This excerpt is from the project entitled "Non-Occupational Ladder Accident Prevention" addressing an issue that exists with stabilizing ladders commonly used in residential settings.

Element I: Testing, data collection and analysis

This entry would be likely to receive a score of 3, based on the EDPPSR. The entry includes evidence that a few tests for design requirements were conducted through physical modeling (sense of stability, comfort during lean/reach, tipping point). The entry provides adequate evidence of understanding of testing procedure (identifying tools and materials, safety concerns, steps/procedure). The tables that were included demonstrate that data were gathered, but analysis is superficial/basic (a single summary statement for each test) and to some extent requires that readers draw inferences about results. One strength of the entry was the inclusion of detailed survey results, while one weakness was the lack of any summary of the implications of the data for proceeding with the design and solving the problem of preventing falls from ladders while conducting routine tasks. One engineering educator who scored this entry noted that units of measurement were missing from the tables; while completeness of visuals is not a criterion for scoring Element I, it is possible that some may regard this omission as impairing presentation of testing data.

Engineering Design Process Portfolio Scoring Rubric
Component and Element Titles

Component I: Presenting and Justifying a Problem and Solution Requirements

- Element A: Presentation and justification of the problem
- Element B. Documentation and analysis of prior solution attempts
- Element C. Presentation and justification of solution design requirements

Component II: Generating and Defending an Original Solution

- Element D: Design concept generation, analysis, and selection
- Element E: Application of STEM principles and practices
- Element F: Consideration of design viability

Component III: Constructing and Testing a Prototype

- Element G: Construction of a testable prototype
- Element H: Prototype testing and data collection plan
- **Element I: Testing, data collection and analysis**

Component IV: Evaluation, Reflection, and Recommendations

- Element J: Documentation of external evaluation
- *Element K: Reflection on the design project*
- Element L: Presentation of designer's recommendations

Component V: Documenting and Presenting the Project

- Element M: Presentation of the project portfolio
- Element N: Writing like an Engineer

Please Note: Elements M and N require no submission from the portfolio author(s) and are intended to be scored based on the portfolio work as a whole from what has been submitted from Elements A through L

Element I: Testing, data collection and analysis

5 Through the conduct of several tests for high priority requirements that are reasonable based on instructional contexts, or through physical or mathematical modeling, the student demonstrates considerable understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals includes a consistently detailed explanation [and summary] of the data from each portion of the testing procedure and from expert reviews, generously supported by pictures, graphs, charts and other visuals; the analysis includes an overall summary of the implications of all data for proceeding with the design and solving the problem.

4 Through the conduct of several tests for high priority requirements that are reasonable based on instructional contexts, or through physical or mathematical modeling, the student demonstrates ample understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals includes a generally detailed explanation [and summary] of the data from each portion of the testing procedure and from expert reviews, generally supported by pictures, graphs, charts and other visuals; the analysis includes an overall summary of the implications of most if not all of the data for proceeding with the design and solving the problem.

3 Through the conduct of a few tests for high priority requirements that are reasonable based on instructional contexts, or through physical or mathematical modeling, the student demonstrates adequate understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals includes a somewhat detailed explanation [and summary] of the data from each portion of the testing procedure and from expert reviews, at least somewhat supported by pictures, graphs, charts and other visuals; the analysis includes a summary of the implications of at least some of the data for proceeding with the design and solving the problem.

2 Through the conduct of one or two tests for high priority requirements that are reasonable based on instructional contexts, or through physical or mathematical modeling, the student demonstrates partial or overly general understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals includes a partial explanation [and summary] of the data (partially complete and/or partially correct), at least minimally supported by pictures, graphs, charts and other visuals; the analysis includes a partial and/or overly-general summary of the implications of at least some of the data for proceeding with the design and solving the problem.

