Fasteners & Metals Interlaboratory Testing Program

Research Summary Report

Analyses:

Plastic Strain Ratio r for Sheet Metal

Tensile Strain-Hardening Exponents (n-Values) for Metallic Sheet Materials

Materials:

4130 Flat Steel (12 gage & 14 gage)

Overview:

Determination of the Strain Ratio (r value) and the Strain Hardening Exponent (n value) for two samples of 4130 flat steel was conducted in the fourth quarter of 2016. The two samples were differentiated by their gage with the 12 gage sample labled F39 and the 14 gage sample labeled F40. These were the same samples used for the Tensile Properties of Lab-Machined Flat Steel interlaboratory test. Of the subset of labs asked to report additional properties for this research test 16 reported n values and 11 reported r values. Labs were required to machine the samples into standard tensile specimens according to ASTM E8. ASTM E517 and ASTM E646 were referenced for determining the r values and the n values respectively.

Analysis:

The results were analyzed using a two sample statistical model. The following tables and graphs represent the results of the preliminary test. The Data Flags assigned do not warrant corrective actions. This report is for study only and should not be used as proof of participation in a proficiency testing program for the properties analyzed herein. Owing to the success of this test, an open research test will be offered in the second quarter of 2017 testing cycle with an eye toward full implementation into the proficiency testing program in the fourth quarter of 2017 testing cycle.

Key for Fasteners & Metals Program Research Summary Report

WebCode - Assigned laboratory identification number(temporary)used to ensure lab confidentiality while permitting a lab to locate its data in the report published on the CTS website.

Lab Mean - The average of the test results obtained by the participant.

Grand Mean - The average of the LAB MEANS for all included participants. Laboratories flagged with an X or an M (see DATA FLAG column) are excluded from the GRAND MEAN.

Between-Lab Standard Deviation - An indication of the precision of measurement between the laboratories. The greater the spread of the LAB MEANS about the GRAND MEAN, the larger the BETWEEN-LAB STANDARD DEVIATION (and vice versa).

Comparative Performance Value (CPV) - An indication of how well a laboratory's results agree with the other participants. The CPV is a ratio indicating the number of standard deviations from the GRAND MEAN. CPV = (LAB MEAN - GRAND MEAN)/ BETWEEN-LAB STANDARD DEVIATION. The closer a laboratory's COMPARATIVE PERFORMANCE VALUE is to zero, the more consistent its results are with the other participants' data (and vice versa).

Instr. Code - A code indicating the manufacturer of the instrument used to perform the test (see separate INSTRUMENT CODE LIST for each test section).

Data Flag - DATA FLAGS are assigned based on the simultaneous analysis of both samples tested. Refer to the following chart for an explanation of each symbol:

Data Flags

Data Flag Type	Statistically Included/Excluded	ACTION REQUIRED
*	INCLUDED	CAUTION - review testing procedure and monitor future results. Results fall outside the drawn 95% ellipse but within a 99% ellipse that is calculated but not drawn. Labs flagged with an * do not typically receive a specific note regarding the flag. If this error is repeated in future rounds, however, a lab may need to stop and review its testing procedures. The initial data flag is not cause for alarm.
X	EXCLUDED	STOP - immediate review of data and/or testing procedure is required (all tests exept Chemical Analyses). Results fall outside the 99% ellipse. See the specific note following the data for more information on why the data are excluded. For Chemical Analyses see an additional Memo.
M	EXCLUDED	PROCEED - lab was unable to report data for at least one sample. However, a lab receiving two or more M flags for a test may need to stop and review its testing procedures.

Graph - For each laboratory, the Lab Mean for the second sample (y-axis) is plotted against the Lab Mean for the first sample (x-axis) with each point representing a laboratory. The horizontal and vertical cross-hairs are the Grand Means for each sample. When 20 or more laboratories are included in the statistics, an ellipse is also drawn so that 95% of the time a randomly selected laboratory will be included inside the ellipse. Plotted data flags are explained above. Labs not receiving a data flag appear as points on the plot.

