-
3539c7	-	-	-	-	✓	-	-	-	-	-
362e18	✓	✓	✓	✓	-	-	-	-	-	-
e1bfb8	✓	✓	-	✓	-	-	-	-	-	-
a191ba	✓	-	-	✓	-	-	-	-	-	-
68d36b	!	-	-	✓	-	-	-	-	-	-
658f36	✓	-	-	-	-	-	-	-	-	-
23af1e	-	-	-	-	-	-	-	-	-	✓
c36d82	✓	✓	-	✓	-	-	-	-	-	-

References

[1] EN 12390-3. *Testing hardened concrete - Part 3: Compressive strength of test specimens*. 2020.

[2] EN 12390-5. *Testing hardened concrete - Part 5: Flexural strength of test specimens*. 2020.

[3] EN 12390-6. *Testing hardened concrete - Part 6: Tensile splitting strength of test specimens*. 2010.

[4] EN 12390-7. *Testing hardened concrete - Part 7: Density of hardened concrete*. 2020.

[5] ISO 1920-10. *Testing of concrete - Part 10: Determination of static modulus of elasticity in compression*. 2016.

[6] EN 12390-13. *Testing hardened concrete - Part 13: Determination of secant modulus of elasticity in compression*. 2014.

[7] EN 12504-4. *Testing concrete - Part 4: Determination of ultrasonic pulse velocity*. 2005.

[8] ČSN 731371. *Non-destructive testing of concrete - Method of ultrasonic pulse testing of concrete*. 2011.

[9] ČSN 731373. *Non-destructive testing of concrete - Determination of compressive strength by hardness testing methods*. 2011.

[10] EN 12504-2. *Testing concrete in structures - Part 2: Non-destructive testing - Determination of rebound number*. 2013.

[11] EN 1542. *Products and systems for the protection and repair of concrete structures - Test methods - Measurement of bond strength by pull-off*. 2000.

[12] ČSN 736242. *Design and construction of pavements on road bridges*. 2010.

[13] EN 206. *Concrete - Specification, performance, production and conformity*. 2014.

[14] ISO 5725-2. *Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*. 1997.

[15] EN ISO/IEC 17043. *Conformity assessment - General requirements for proficiency testing*. 2010.

1 Appendix – EN 12390-3 – Compressive strength of test specimens

1.1 Test results

Table 4: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [N/mm^2]			u_X [N/mm^2]	$\bar{x}$ [N/mm^2]	s_0 [N/mm^2]	V_X [%]
9c2e92	33.6	34.7	35.5	0.6	34.6	0.95	2.76
e0fba4	34.0	34.6	35.3	0.4	34.6	0.65	1.88
a191ba	34.5	35.5	34.0	-	34.7	0.76	2.2
c44c48	35.9	34.6	34.9	1.2	35.1	0.68	1.94
78d877	36.3	34.4	35.5	1.2	35.4	0.95	2.69
64c7e3	35.4	36.3	35.5	1.2	35.7	0.49	1.38
f1c786	36.6	35.1	35.6	1.6	35.8	0.76	2.14
9d1087	35.7	36.2	35.6	1.4	35.8	0.32	0.9
658f36	35.2	36.6	36.1	1.9	36.0	0.71	1.97
8699f5	35.8	37.1	35.9	0.8	36.3	0.72	1.99
362e18	36.4	36.6	36.3	-	36.4	0.15	0.42
d38b83	37.2	36.7	36.4	1.3	36.8	0.4	1.1
84db56	37.4	36.8	36.4	1.4	36.9	0.5	1.37
e1bfb8	36.2	37.8	37.1	-	37.0	0.8	2.17
a83fcd	38.8	36.9	35.8	2.1	37.2	1.52	4.08
f73b2c	37.6	36.5	37.8	1.6	37.3	0.7	1.88
c36d82	37.1	38.4	36.6	0.4	37.4	0.93	2.49
0f0db2	37.7	37.0	38.4	2.4	37.7	0.7	1.86
ac6b0d	37.8	38.3	38.5	0.4	38.2	0.36	0.94
dd036d	38.4	37.9	38.4	1.7	38.2	0.29	0.76
ec4d76	39.6	37.8	37.3	1.7	38.2	1.24	3.25
c03a46	38.1	40.1	37.6	2.5	38.6	1.32	3.43
271d81	38.0	39.0	39.0	0.2	38.7	0.53	1.38
76bfd8	39.1	39.4	38.9	0.6	39.1	0.25	0.64
aaf2c2	39.2	40.2	38.8	0.8	39.4	0.72	1.83
73eaf6	40.6	39.6	38.9	-	39.7	0.85	2.15
33033a	41.3	38.9	40.4	5.9	40.2	1.21	3.02
1e1eec	41.6	38.6	40.7	1.0	40.3	1.54	3.82
4b9070	42.6	41.9	42.4	2.2	42.3	0.36	0.85
abe715	43.7	46.8	47.8	1.0	46.1	2.14	4.64
68d36b	47.5	47.0	49.0	0.4	47.8	1.04	2.18
f47e64	49.2	49.0	50.2	2.5	49.5	0.65	1.31
51c294	49.7	50.1	49.8	0.5	49.9	0.21	0.42

1.2 The Numerical Procedure for Determining Outliers

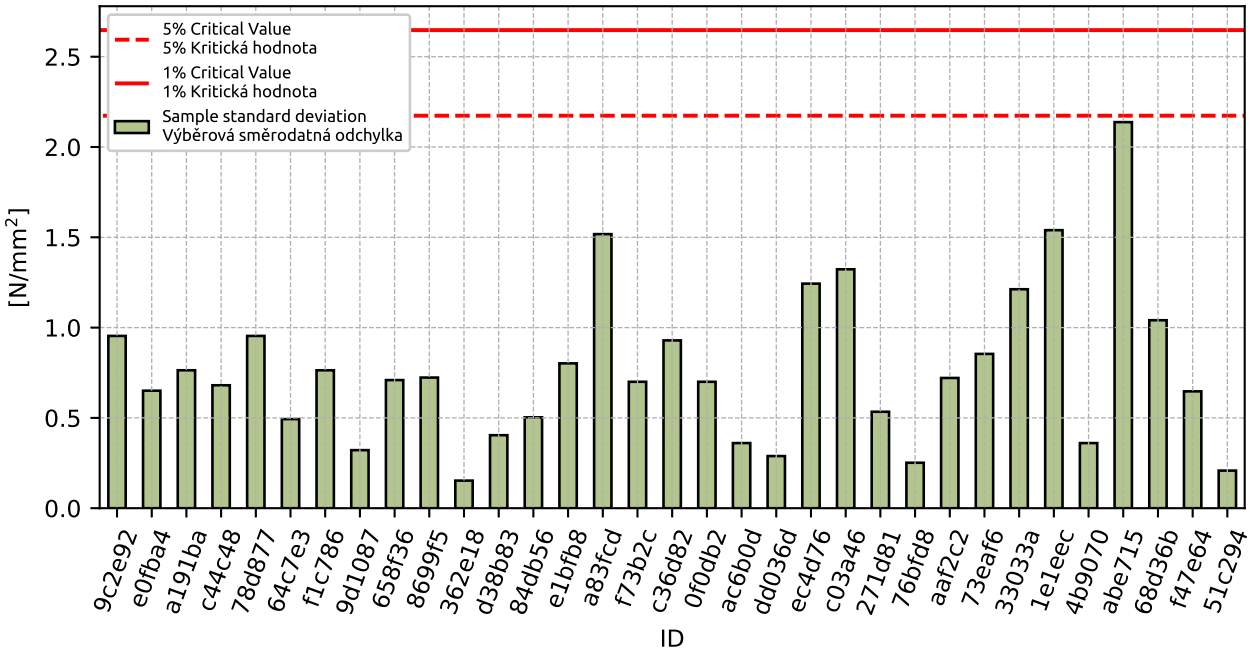

Figure 1: **Cochran's test** - sample standard deviations

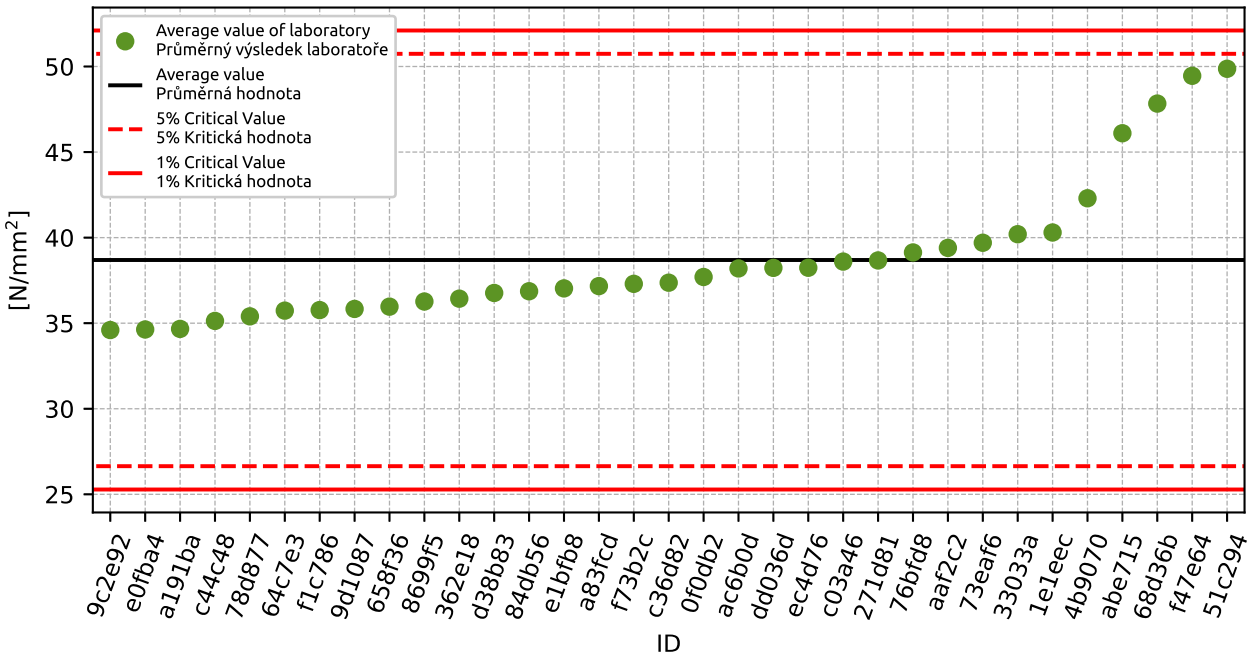

Figure 2: **Grubbs' test** - average values

1.3 Mandel's Statistics

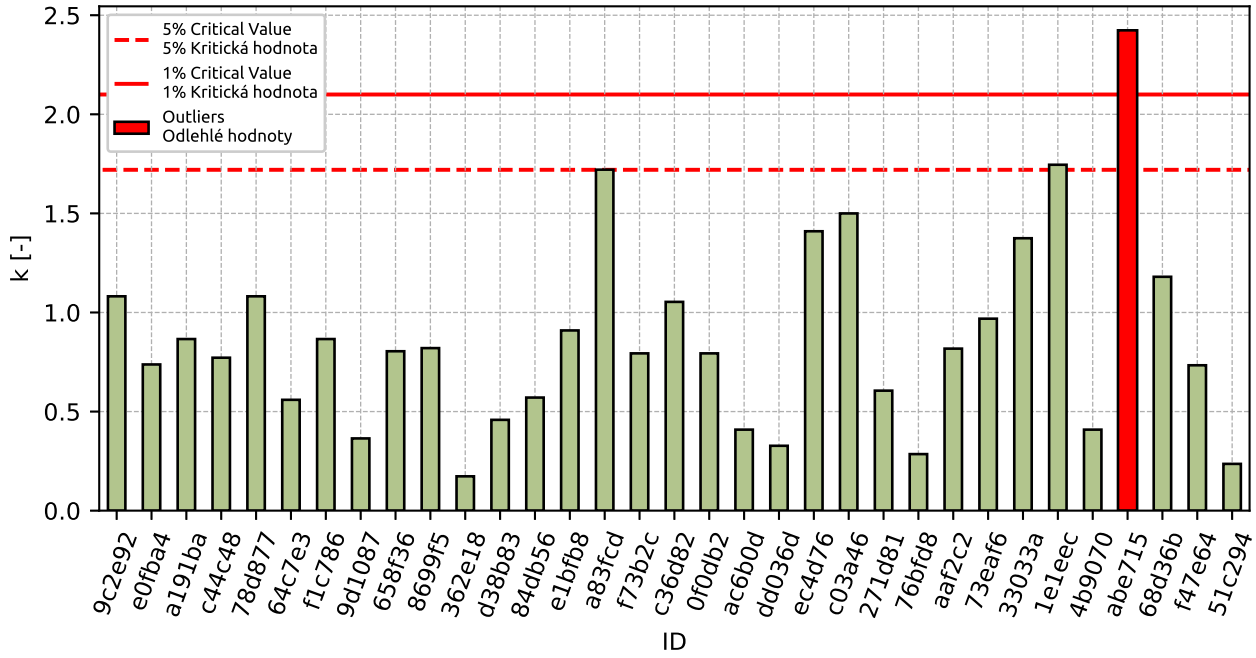

Figure 3: Intralaboratory Consistency Statistic

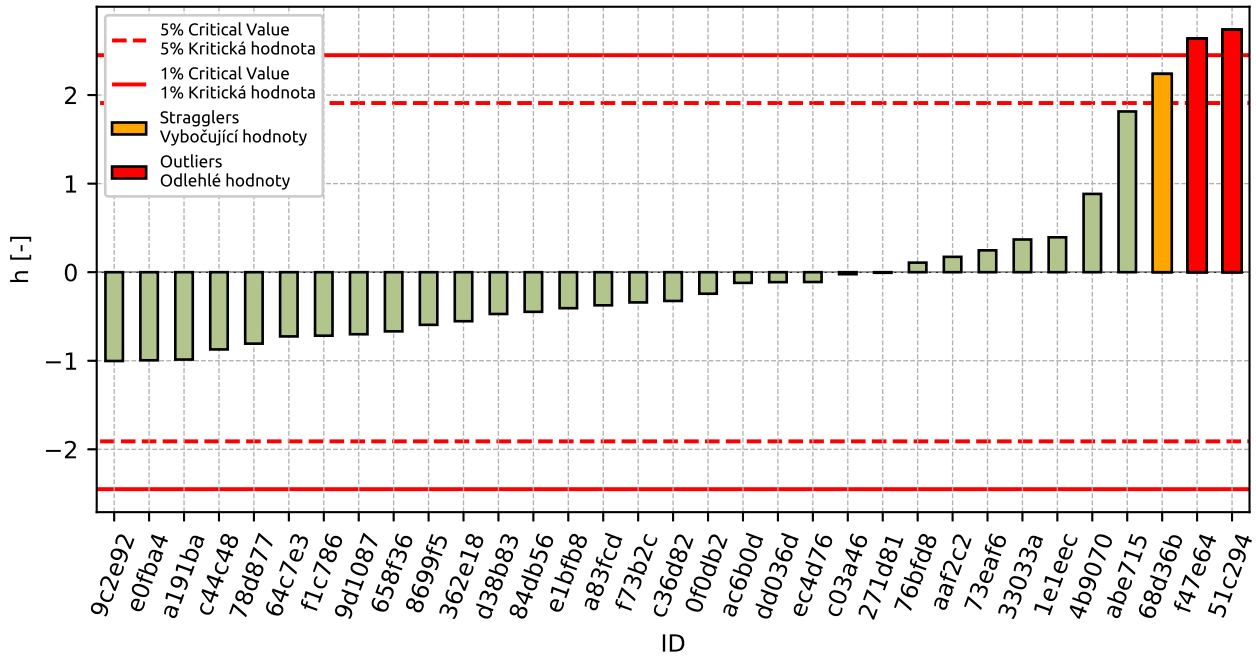

Figure 4: Interlaboratory Consistency Statistic

1.4 Descriptive statistics

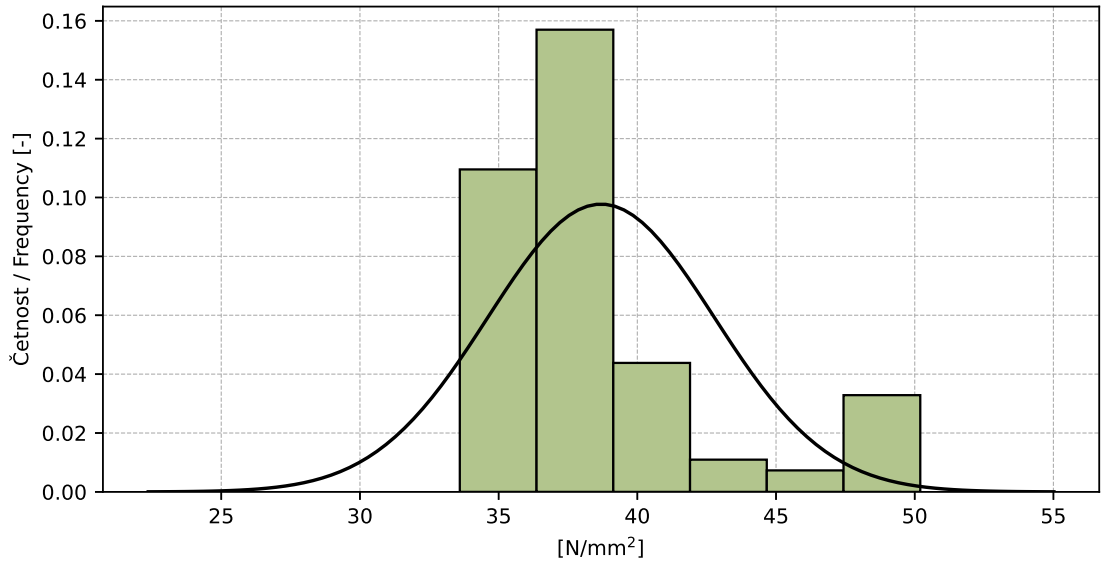

Figure 5: Histogram of all test results

Table 5: Descriptive statistics

Characteristics	[N/mm²]
Průměrná hodnota / Average value – $\bar{x}$	38.7
Výběrová směrodatná odchylka / Sample standard deviation – s	4.08
Vztažná hodnota / Asigned value – x^*	38.7
Robustní směrodatná odchylka / Robust standard deviation – s^*	4.08
Nejistota měření vztažné hodnoty / Measurement uncertainty of asigned value – u_X	2.02
p-hodnota testu normality / p-value of normality test	0.0 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	4.05
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.88
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	4.14
Opakovatelnost / Repeatability – r	2.5
Reprodukovatelnost / Reproducibility – R	11.6