1 Through the conduct of one or two tests for requirements (which may or may not be high priority) that are reasonable based on instructional contexts, or through physical or mathematical modeling, the student demonstrates minimal understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals includes an attempted explanation [and summary] of the data but may not be supported by any pictures, graphs, charts or other visuals; the analysis may be missing even a partial and/or overly-general summary of the implications of any of the data for proceeding with the design and solving the problem.

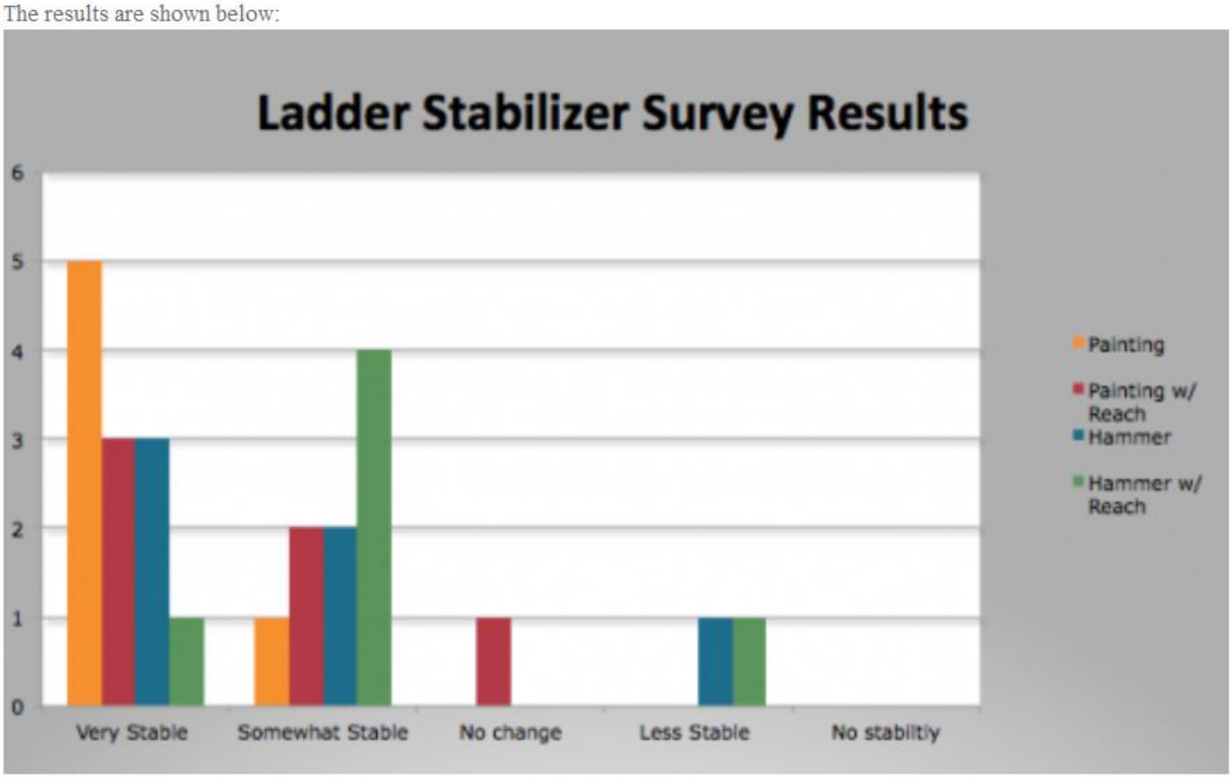
0 Any test(s) for requirement(s) or attempts at physical or mathematical modeling fail to demonstrate even minimal understanding of testing procedure, including the gathering and analysis of resultant data; OR there is no evidence of testing or physical or mathematical modeling to address any requirements.

Element I Reflective questions;
_ What did I/we learn from testing about how well this design met the stated design requirements?
_ Why should others believe my/our analysis of the data?