Fasteners & Metals Interlaboratory Testing Program

Strain Ratio (r value)

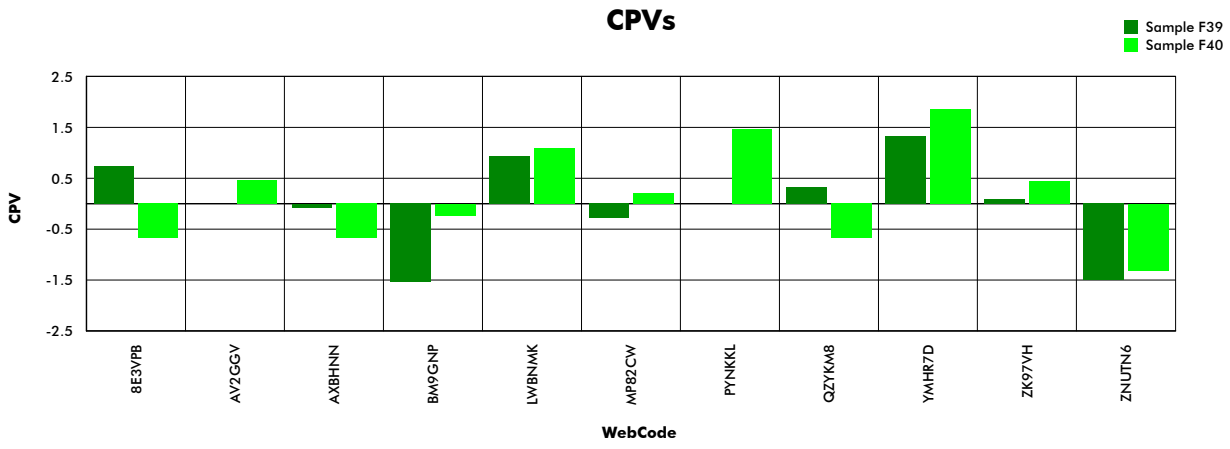
ASTM E517

Research Conducted in 2016

		Sample F39		Sample F40	
WebCode	Flag	Lab Mean	CPV	Lab Mean	CPV
8E3VPB		0.810	0.729	0.650	-0.679
AV2GGV	M			0.740	0.459
AXBHNN		0.770	-0.081	0.650	-0.679
BM9GNP		0.698	-1.539	0.685	-0.236
LWBNMK		0.820	0.932	0.790	1.092
MP82CW		0.760	-0.284	0.720	0.207
PYNKKL	M			0.819	1.454
QZYKM8		0.790	0.324	0.650	-0.679
YMHR7D		0.840	1.337	0.850	1.850
ZK97VH		0.778	0.081	0.738	0.434
ZNUTN6		0.700	-1.499	0.600	-1.311

Summary Statistics

	Sample F39	Sample F40
Grand Means	0.774	0.704
Stnd Dev Btwn Labs	0.049	0.079



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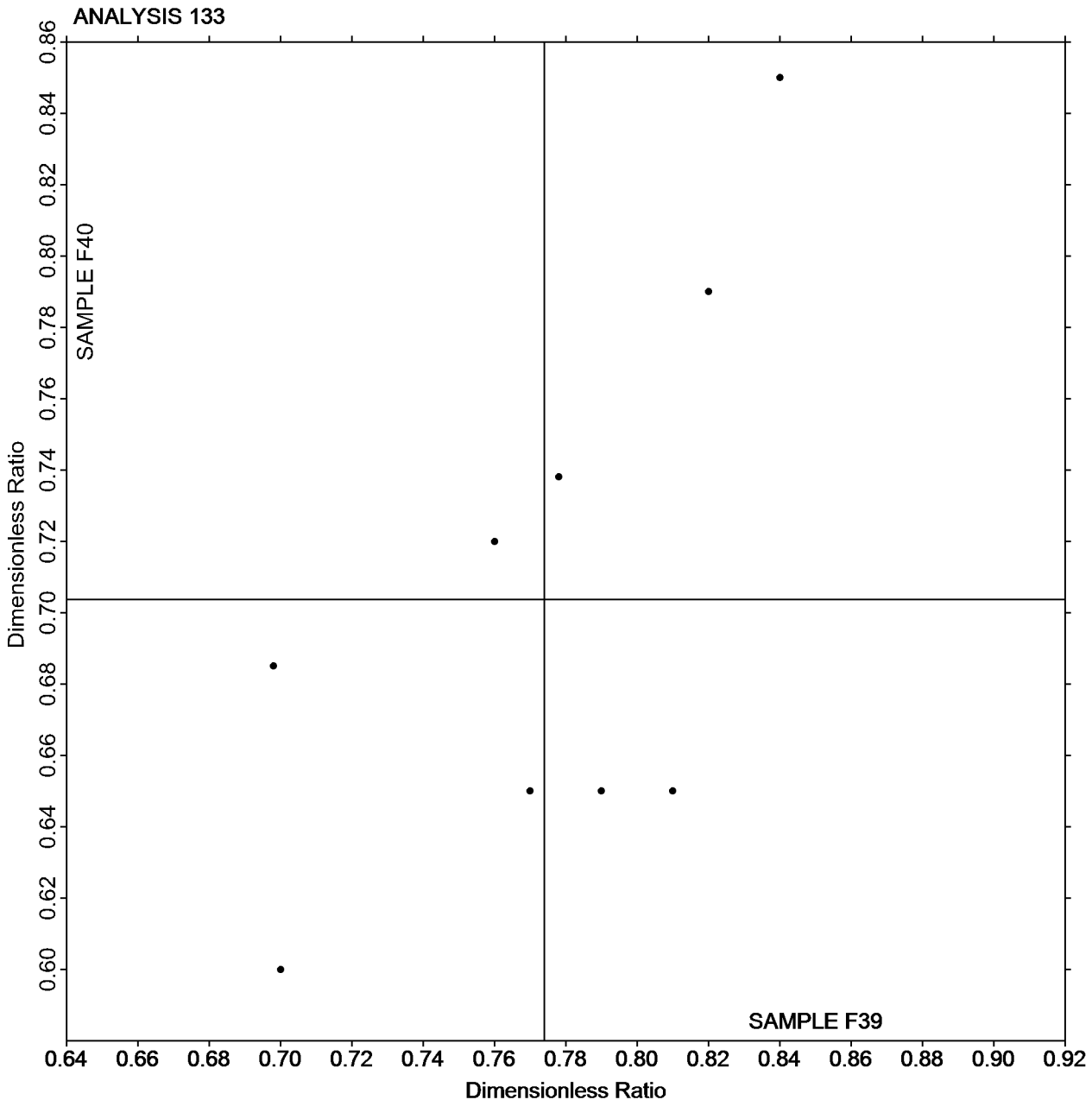
Sample F39	Sample F40
0.774	0.704