1.5 Evaluation of Performance Statistics

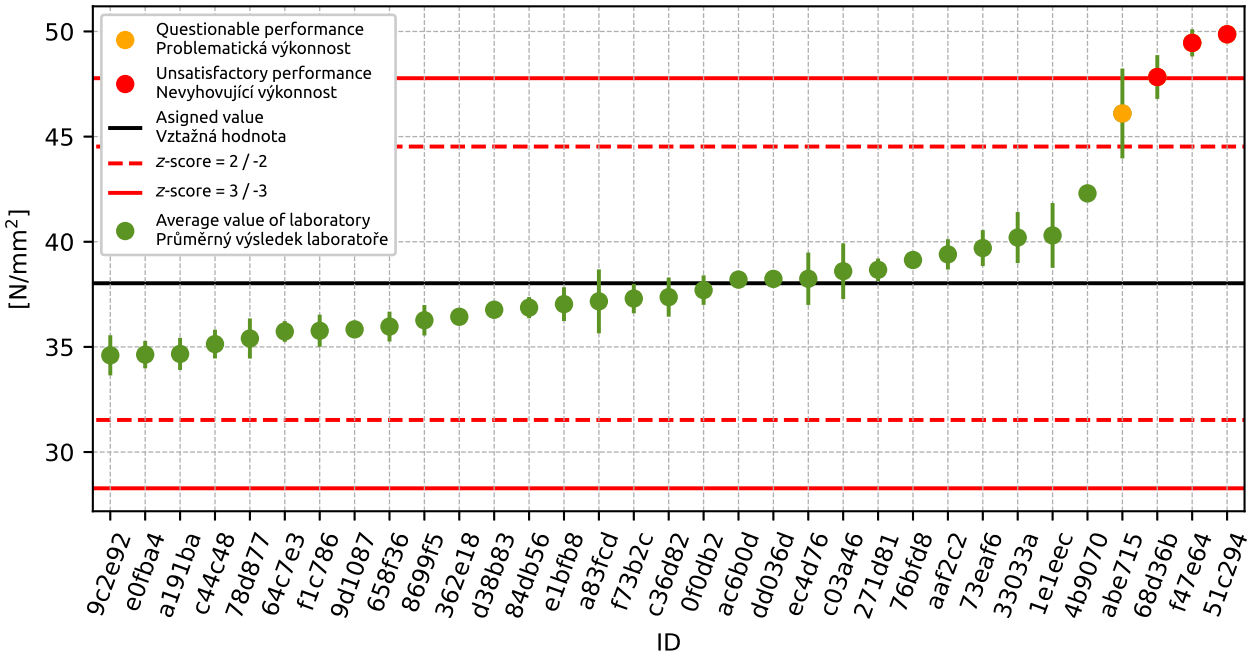

Figure 6: Average values and sample standard deviations

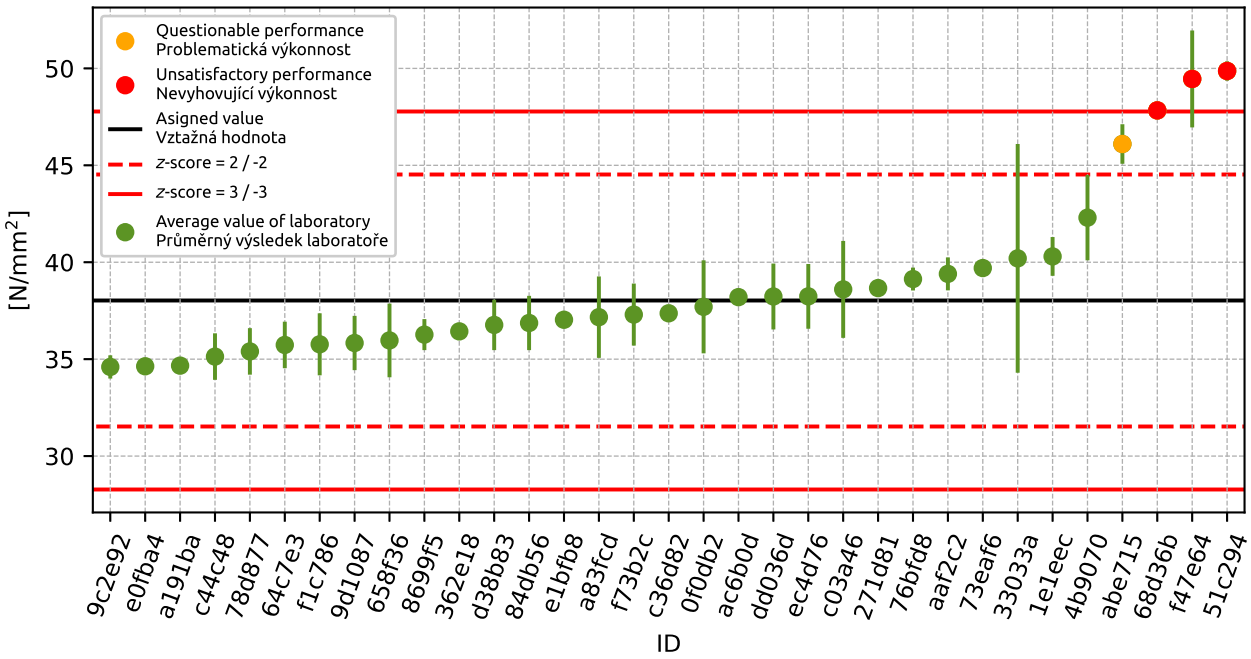

Figure 7: Average values and extended uncertainties of measurement

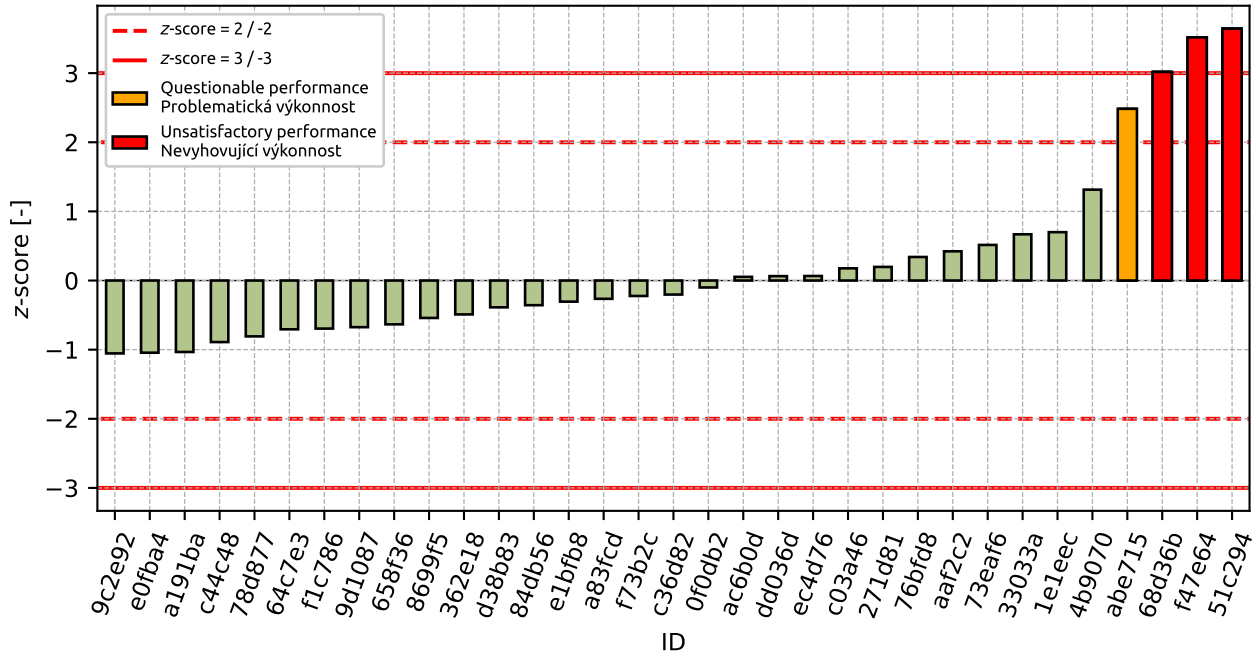

Figure 8: z-score

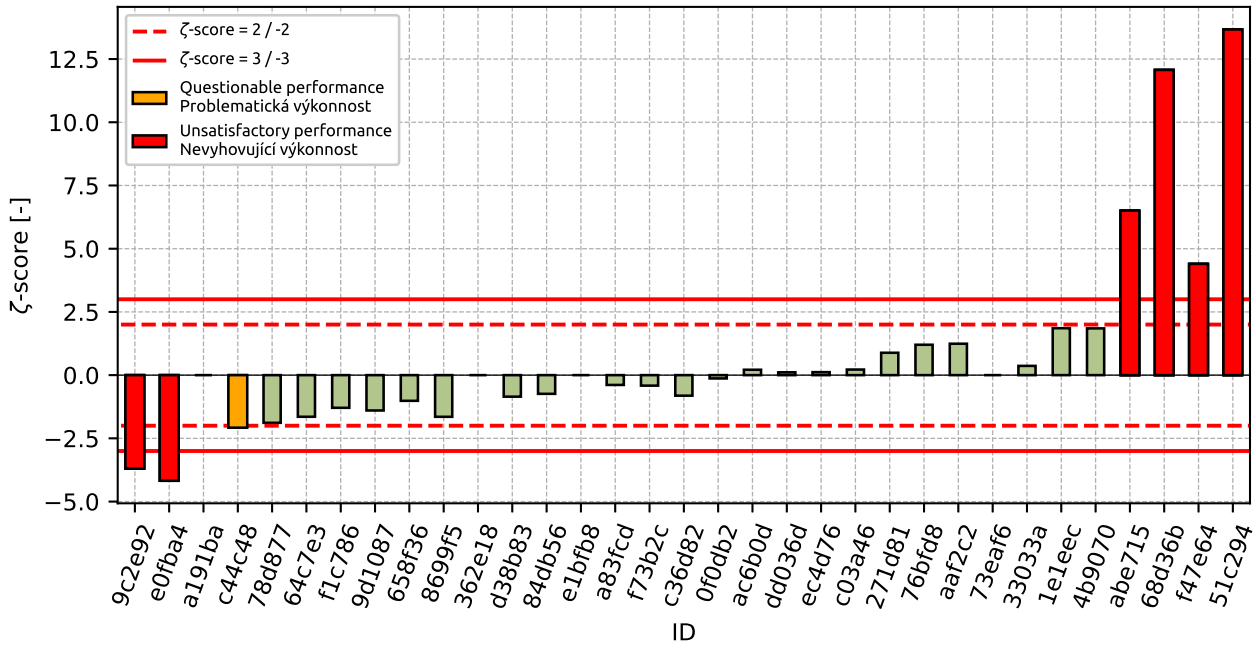

Figure 9: ζ-score

Table 6: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
9c2e92	-1.05	-3.69
e0fba4	-1.04	-4.18
a191ba	-1.03	-
c44c48	-0.89	-2.08
78d877	-0.81	-1.89
64c7e3	-0.71	-1.65
f1c786	-0.7	-1.29
9d1087	-0.67	-1.4
658f36	-0.63	-1.02
8699f5	-0.54	-1.65
362e18	-0.49	-
d38b83	-0.39	-0.85
84db56	-0.36	-0.74
e1bfb8	-0.31	-
a83fcd	-0.26	-0.39
f73b2c	-0.22	-0.42
c36d82	-0.2	-0.81
0f0db2	-0.1	-0.13
ac6b0d	0.05	0.21
dd036d	0.06	0.11
ec4d76	0.07	0.12
c03a46	0.18	0.22
271d81	0.2	0.88
76bfd8	0.34	1.2
aaf2c2	0.42	1.24
73eaf6	0.51	-
33033a	0.67	0.37
1e1eec	0.7	1.86
4b9070	1.31	1.85
abe715	2.48	6.5
68d36b	3.02	12.07
f47e64	3.52	4.4
51c294	3.64	13.67

2 Appendix – EN 12390-5 – Flexural strength of test specimens

2.1 Test results

Table 7: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [N/mm^2]			u_X [N/mm^2]	$\bar{x}$ [N/mm^2]	s_0 [N/mm^2]	V_X [%]
362e18	4.2	4.2	4.2	-	4.2	0.0	0.0
ec4d76	4.6	4.2	4.7	0.1	4.5	0.26	5.81
a83fcd	4.5	4.9	4.9	0.3	4.8	0.23	4.84
e1bfb8	4.9	4.5	4.9	-	4.8	0.23	4.84
c91d8a	4.7	5.1	4.9	0.7	4.9	0.2	4.08
c36d82	5.0	4.8	5.1	0.4	5.0	0.15	3.08
4b9070	5.5	4.9	4.9	0.9	5.1	0.35	6.79
73eaf6	5.3	4.9	5.3	-	5.2	0.23	4.47
a9a27b	5.7	5.4	5.4	0.1	5.5	0.17	3.15
9b5cad	5.7	5.1	5.8	-	5.5	0.38	6.84
3b59a5	6.0	5.7	5.4	1.3	5.7	0.3	5.26

2.2 The Numerical Procedure for Determining Outliers

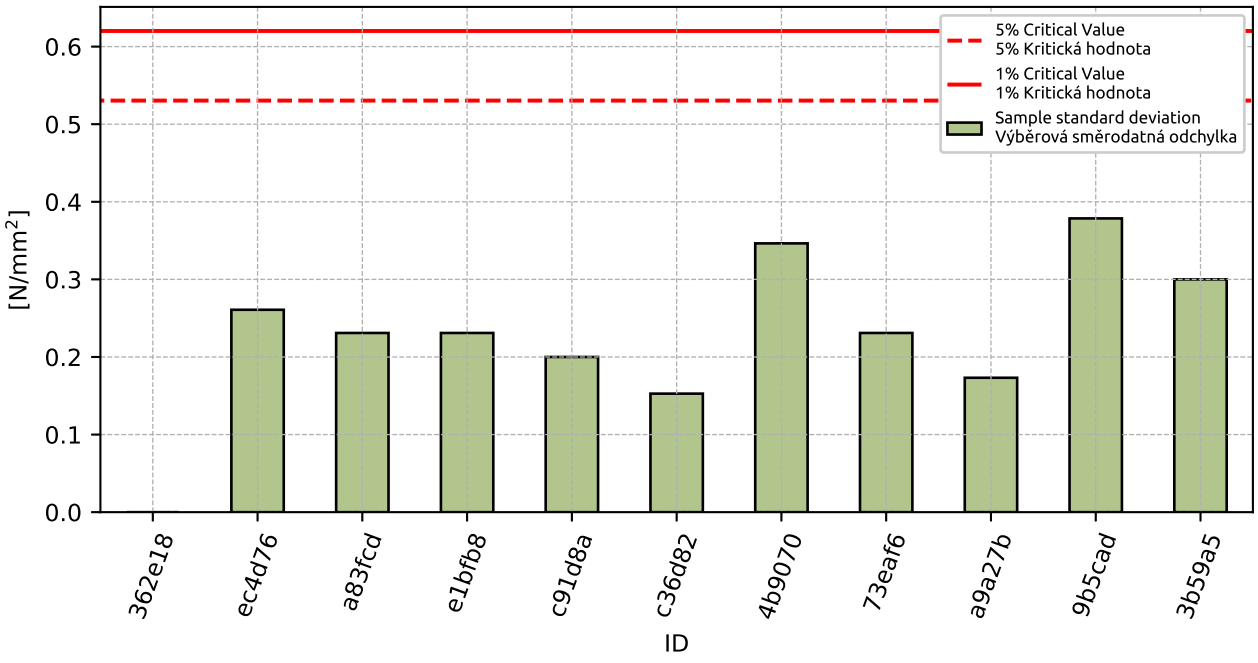

Figure 10: **Cochran's test** - sample standard deviations

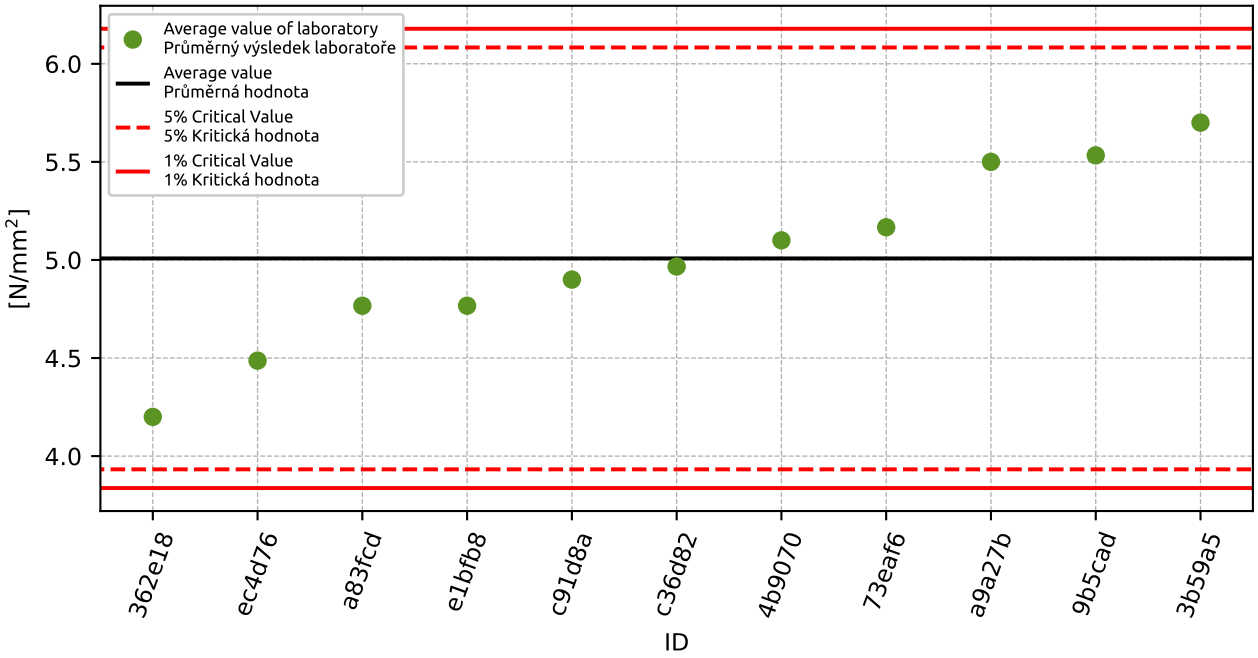

Figure 11: **Grubbs' test** - average values

2.3 Mandel's Statistics

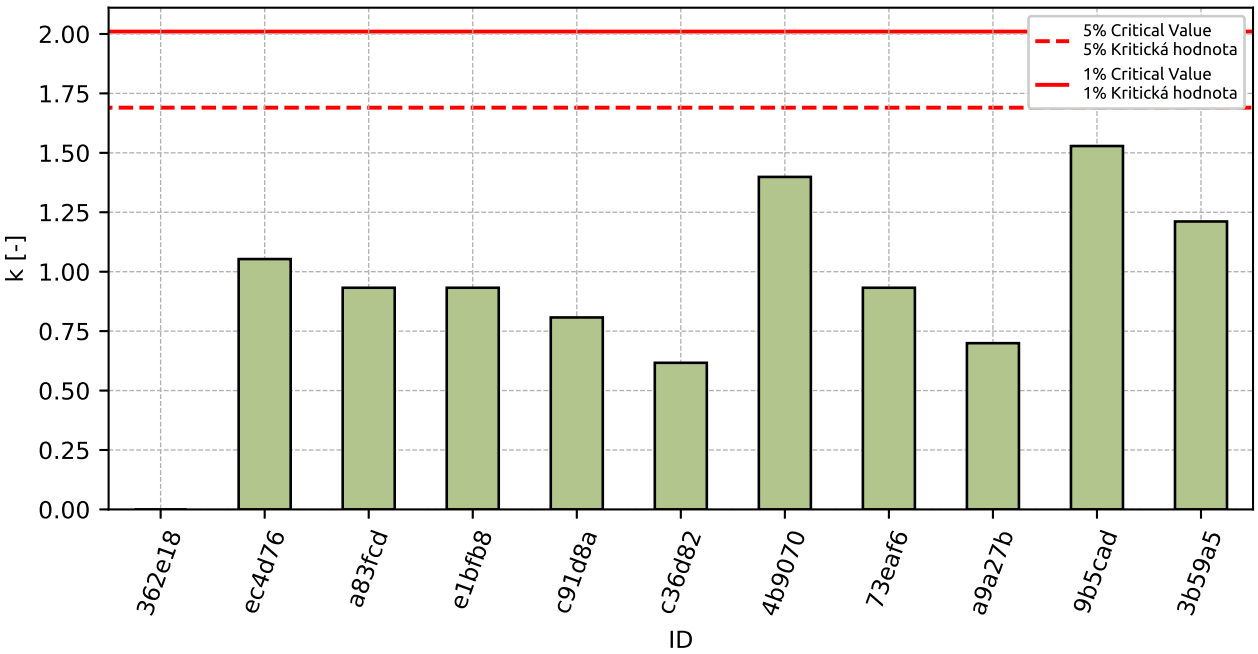

Figure 12: Intralaboratory Consistency Statistic

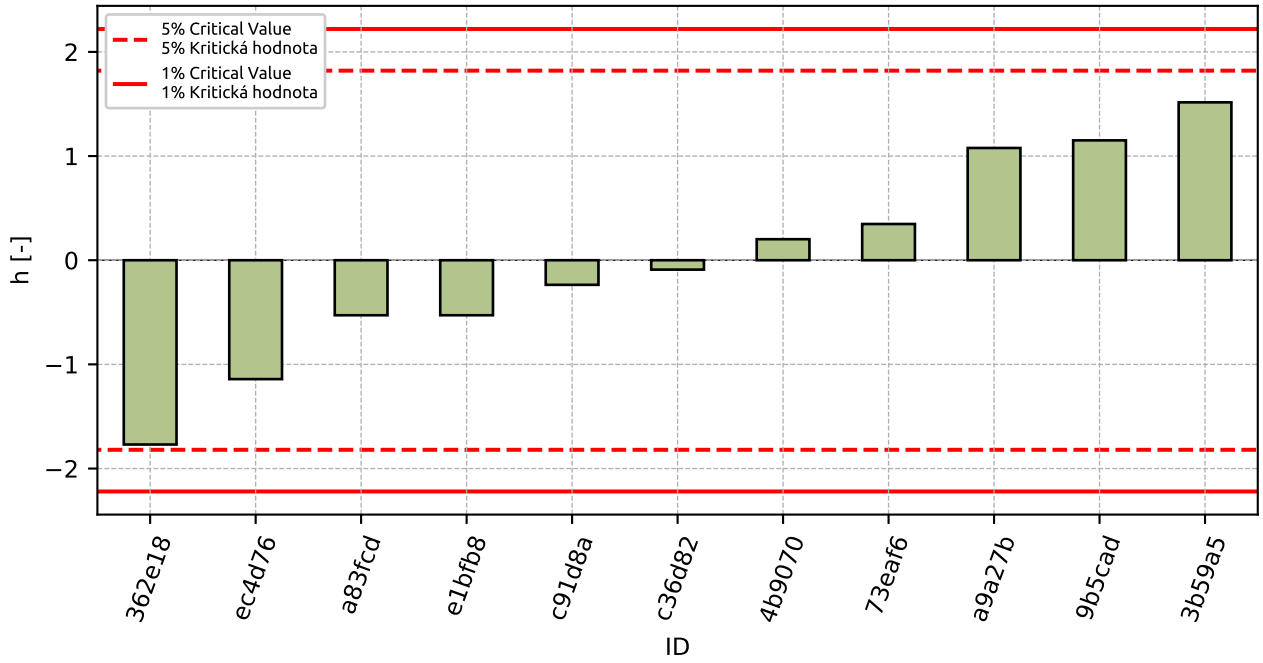

Figure 13: Interlaboratory Consistency Statistic

2.4 Descriptive statistics

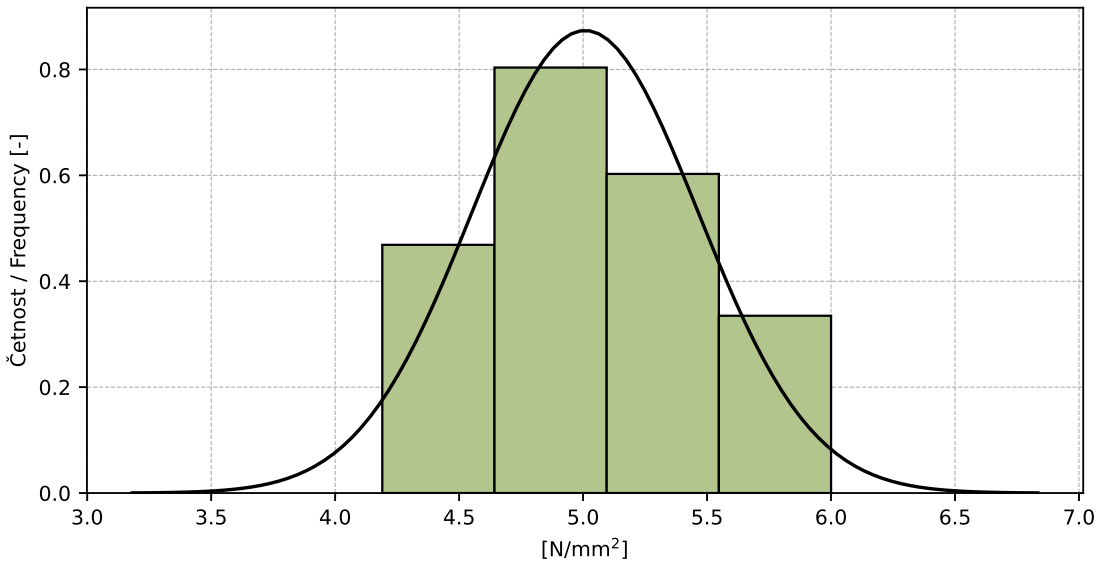

Figure 14: Histogram of all test results

Table 8: Descriptive statistics

Characteristics	[N/mm²]
Průměrná hodnota / Average value – $\bar{x}$	5.0
Výběrová směrodatná odchylka / Sample standard deviation – s	0.46
Vztažná hodnota / Asigned value – x^*	5.0
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.46
Nejistota měření vztažné hodnoty / Measurement uncertainty of asigned value – u_X	0.68
p-hodnota testu normality / p-value of normality test	0.273 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.43
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.25
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.5
Opakovatelnost / Repeatability – r	0.7
Reprodukovatelnost / Reproducibility – R	1.4

