



REPUBLIC OF TURKEY
MINISTRY OF AGRICULTURE
AND FORESTRY



Interlaboratory Comparison Test Report

General Directorate of State Hydraulic Works (DSİ) Technical Research and Quality Control Department

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3. Confidentiality and Impartiality

The Interlaboratory Comparison Test Report (ILC) testing provider,

- has policies and procedures to avoid involvement in any activities that might diminish confidence in its competence and impartiality,
- has policies and procedures to ensure the protection of its participants' confidential information and proprietary rights,
- has no conflict of interest in connection with the contract; a conflict of interest could arise in particular as a result of economic interests, political or national affinity, family, emotional life or any other shared interest,
- will inform the contracting authority, without delay, of any situation considered a conflict of interest or which could give rise to a conflict of interest.

In this ILC testing program, each laboratory was defined with a laboratory code, which is only known by the relevant participant, and the results were reported with a laboratory code.

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6. Introduction

Technical Research and Quality Control Department (TAKK) was established in 1958 and is mainly responsible for research, development, training and quality control activities in subjects related to General Directorate of State Hydraulic Works (DSİ) to develop water resources in Turkey. TAKK and branch laboratories has been accredited TS EN ISO IEC 17025 in 2004 by Turkish Accreditation Agency (TÜRKAK) based on particular tests.

6.1. Division of Hydraulic Modeling Laboratory

Division of Hydraulic Modelling Laboratory aims to prevent the failure of hydraulic structures that have high construction costs and to find the most appropriate solution since it is not possible to determine all the effective factors of hydraulic problems in theoretical designs. The alternative ways of solutions can be possible with physical modeling and/or mathematical modeling.

Division of Hydraulic Modeling Laboratory consists of three laboratories:

- 1) Physical Modeling Laboratory
- 2) Numerical Modeling, Research and Training Laboratory
- 3) Current Meter Calibration Laboratory

6.1.1. Current Meter Calibration Laboratory

Current Meter Calibration Laboratory is a calibration laboratory accredited by Turkish Accreditation Agency (TÜRKAK) in accordance with ISO 3455 (Hydrometry - Calibration of current-meters in straight open tanks) in 2008. The laboratory has the number AB-0051-K. The scope is restricted with only calibration of propeller-type (horizontal axis) current meters.

7. Testing Program

The comparison testing program was organized by DSİ TAKK, Current Meter Calibration Laboratory, which is responsible analyzing the ILC results and preparing ILC report according to ISO/IEC 17043.

Current meter calibrations were performed by five (5) laboratories according to ISO 3455: 2021 "Hydrometry - Calibration of current-meters in straight open tanks" measuring at least 12 calibration points. The calibration equations were given as two/three equations as a best fit for the calibration points by each laboratory and given results were analyzed by TAKK laboratory. Evaluation of calibration tests are given in this report.

8. Participants' Results

Table 1. Calibration equations provided by participants

Laboratory Code	Calibration Equation		
	<n	n≤	a + bn
A	0.381	3.0800	0.018 + 0.2472n
	3.0800	10.9650	-0.013 + 0.2573n
B	0.5900	0.5900	0.024 + 0.2297n
	8.1800	8.1800	0.007 + 0.2587n
C	0.0000	6.9444	0.0121 + 0.2594n
	6.9444	9.6253	0.0371 + 0.2558n
D	0.2500	0.7800	0.01345 + 0.00331n
	0.7800	15.1400	0.24958 + 0.25795n
E	0.1163	0.6216	0.01453 + 0.24831n
	0.6216	12.9122	0.00749 + 0.25964n

Table 2. Velocity values of participants

n	Velocity (m/s)				
	A	B	C	D	E
0.340	0.102	0.102	0.100	0.098	0.099
0.741	0.201	0.199	0.204	0.198	0.200
1.133	0.298	0.300	0.306	0.295	0.302
1.519	0.394	0.400	0.406	0.395	0.402
1.906	0.489	0.500	0.506	0.495	0.502
2.872	0.728	0.750	0.757	0.744	0.753
3.838	0.975	1.000	1.008	0.993	1.004
4.805	1.223	1.250	1.258	1.243	1.255
5.771	1.472	1.500	1.509	1.492	1.506
6.738	1.721	1.750	1.760	1.741	1.757
7.704	1.969	2.000	2.008	1.991	2.008
8.677	2.219	2.250	2.257	2.241	2.260
9.655	2.471	2.500	2.507	2.494	2.514
10.635	2.723	2.750	2.758	2.747	2.769
11.612	2.975	3.000	3.007	2.999	3.022
12.587	3.226	3.249	3.257	3.250	3.275
13.555	3.475	3.496	3.504	3.500	3.527
14.525	3.724	3.744	3.753	3.750	3.779
15.495	3.974	3.991	4.001	4.000	4.031

9. Statistical Evaluation

The calibration data obtained from five laboratories were analyzed according to ISO 13528: 2015. The evaluation was done according z score (Equation 1) which is calculated with an assigned value and standard deviation for proficiency assessment. The assigned value was determined by calculation of the median value of all the participants' results.

$$z = \frac{x-X}{\sigma}$$

Equation (1)

x: The participant's result

X: The median value of all the participant's results

σ : The standard deviation

z scores were calculated by considering 14 velocity values; 0.1, 0.2, 0.3, 0.4, 0.5, 0.75, 1.00, 1.25, 1.50, 1.75, 2.00, 2.25, 2.50, 2.75, 3.00, 3.25, 3.50, 3.75, 4.00 m/s.

10. Z scores

Table 3. x and z score values (v=0.1 m/s)

X = 0.1 m/s $\sigma = 0.002$	A	B	C	D	E
x	0.102	0.102	0.100	0.098	0.099
z score	1.01	1.04	0.00	-1.15	-0.77

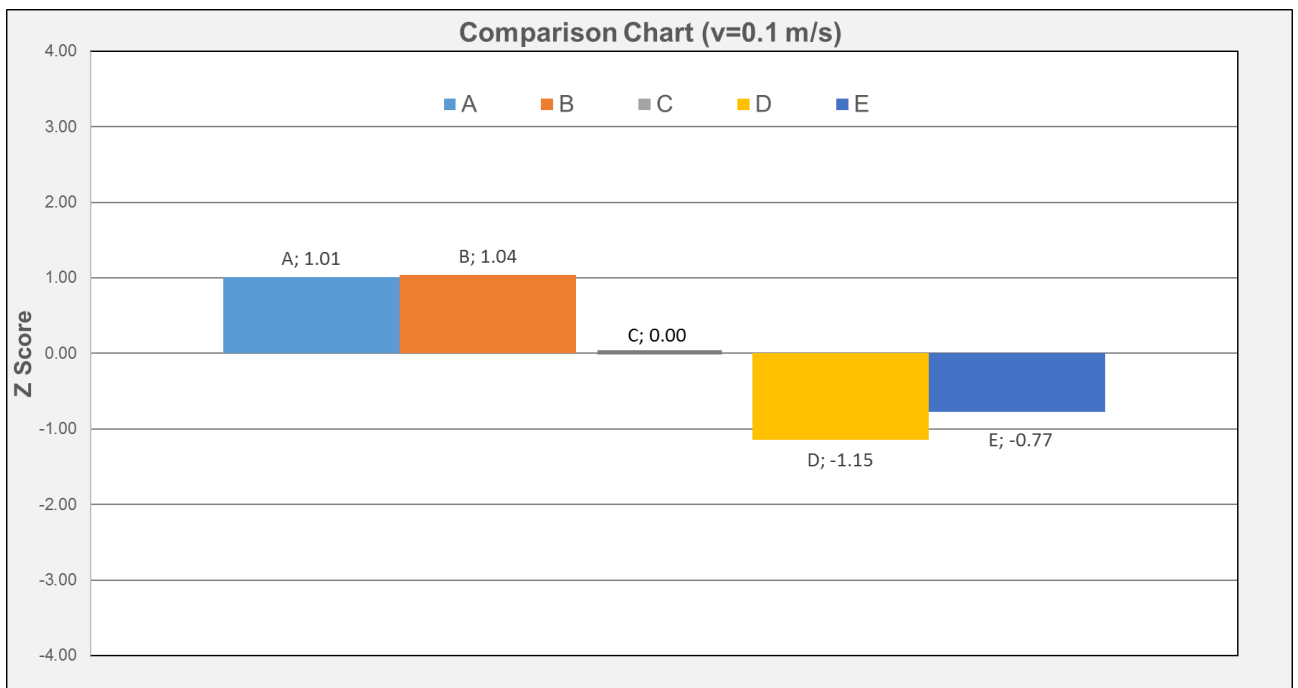


Figure 1. z scores for v=0.1 m/s

Table 4. x and z score values ($v=0.2$ m/s)