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Fasteners & Metals Interlaboratory Testing Program

Strain Hardening Exponent (n value)

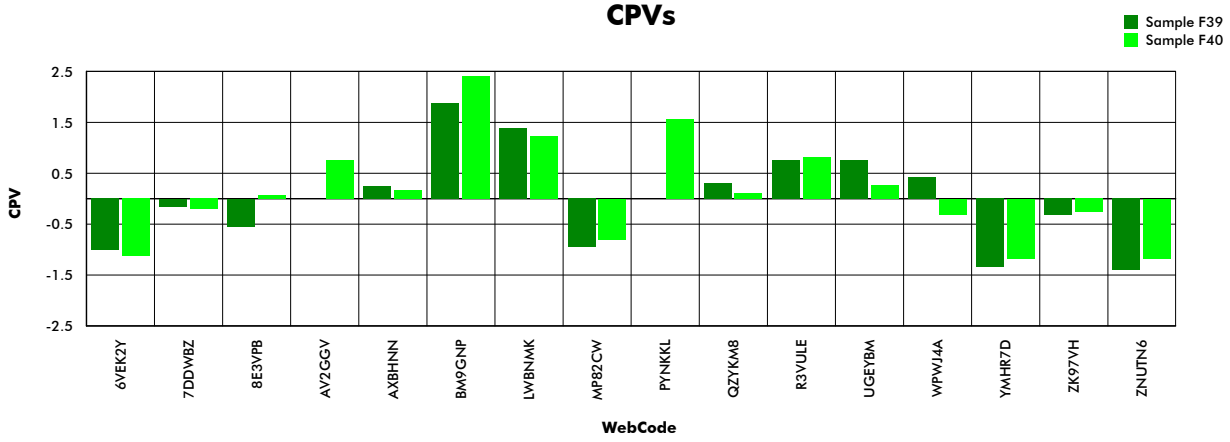
ASTM E646

Research Conducted in 2016

		Sample F39		Sample F40	
WebCode	Flag	Lab Mean	CPV	Lab Mean	CPV
6VEK2Y		0.169	-1.004	0.154	-1.130
7DDWBZ		0.184	-0.154	0.171	-0.210
8E3VPB		0.177	-0.550	0.176	0.058
AV2GGV	M			0.189	0.754
AXBHNN		0.191	0.243	0.178	0.165
BM9GNP		0.220	1.886	0.220	2.413
LWBNMK		0.211	1.376	0.198	1.236
MP82CW		0.170	-0.947	0.160	-0.798
PYNKKL	M			0.204	1.557
QZYKM8		0.192	0.299	0.177	0.112
R3VULE		0.200	0.753	0.190	0.807
UGEYBM		0.200	0.753	0.180	0.272
WPWJ4A		0.194	0.413	0.169	-0.317
YMHR7D		0.163	-1.343	0.153	-1.173
ZK97VH		0.181	-0.324	0.170	-0.263
ZNUTN6		0.162	-1.400	0.153	-1.173