2.5 Evaluation of Performance Statistics

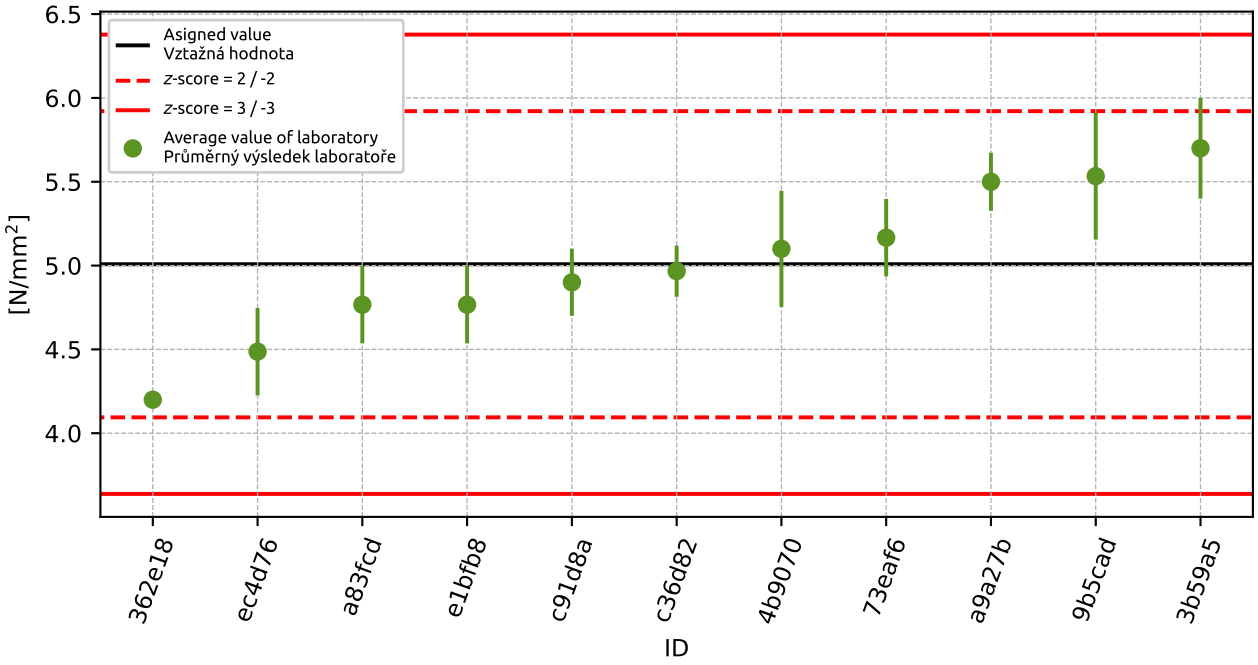

Figure 15: Average values and sample standard deviations

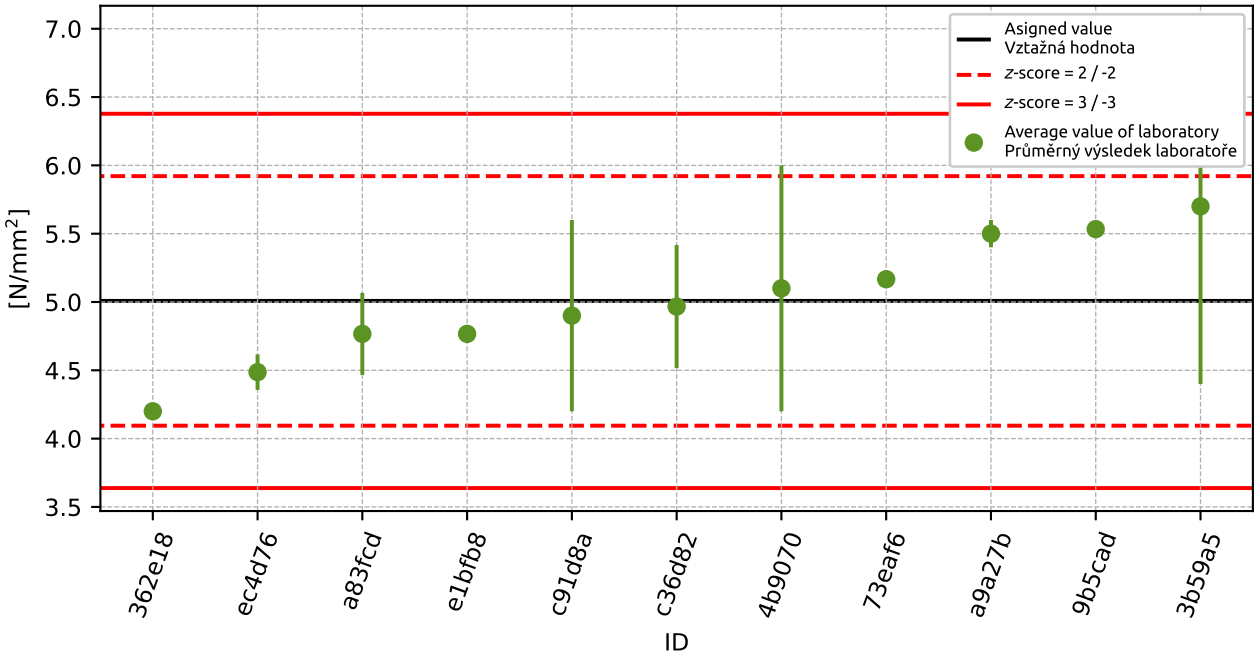

Figure 16: Average values and extended uncertainties of measurement

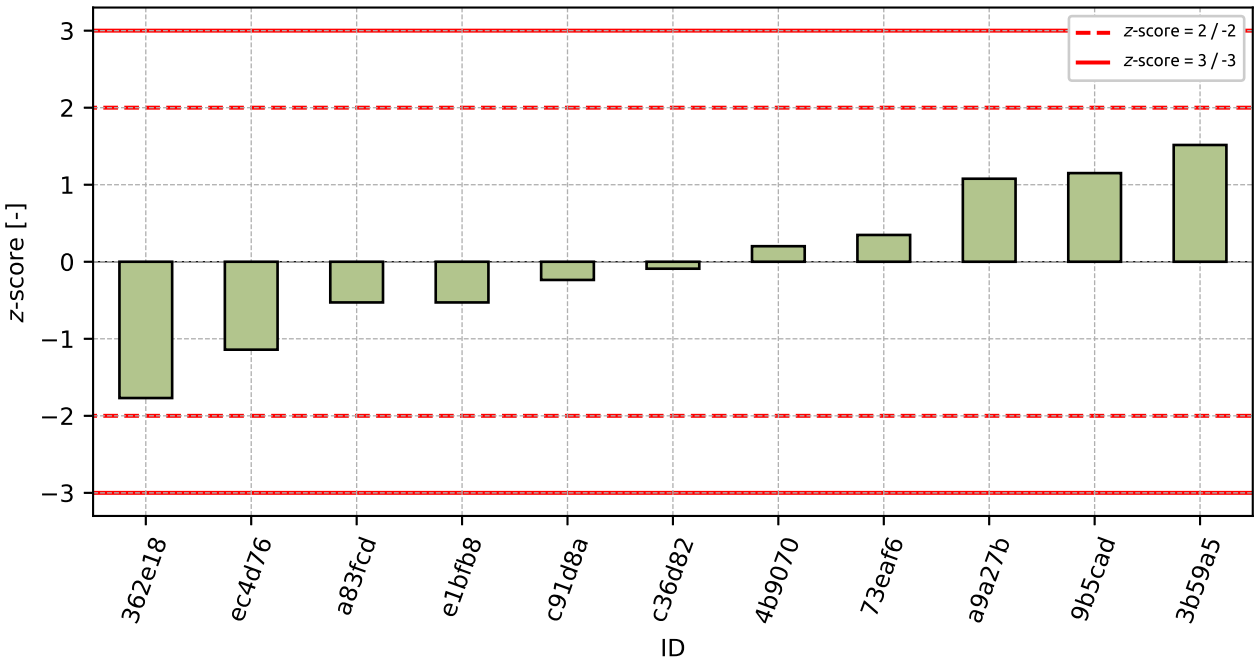

Figure 17: z-score

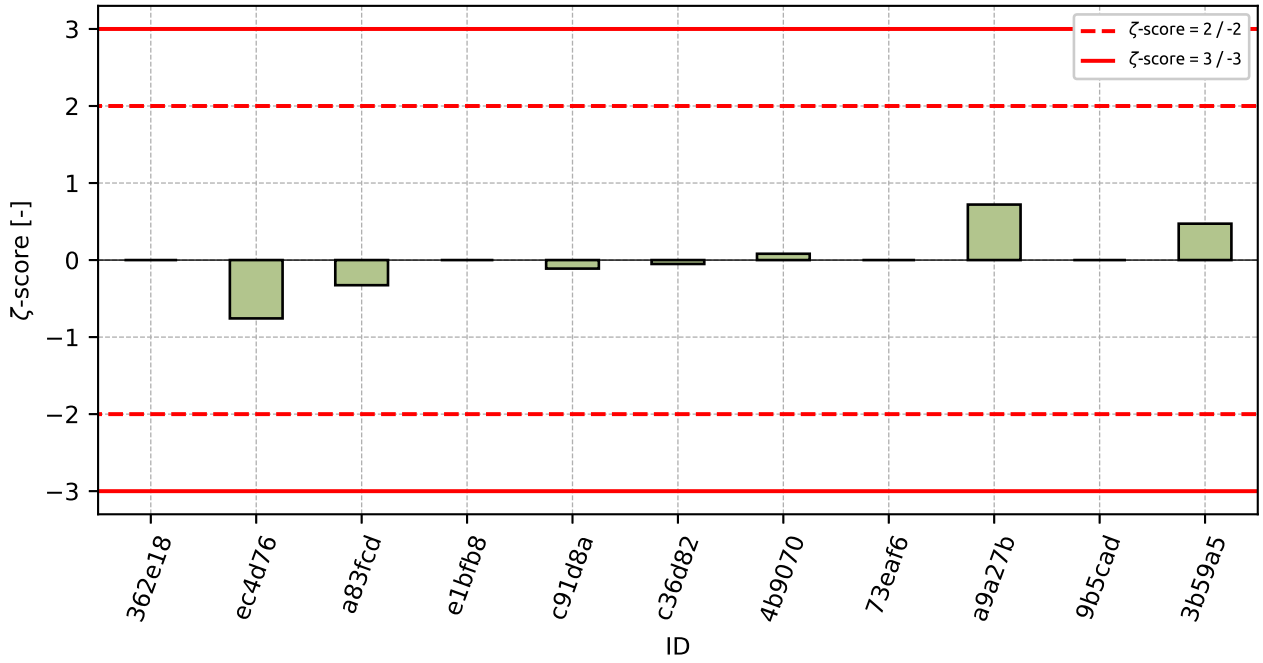

Figure 18: ζ-score

Table 9: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
362e18	-1.77	-
ec4d76	-1.14	-0.76
a83fcd	-0.53	-0.33
e1bfb8	-0.53	-
c91d8a	-0.24	-0.11
c36d82	-0.09	-0.05
4b9070	0.2	0.08
73eaf6	0.35	-
a9a27b	1.08	0.72
9b5cad	1.15	-
3b59a5	1.52	0.47

3 Appendix – EN 12390-6 – Tensile splitting strength of test specimens

3.1 Test results

Table 10: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [N/mm^2]			u_X [N/mm^2]	$\bar{x}$ [N/mm^2]	s_0 [N/mm^2]	V_X [%]
a83fcd	3.1	3.1	3.3	0.15	3.17	0.115	3.65
ec4d76	3.38	3.04	3.23	0.17	3.22	0.17	5.3
362e18	3.6	2.95	3.2	-	3.25	0.328	10.09
accaa8	3.4	3.3	3.2	0.8	3.3	0.1	3.03
76e1de	3.65	3.45	3.65	0.15	3.58	0.115	3.22
d48859	3.8	3.8	3.85	0.15	3.82	0.029	0.76
73eaf6	3.8	4.0	3.85	-	3.88	0.104	2.68
b8975c	3.9	4.05	4.4	0.02	4.12	0.257	6.23

3.2 The Numerical Procedure for Determining Outliers

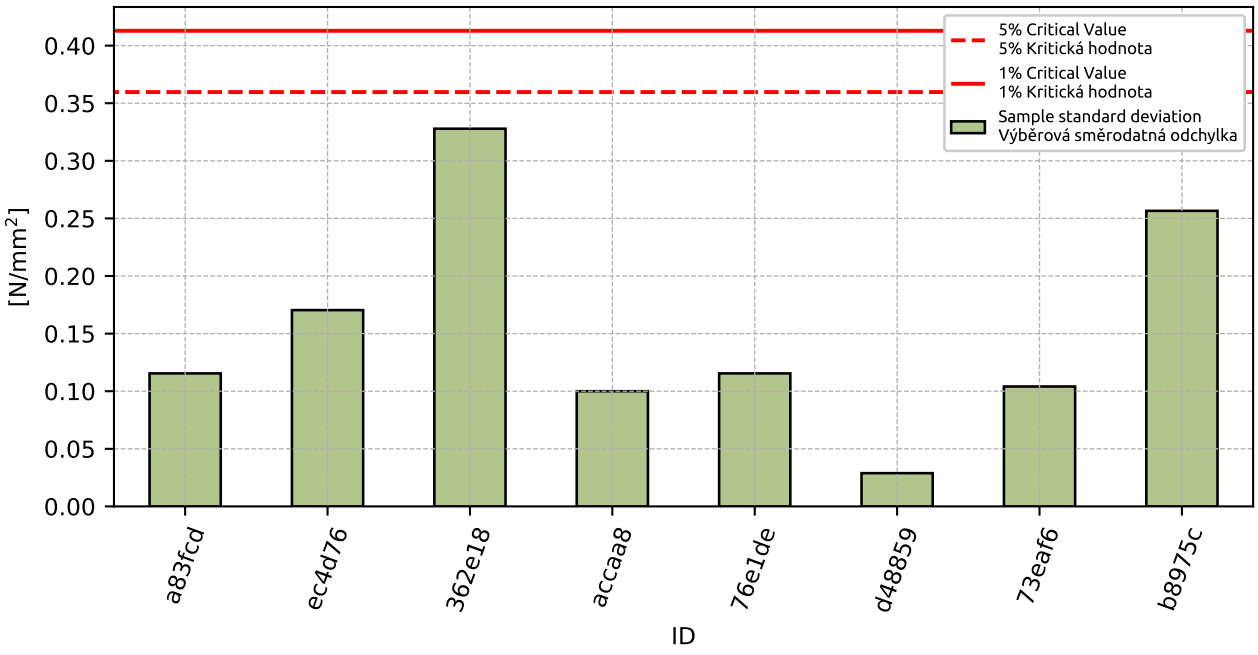

Figure 19: **Cochran's test** - sample standard deviations

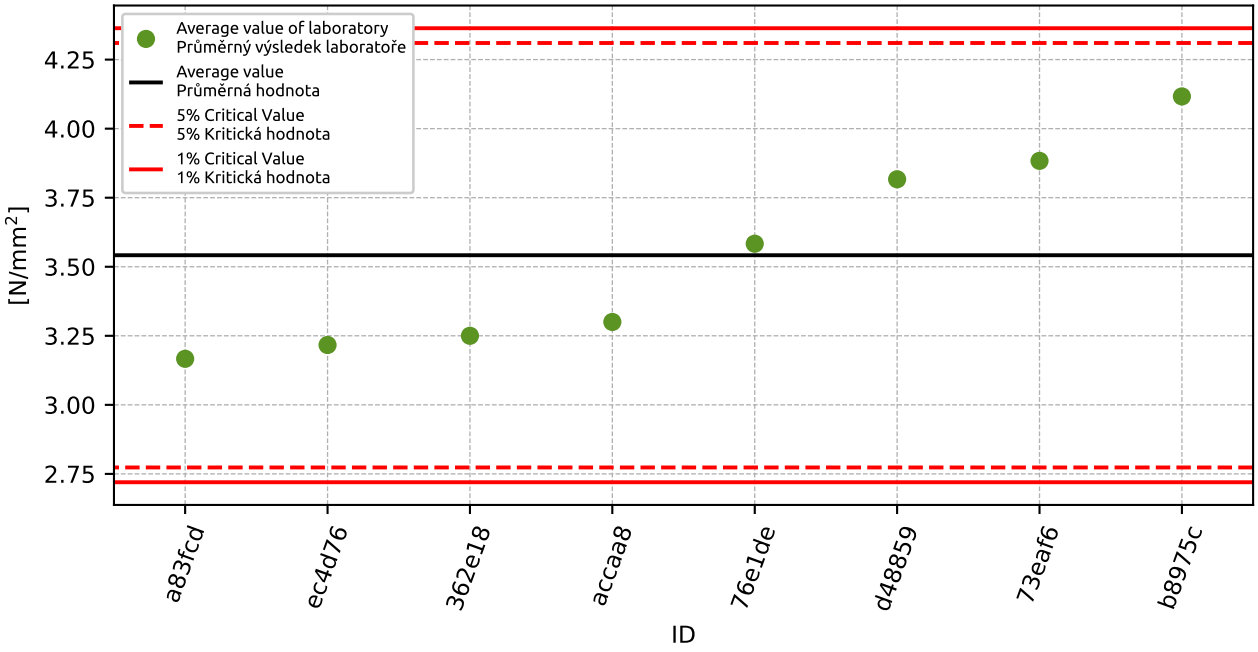

Figure 20: **Grubbs' test** - average values

3.3 Mandel's Statistics

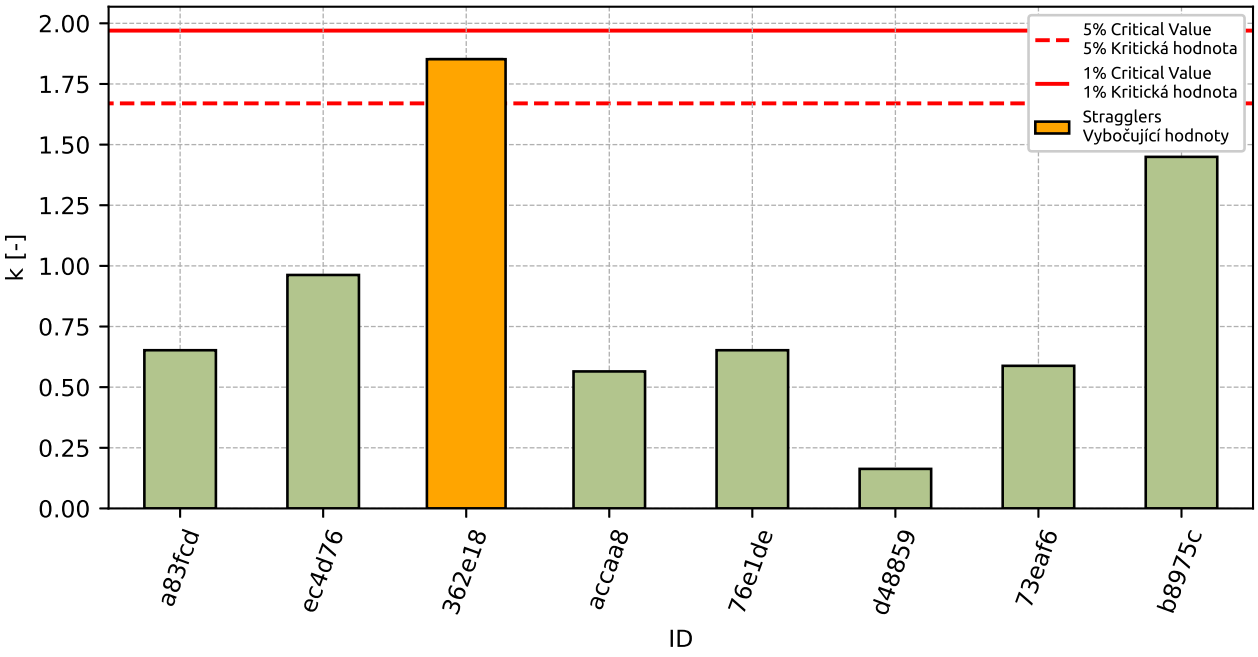

Figure 21: Intralaboratory Consistency Statistic

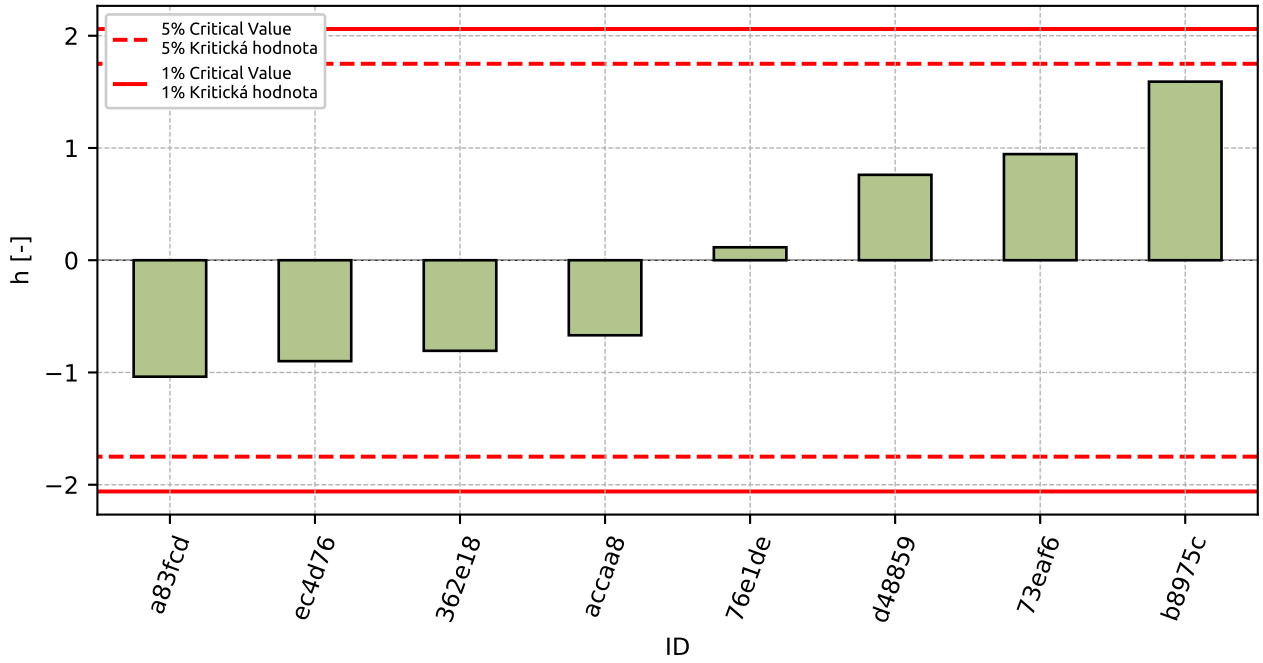

Figure 22: Interlaboratory Consistency Statistic

3.4 Descriptive statistics

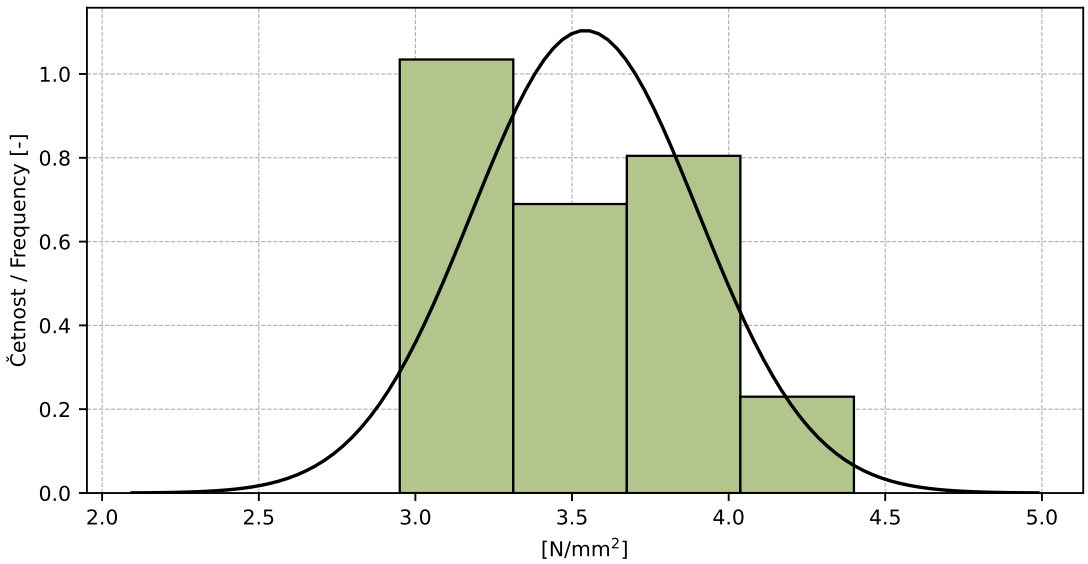

Figure 23: Histogram of all test results

Table 11: Descriptive statistics

Characteristics	[N/mm²]
Průměrná hodnota / Average value – $\bar{x}$	3.54
Výběrová směrodatná odchylka / Sample standard deviation – s	0.361
Vztažná hodnota / Asigned value – x^*	3.54
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.361
Nejistota měření vztažné hodnoty / Measurement uncertainty of asigned value – u_X	0.601
p-hodnota testu normality / p-value of normality test	0.436 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.347
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.177
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.389
Opakovatelnost / Repeatability – r	0.5
Reprodukovatelnost / Reproducibility – R	1.09