X = 0.2 m/s $\sigma = 0.002$	A	B	C	D	E
x	0.201	0.199	0.204	0.198	0.200
z score	0.54	-0.49	1.84	-0.62	0.00

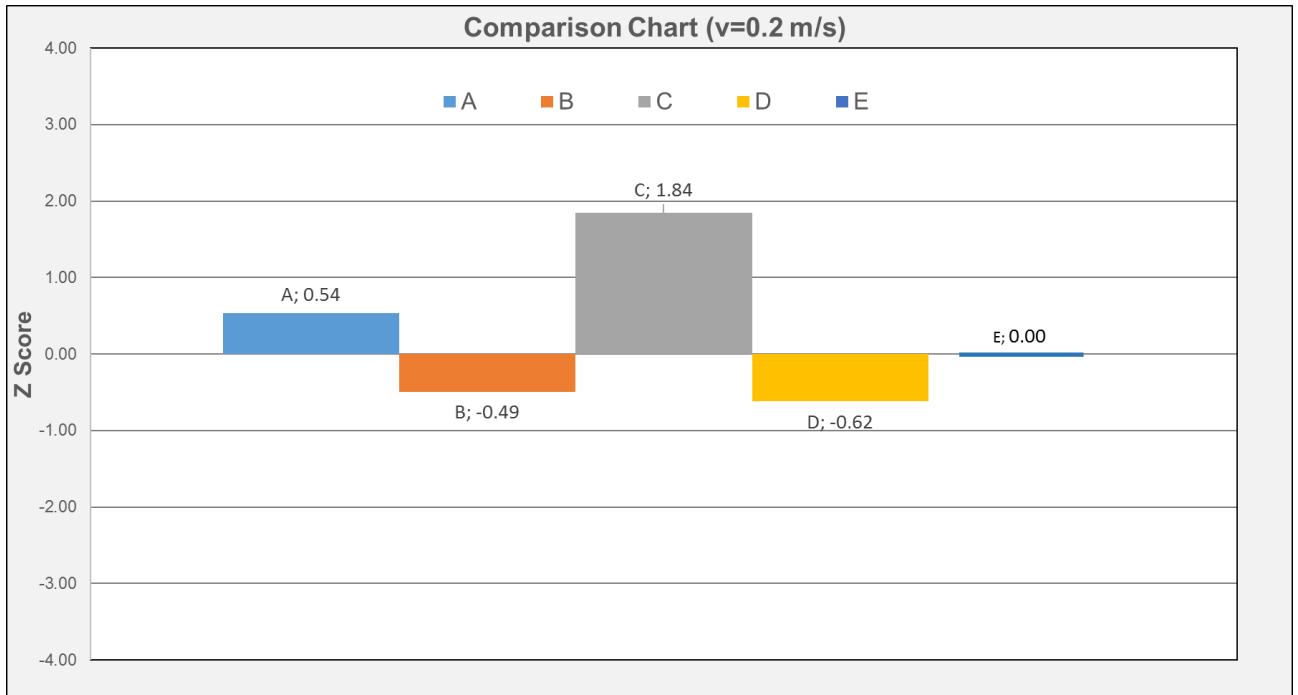
Figure 2. z scores for $v=0.2$ m/s

Table 5. x and z score values ($v=0.3$ m/s)

X = 0.3 m/s $\sigma = 0.004$	A	B	C	D	E
x	0.298	0.300	0.306	0.295	0.302
z score	-0.52	0.00	1.50	-1.16	0.40

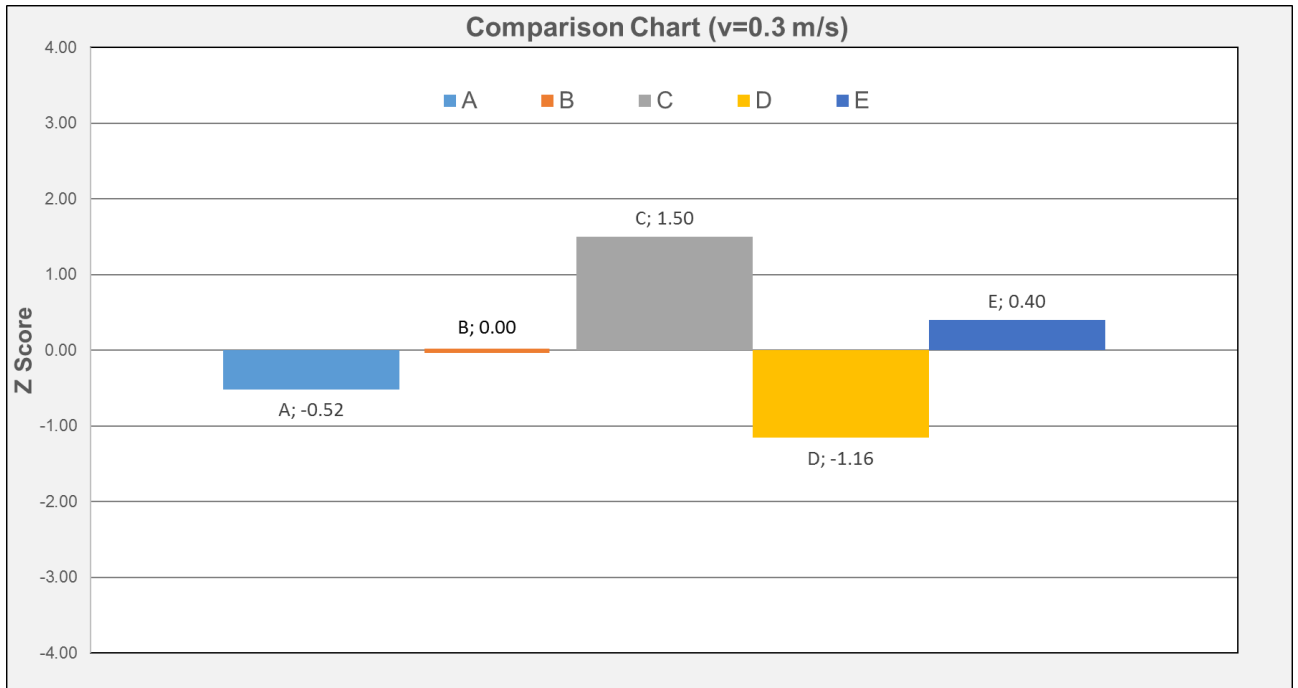
Figure 3. z scores for $v=0.3$ m/s

Table 6. x and z score values ($v=0.4$ m/s)

X = 0.4 m/s $\sigma = 0.005$	A	B	C	D	E
x	0.394	0.400	0.406	0.395	0.402
z score	-1.26	0.00	1.20	-0.94	0.37

