

# OneLace

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**Problem:** Young children are not able to secure ice skates by themselves



**Our Proposition:** To develop a mechanism by which children can **efficiently** and **securely** put on their **own** skates every time

533,000 children registered with USA Hockey last year <sup>1</sup>

92% of children under the age of 10 are **unable**  
**to properly secure their skates \***

almost 60 seconds for parents to tie kids' skates \*

“I shouldn’t have to **go to the gym** when I’m  
**nine years old** so I can be strong enough to  
**tie my own skates.”**

\* From our surveys and tests of over thirty parents and children

# Users

Youth Hockey Players  
Aged 5-12



Do your young skaters wish they could tie their own skates?

- **60.9%** - Yes
- **39.1%** - No

# Purchasers

Hockey Parents



When they tie their own skates, do they stay tied and secure?

- **8%** - Yes (to both)
- **32%** - Tied but not secure
- **12%** - Initially secure but need to be re-tied
- **48%** - No (to both)

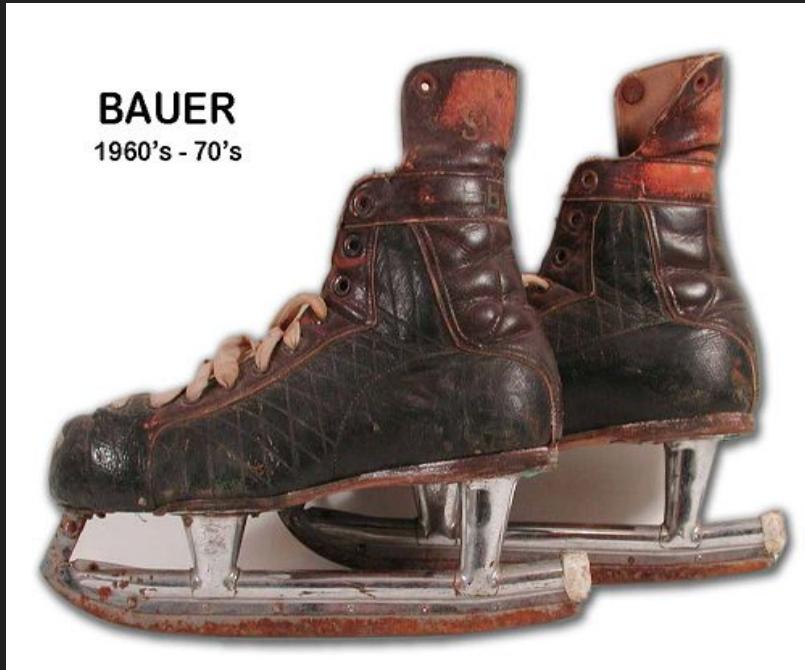
**92% negative response**

# Specifications

Specs	Justification	Quantification	Test
Time to secure	Our project goal is to reduce the time it takes to put on skates	Time users (< 30 seconds)	Use stopwatch to time how long it took to put on skates
Security	It is imperative that skates are properly fastened to the foot	User “feel” test	Acquire qualitative feedback from users
Force Needed to Tighten	Minimal force should be required to secure, so a child can do it themselves	Measure how much force it takes to secure the alternatives (< 100 N)	Use force sensors to measure the force needed to secure at different points
Product Cost	Our technique will not be adopted if it increases the cost of skates significantly	Cost of materials (not much more expensive than current models)	Research how expensive each solution is
Ease of assembly/repairability	Our technique will not be used if it is easily left at home or otherwise unaccessible	Time to assemble system from scratch (~ 2 minutes)	Use stopwatch to time how long it takes to assemble

Specs	Justification	Quantification	Test
Traditional Aesthetic	Our design should look like a traditional hockey skate	Does our design incorporate elements of a traditional skate? (y/n)	Acquire qualitative feedback from users
“Cool” look	We want a design that children would want to wear	Are children willing to wear our skate? (y/n)	Acquire qualitative feedback from users
Originality	The project is uninteresting if solutions of that type already exist	Has our design been thought of before? (y/n)	Research state of the art
Simplicity	Our design should not be too complicated.	How many parts does our skate have, including eyelets, straps, etc? (< 25)	Quantify number of parts
Variable tightness	Users have stated that they often like to have different tightness at different points on their foot	Does the design allow the user to achieve the desired tightness at different points of the foot? (y/n)	Analyze different designs
Safe to put on	Our technique should not pose any risk of injury to the child	Is the design friendly for children between ages 5-10? (y/n)	Examine possible areas of danger

# Same design 50 years later ...



**BAUER**  
1960's - 70's

**1960**



**2016**

Over half of those surveyed  
want the traditional design

# State of the Art



Traditional Laces



Velcro (Option B)