3.5 Evaluation of Performance Statistics

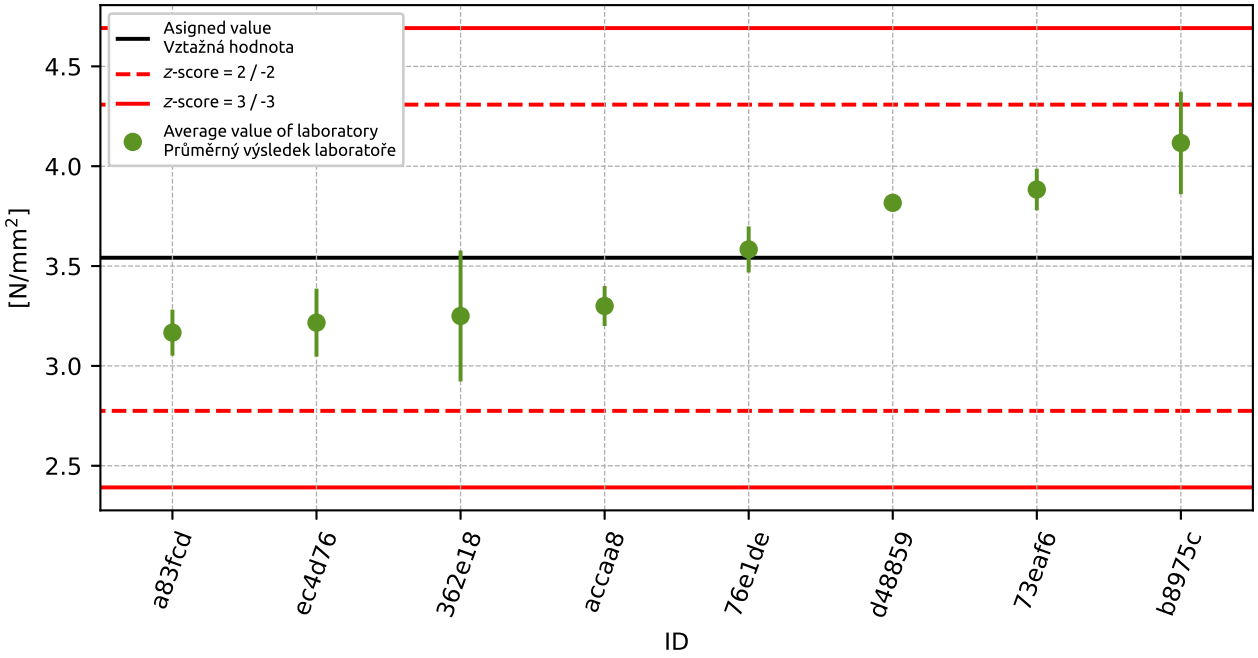

Figure 24: Average values and sample standard deviations

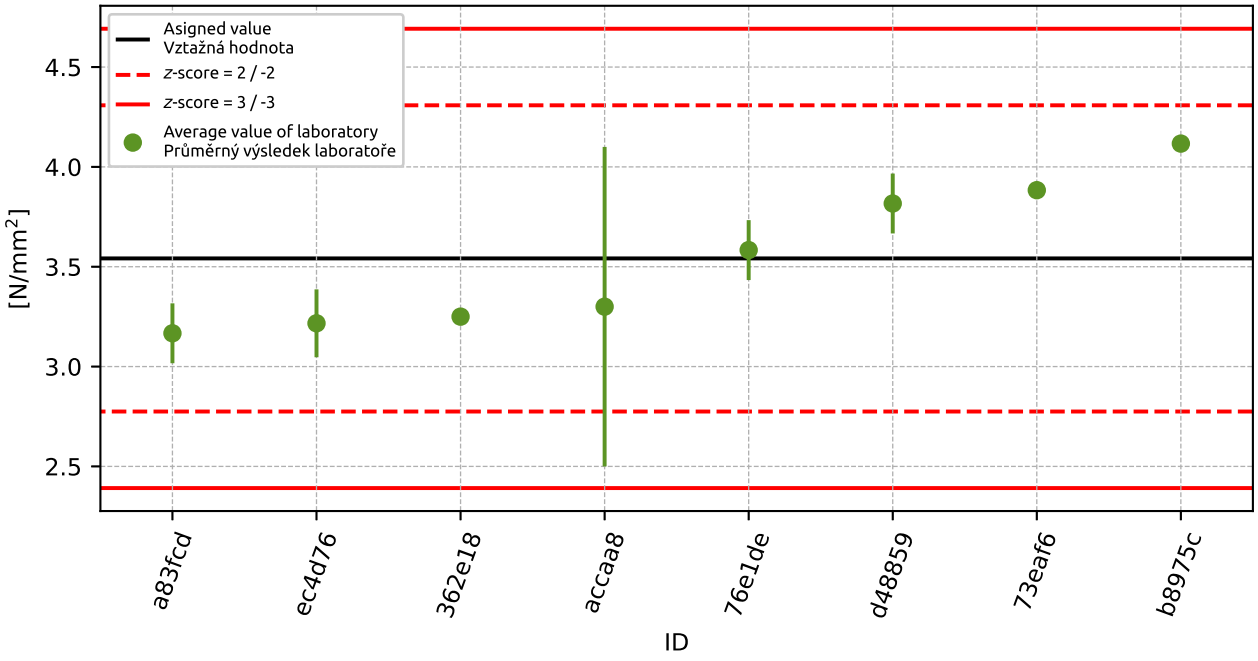

Figure 25: Average values and extended uncertainties of measurement

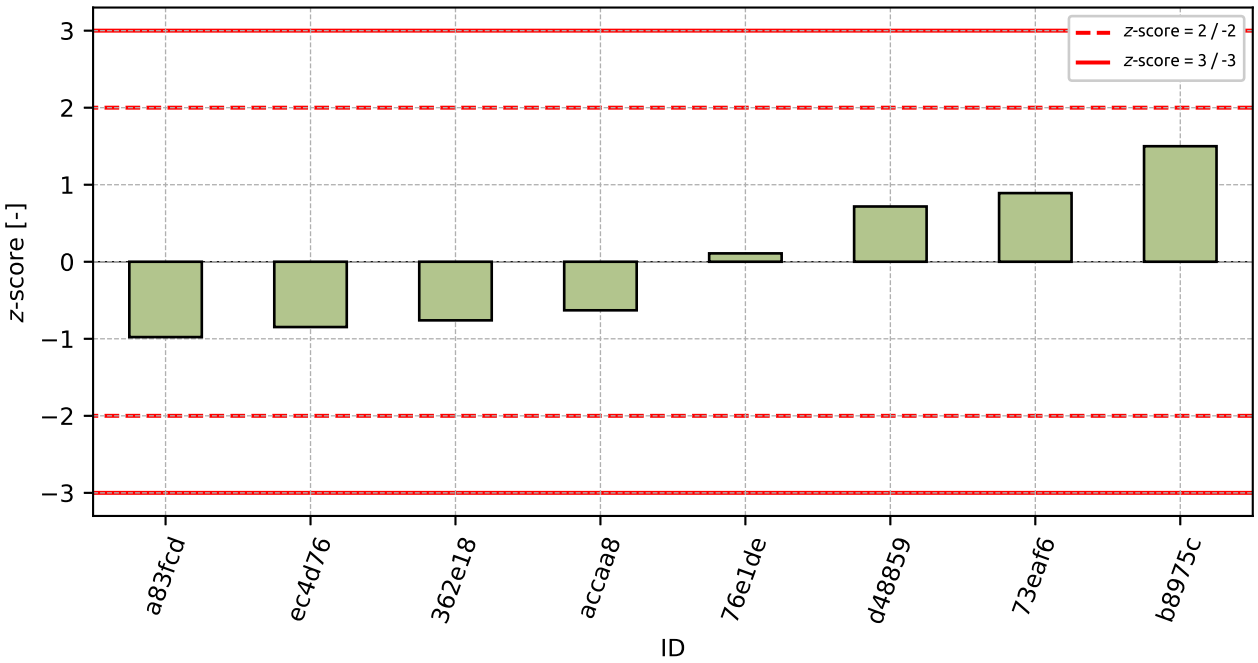

Figure 26: z-score

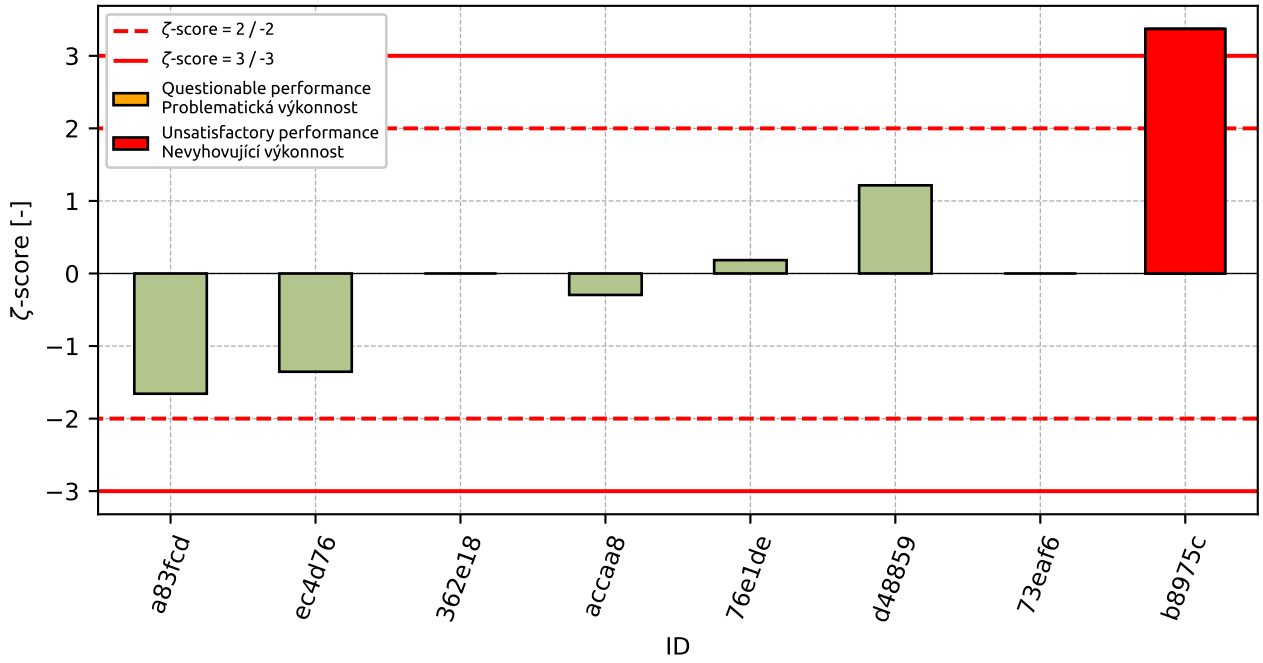

Figure 27: ζ-score

Table 12: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
a83fcd	-0.98	-1.66
ec4d76	-0.85	-1.35
362e18	-0.76	-
accaa8	-0.63	-0.3
76e1de	0.11	0.18
d48859	0.72	1.22
73eaf6	0.89	-
b8975c	1.5	3.37

4 Appendix – EN 12390-7 – Density of hardened concrete

4.1 Test results

Table 13: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [kg/mm^3]			u_X [kg/mm^3]	$\bar{x}$ [kg/mm^3]	s_0 [kg/mm^3]	V_X [%]
c44c48	2250	2220	2230	9.0	2233	15.3	0.68
e0fba4	2240	2230	2240	10.0	2237	5.8	0.26
73eaf6	2240	2240	2250	-	2243	5.8	0.26
0f0db2	2250	2240	2240	10.0	2243	5.8	0.26
d38b83	2260	2240	2240	10.0	2247	11.5	0.51
ec4d76	2248	2254	2246	52.0	2249	3.9	0.18
a83fcd	2280	2250	2220	20.0	2250	30.0	1.33
f1c786	2230	2260	2260	8.0	2250	17.3	0.77
d48859	2250	2250	2250	30.0	2250	0.0	0.0
f73b2c	2250	2240	2260	16.0	2250	10.0	0.44
362e18	2260	2250	2250	-	2253	5.8	0.26
8699f5	2250	2260	2250	10.0	2253	5.8	0.26
51c294	2264	2263	2241	11.0	2256	13.0	0.58
e1bfb8	2250	2270	2260	-	2260	10.0	0.44
c36d82	2250	2280	2250	16.0	2260	17.3	0.77
9d1087	2260	2260	2260	10.0	2260	0.0	0.0
aaf2c2	2260	2270	2250	0.0	2260	10.0	0.44
dd036d	2270	2260	2260	6.0	2263	5.8	0.26
68d36b	2270	2270	2260	15.0	2267	5.8	0.25
64c7e3	2260	2260	2280	8.0	2267	11.5	0.51
33033a	2260	2270	2270	41.0	2267	5.8	0.25
78d877	2260	2280	2270	7.0	2270	10.0	0.44
ac6b0d	2290	2260	2290	23.0	2280	17.3	0.76
a191ba	2290	2280	2290	-	2287	5.8	0.25
c03a46	2280	2290	2300	13.0	2290	10.0	0.44