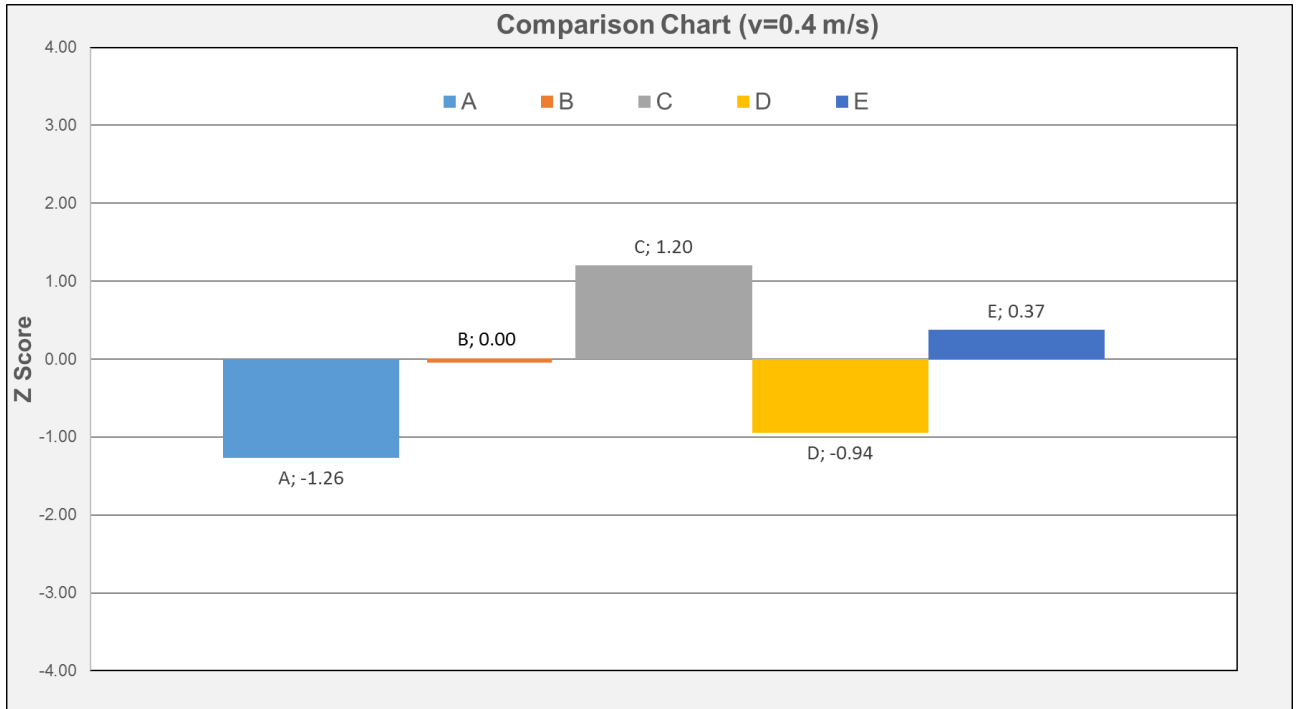
Figure 4. z scores for $v=0.4$ m/s

Table 7. x and z score values ($v=0.5$ m/s)

$X = 0.5$ m/s $\sigma = 0.007$	A	B	C	D	E
x	0.489	0.500	0.506	0.495	0.502
z score	-1.62	0.00	0.96	-0.76	0.34

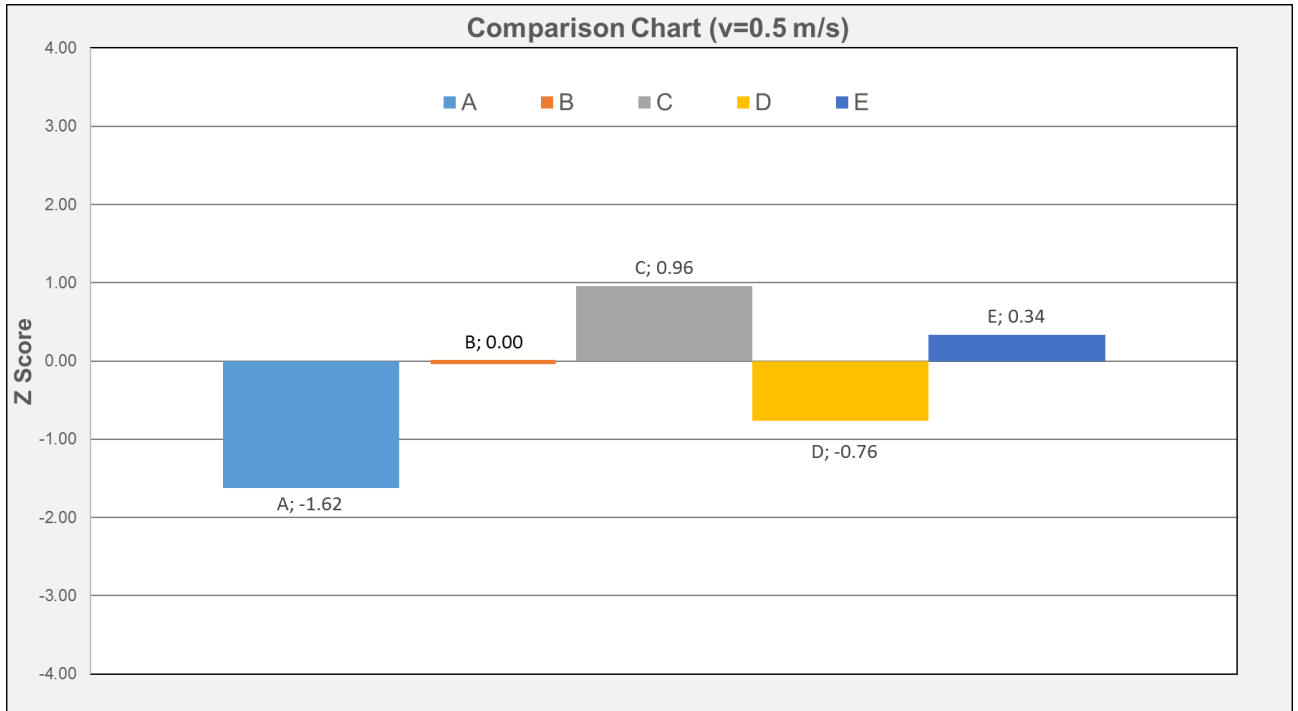
Figure 5. z scores for $v=0.5$ m/s

Table 8. x and z score values ($v=0.75$ m/s)

$X = 0.75$ m/s $\sigma = 0.011$	A	B	C	D	E
x	0.728	0.750	0.757	0.744	0.753
z score	-1.94	0.00	0.62	-0.51	0.28

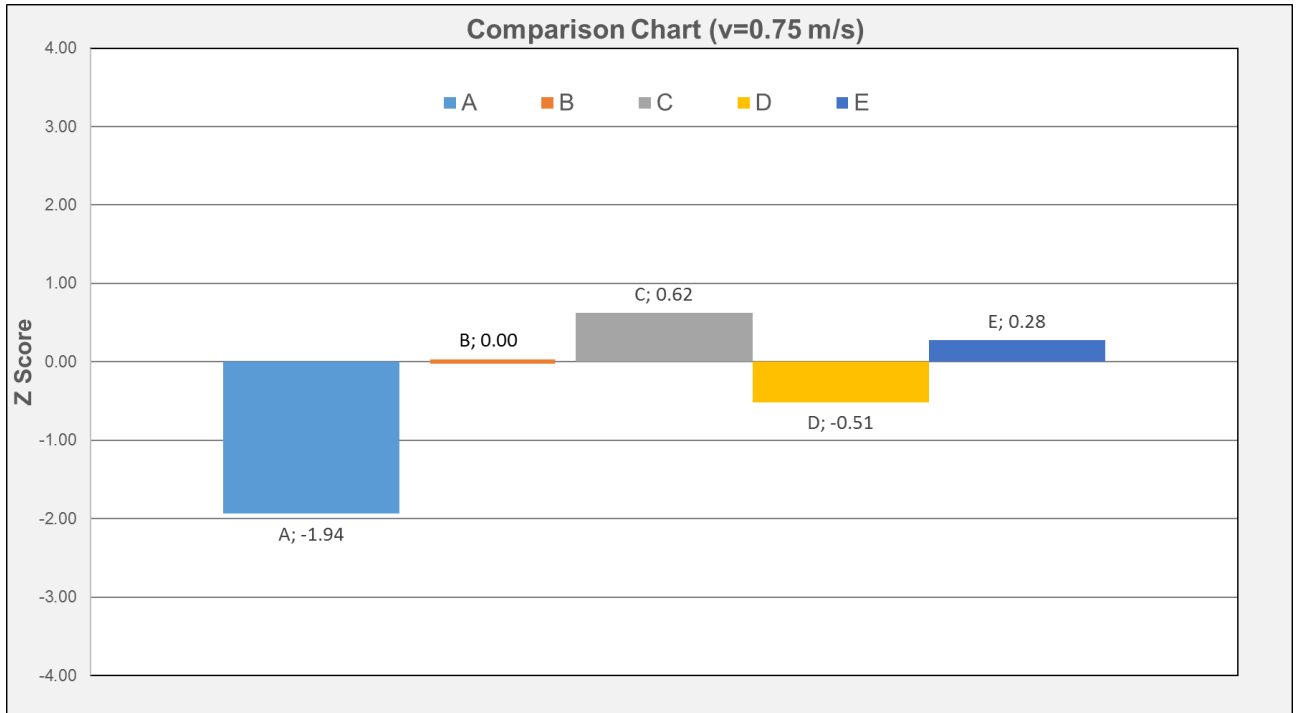
Figure 6. z scores for $v=0.75$ m/s

Table 9. x and z score values ($v=1.00$ m/s)

$X = 1.00$ m/s $\sigma = 0.013$	A	B	C	D	E
x	0.975	1.000	1.008	0.993	1.004
z score	-1.94	0.00	0.60	-0.50	0.31