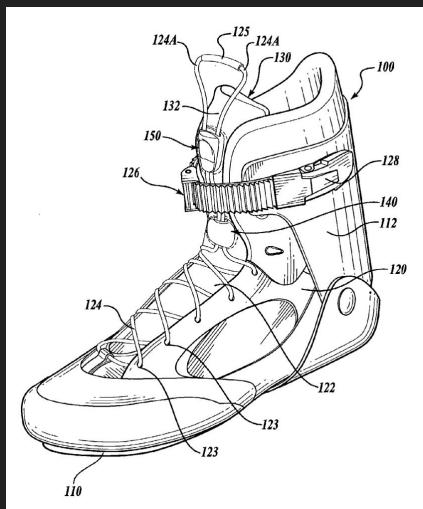


Elastic Laces

# State of the Art



Boa



Patent Design

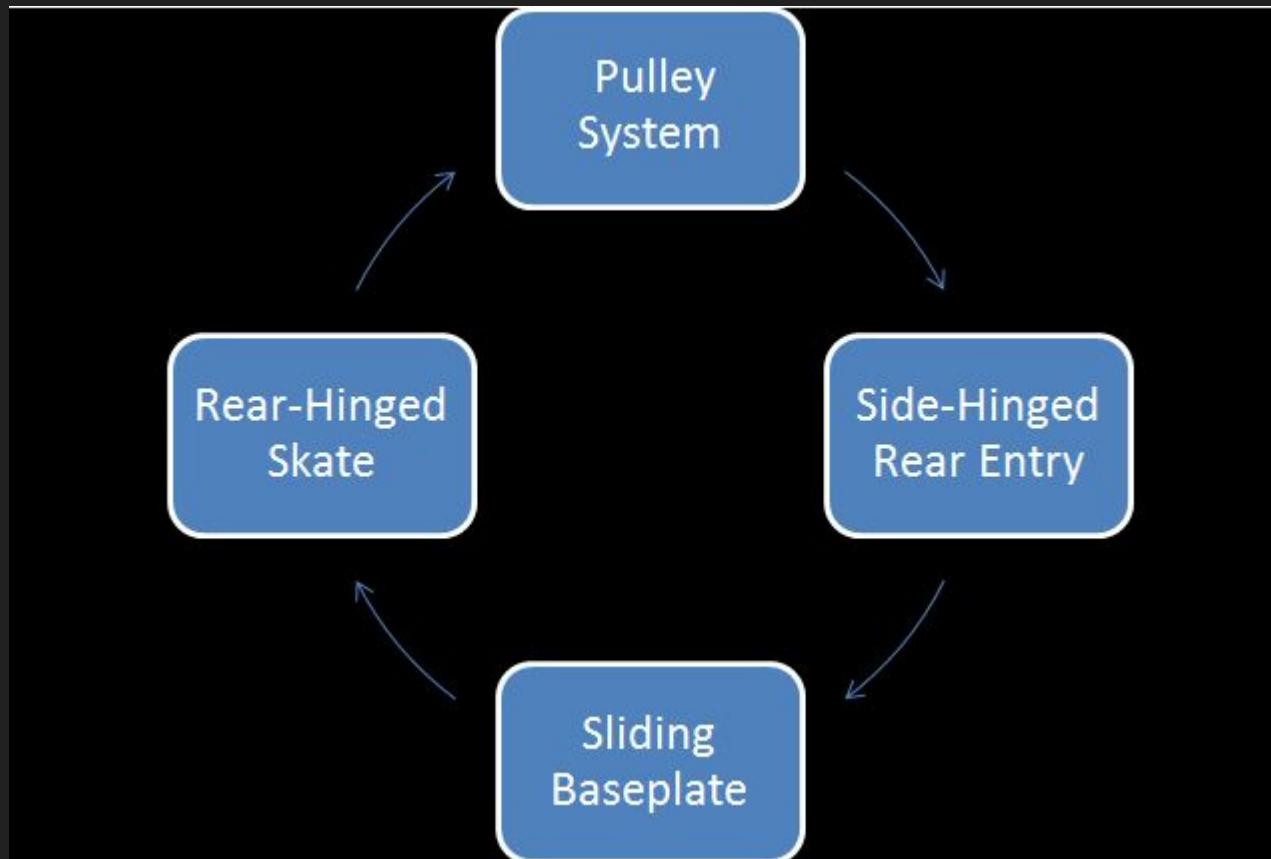


Buckles

Implementation Matrix							
Implementation Matrix	Time to Secure (x3)	Security (x2)	Tightening Force (x3)	Product Cost	Repairability	Traditional Aesthetic (x2)	Looks cool (x2)
New Lacing Pattern	3	3	3	4	4	2	4
New Eyelets	4	3	3	4	3	4	4
New Locking Mechanism	4	3	3	4	4	3	3
Change Lace Material	3	3	2	5	3	3	2
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Zipper	5	1	4	3	1	1	1
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Mechanical Crank	4	4	4	3	2	3	3

Implementation Matrix	Simplicity	Originality	Variable Tightness	Safe to Put on	Ethical	Legal	Total
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# Problem Solving Methodology



# 1st Prototype: Rear-entry Skate



- Side hinged rear entry skate to avoid interfering with blade
- Clips used to secure opening piece
- Waxed laces tied once and then stay in place



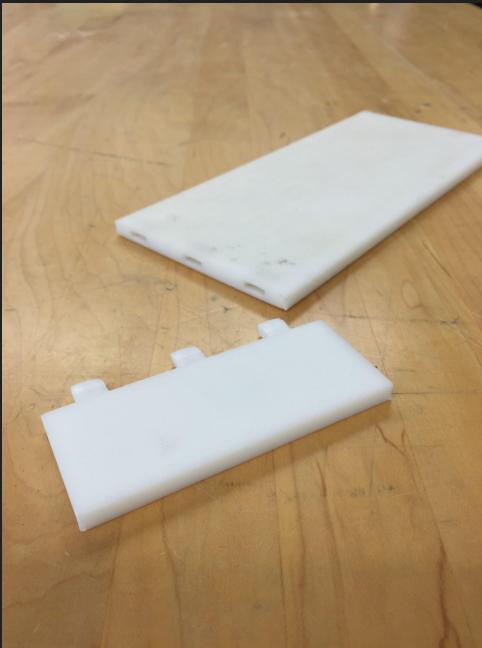
# Problems with our 1st Prototype

- Limited lateral stability
- Took a lot of force to insert foot
- Securing mechanism did not stay tight