4.2 The Numerical Procedure for Determining Outliers

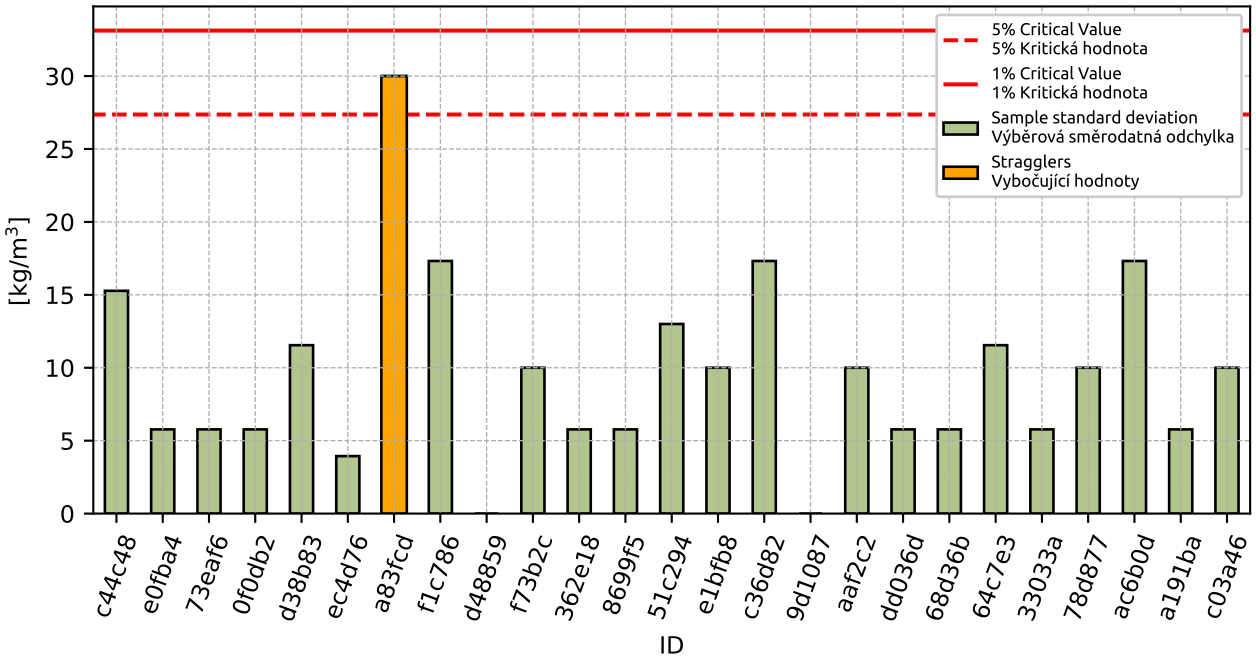

Figure 28: **Cochran's test** - sample standard deviations

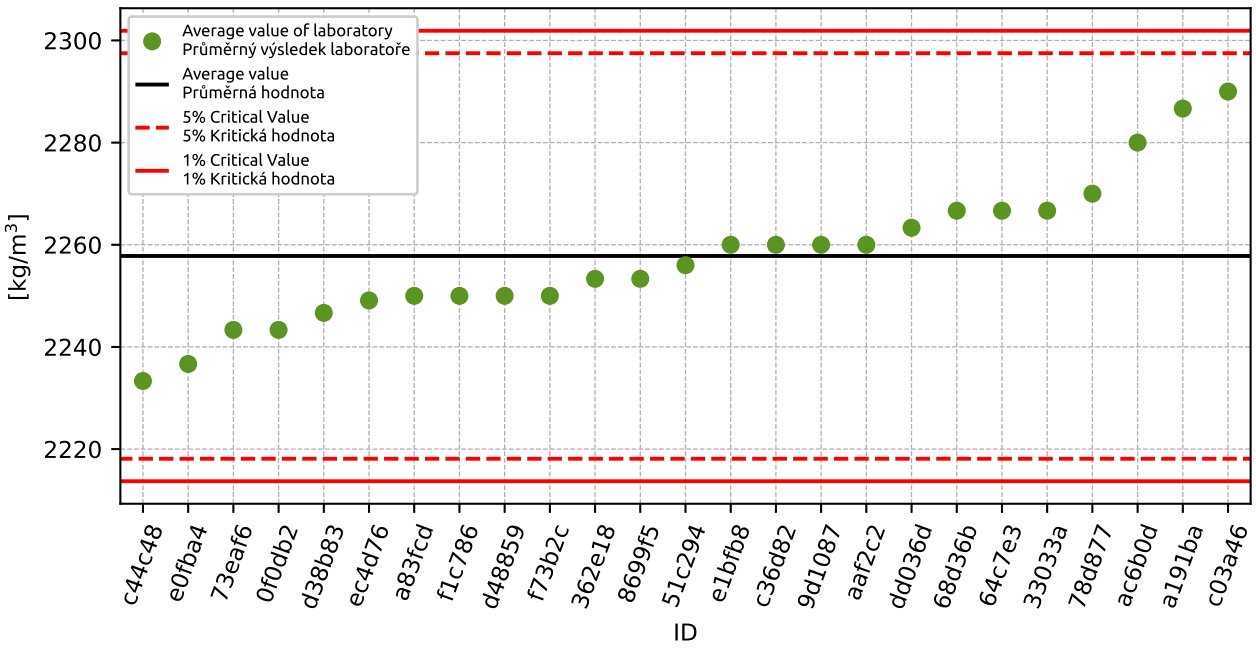

Figure 29: **Grubbs' test** - average values

4.3 Mandel's Statistics

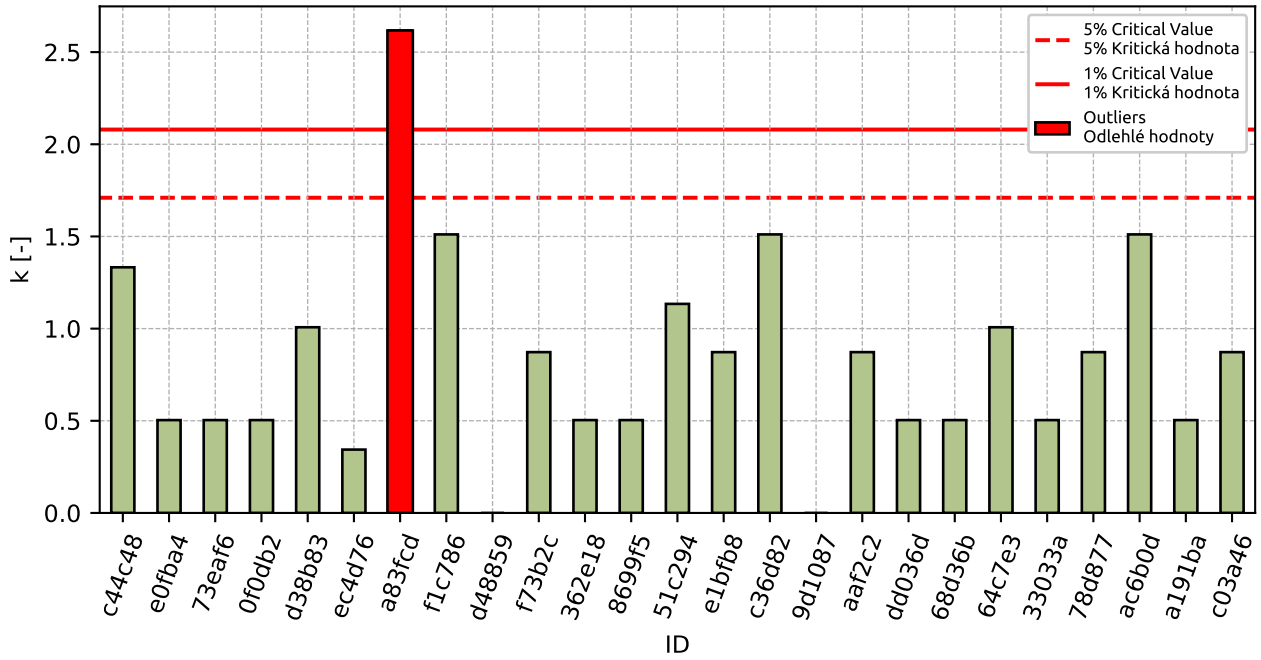

Figure 30: Intralaboratory Consistency Statistic

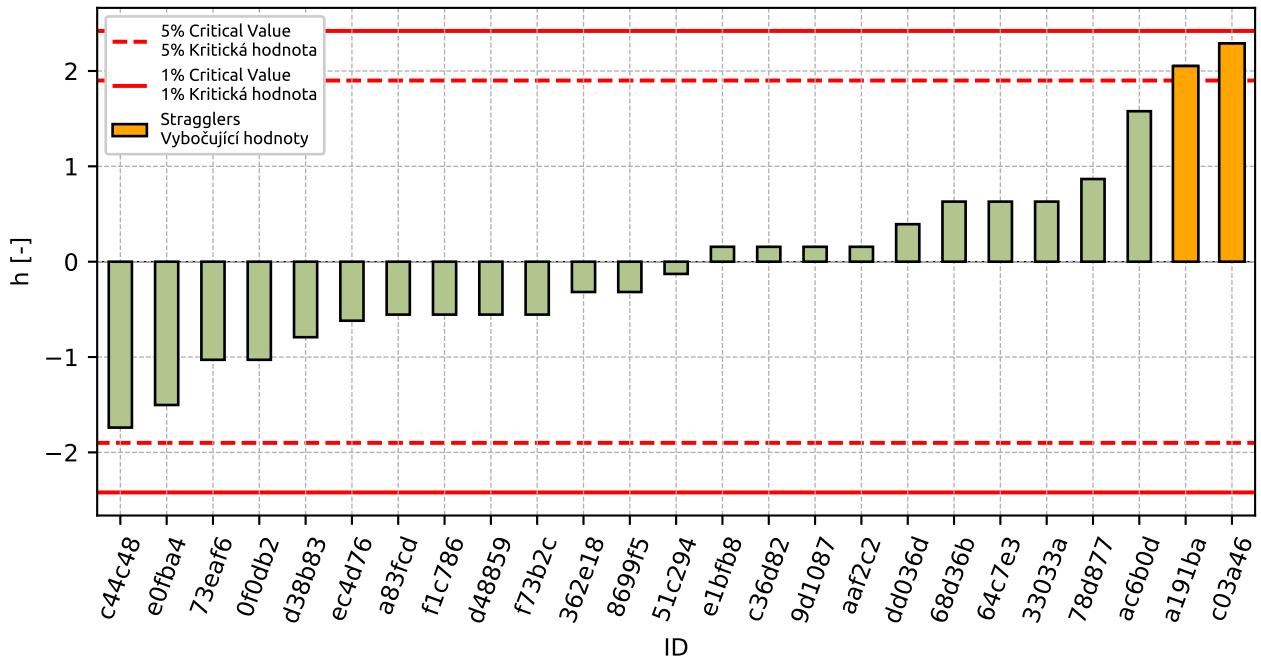

Figure 31: Interlaboratory Consistency Statistic

4.4 Descriptive statistics

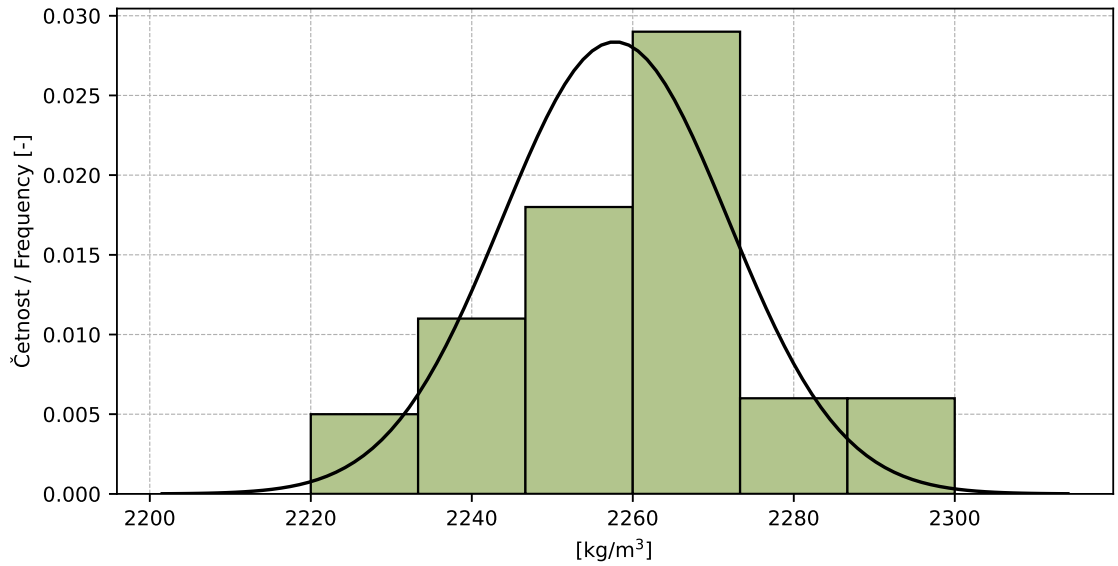

Figure 32: Histogram of all test results

Table 14: Descriptive statistics

Characteristics	[kg/mm³]
Průměrná hodnota / Average value – $\bar{x}$	2258.0
Výběrová směrodatná odchylka / Sample standard deviation – s	14.1
Vztažná hodnota / Asigned value – x^*	2257.0
Robustní směrodatná odchylka / Robust standard deviation – s^*	13.3
Nejistota měření vztažné hodnoty / Measurement uncertainty of asigned value – u_X	3.3
p-hodnota testu normality / p-value of normality test	0.026 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	12.4
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	11.5
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	16.9
Opakovatelnost / Repeatability – r	32.0
Reprodukovatelnost / Reproducibility – R	47.0

4.5 Evaluation of Performance Statistics

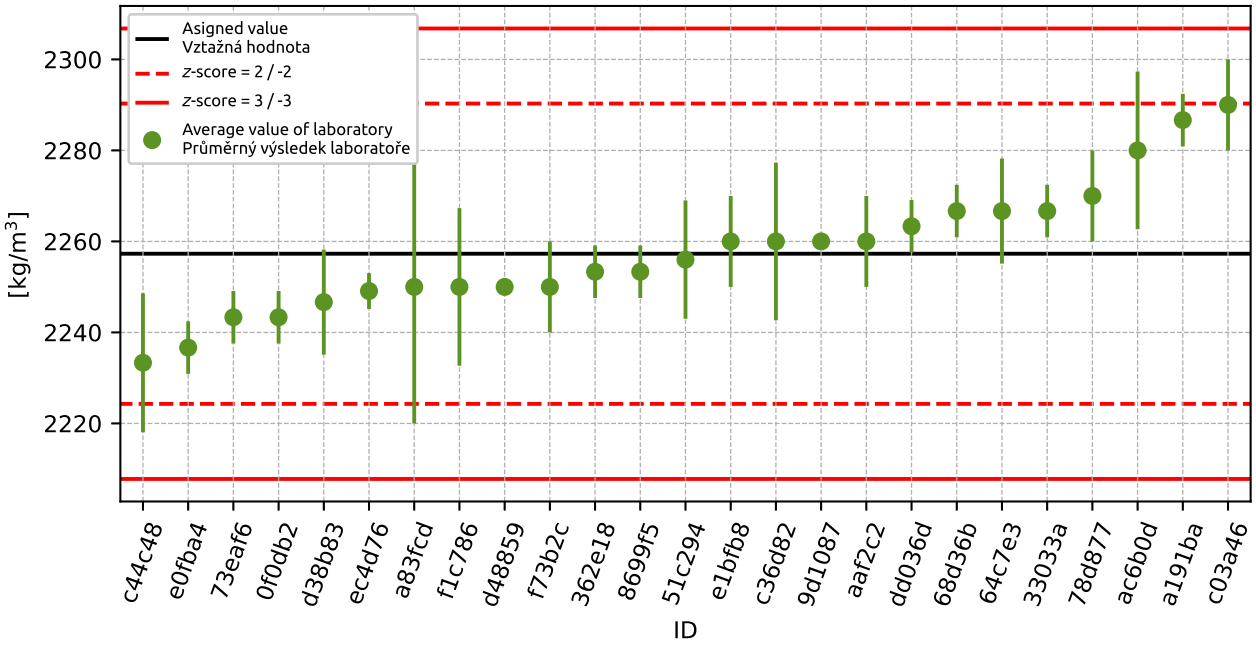

Figure 33: Average values and sample standard deviations

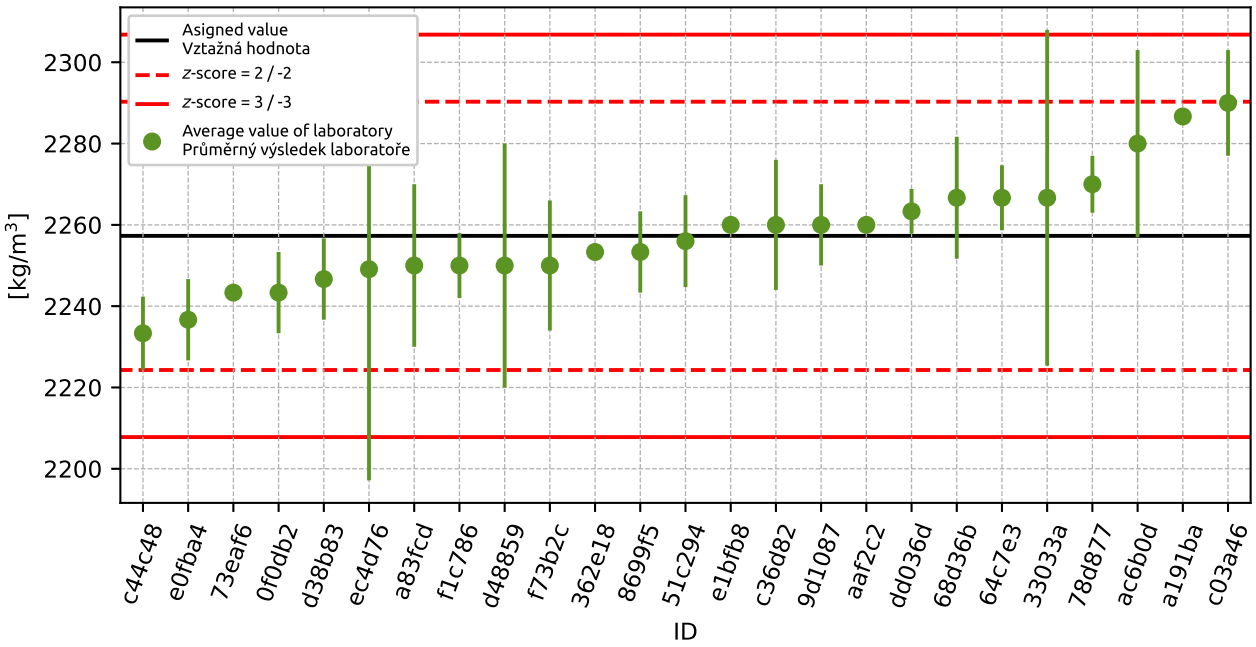

Figure 34: Average values and extended uncertainties of measurement

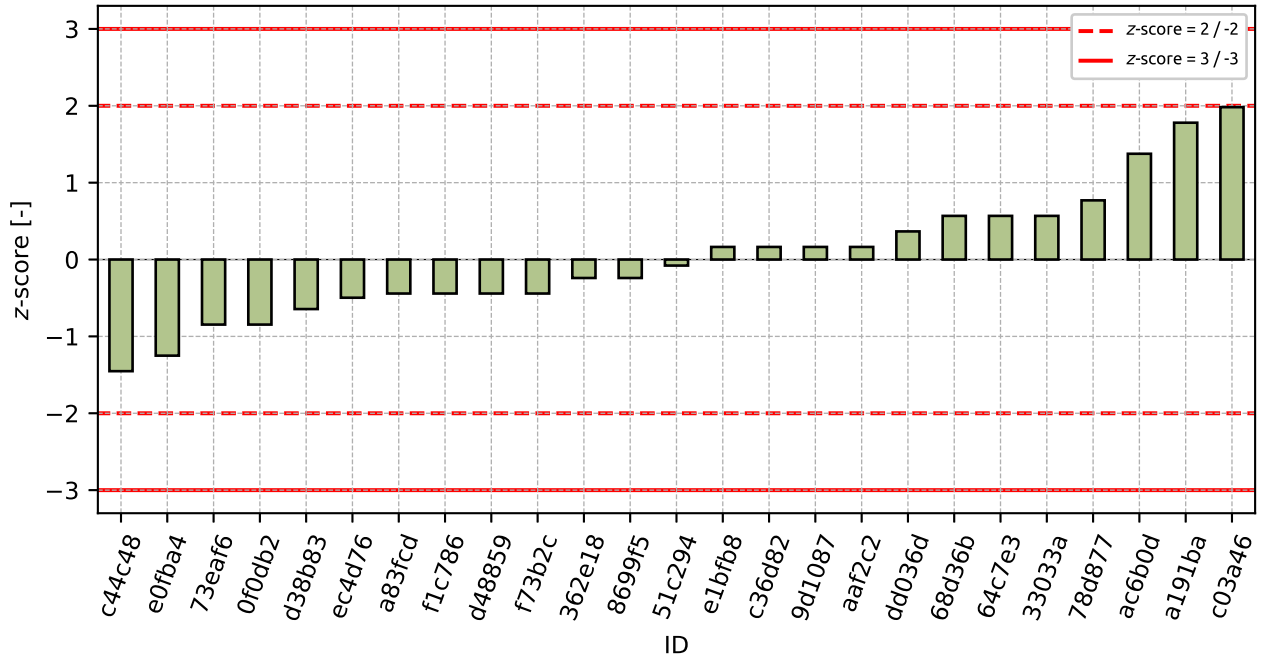

Figure 35: z-score

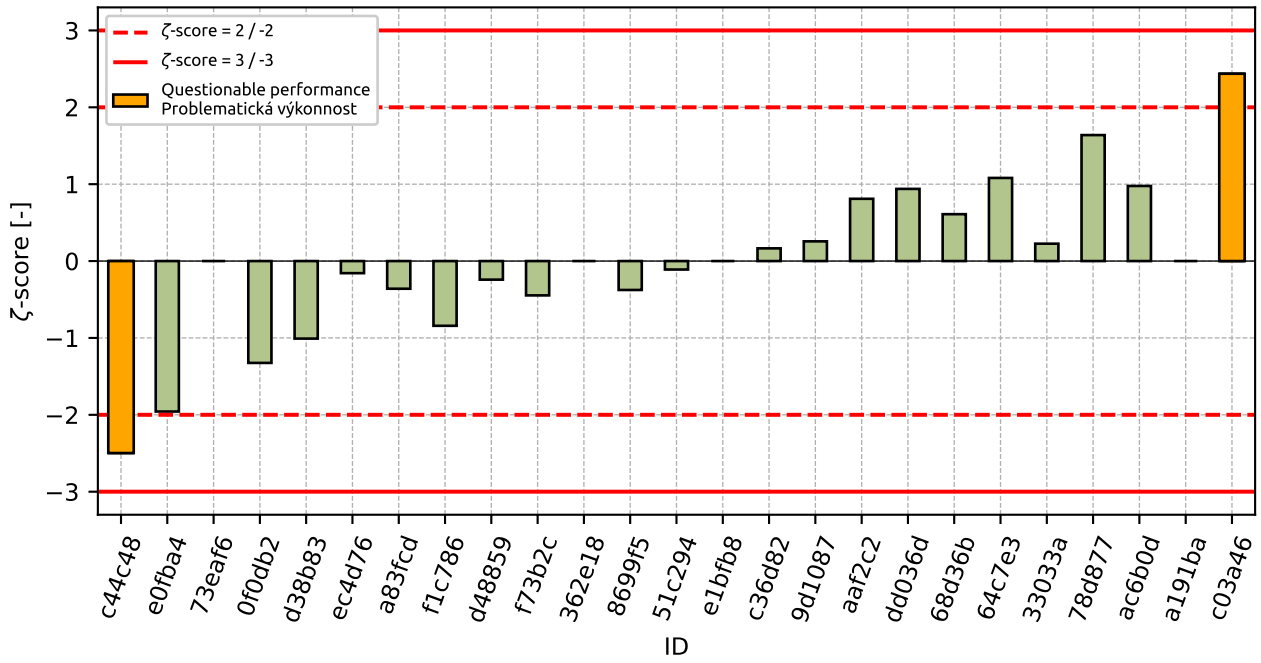

Figure 36: ζ-score

Table 15: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
c44c48	-1.45	-2.5
e0fba4	-1.25	-1.96
73eaf6	-0.85	-
0f0db2	-0.85	-1.32
d38b83	-0.64	-1.01
ec4d76	-0.5	-0.16
a83fcd	-0.44	-0.36
f1c786	-0.44	-0.84
d48859	-0.44	-0.24
f73b2c	-0.44	-0.45
362e18	-0.24	-
8699f5	-0.24	-0.38
51c294	-0.08	-0.11
e1bfb8	0.16	-
c36d82	0.16	0.17
9d1087	0.16	0.26
aaf2c2	0.16	0.81
dd036d	0.37	0.94
68d36b	0.57	0.61
64c7e3	0.57	1.08
33033a	0.57	0.23
78d877	0.77	1.64
ac6b0d	1.38	0.98
a191ba	1.78	-
c03a46	1.98	2.44

5 Appendix – ISO 1920-10 – Determination of static modulus of elasticity in compression

5.1 Test results

Table 16: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [N/mm²]		u_X [N/mm²]	$\bar{x}$ [N/mm²]	s_0 [N/mm²]	V_X [%]
accaa8	28305	29616	100	28960	927.0	3.2
0f0db2	29000	29100	1000	29050	70.7	0.24
3539c7	29100	29600	500	29350	353.6	1.2
14bad1	30900	30400	1700	30650	353.6	1.15
ac6b0d	31100	32100	800	31600	707.1	2.24
4b9070	31800	31800	1	31800	0.0	0.0