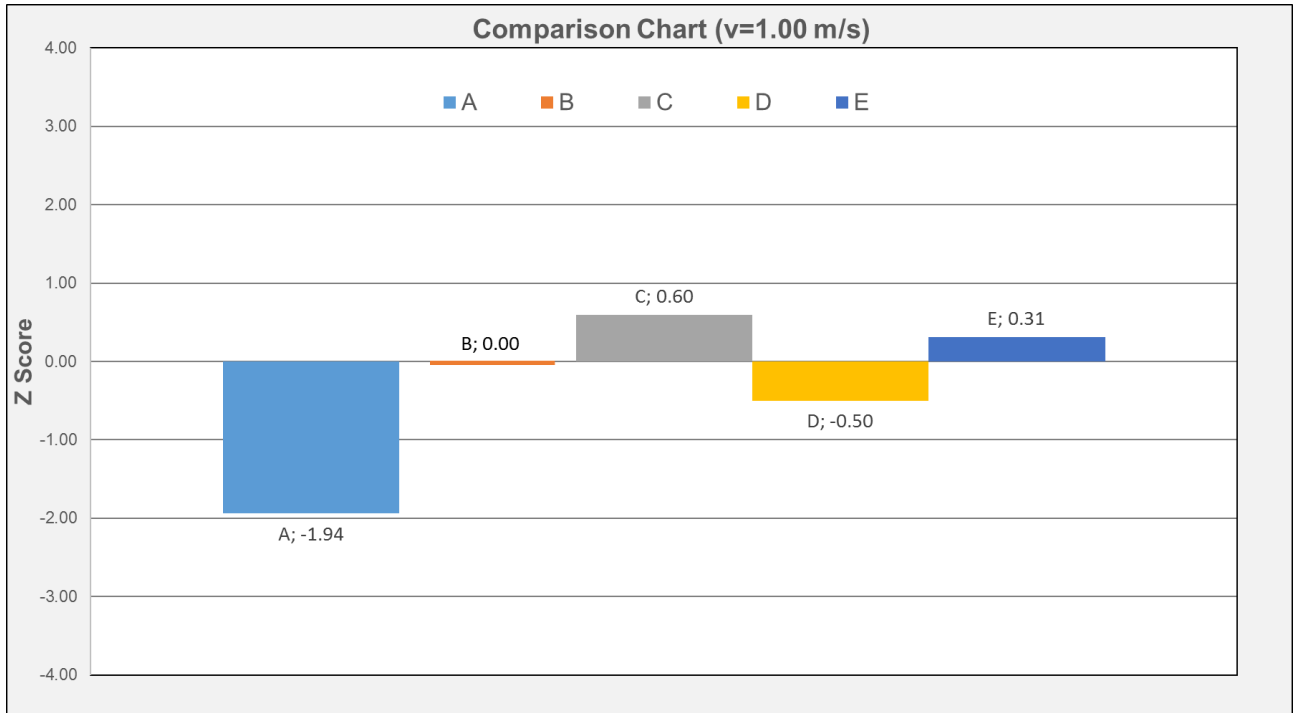
Figure 7. z scores for $v=1.00$ m/s

Table 10. x and z score values ($v=1.25$ m/s)

$X = 1.25$ m/s $\sigma = 0.014$	A	B	C	D	E
x	1.223	1.250	1.258	1.243	1.255
z score	-1.91	0.00	0.61	-0.52	0.36

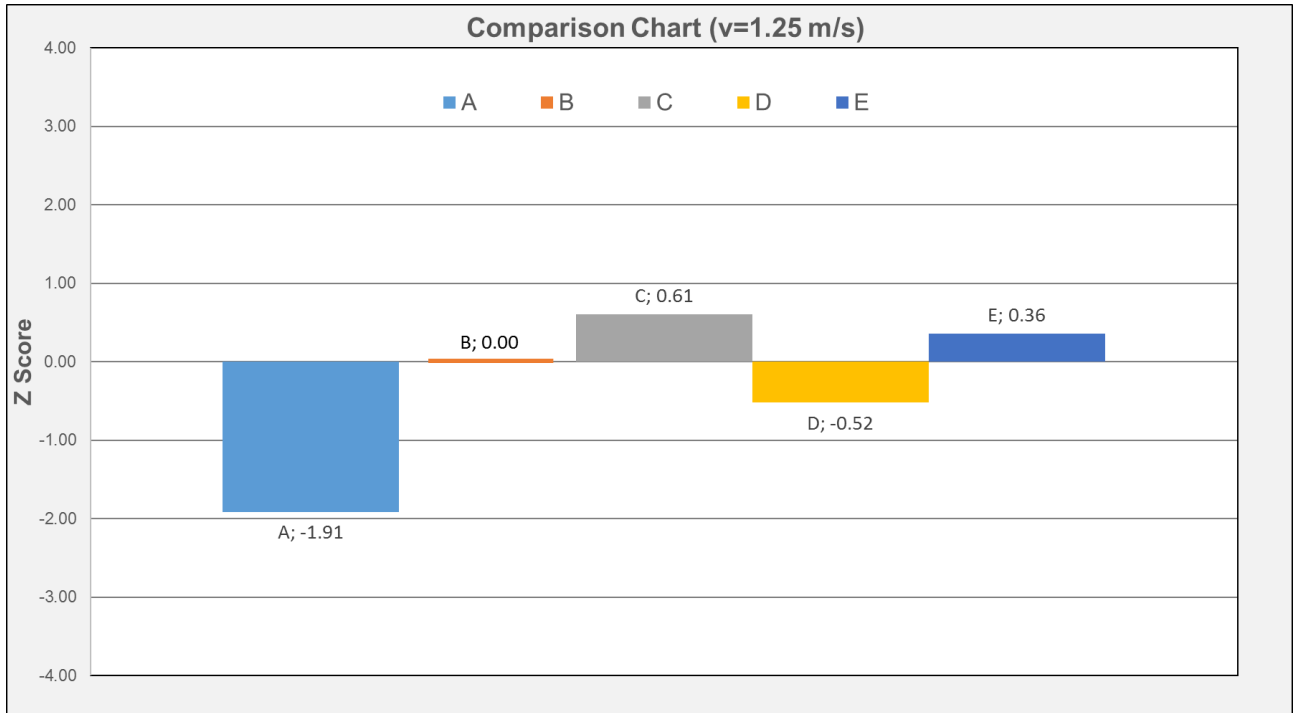
Figure 8. z scores for $v=1.25$ m/s

Table 11. x and z score values ($v=1.50$ m/s)

$X = 1.50$ m/s $\sigma = 0.015$	A	B	C	D	E
x	1.472	1.500	1.509	1.492	1.506
z score	-1.89	0.00	0.62	-0.54	0.40

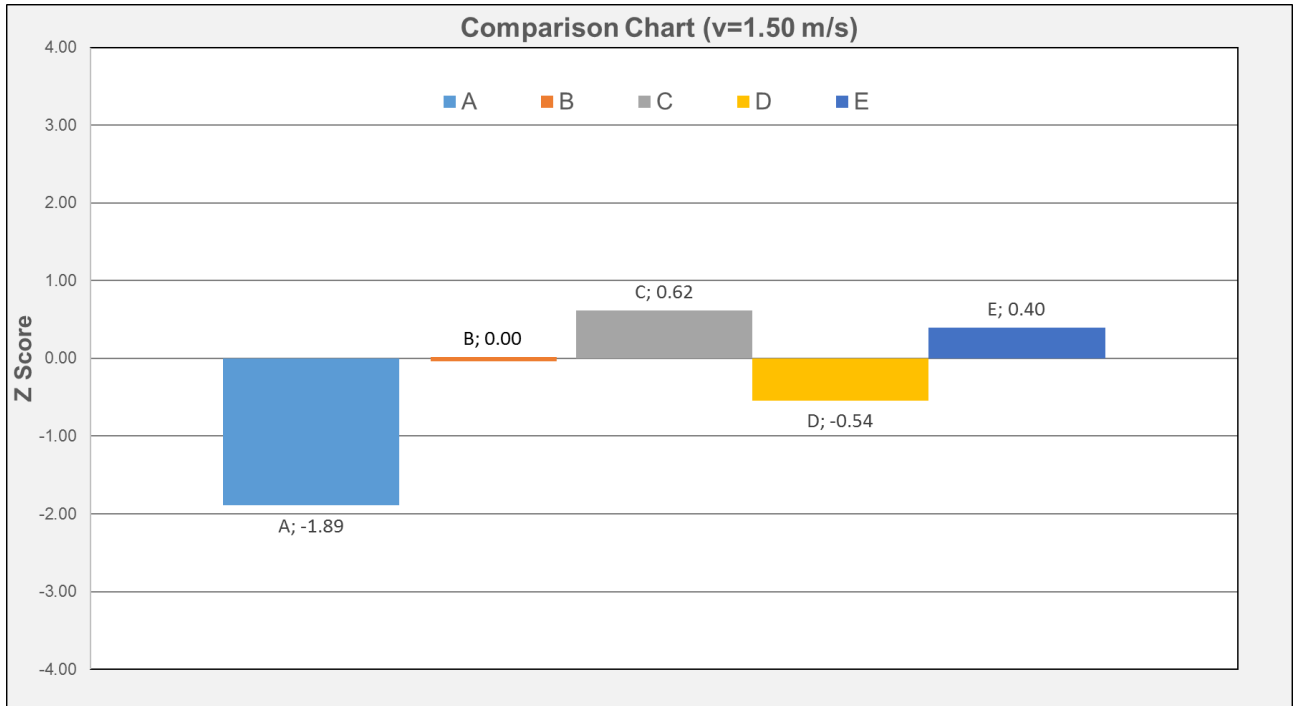
Figure 9. z scores for $v=1.50$ m/s

Table 12. x and z score values ($v=1.75$ m/s)