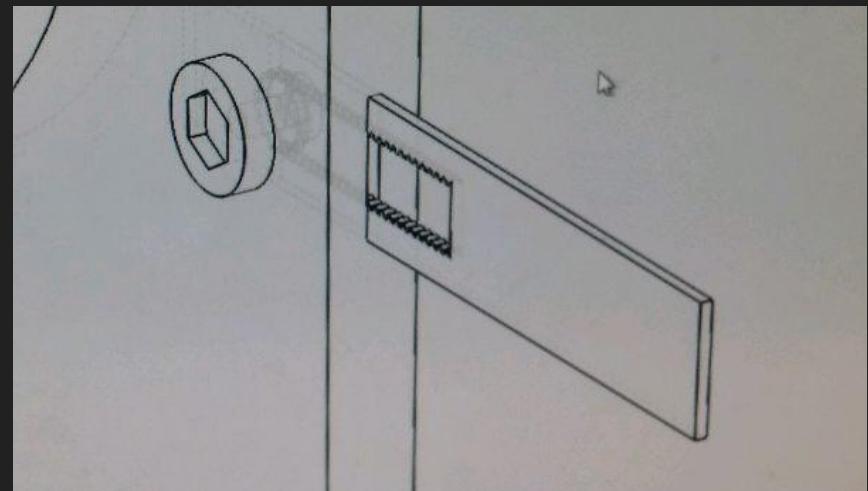


# Intermediate Design

Sliding baseplate



Ratchet design



- Easily breakable
- Problem with securing mechanism

- Poor lateral support
- Difficult for child to fasten

# Intermediate Design

Rear hinge with overlap



Cut at different points to optimize heel security



- Cutting skates difficult
- Locking device not discrete
- High cost

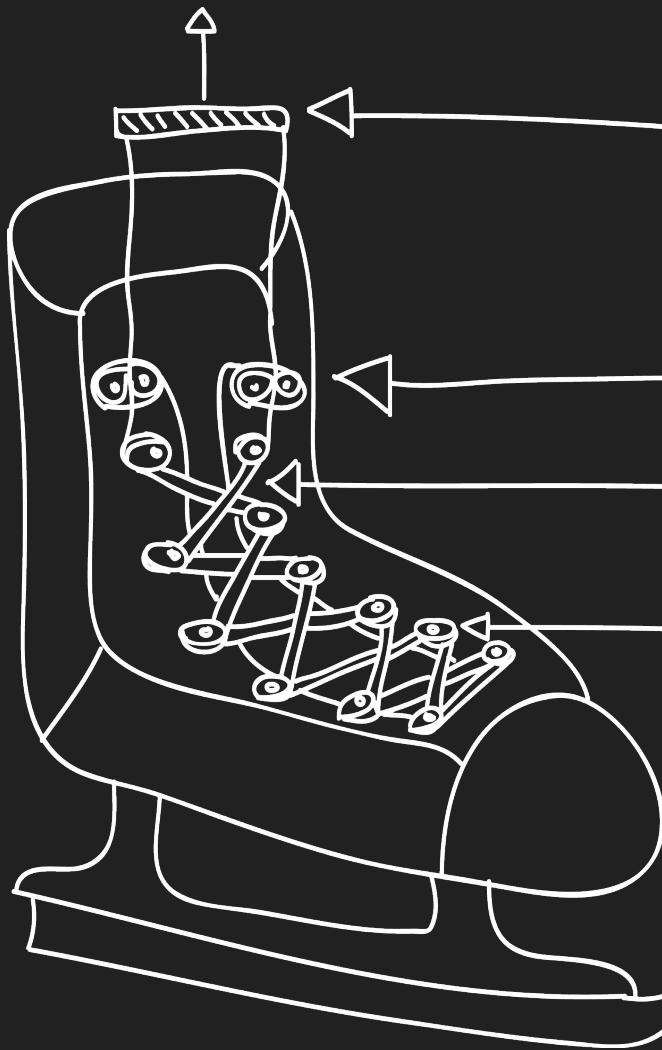
Had to cut all the way down to get foot in

# Final Prototype: Pulley and Cleat



- Retrofittable pulley system that attaches to the skate eyelets
- Special cam cleats to secure laces at the desired tightness
- Laces maintain traditional aesthetic

# How It Works



Handle

Cleat / Locking mechanism

Traditional style laces

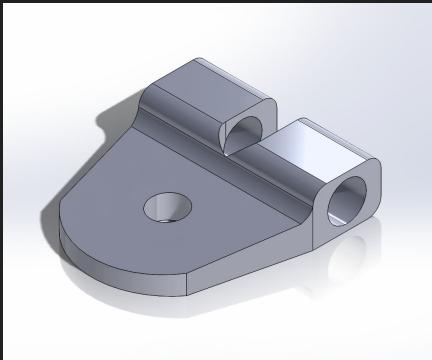
Pulleys to reduce friction  
when tightening

**Entirely Retrofittable!  
Traditional Look!**

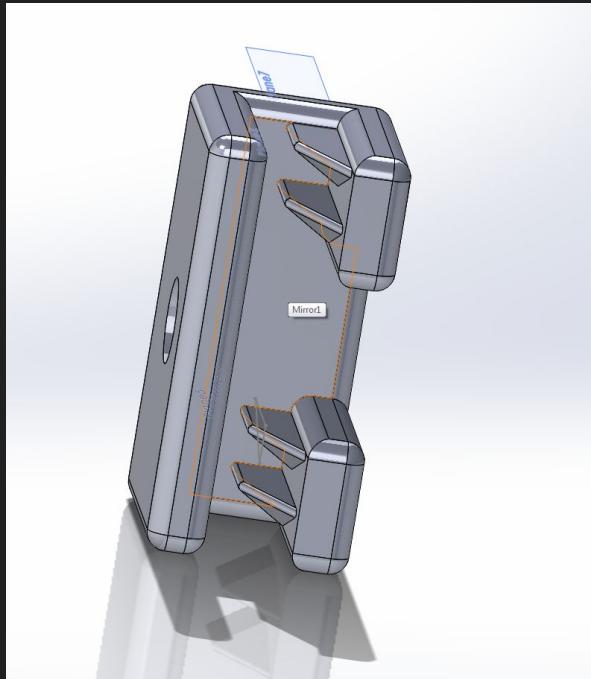
# Pulleys



- Reduce friction caused by eyelets
- Attached to skate with clips that are screwed in



# Cleat



- Once desired tightness is achieved, locks lace in place
- Easy to tie or secure the lace to the skate once firmly in the cleet

# Handle



- Ergonomic handle to decrease pain on user's hands while pulling lace
- Lace could be secured by rolling with handle