5.2 The Numerical Procedure for Determining Outliers

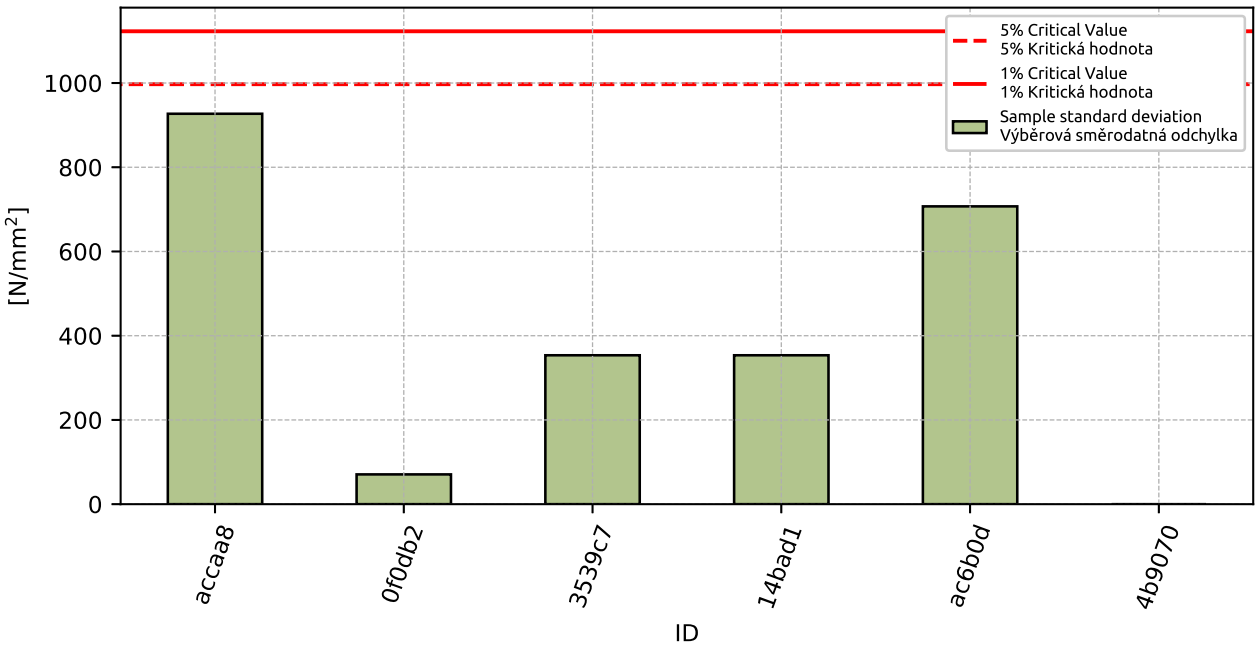

Figure 37: **Cochran's test** - sample standard deviations

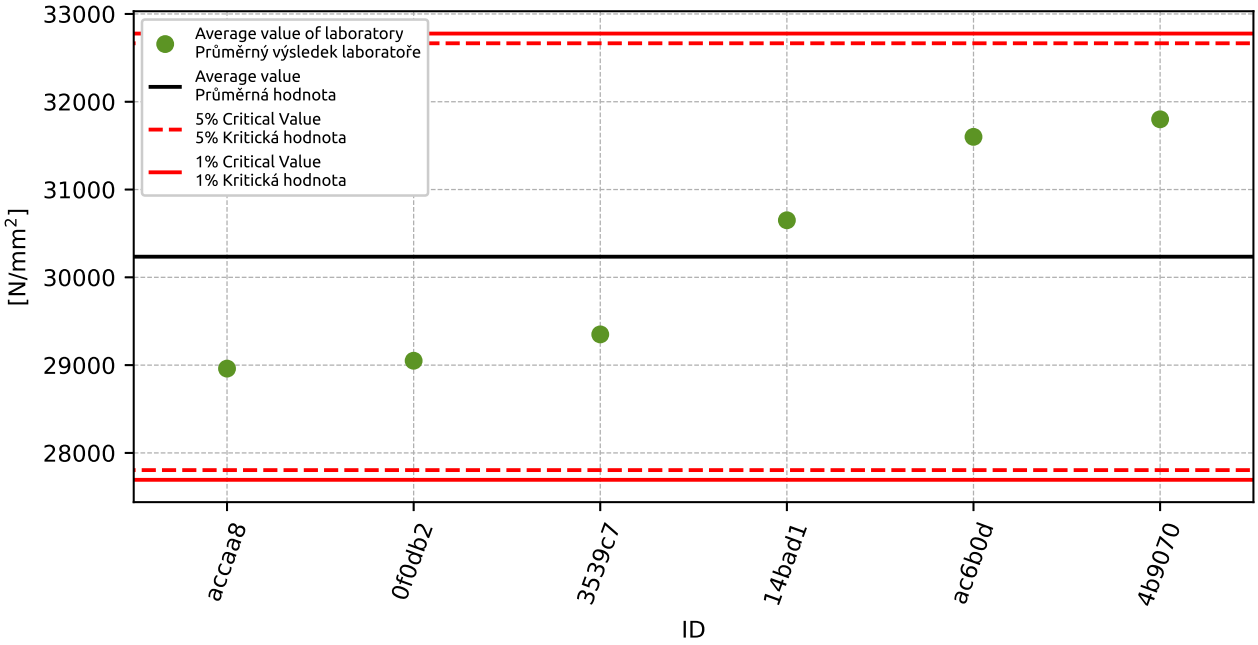

Figure 38: **Grubbs' test** - average values

5.3 Mandel's Statistics

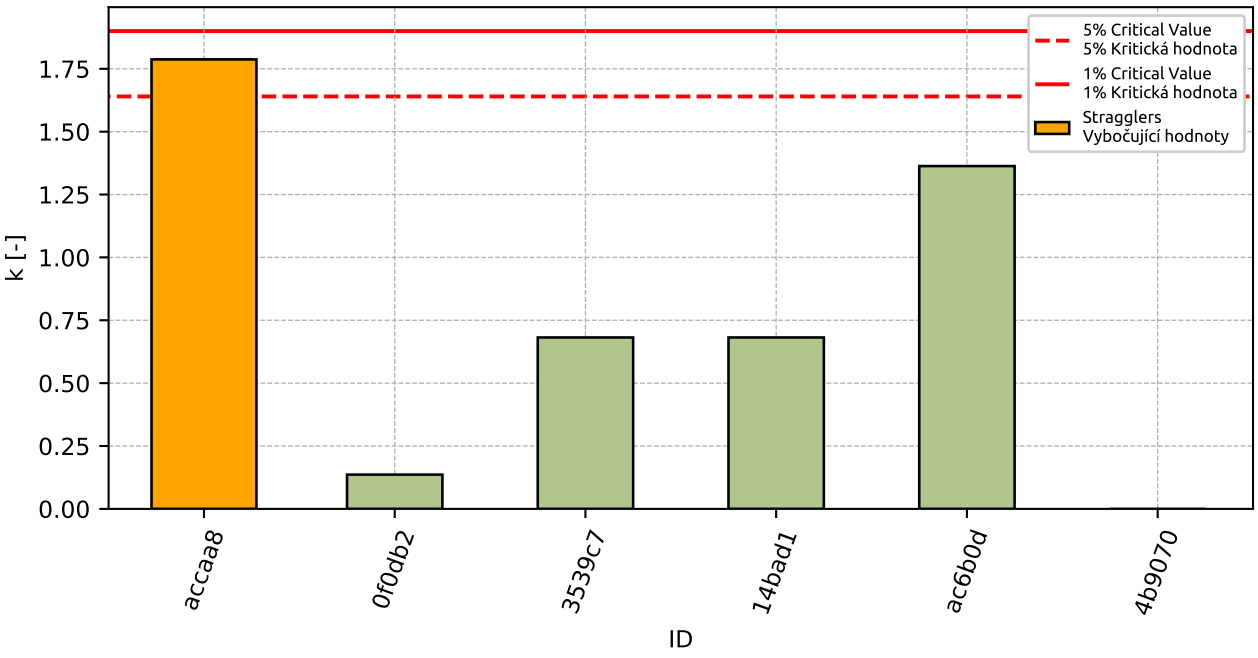

Figure 39: Intralaboratory Consistency Statistic

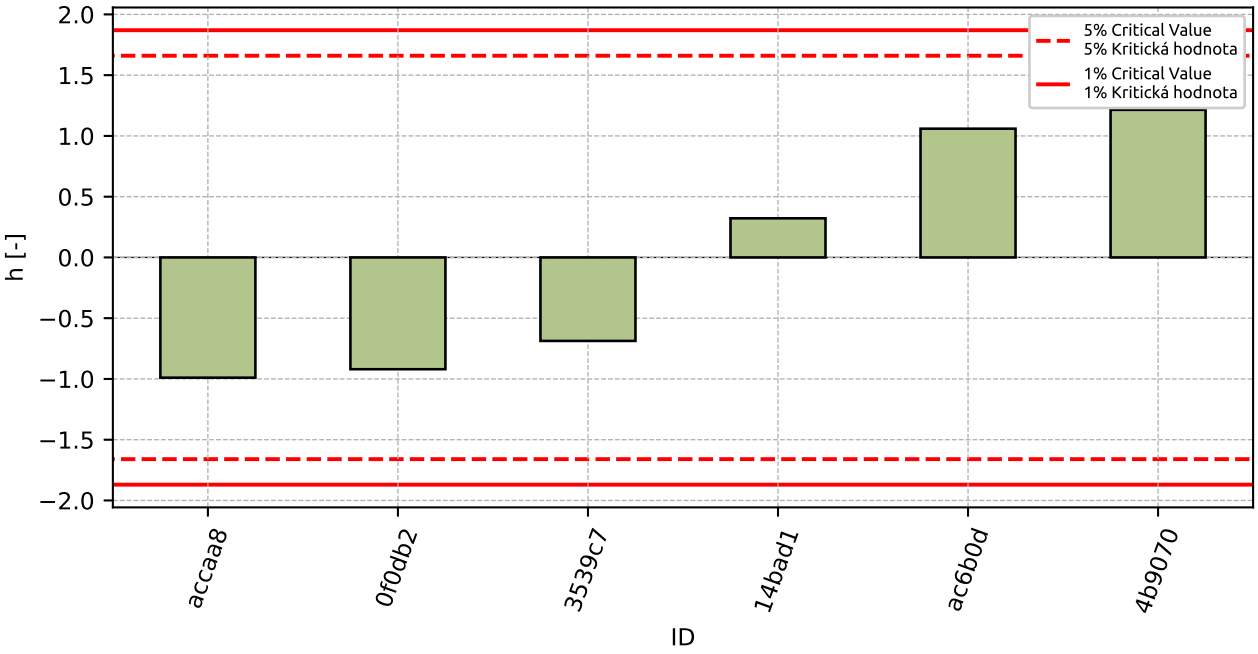

Figure 40: Interlaboratory Consistency Statistic

5.4 Descriptive statistics

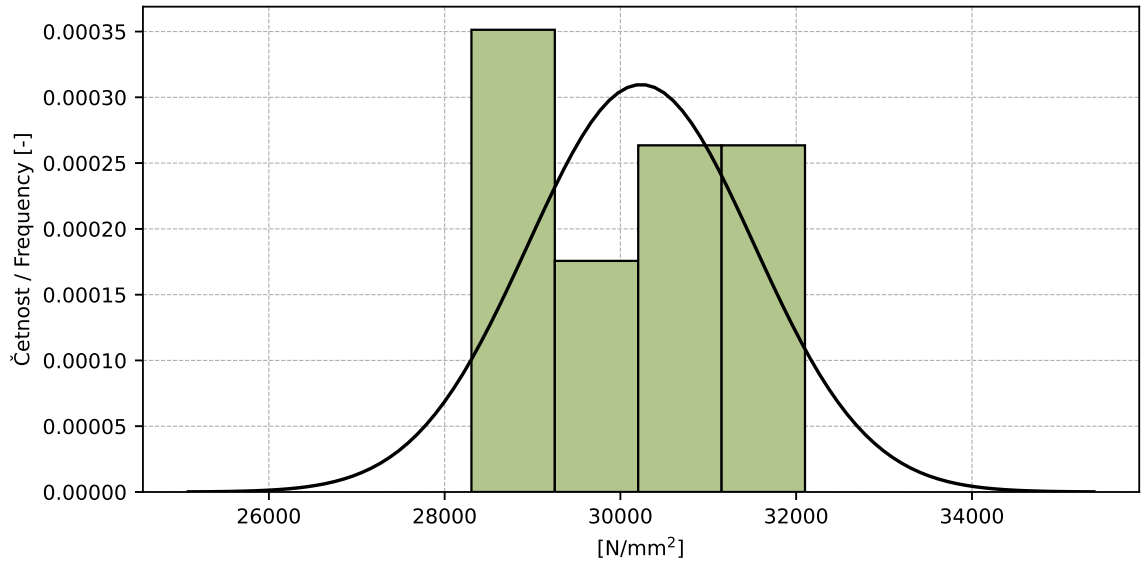

Figure 41: Histogram of all test results

Table 17: Descriptive statistics

Characteristics	[N/mm²]
Průměrná hodnota / Average value – $\bar{x}$	30235.0
Výběrová směrodatná odchylka / Sample standard deviation – s	1288.1
Vztažná hodnota / Asigned value – x^*	30235.0
Robustní směrodatná odchylka / Robust standard deviation – s^*	1333.5
Nejistota měření vztažné hodnoty / Measurement uncertainty of asigned value – u_X	680.5
p-hodnota testu normality / p-value of normality test	0.329 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	1234.8
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	518.7
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	1339.3
Opakovatelnost / Repeatability – r	1452.0
Reprodukovatelnost / Reproducibility – R	3750.0

5.5 Evaluation of Performance Statistics

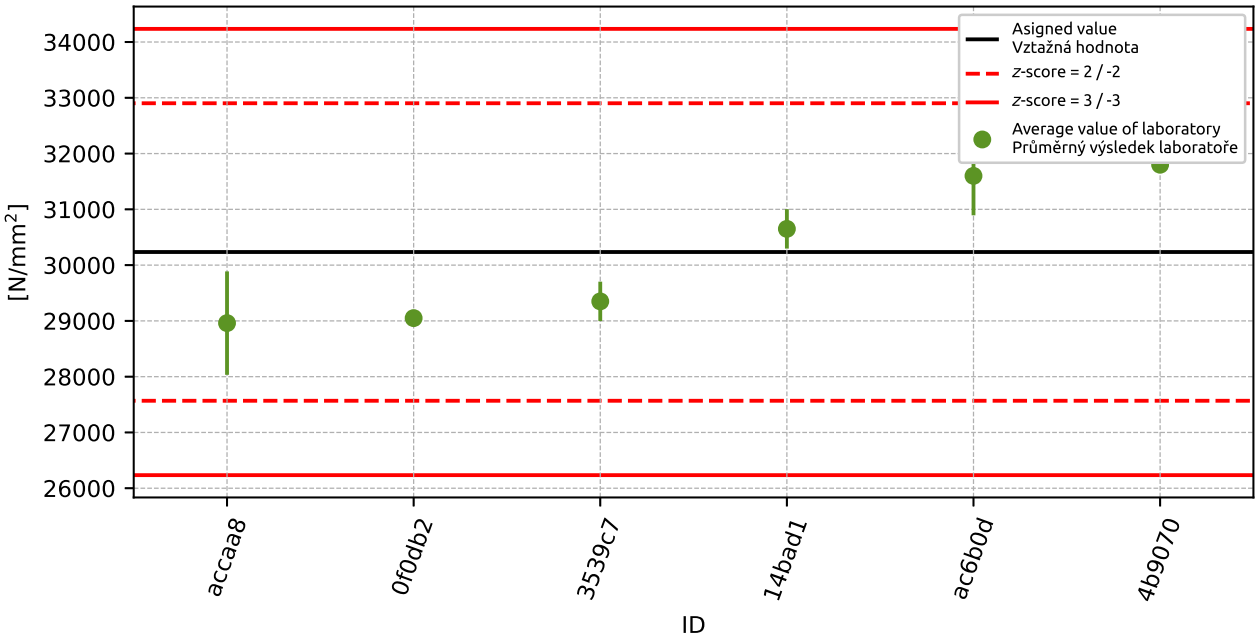

Figure 42: Average values and sample standard deviations

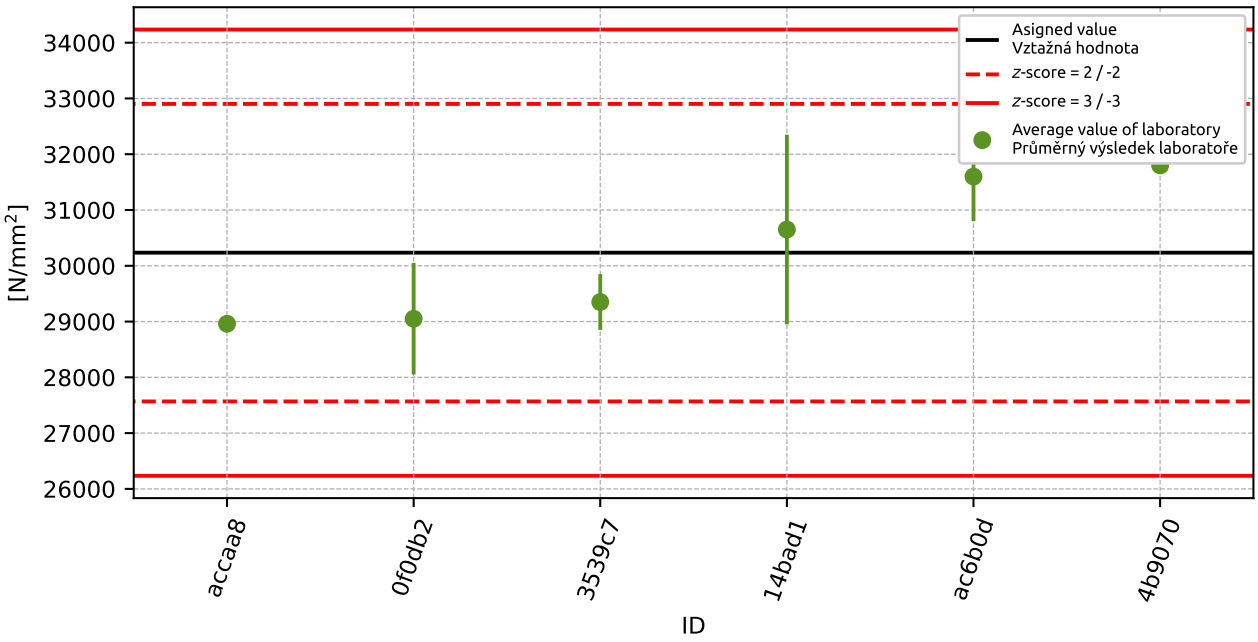

Figure 43: Average values and extended uncertainties of measurement

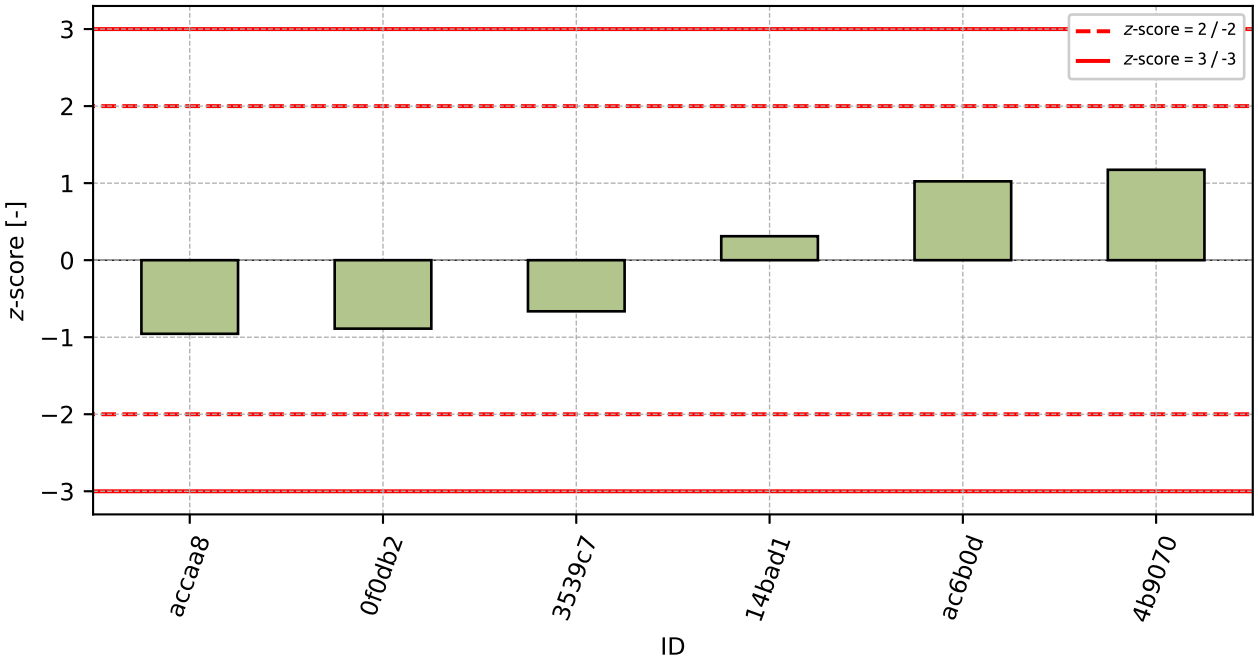

Figure 44: z-score

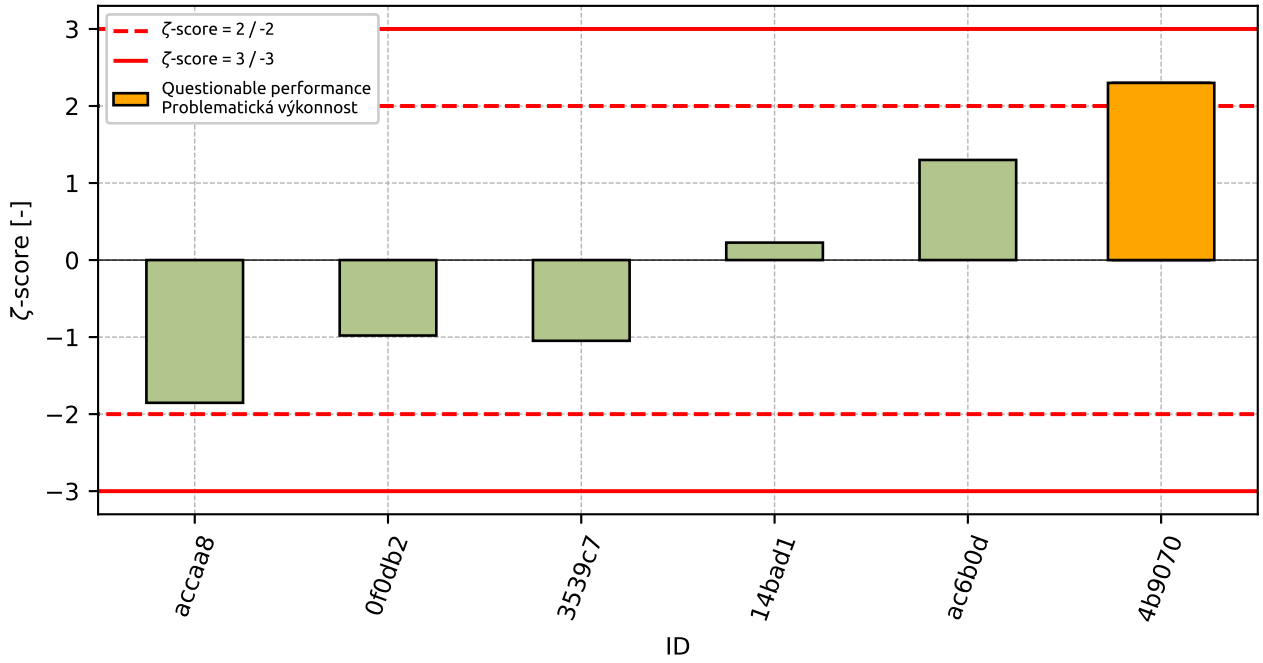

Figure 45: ζ-score

Table 18: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
accaa8	-0.96	-1.85
0f0db2	-0.89	-0.98
3539c7	-0.66	-1.05
14bad1	0.31	0.23
ac6b0d	1.02	1.3
4b9070	1.17	2.3

6 Appendix – EN 12390-13, method A – Determination of secant modulus of elasticity in compression

This part of PT program was not open due to the low number of participants.

7 Appendix – EN 12390-13, method B – Determination of secant modulus of elasticity in compression

This part of PT program was not open due to the low number of participants.

8 Appendix – EN 12504-4, ČSN 731371 – Non-destructive testing of concrete

This part of PT program was not open due to the low number of participants.

9 Appendix – ČSN 731373, EN 12504-2 – Determination of rebound number

9.1 Test results

Table 19: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [-]			u_X [-]	$\bar{x}$ [-]	s_0 [-]	V_X [%]
f47e64	26.0	28.0	28.0	4.0	27.3	1.15	4.22
3b59a5	35.0	35.0	35.0	5.0	35.0	0.0	0.0
a83fcd	36.0	36.0	35.0	3.0	35.7	0.58	1.62
ae9208	35.0	37.0	35.0	5.0	35.7	1.15	3.24
1e1eec	37.0	35.0	37.0	2.2	36.3	1.15	3.18
d48859	40.0	39.0	38.0	2.0	39.0	1.0	2.56
8b7ed8	43.0	44.0	44.0	1.2	43.7	0.58	1.32
33033a	49.3	44.5	46.3	2.8	46.7	2.42	5.19