$X = 1.75$ m/s $\sigma = 0.016$	A	B	C	D	E
x	1.721	1.750	1.760	1.741	1.757
z score	-1.87	0.00	0.62	-0.55	0.43

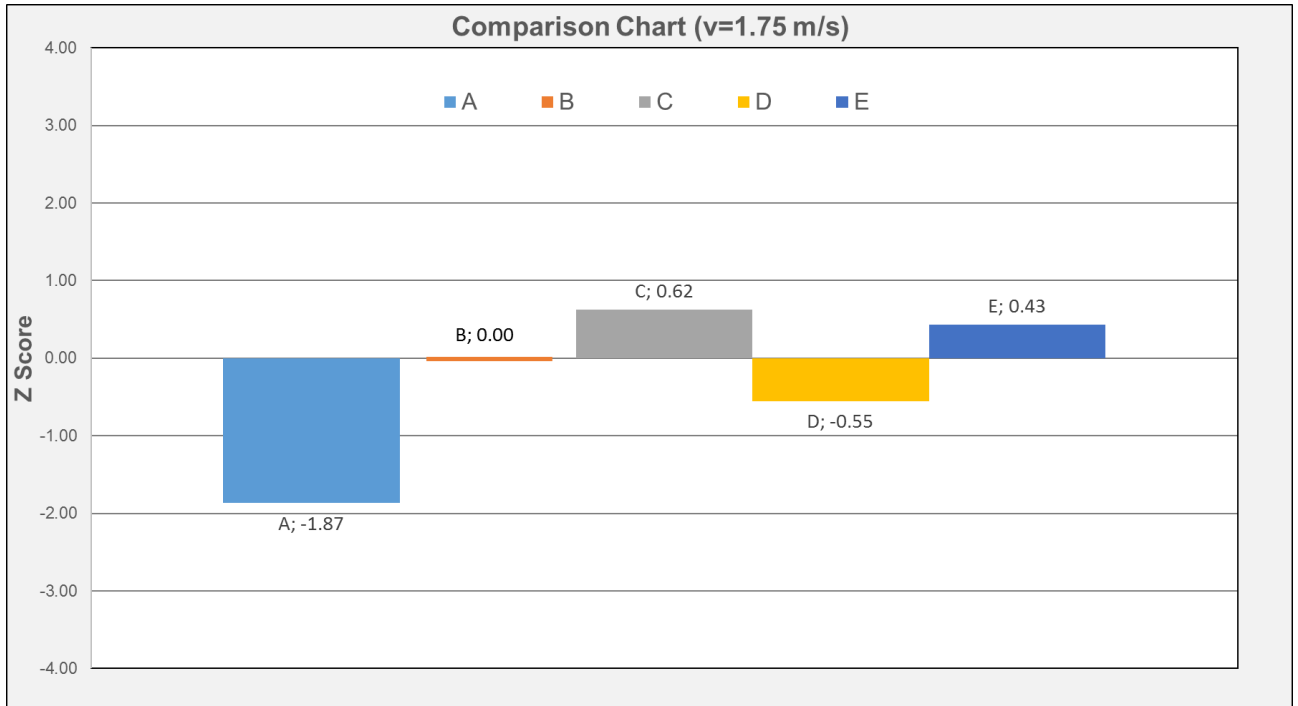
Figure 10. z scores for $v=1.75$ m/s

Table 13. x and z score values ($v=2.00$ m/s)

$X = 2.00$ m/s $\sigma = 0.016$	A	B	C	D	E
x	1.969	2.000	2.008	1.991	2.008
z score	-1.91	0.00	0.48	-0.59	0.48

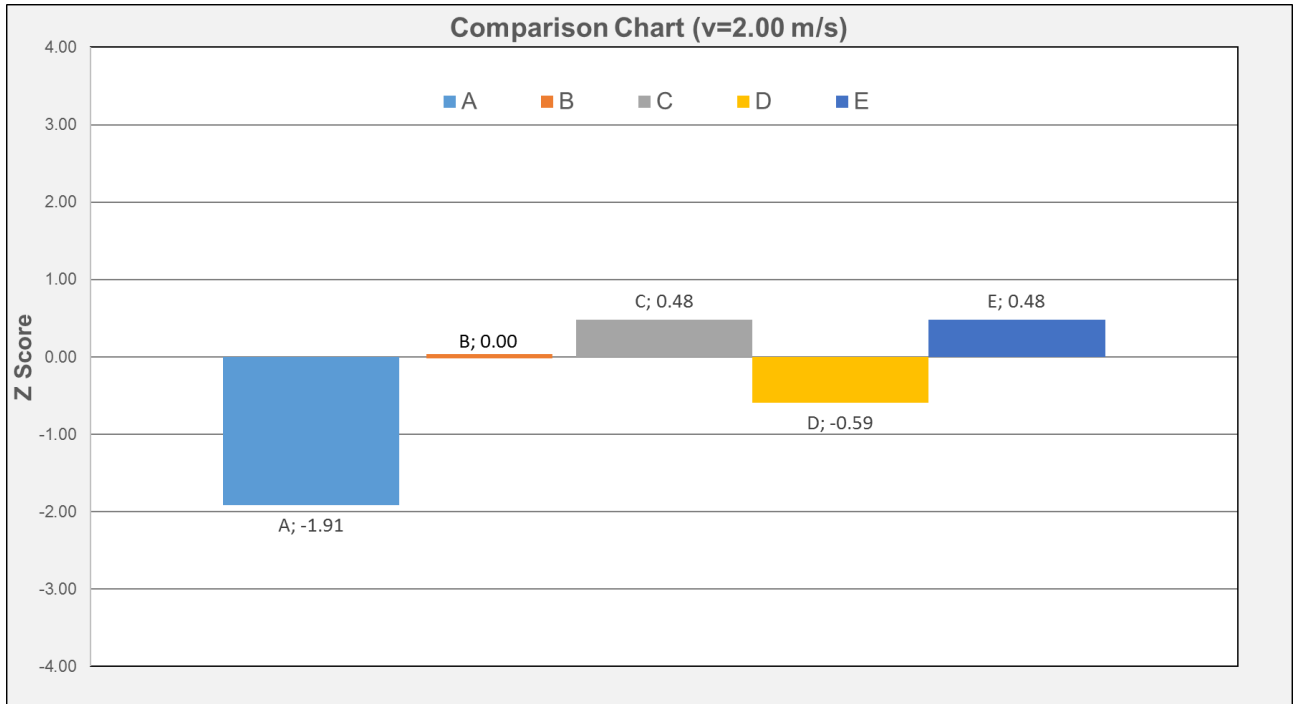
Figure 11. z scores for $v=2.00$ m/s

Table 14. x and z score values ($v=2.25$ m/s)

$X = 2.25$ m/s $\sigma = 0.016$	A	B	C	D	E
x	2.219	2.250	2.257	2.241	2.260
z score	-1.88	0.00	0.40	-0.53	0.63

