



# Team 20: Levered Manhole Cover Remover

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## Project Statement

- Current design has not changed in the last 50 years.
- Sponsor is looking for a portable and cost effective tool that they can manufacture and sell.
- The new design should allow a user to safely and more easily remove manhole covers.

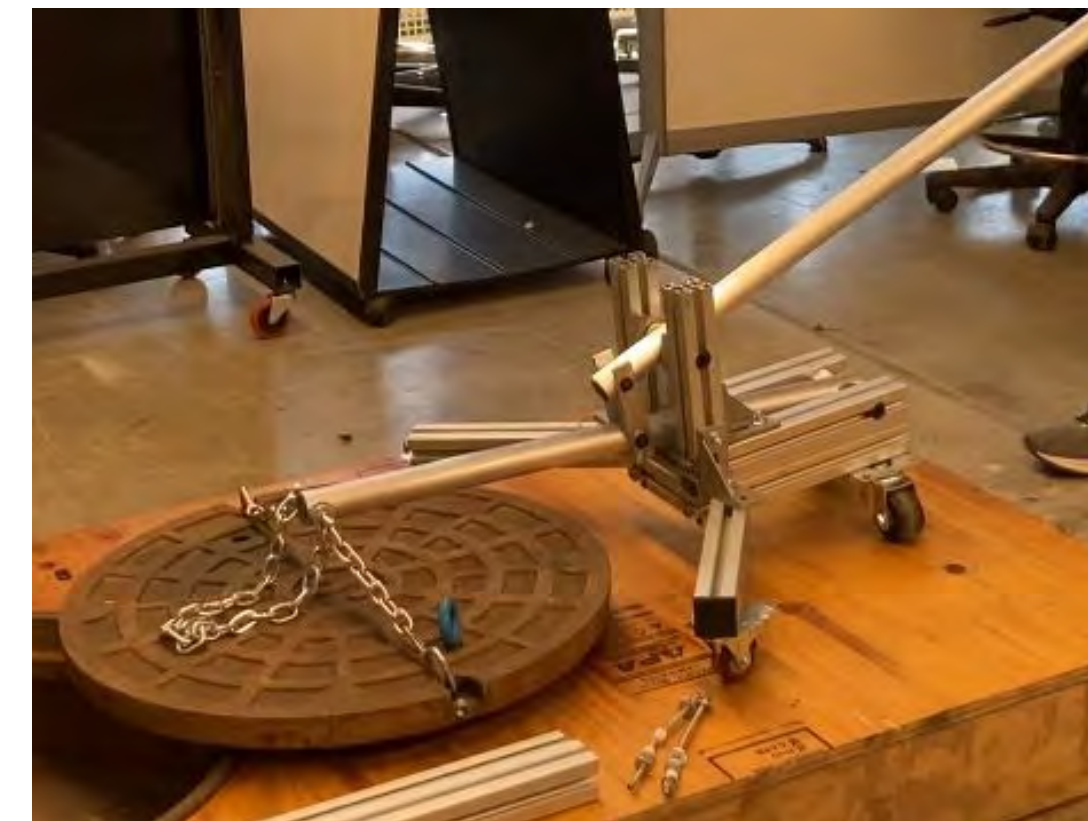


Current T&T Manhole Cover Remover

## Key Specifications

- Lift a slotstyle manhole cover up to 175 pounds - ✓
- Operate within 24 pounds of horizontal force - ✓
- Store into a 6 foot x 2 foot x 2 foot envelope - ✓
- Operate within 64 pounds of vertical force - ✓
- Have a final BOM cost of \$150 or less - ✓
- Weigh less than 30 pounds - ✓