Summary Statistics

	Sample F39	Sample F40
Grand Means	0.187	0.175
Stnd Dev Btwn Labs	0.018	0.019



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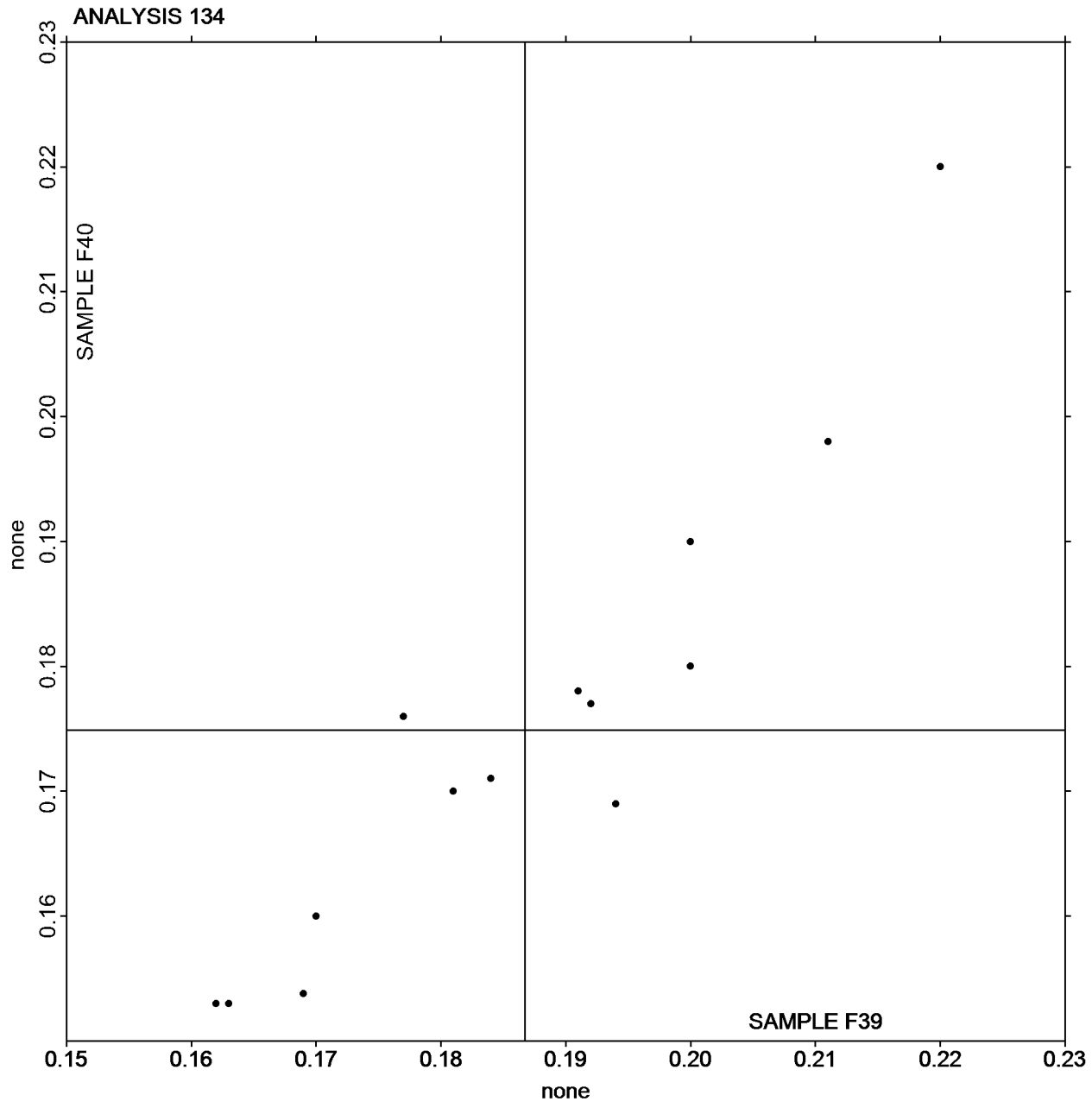
Sample F39	Sample F40
0.187	0.175



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