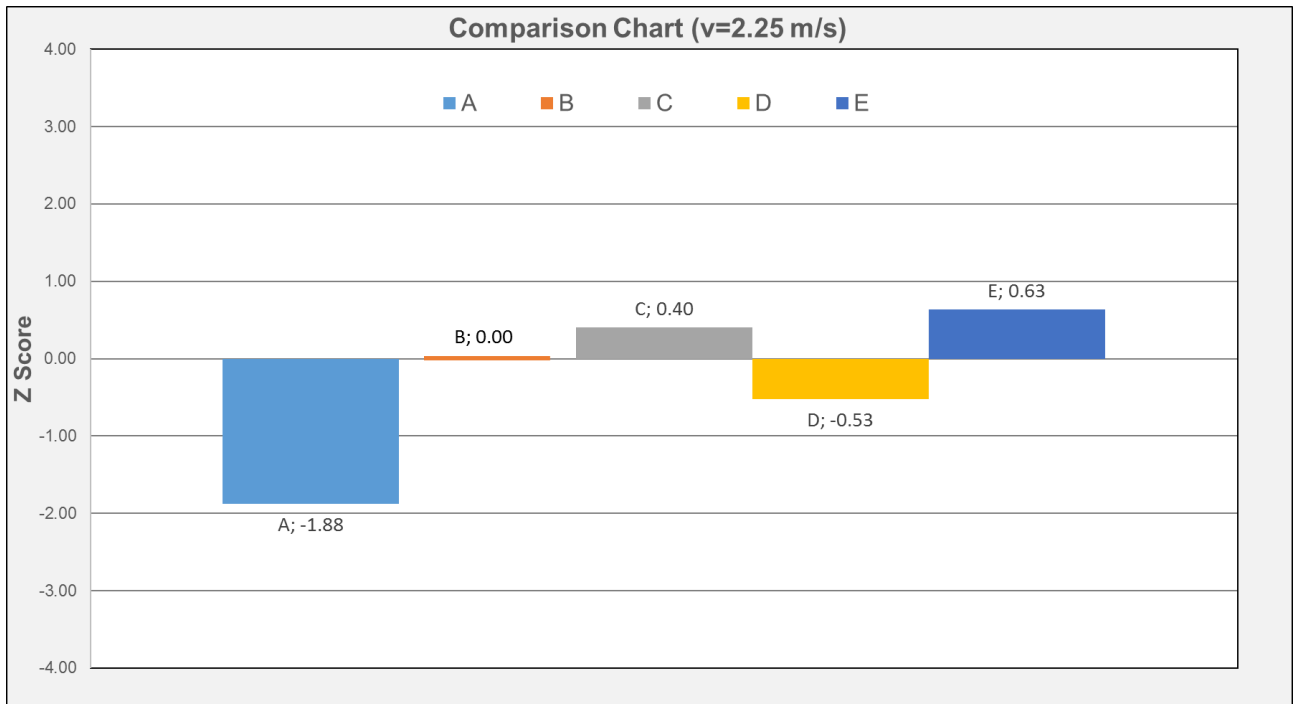
Figure 12. z scores for $v=2.25$ m/s

Table 15. x and z score values ($v=2.50$ m/s)

$X = 2.50$ m/s $\sigma = 0.016$	A	B	C	D	E
x	2.471	2.500	2.507	2.494	2.514
z score	-1.74	0.00	0.42	-0.37	0.88

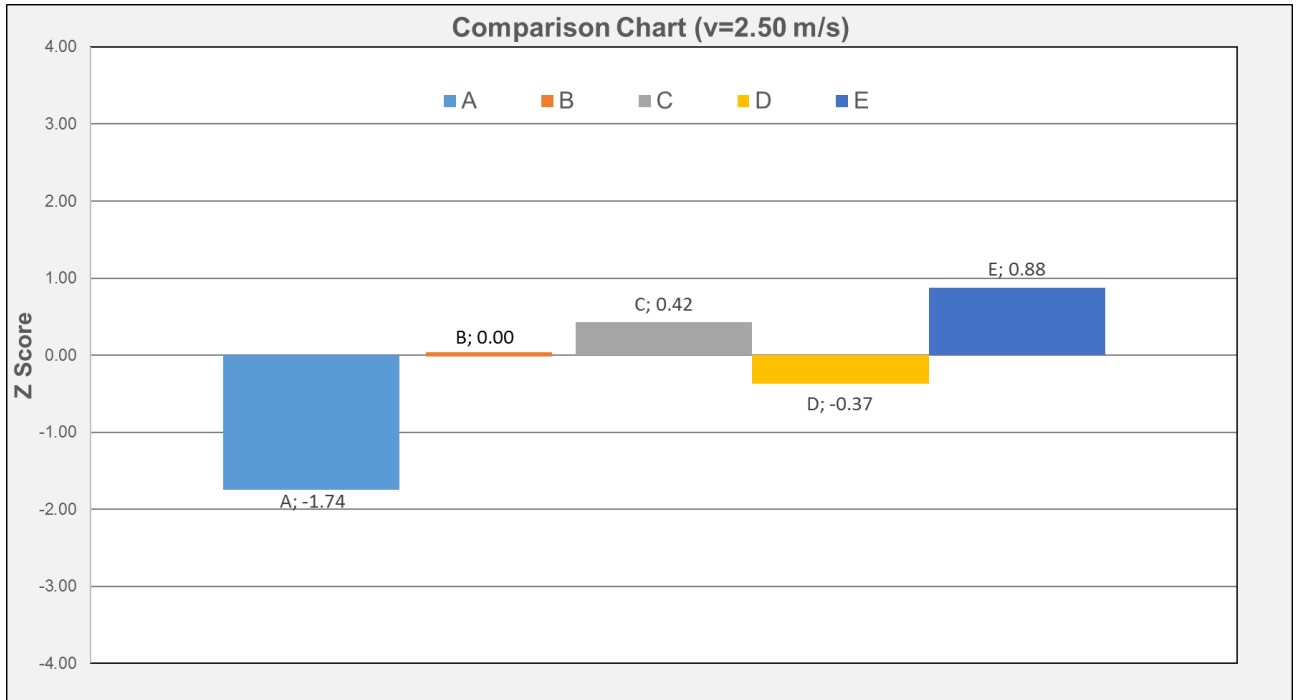
Figure 13. z scores for $v=2.50$ m/s

Table 16. x and z score values ($v=2.75$ m/s)

$X = 2.75$ m/s $\sigma = 0.017$	A	B	C	D	E
x	2.723	2.750	2.758	2.747	2.769
z score	-1.60	0.00	0.44	-0.21	1.11

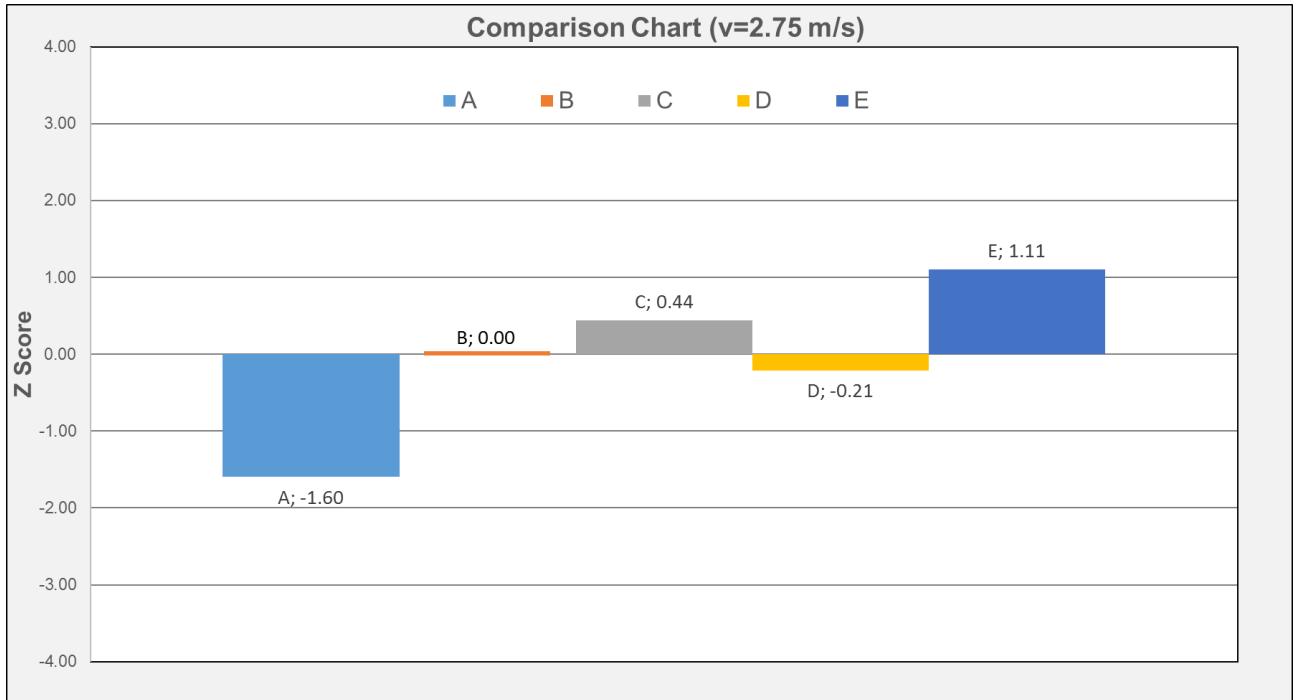
Figure 14. z scores for $v=2.75$ m/s

Table 17. x and z score values ($v=3.00$ m/s)