## First Round Prototypes



Compound Lever

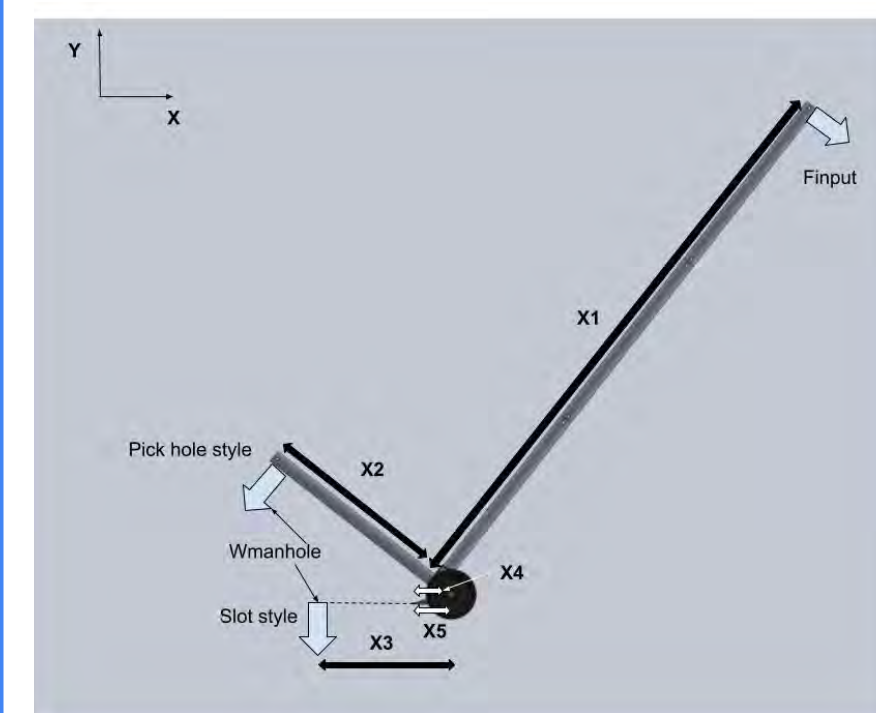


Tripod Lifter

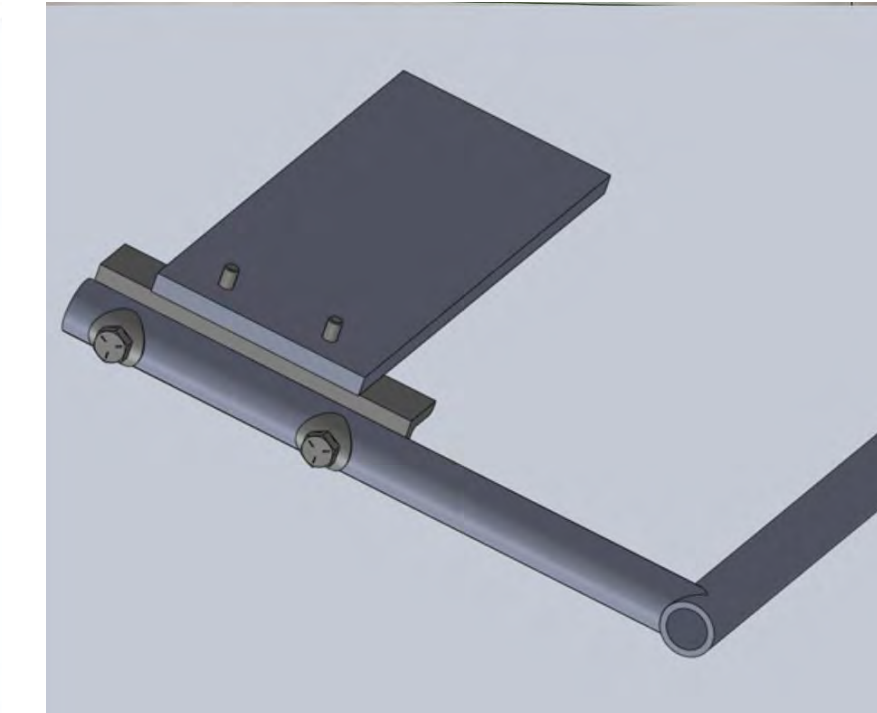


Simple Lever

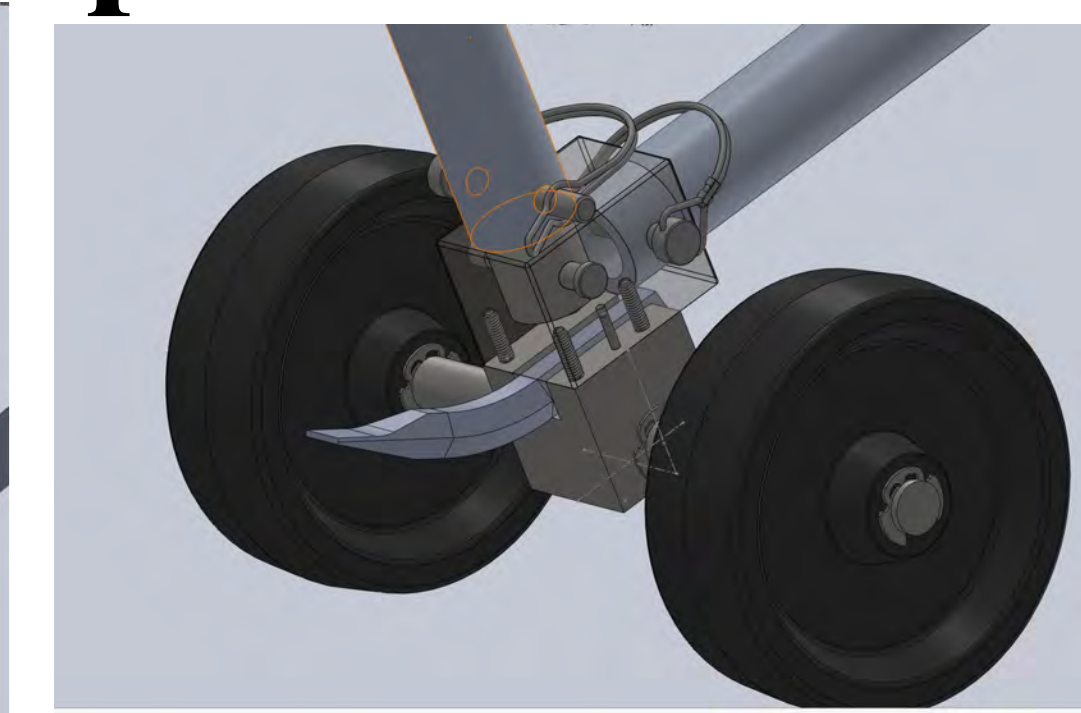