# Final Prototype: Pulley and Cleat

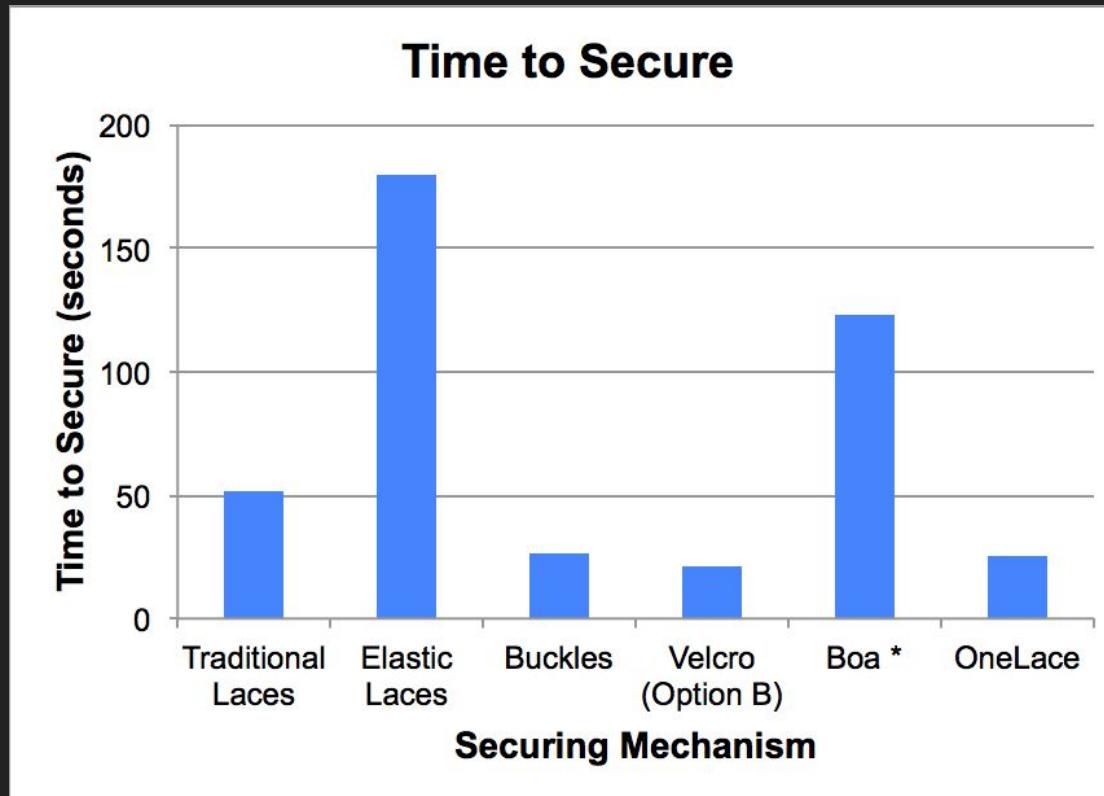
- Maintains retrofittability from Option B
- Provides the mechanical advantage/ease of the Boa system
- Resembles traditional aesthetic users love
- Children can tighten by themselves
- Secures faster than traditional and most state of art



**Speed Skating**

# Test #1: Time to Secure

When foot is inserted, time to secure the skate is measured using a stopwatch



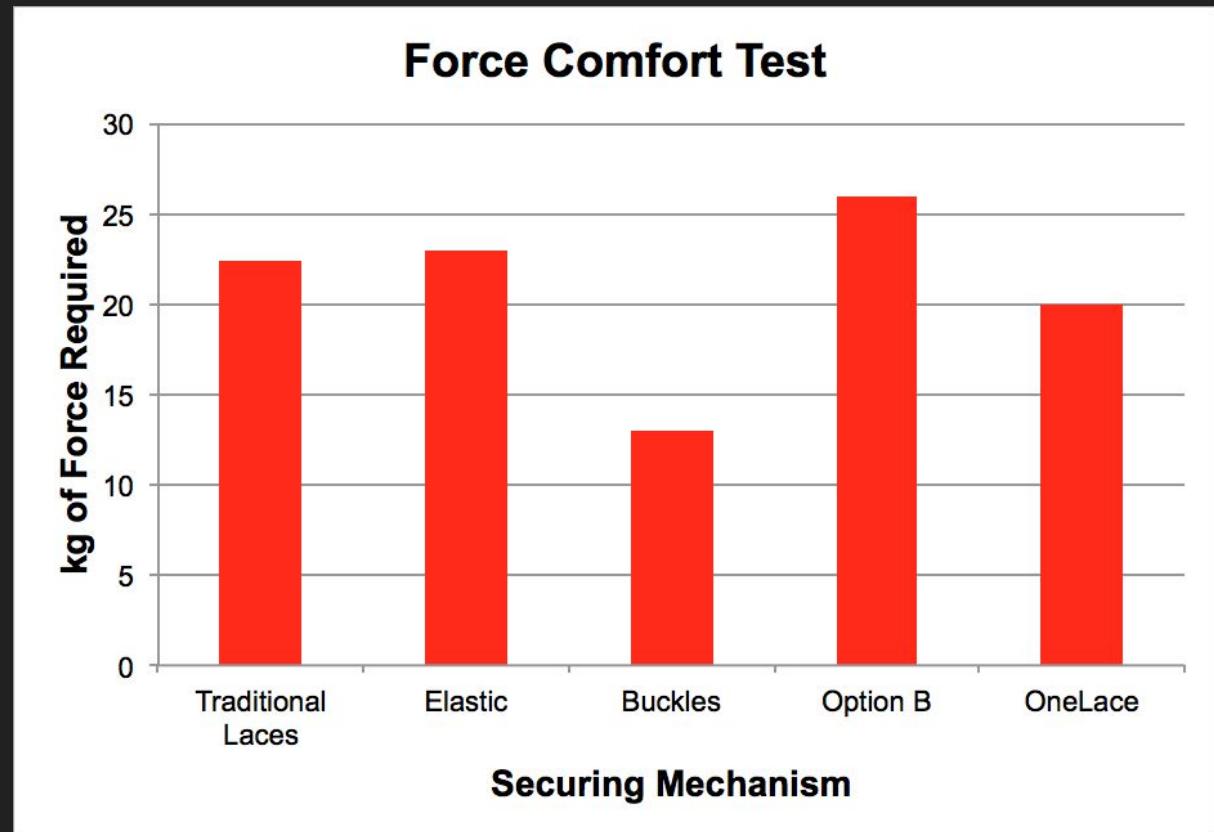
\* Using a modified Boa system because our group could not order all the necessary parts for a boa skate.