Testing

The first tests we did were testing comfort ability on a ladder with and without the ladder stabilizer doing simple jobs such as painting and hammering. The second test we did was to have test subjects reach to their comfort zone both with and without the ladder stabilizer. The final test we used was to test the force to the tipping point both with and without the ladder stabilizer at 3ft and 6ft.

The results are shown below:



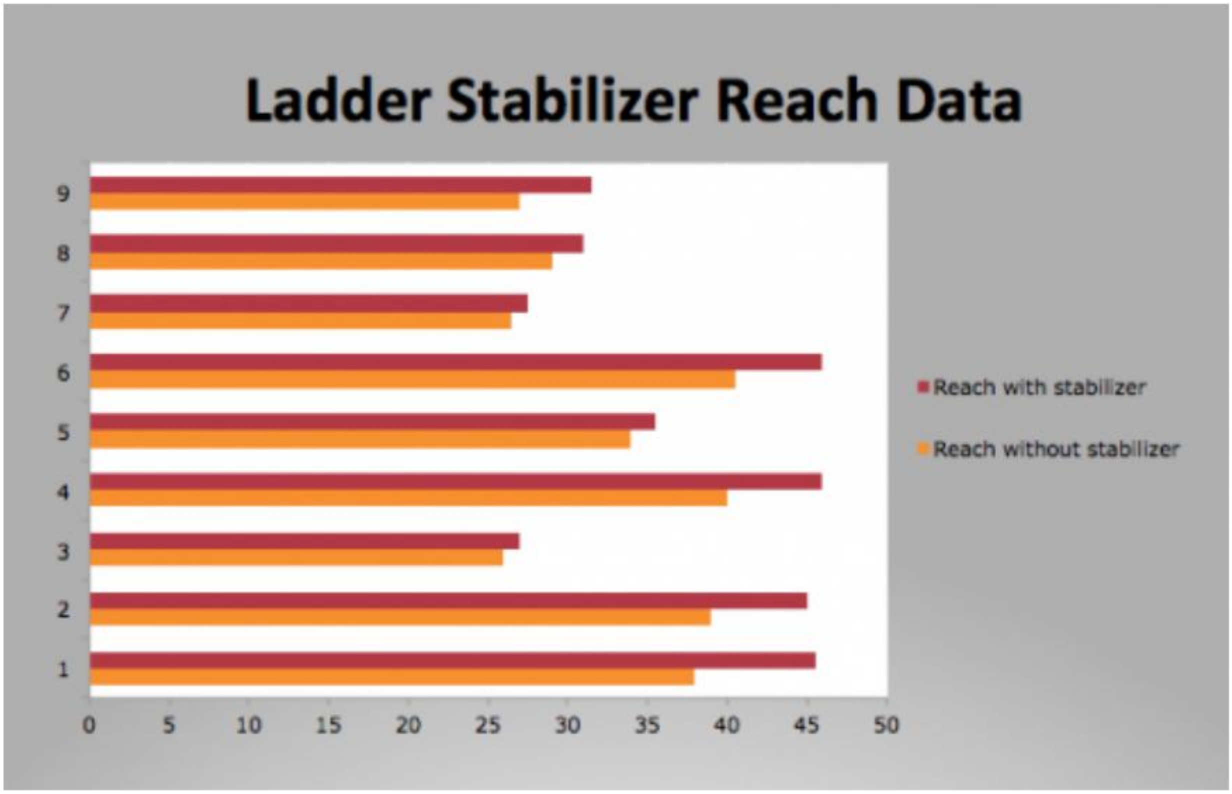
Ladder Stabilizer Survey

After completing routine tasks on a ladder, participants were asked to rate the stability they felt with the ladder stabilizers.