$X = 3.00$ m/s $\sigma = 0.017$	A	B	C	D	E
x	2.975	3.000	3.007	2.999	3.022
z score	-1.44	0.00	0.45	-0.06	1.31

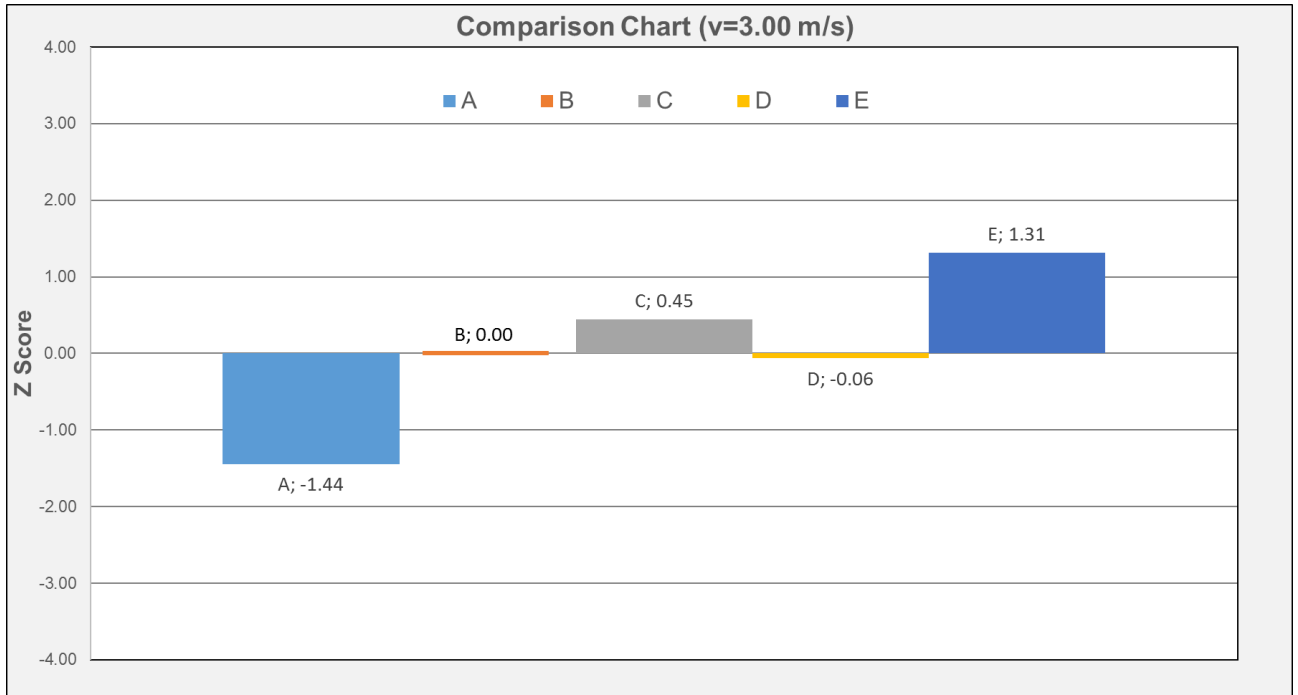
Figure 15. z scores for $v=3.00$ m/s

Table 18. x and z score values ($v=3.25$ m/s)

X = 3.25 m/s $\sigma = 0.018$	A	B	C	D	E
x	3.226	3.249	3.257	3.250	3.275
z score	-1.37	-0.08	0.38	0.00	1.42

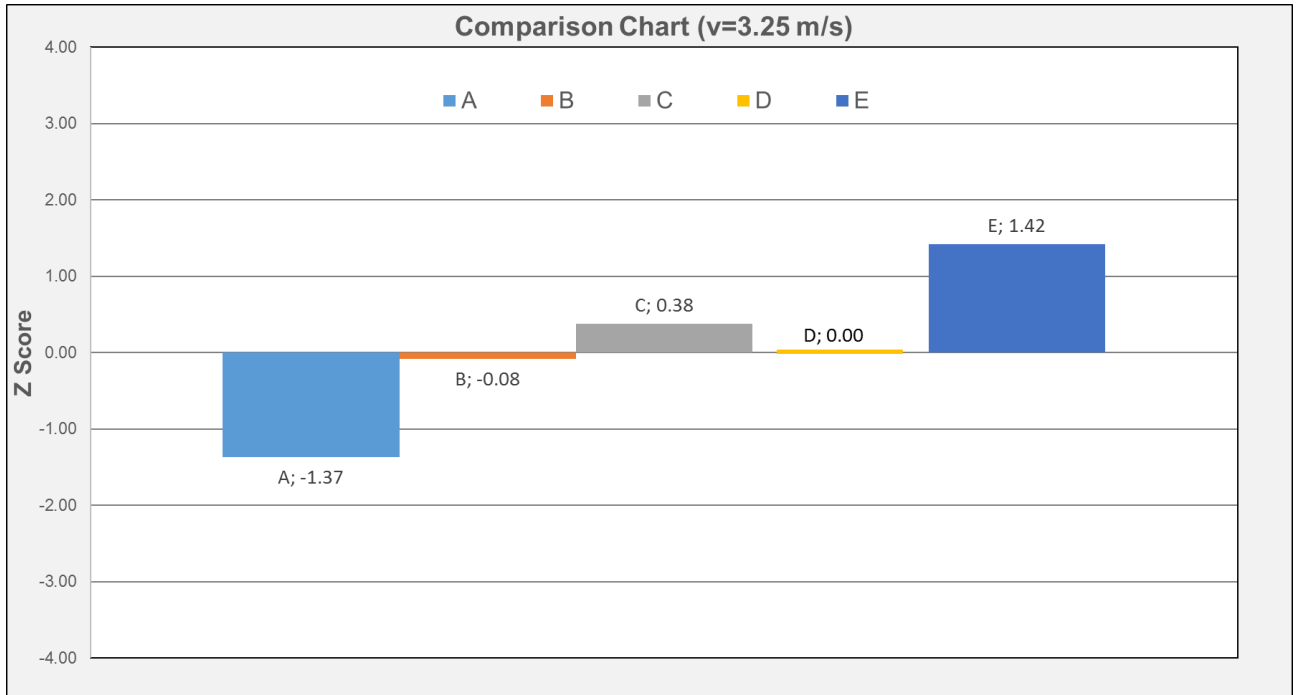
Figure 16. z scores for $v=3.25$ m/s

Table 19. x and z score values ($v=3.50$ m/s)

X = 3.50 m/s $\sigma = 0.019$	A	B	C	D	E
x	3.475	3.496	3.504	3.500	3.527
z score	-1.34	-0.21	0.25	0.00	1.45