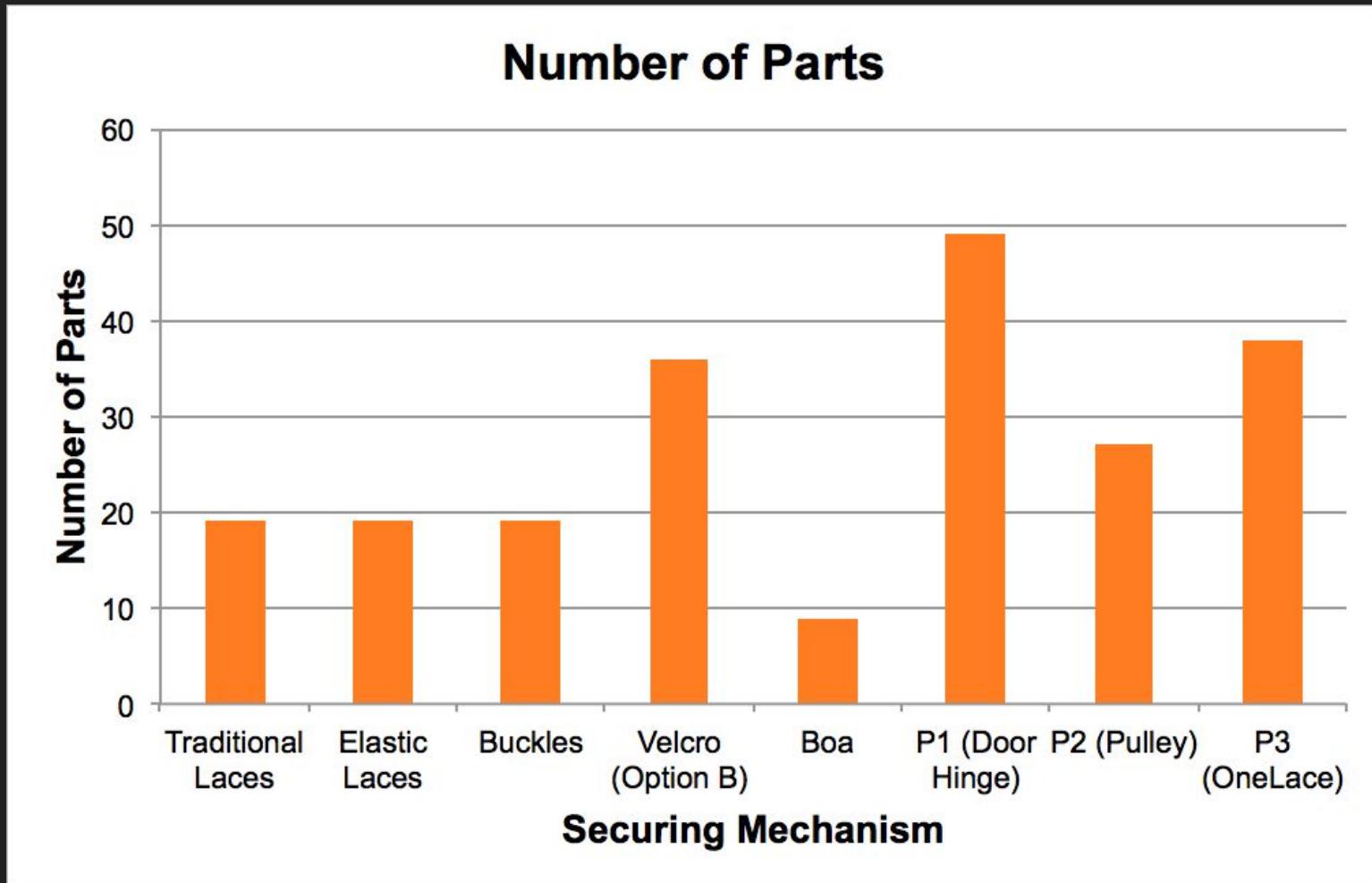
00:00:19.774

# Test #2: Force Comfort Test

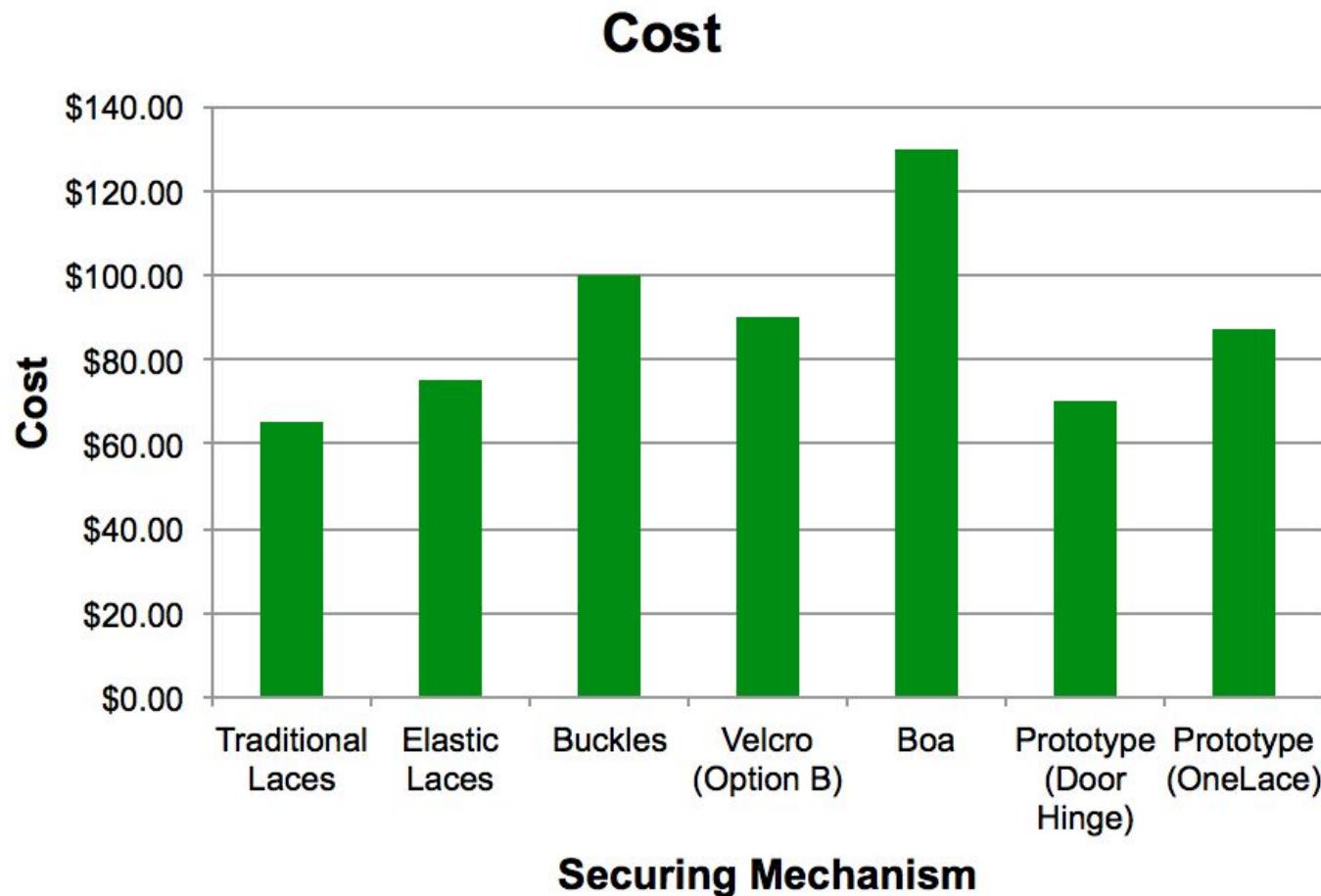
Sensors are used while pulling on laces and the force required to reach comfort is recorded