	Very Stable	Somewhat Stable	No change	Less Stable	No stabiltiy
Painting	5	1	0	0	0
Painting w/ Reach	3	2	1		
Hammer	3	2	0	1	0

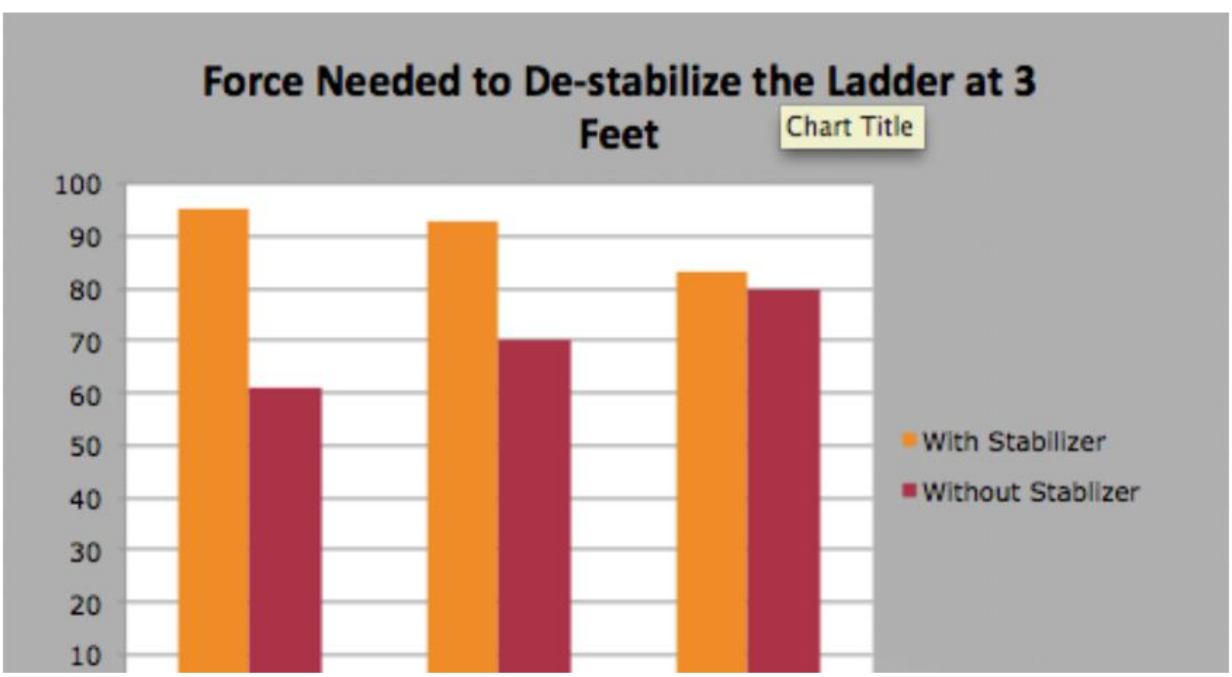
Hammer w/ Reach	1	4	0	1	0

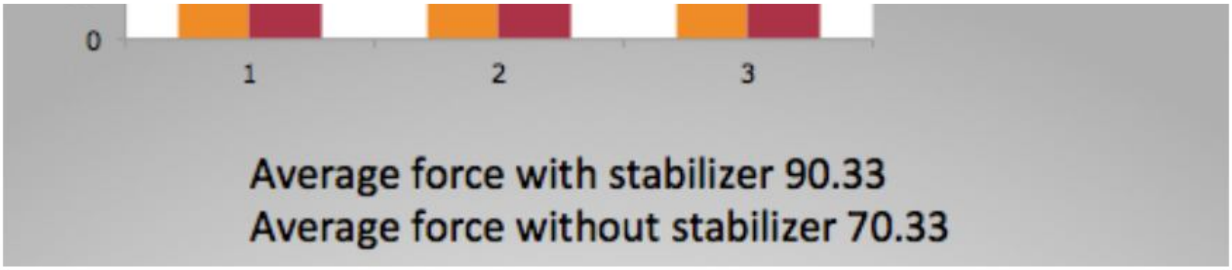
Of the responses, 87% indicated more stability with the ladder stabilizer.