9.2 The Numerical Procedure for Determining Outliers

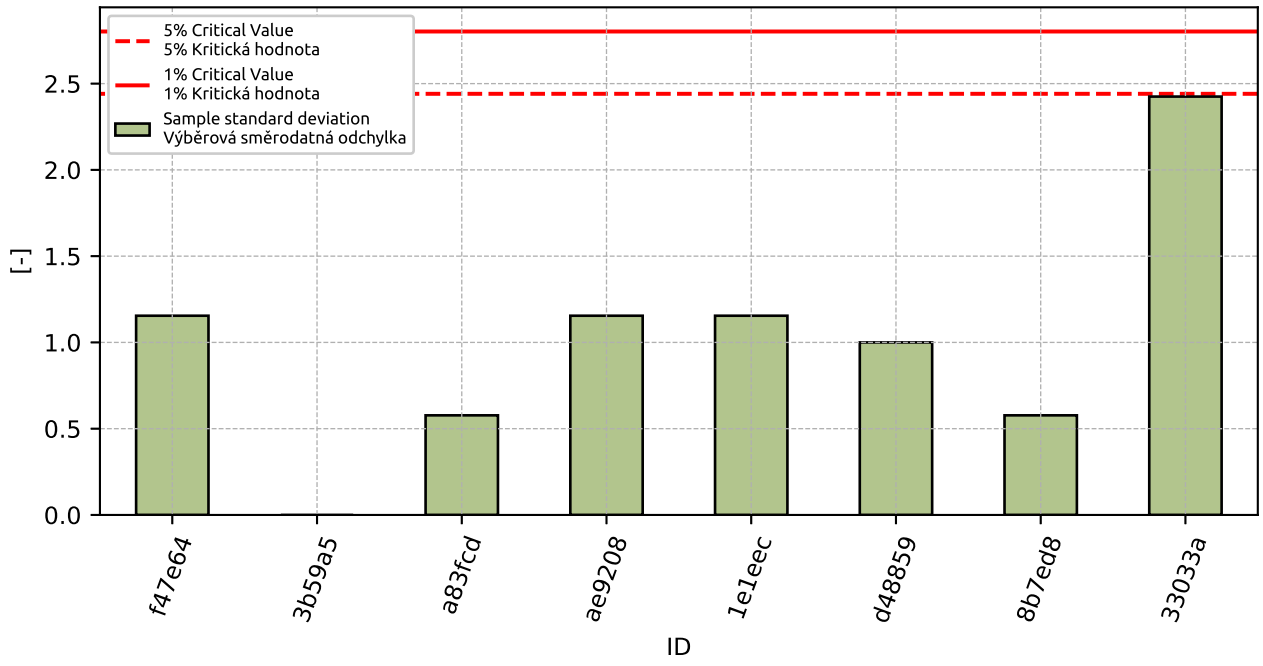

Figure 46: **Cochran's test** - sample standard deviations

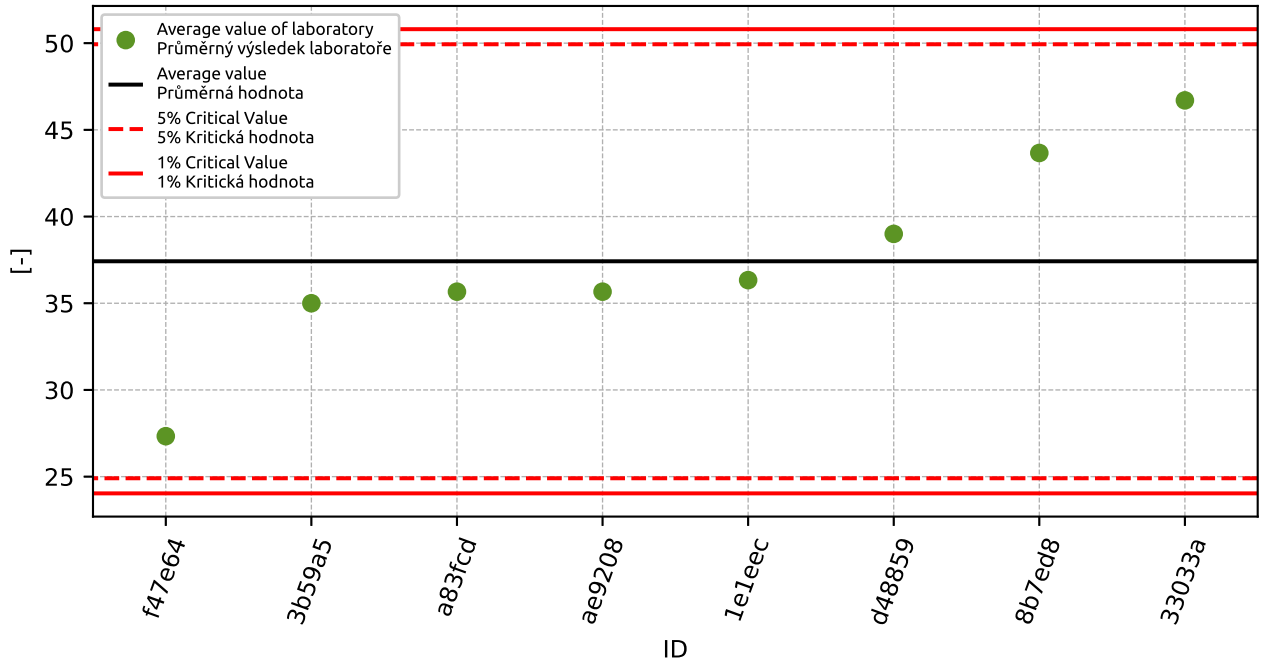

Figure 47: **Grubbs' test** - average values

9.3 Mandel's Statistics

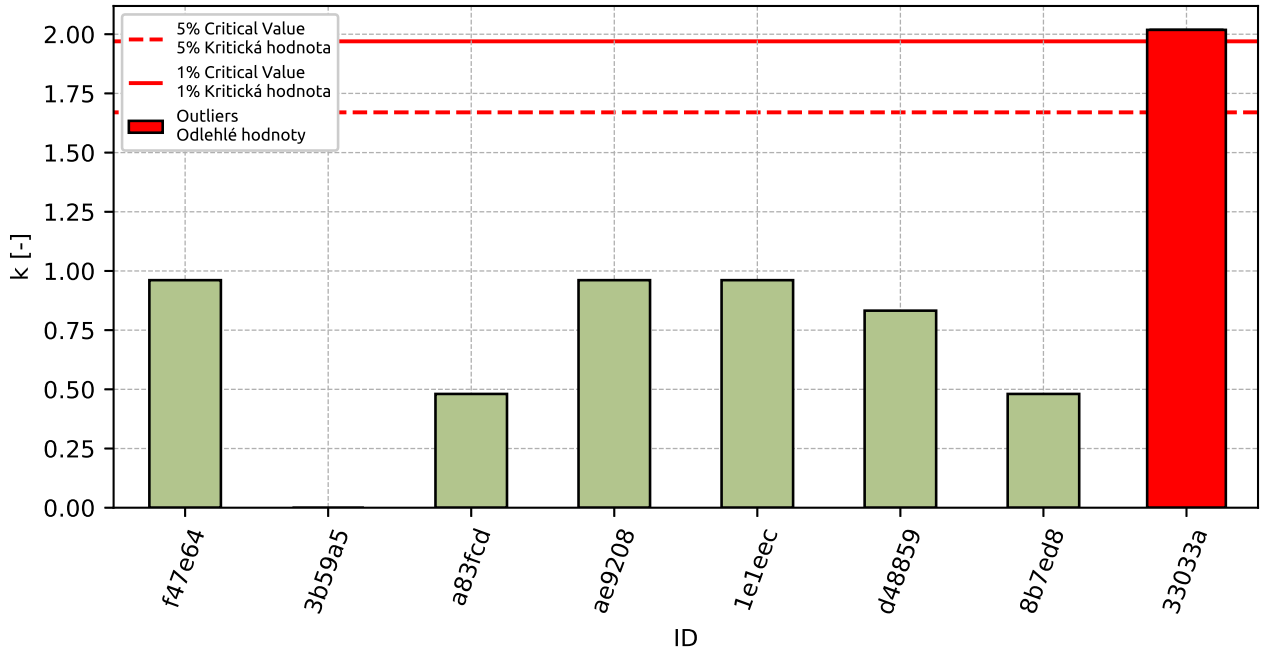

Figure 48: Intralaboratory Consistency Statistic

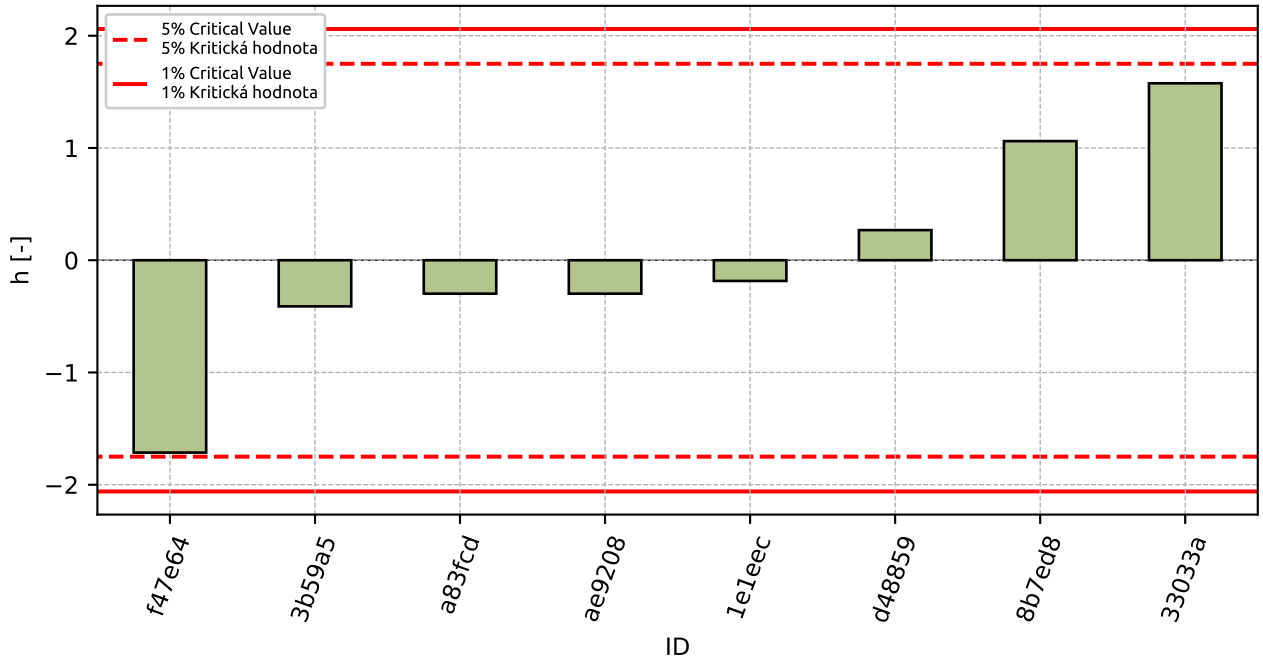

Figure 49: Interlaboratory Consistency Statistic

9.4 Descriptive statistics

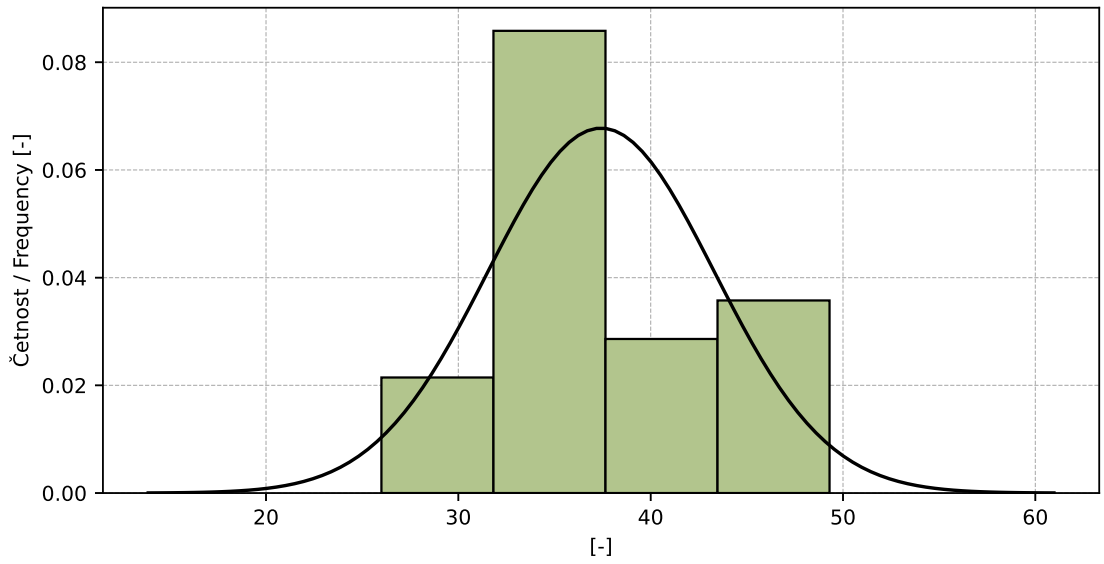

Figure 50: Histogram of all test results

Table 20: Descriptive statistics

Characteristics	[-]
Průměrná hodnota / Average value – $\bar{x}$	37.4
Výběrová směrodatná odchylka / Sample standard deviation – s	5.89
Vztažná hodnota / Asigned value – x^*	37.5
Robustní směrodatná odchylka / Robust standard deviation – s^*	16.5
Nejistota měření vztažné hodnoty / Measurement uncertainty of asigned value – u_X	2.14
p-hodnota testu normality / p-value of normality test	0.142 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	5.85
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	1.2
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	5.97
Opakovatelnost / Repeatability – r	3.4
Reprodukovatelnost / Reproducibility – R	16.7

9.5 Evaluation of Performance Statistics

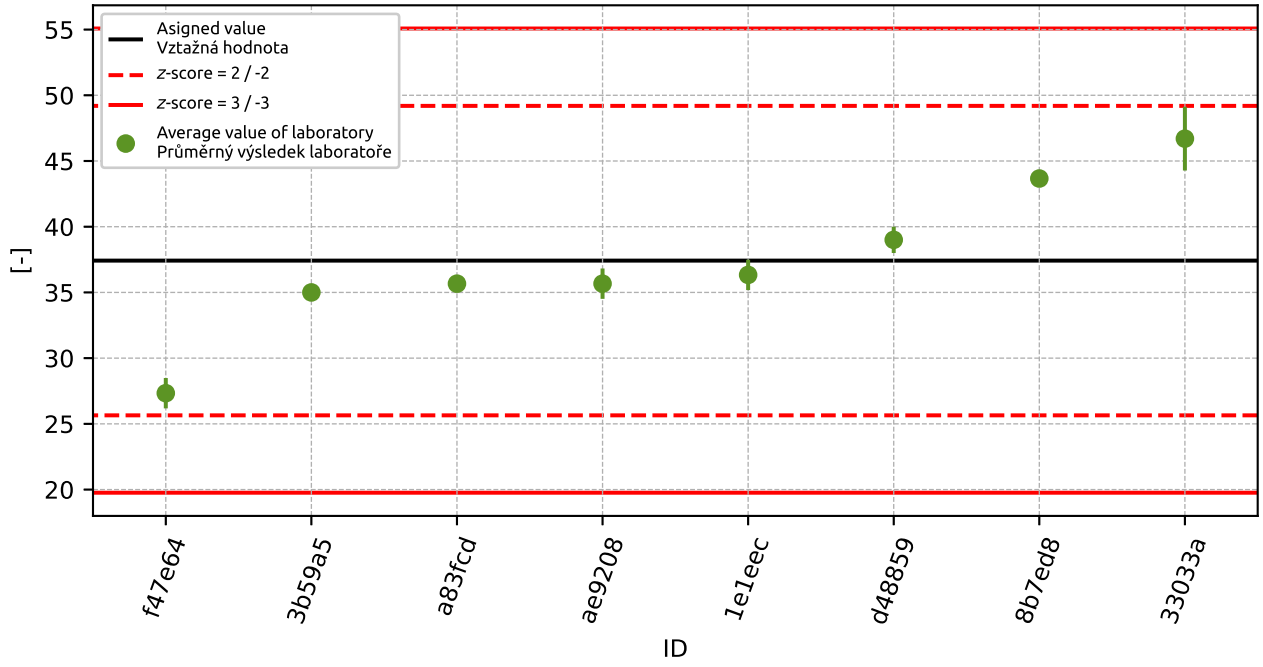

Figure 51: Average values and sample standard deviations

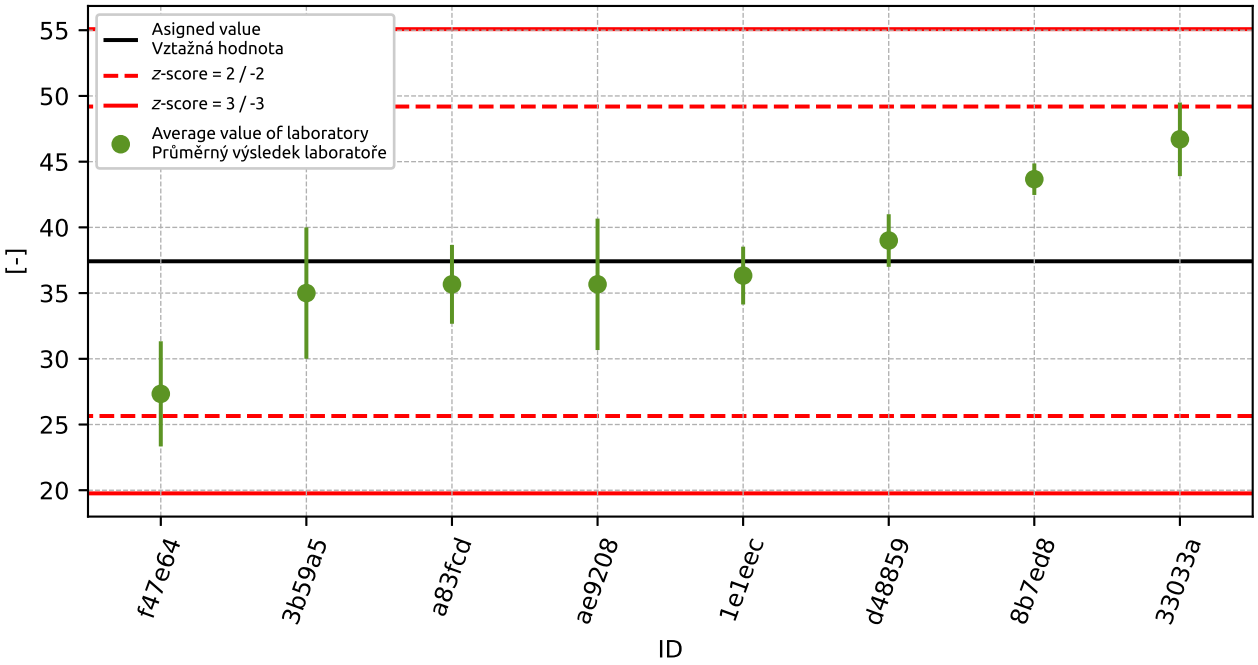

Figure 52: Average values and extended uncertainties of measurement

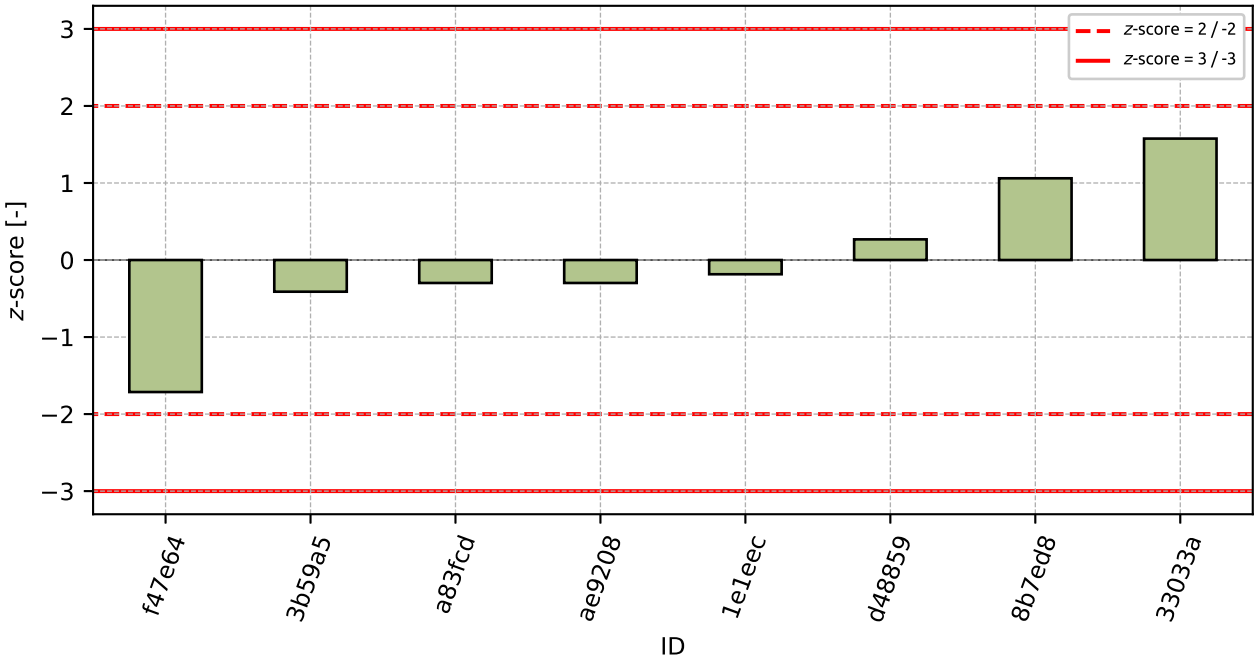

Figure 53: z-score

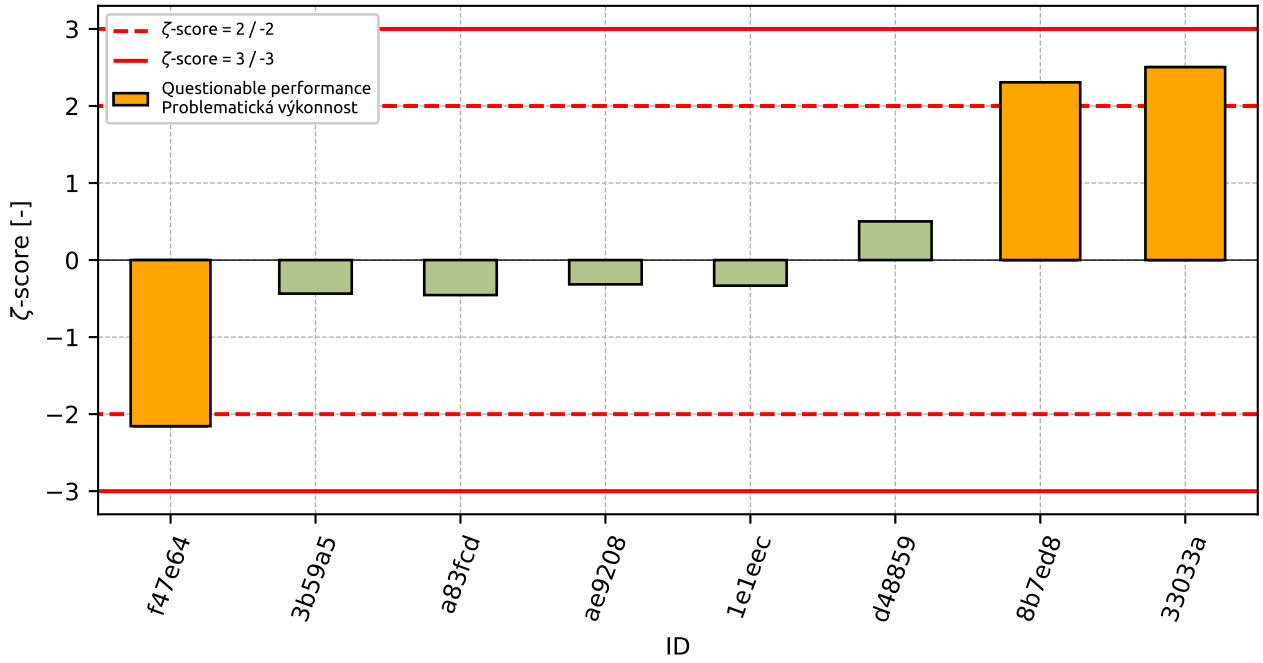

Figure 54: ζ-score

Table 21: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
f47e64	-1.71	-2.16
3b59a5	-0.41	-0.44
a83fcd	-0.3	-0.45
ae9208	-0.3	-0.32
1e1eec	-0.18	-0.33
d48859	0.27	0.5
8b7ed8	1.06	2.31
33033a	1.58	2.5

10 Appendix – EN 1542, ČSN 736242, Appendix B – Measurement of bond strength by pull-off

10.1 Test results

Table 22: Test results - ordered by average value. Outliers are marked by red color. u_X - extended uncertainty of measurement; $\bar{x}$ - average value; s_0 - sample standard deviation; V_X - variation coefficient

ID	Test results [N/mm²]					u_X [N/mm²]	$\bar{x}$ [N/mm²]	s_0 [N/mm²]	V_X [%]
10984f	1.38	2.96	1.74	1.73	1.77	0.16	1.92	0.606	31.61
1165f2	1.56	1.57	2.61	2.35	2.16	0.18	2.05	0.468	22.86
7bb808	1.92	2.14	2.39	2.24	1.78	0.18	2.09	0.242	11.56
68d869	1.89	2.22	2.16	2.39	2.32	0.19	2.19	0.193	8.8
c03a46	2.76	2.63	3.05	2.72	3.04	0.1	2.84	0.193	6.8
f47e64	2.89	3.59	3.61	4.07	4.0	0.8	3.63	0.469	12.91
8699f5	3.8	3.4	3.9	3.9	3.3	0.3	3.66	0.288	7.87
86bdde	3.32	3.94	3.92	3.5	3.83	0.13	3.7	0.279	7.53
1e1eec	3.28	3.98	3.9	3.47	3.89	0.13	3.7	0.312	8.44
695bf7	3.48	3.65	4.13	4.18	3.13	0.5	3.71	0.444	11.97
23af1e	4.16	3.76	3.7	3.27	4.17	0.01	3.81	0.374	9.8
9b5cad	3.6	3.7	4.2	4.0	3.7	-	3.84	0.251	6.54
a83fcd	3.41	3.87	4.23	3.62	4.43	0.6	3.91	0.421	10.76
ae9208	3.83	4.15	4.05	3.82	4.09	0.3	3.99	0.153	3.84