# Test #3: Additional Number of Parts

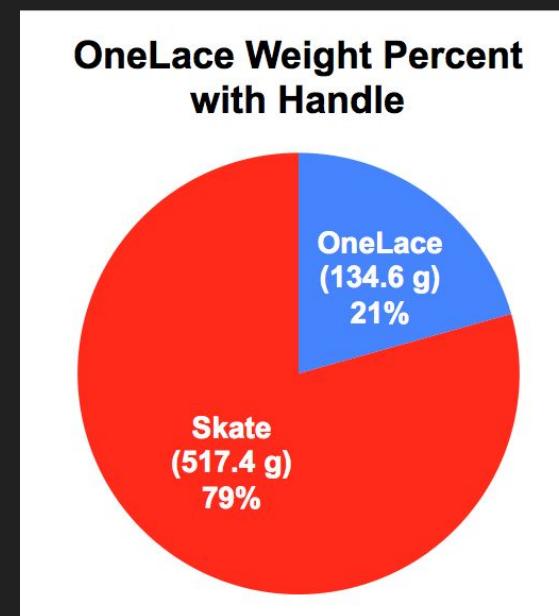
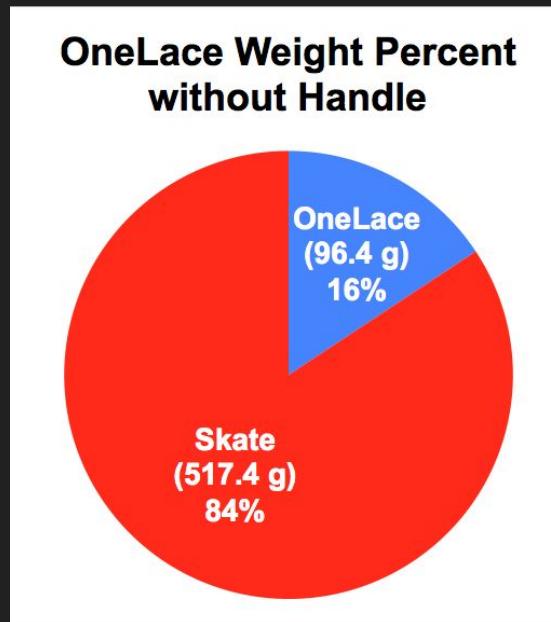


# Test #4: Cost



# Test #5: Weight added to the Skate

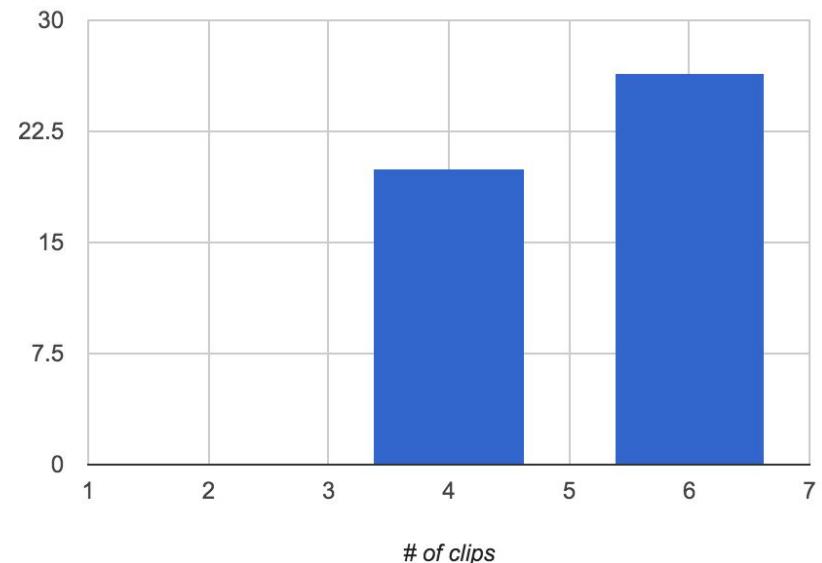
We intend for our system not to significantly alter the weight of the skate



