

## 2007 Senior Design Show – University of St. Thomas – School of Engineering

### Marvin Windows Casement Lock Redesign

**Sponsor:** Marvin Windows

**Sponsor Mission Statement:** The Marvin Companies produce windows, doors and allied products that customers perceive as having high quality and value. In doing so, Marvin is able to grow market share, enjoy long term profitability, provide employment opportunities and thereby strengthen communities where it does business.

**Sponsor Contact Title and Info:** Cynthia L. Bracht, P.E., Product Development Team Leader, (218) 386.4141 x 1938

**Sponsor Address:** Highway 11 West, P.O. Box 100, Warroad, MN, 56763

**University of St. Thomas School of Engineering Project Advisor:** Dr. AnnMarie P. Thomas

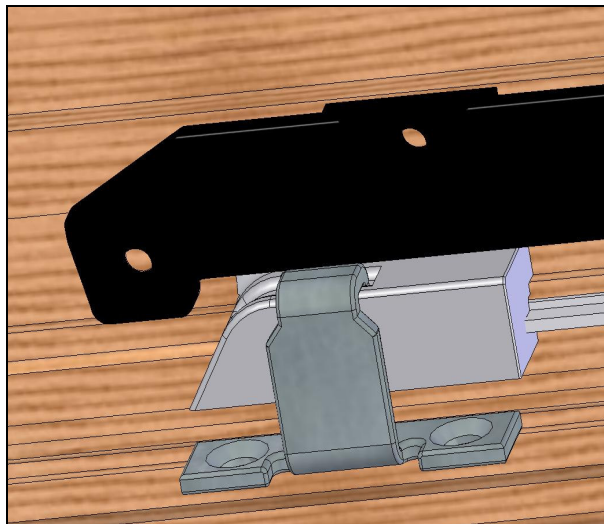
**Team Members:** Christopher E. Carson, John W. Henderson, Jonathan P. Soldner, Jacob H. Stewart

**Senior Design Project Mission Statement:** To safely and ethically design a casement window locking mechanism which successfully passes all IZ4 test requirements and is producible for under \$7.61.

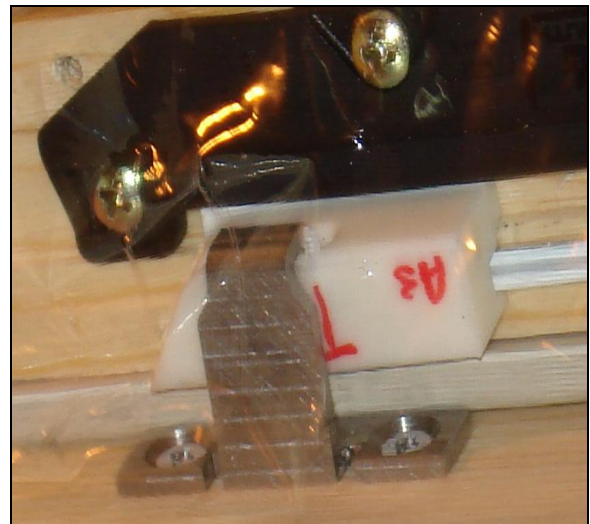
#### Project Requirements:

1. Pass IZ4 Test Requirements
  - a. 140 mph winds
  - b. Impact of two, 8' 2x4 studs shot at 50 ft/s
  - c. +105 psf and -127.5 psf applied pressure
  - d. 4500 positive and 4500 negative pressure cycles
2. Maintain similar assembly and manufacturing process for production
  - a. Maintain current hardware placement locations
  - b. Compatible with all external hardware
3. Maintain similar operation and appearance characteristics
4. Produce locking mechanism to be mass produced for less \$7.61 per lock

**Project Summary:** This project required an immersion into the world of casement windows and locks. By thoroughly defining customer requirements and engineering specifications, familiarizing ourselves with the intricacies of casement window locks, and maintaining a very close working relationship with Marvin Windows, conceptual designs were generated, evaluated, and narrowed down to a final design. This design continuously evolved and came to include highlighted features such as: a finned keeper and slotted cam design to improve performance and reduce cost; a redesigned tie-bar and interface to reduce cost; the use of a super-tough acetal for the cams to improve performance; a redesigned cam guide interface to maintain system integrity; and cam geometry designed to reduce stress. This project required extensive computer aided drafting, finite element analysis, materials analysis, and project management skills to complete.



*Solidworks® representation of Locking System*



*Locking System fixed to window.*