10.2 The Numerical Procedure for Determining Outliers

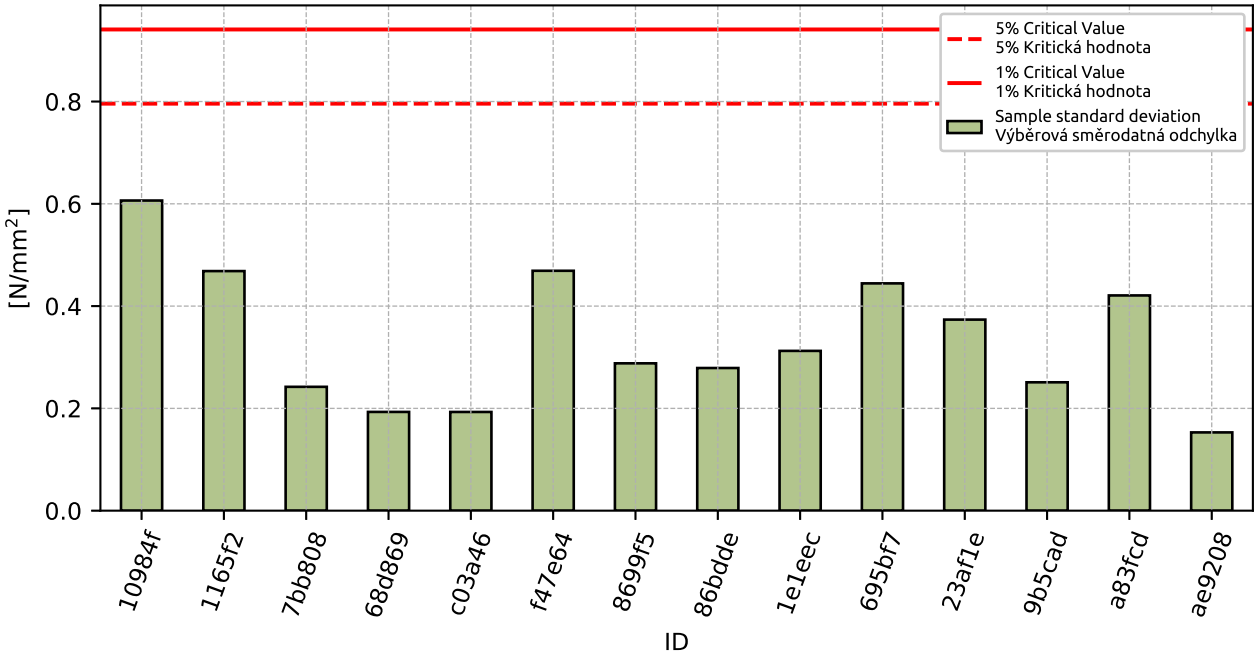

Figure 55: **Cochran's test** - sample standard deviations

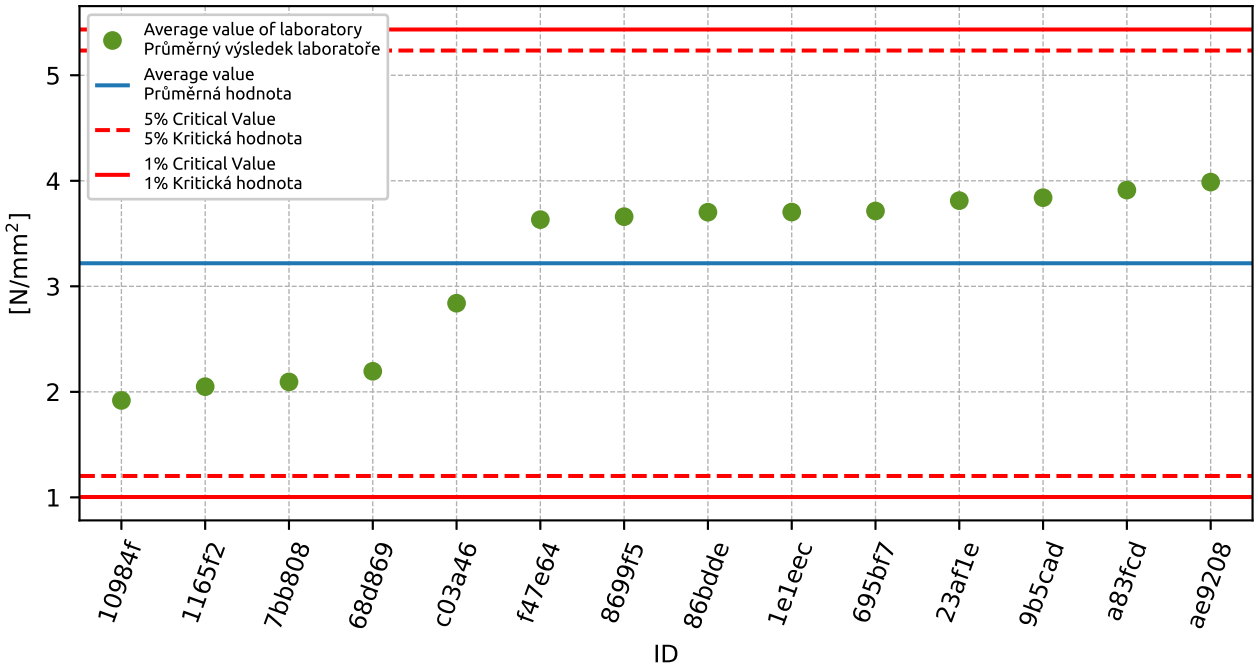

Figure 56: **Grubbs' test** - average values

10.3 Mandel's Statistics

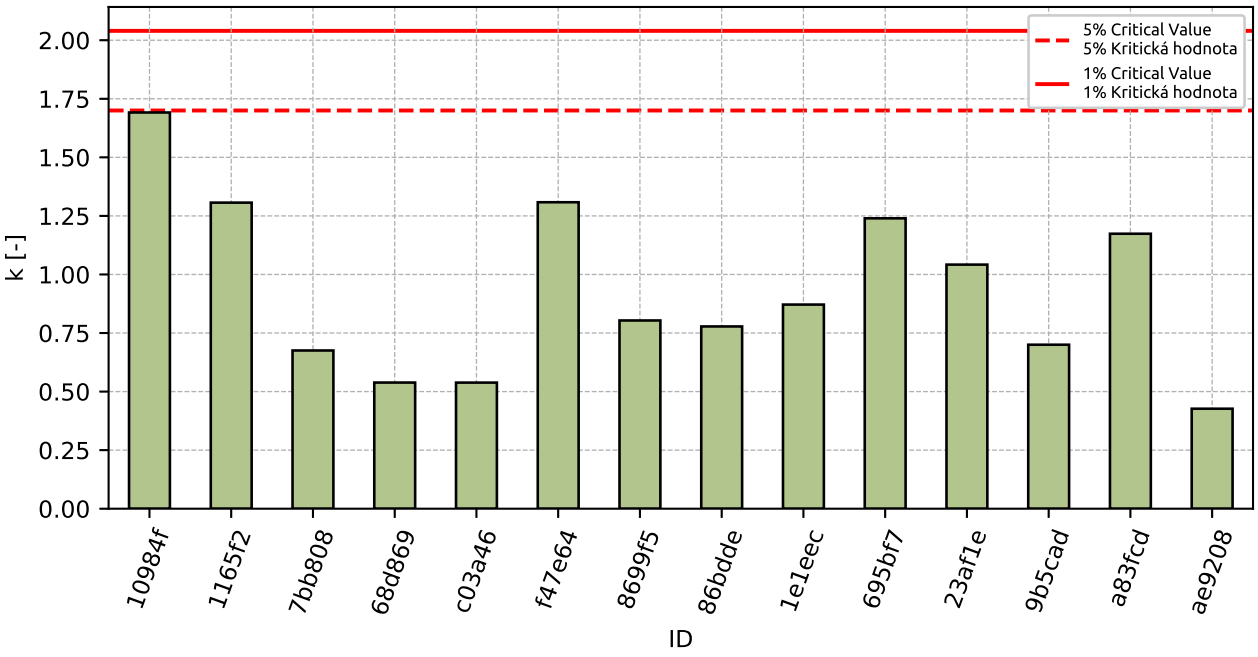

Figure 57: Intralaboratory Consistency Statistic

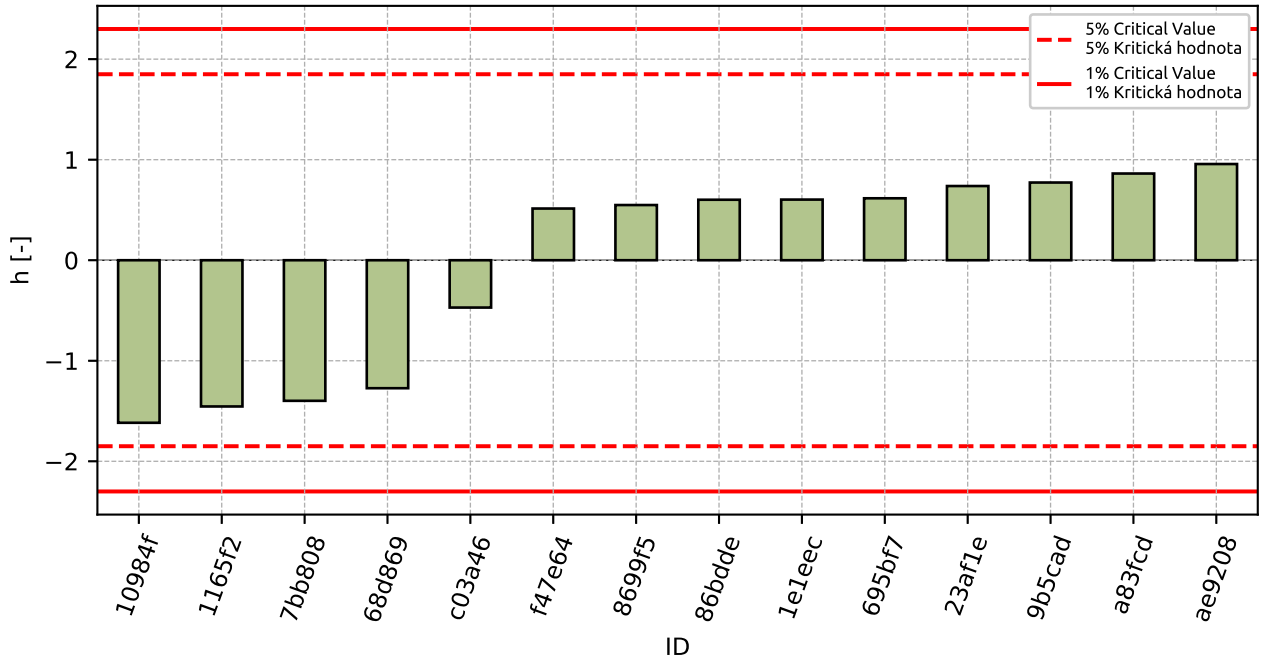

Figure 58: Interlaboratory Consistency Statistic

10.4 Descriptive statistics

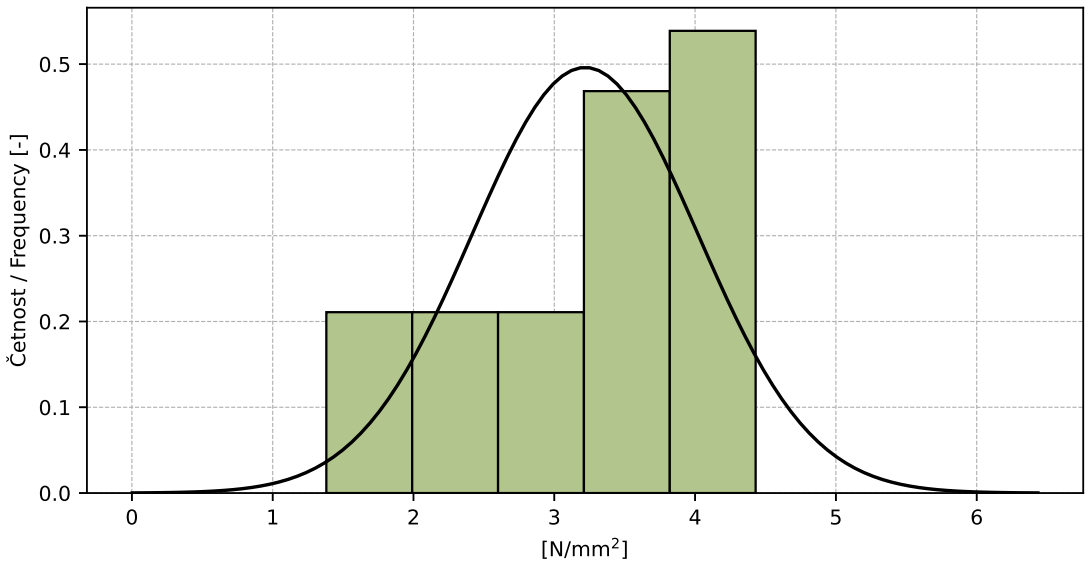

Figure 59: Histogram of all test results

Table 23: Descriptive statistics

Characteristics	[N/mm²]
Průměrná hodnota / Average value – $\bar{x}$	3.22
Výběrová směrodatná odchylka / Sample standard deviation – s	0.804
Vztažná hodnota / Asigned value – x^*	3.59
Robustní směrodatná odchylka / Robust standard deviation – s^*	0.304
Nejistota měření vztažné hodnoty / Measurement uncertainty of asigned value – u_X	0.102
p-hodnota testu normality / p-value of normality test	0.0 [-]
Mezilaboratorní sm. odch. / Interlaboratory standard deviation – s_L	0.788
Směrodatná odchylka opakovatelnosti / Repeatability standard deviation – s_r	0.359
Směrodatná odchylka reprodukovatelnosti / Reproducibility standard deviation – s_R	0.866
Opakovatelnost / Repeatability – r	1.0
Reprodukovatelnost / Reproducibility – R	2.42

10.5 Evaluation of Performance Statistics

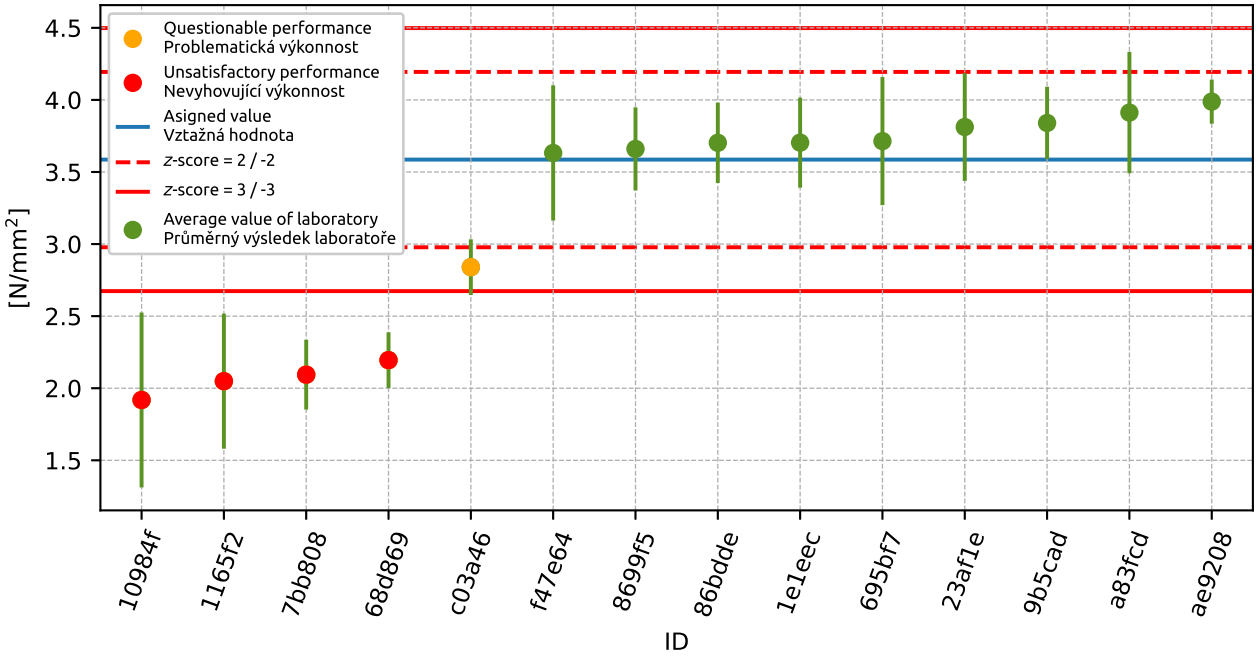

Figure 60: Average values and sample standard deviations

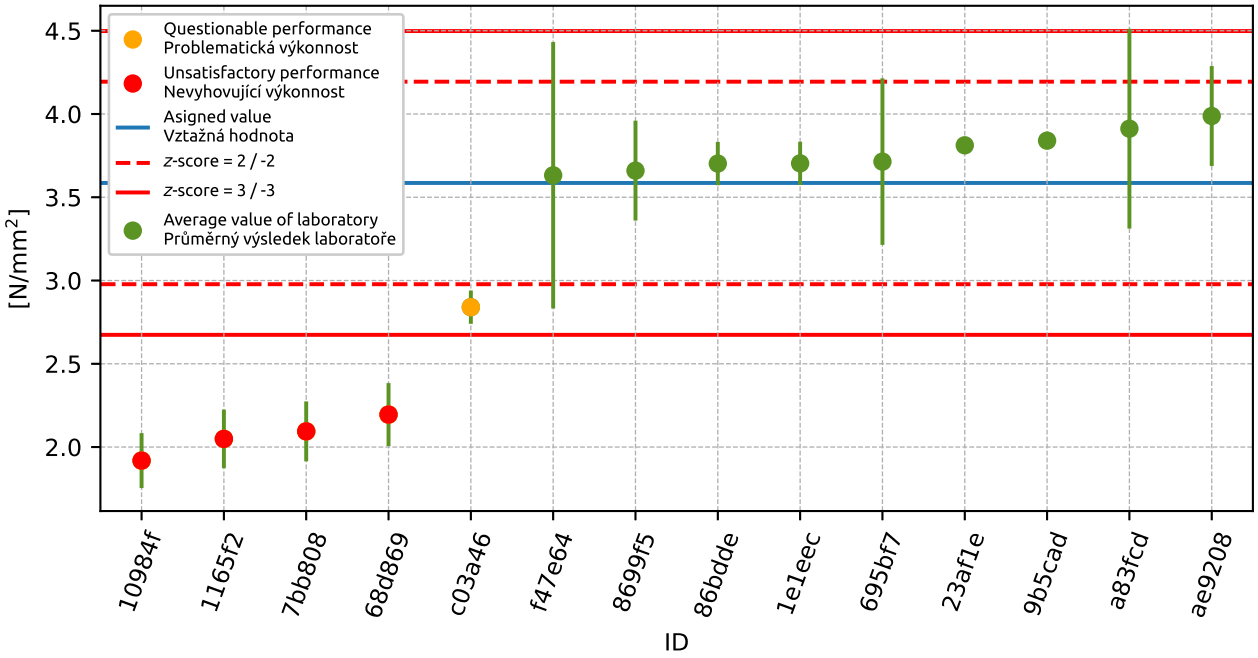

Figure 61: Average values and extended uncertainties of measurement

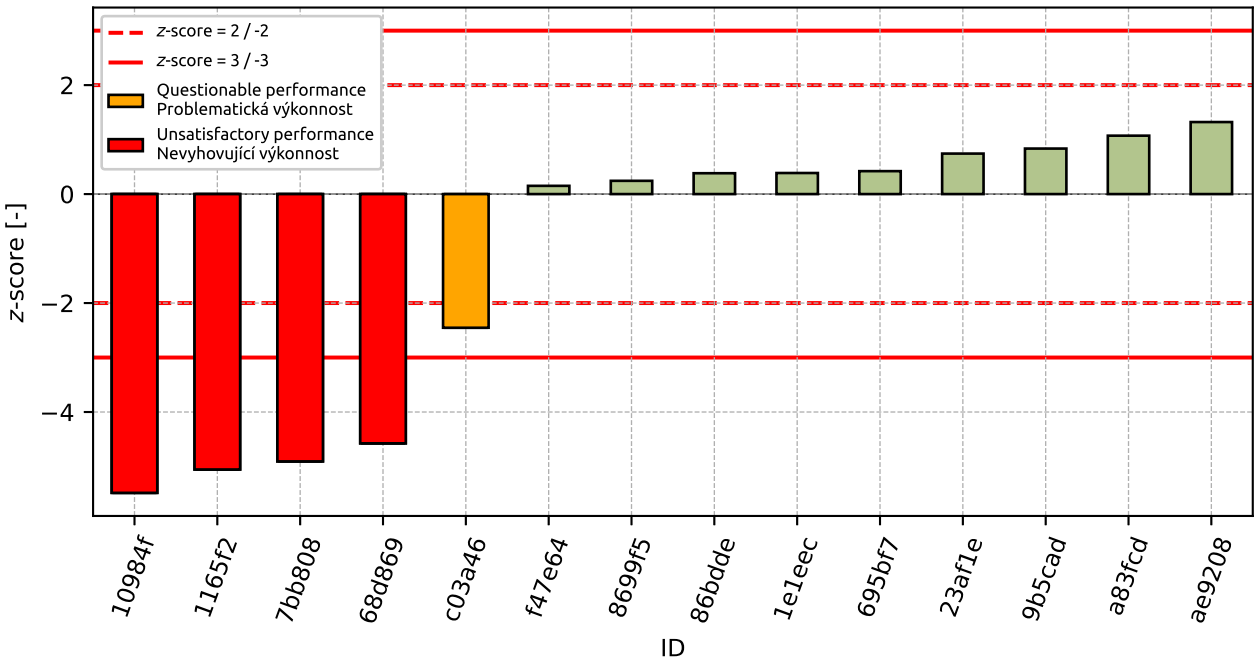

Figure 62: z-score

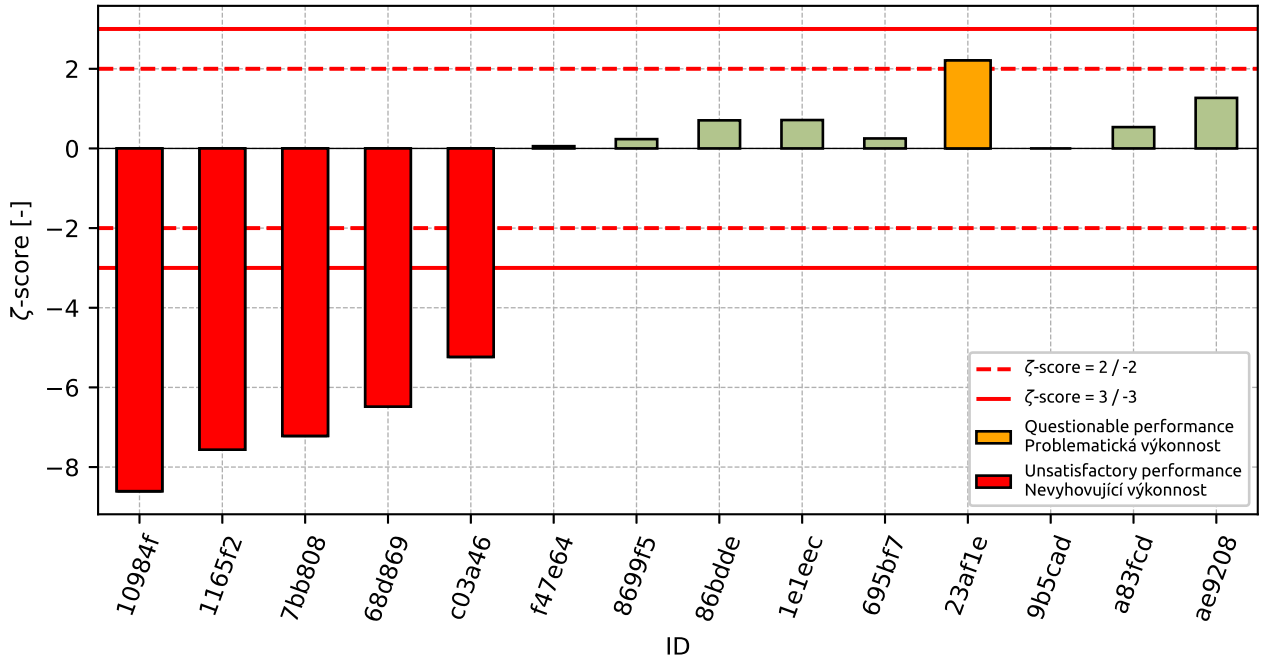

Figure 63: ζ-score

Table 24: z-score and ζ-score

ID	z-score [-]	ζ-score [-]
10984f	-5.48	-8.61
1165f2	-5.05	-7.56
7bb808	-4.91	-7.22
68d869	-4.57	-6.48
c03a46	-2.45	-5.23
f47e64	0.15	0.06
8699f5	0.24	0.23
86bdde	0.38	0.71
1e1eec	0.39	0.71
695bf7	0.42	0.25
23af1e	0.74	2.21
9b5cad	0.84	-
a83fcd	1.07	0.54
ae9208	1.32	1.27