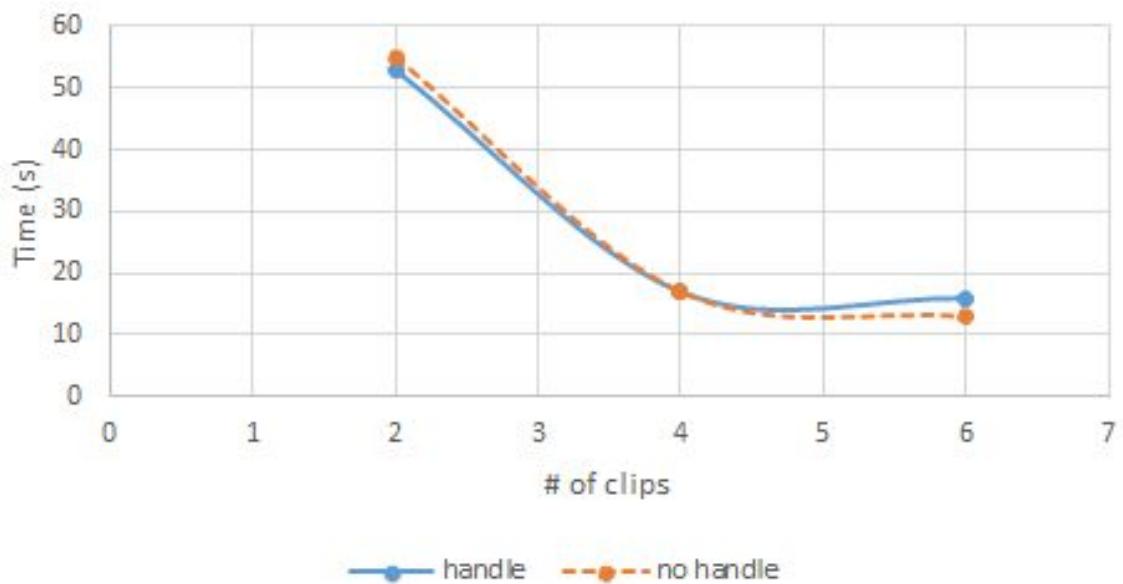
# Prototype Analysis

Only having two clips and pulleys is impractical

Force to secure vs # of clips

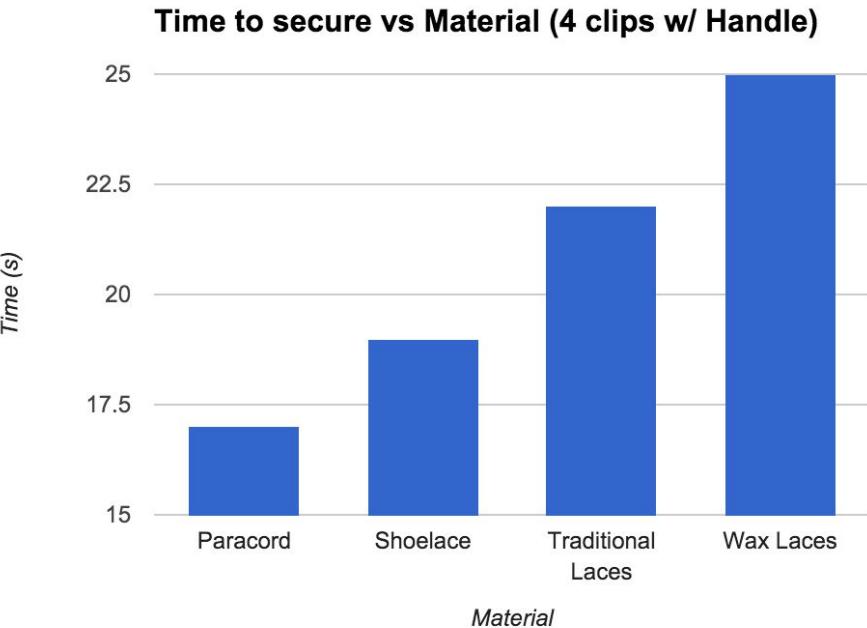
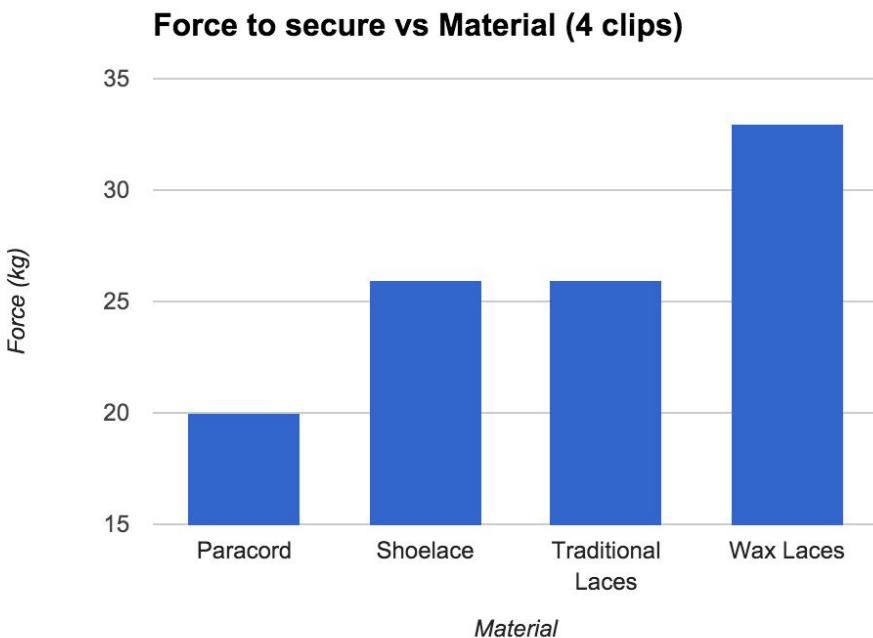