## Further Concepts



Welded Levers

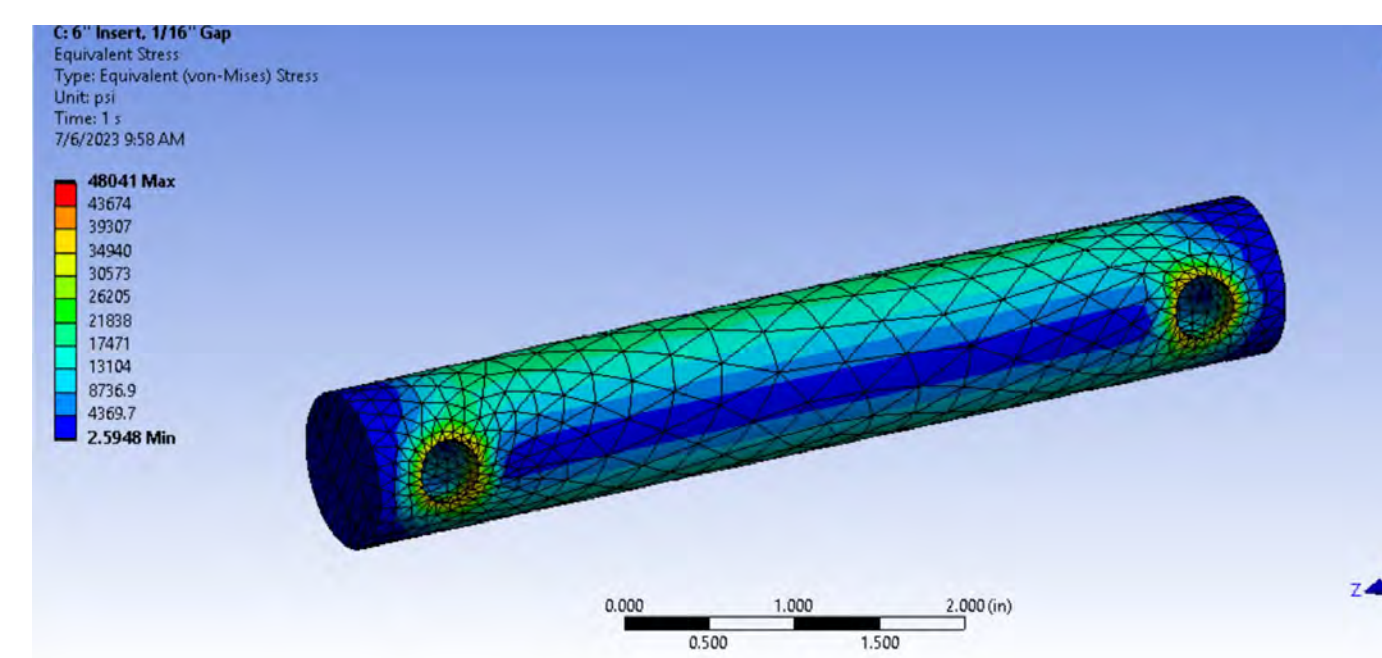


Seated Lever

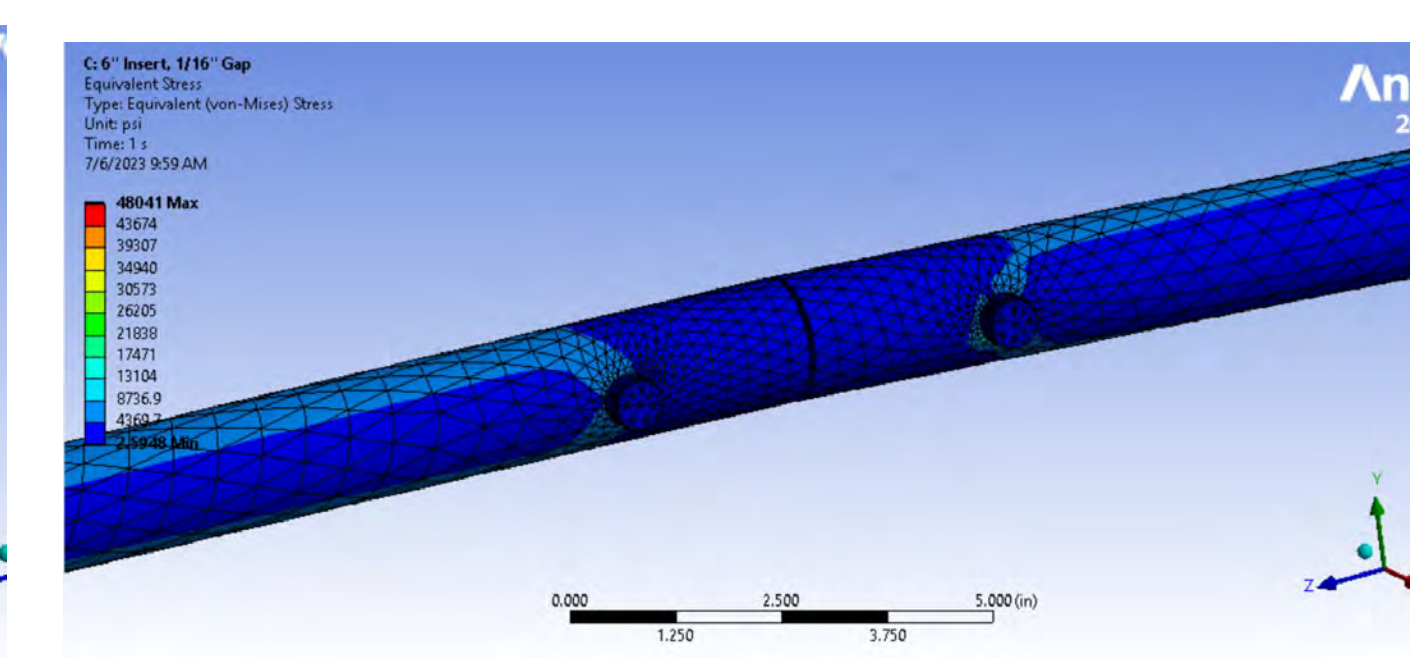


2-piece Chassis

## FEA Screenshots

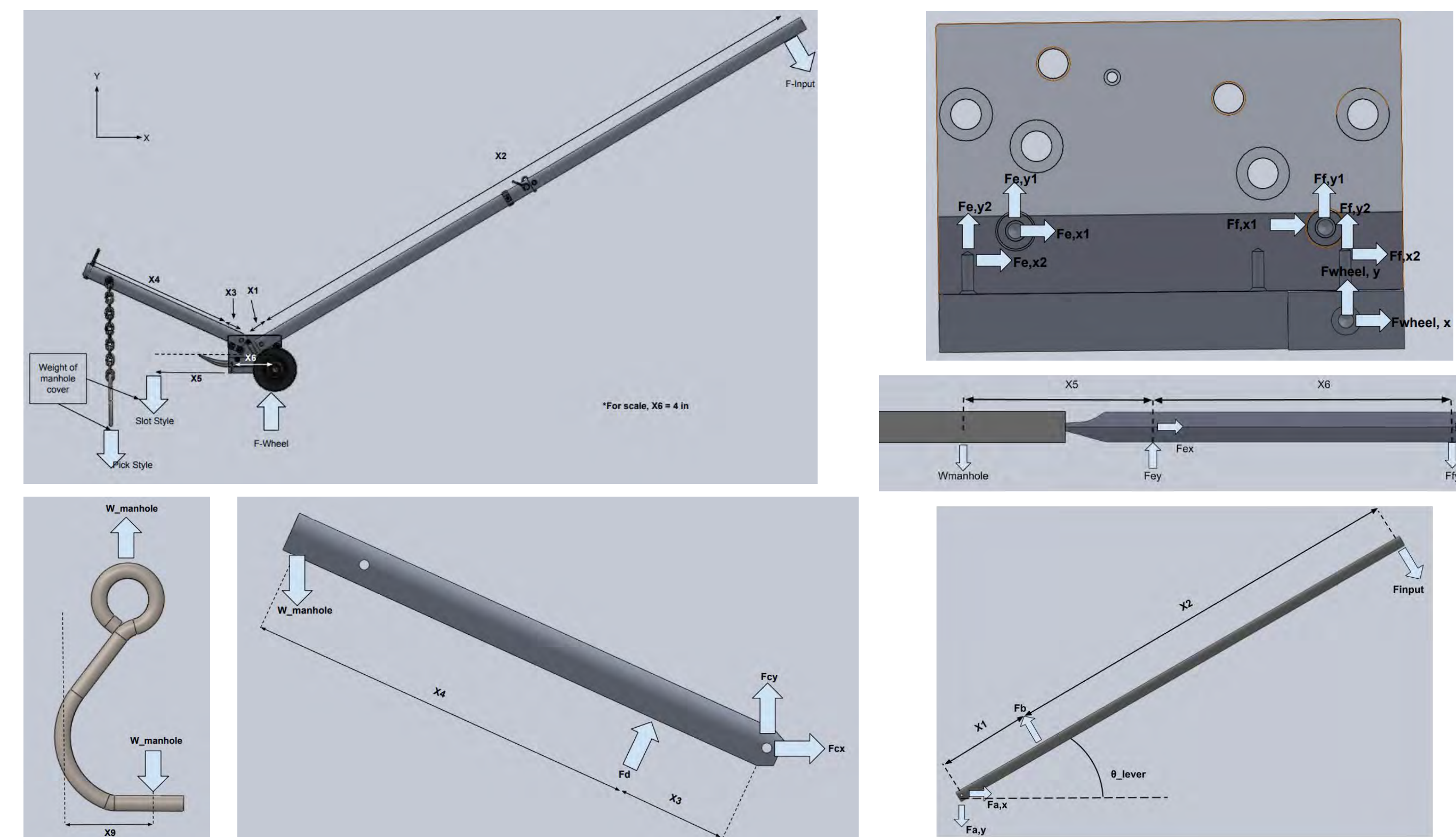


User lever connection rod



User lever pipes (connection area)

## Free Body Diagrams



## Final Product and Testing



Slot Style



Pick-hole Style



Tip Test



Storage position of device compared to standard hook

## Special Thanks

Faculty Advisor: Prof. Philip Hittepole

Sponsor: T&T Tools Inc, Zeeland, Michigan

Assisting Faculty: Dr. Wendy Reffeor, Dr. Farid Jafari, Dr. Blake Ashby, Dr. Christopher Pung, Dr. Ryan Krauss