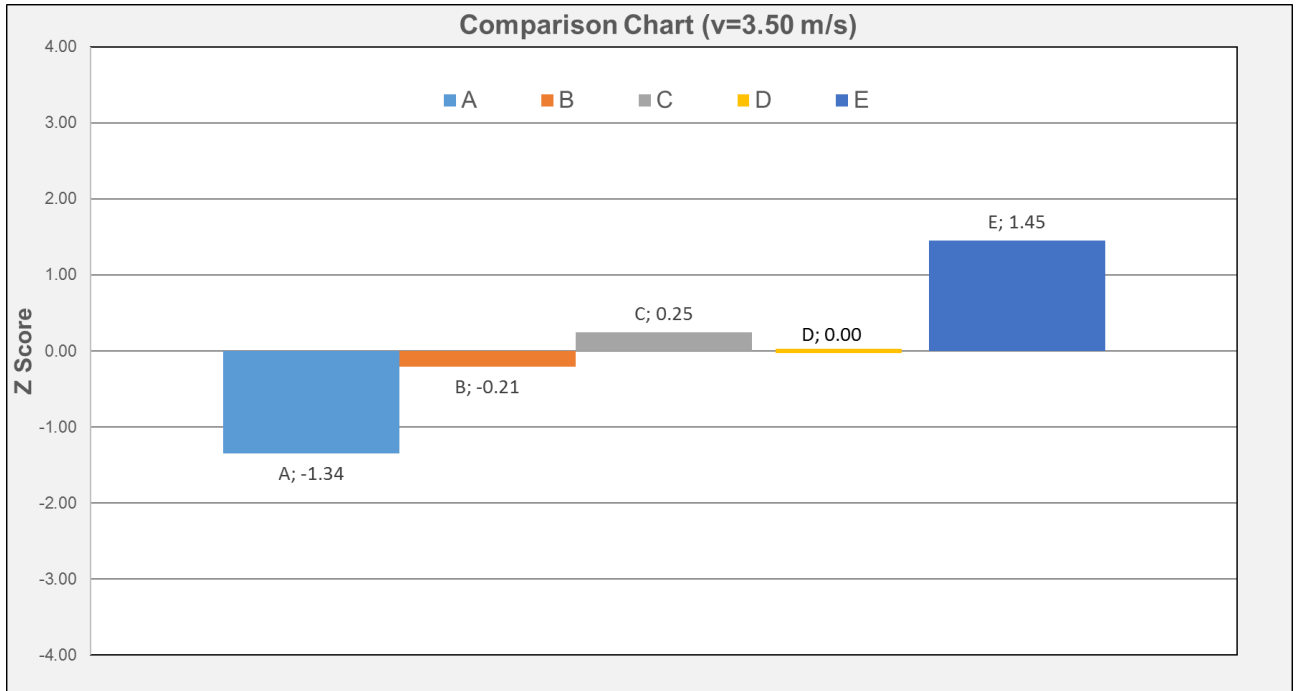
Figure 17. z scores for $v=3.50$ m/s

Table 20. x and z score values ($v=3.75$ m/s)

$X = 3.75$ m/s $\sigma = 0.020$	A	B	C	D	E
x	3.724	3.744	3.753	3.750	3.779
z score	-1.31	-0.32	0.13	0.00	1.47

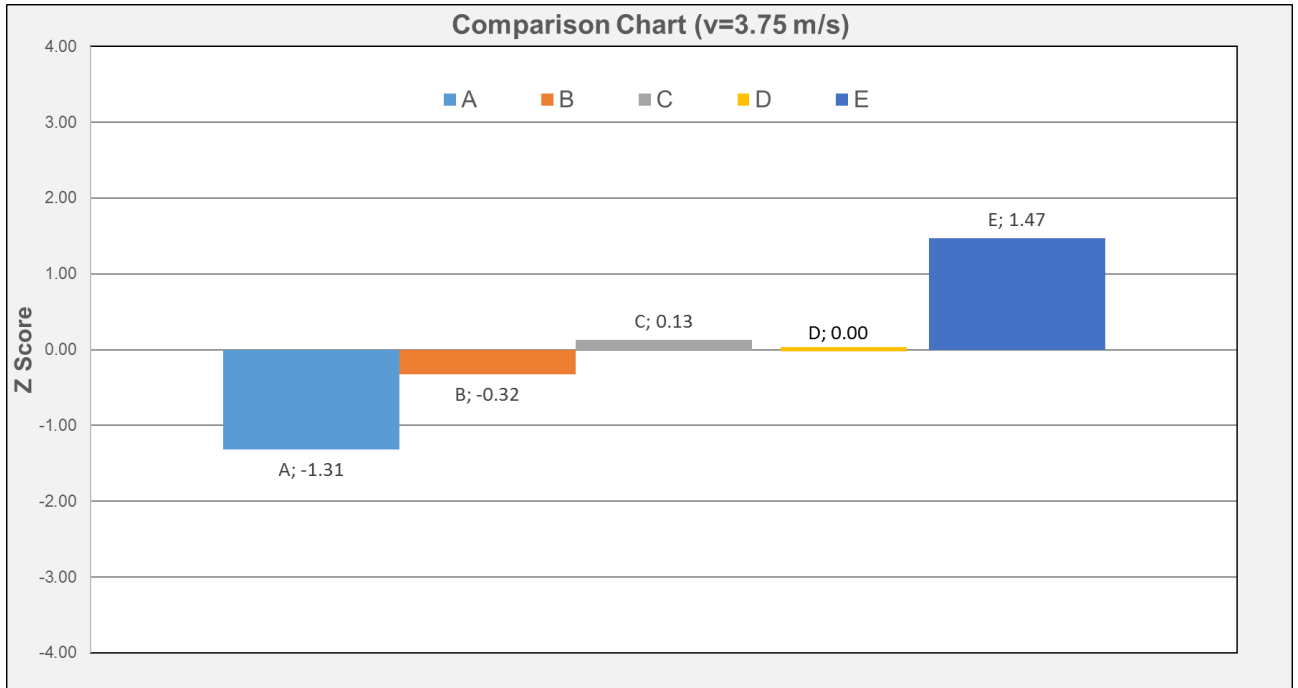
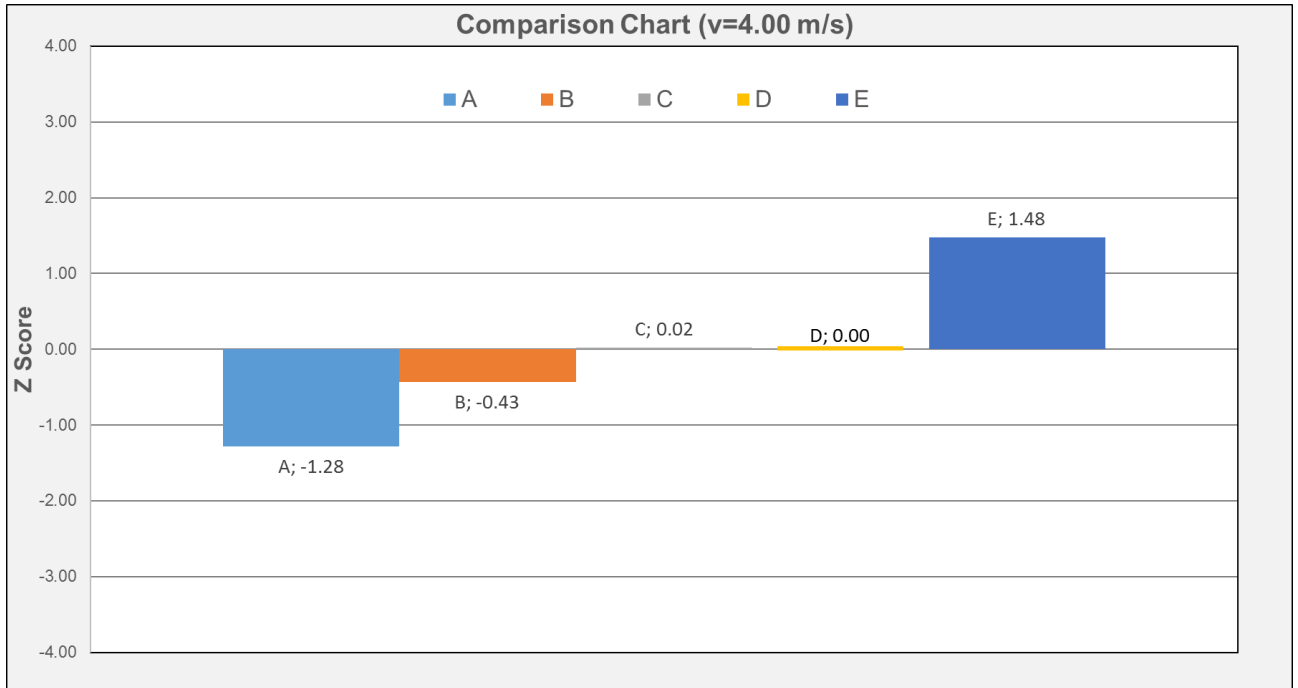
Figure 18. z scores for $v=3.75$ m/s

Table 21. x and z score values ($v=4.00$ m/s)

$X = 4.00$ m/s $\sigma = 0.021$	A	B	C	D	E
x	3.974	3.991	4.001	4.000	4.031
z score	-1.28	-0.43	0.02	0.00	1.48

Figure 19. z scores for $v=4.00$ m/s

11. Resources

- ISO/IEC 17043:2010. Conformity assessment - General requirements for proficiency testing.
- ISO 13528:2015. Statistical methods for use in proficiency testing by interlaboratory comparisons.
- EA-4/21 INF: 2018. Guidelines for the assessment of the appropriateness of small interlaboratory comparisons within the process of laboratory accreditation