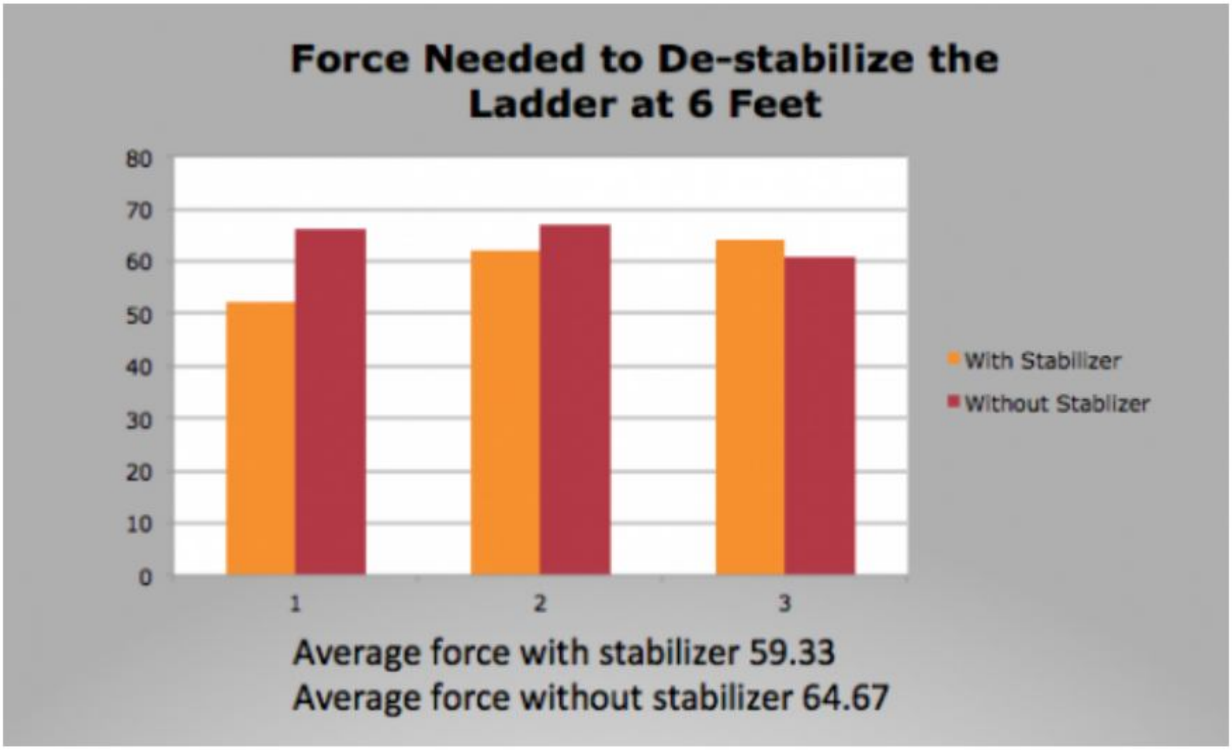


Reach without stabilizer	Reach with stabilizer	% increase	
38	45.5	19.7368421	
39	45	15.3846154	
26	27	3.84615385	
40	46	15	
34	35.5	4.41176471	
40.5	46	13.5802469	
26.5	27.5	3.77358491	
29	31	6.89655172	
27	31.5	16.6666667	
		11.0329363	Average Percent Increase

Average increase in reach utilizing the ladder stabilizer was 11.03%.







	With Stabilizer	Without Stabilizer
3	95	61
3	93	70
3	83	80
	With Stabilizer	Without Stabilizer
6	52	66
6	62	67
6	64	61
	Average with the Stabilizer	Average without the Stabilizer
3 feet	90.33	70.33
6 feet	59.33	64.67

At a greater height, the ladder began to torque or turn about the rail opposite where the force was being applied.