Time to Secure vs # of Clips



Having four clips is ideal

# Prototype Analysis

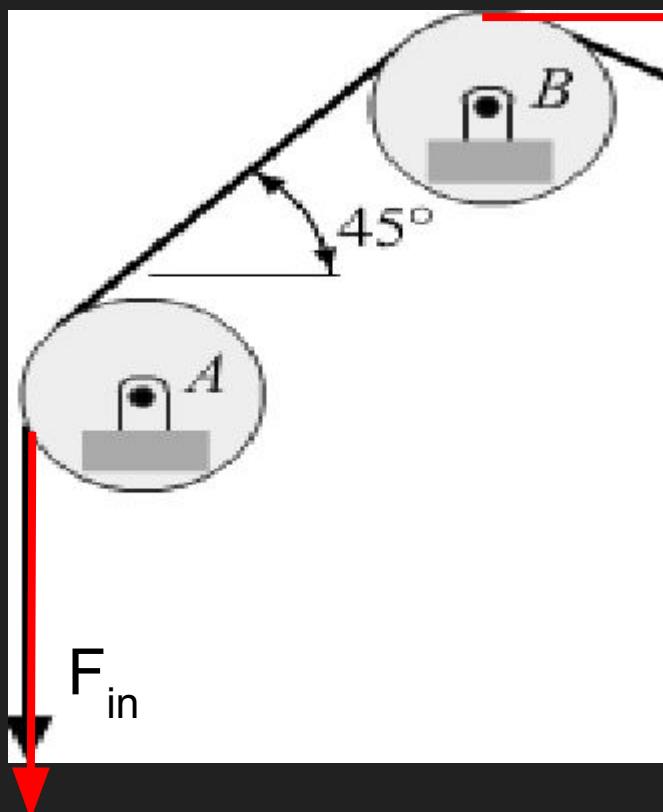


Paracord was the best-performing material for time and force

# Horizontal Force Calculation

## Theoretical Calculation

$$F_{\text{hoz}}$$



$$F_{\text{hoz}} = F_{\text{in}} * \cos(45^\circ)$$

$$F_{\text{in}} = 3\text{N}$$

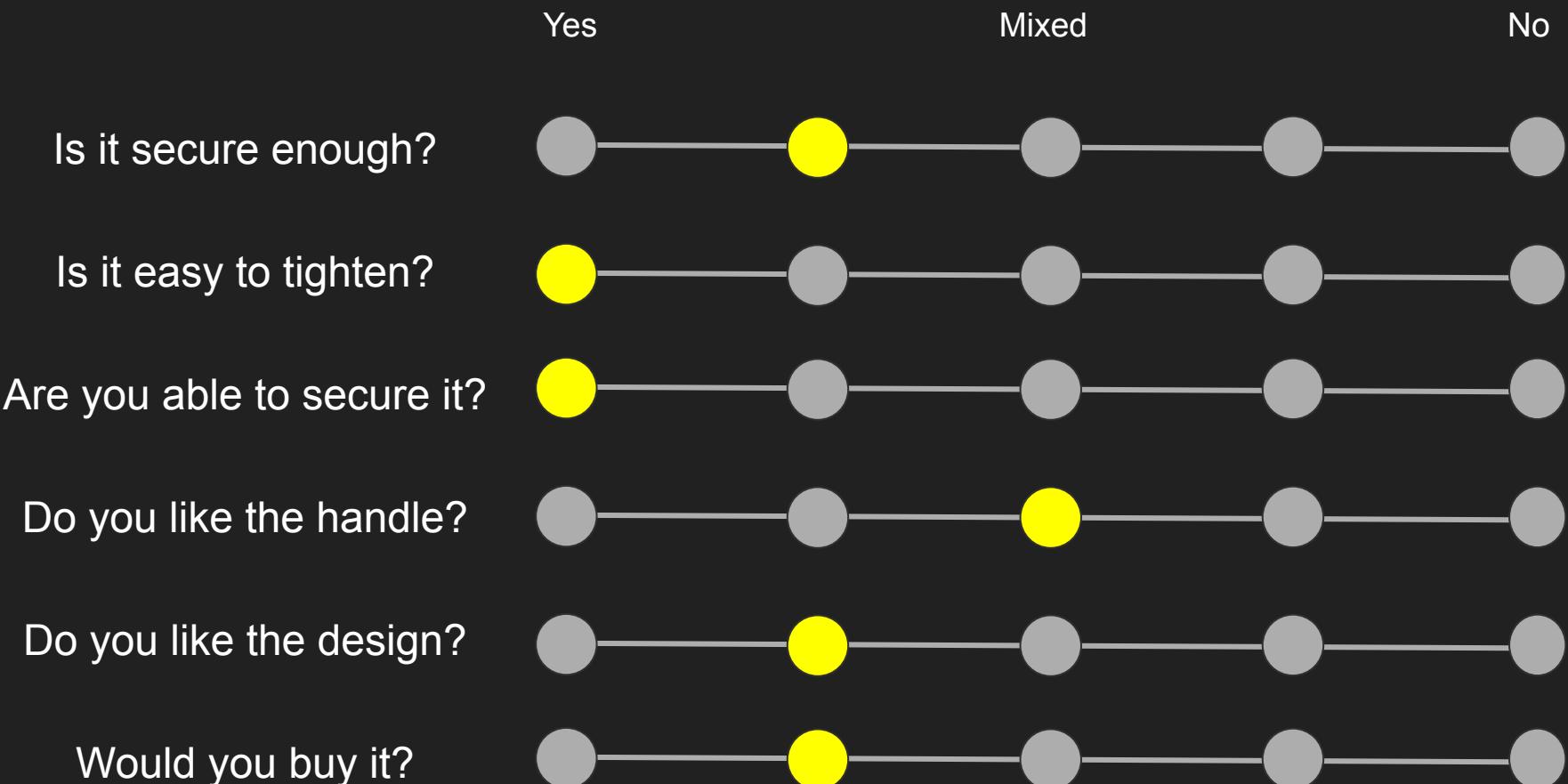
$$F_{\text{hoz}} = F_{\text{in}} * \cos(45^\circ)$$

$$F_{\text{hoz}} = 2.12\text{N}$$

Measured Value

$$F_{\text{hoz}} = 1.99\text{N}$$

# Prototype User Feedback



A photograph of a man in a blue zip-up jacket and a striped knit hat standing next to a child wearing a yellow and green jersey with the word "HANNOVER" on it. The child is also wearing a black helmet with a cage and yellow gloves. They are positioned in front of a red and white wall.

That's really creative

# Ethics / Sustainability / Liability

Ethics: Our product puts control in the hands of the user: the child

Sustainability: Retrofittable, can be reused as children grow out of old skates.

Liability: We will test our product following current skate standards and maximize material strength

# Economics Analysis I: Production and Sales

**TABLE I: VARIABLE COST**

<u>Parts</u>	<u>Amt needed</u>		<u>Unit Price*</u>	<u>Total</u>
Paracord	11.81	Ft.	\$0.04	\$0.47
Connector (4)	0.07	Kg.	\$3.00	\$0.20
Pulleys (8)	8	Ea.	\$0.50	\$4.00
Screws (18)	18	Ea.	\$0.06	\$1.08
Screw nuts (18)	18	Ea.	\$0.07	\$1.26
Screw washers (10)	10	Ea.	\$0.08	\$0.80
Cleats (4)	0.01	Kg	\$3.00	\$0.02
Handle (1)	0.04	Kg	\$3.00	\$0.11
Clip (1)	1.00	Ea.	\$0.10	\$0.10
Assembly	0.50	Hr.	\$7.50	\$3.75
<b>Total Variable Costs</b>				<b>\$11.80</b>

<b>Market Size</b>	<b>500,000</b>
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**Variable Cost**  
**\$11.80 /**  
**Package**

**TABLE II: ANNUAL FIXED COST**

<u>Subjects</u>	<u>Cost</u>
Rent (factory and warehouse)	\$1,000
Leasing of computers, etc.	\$0
Heat	\$1,200
Electricity	\$1,200
Marketing/Advertising	\$1,000
Injection Molding (1 @ \$25k)	\$25,000
Insurance	\$1,000
Salesman (1 @ \$20K/ Yr.)	\$20,000
Executive Salaries (1 @ \$25K/ Yr.)	\$25,000
<b>Total Fixed Costs</b>	<b>\$75,400</b>

**Fixed Cost**  
**\$75,400**  
**(In 2017)**

**\$50,400**  
**(In 2018 and**  
**2019)**

# Sold as package





## Sports Equipment + Hockey Stores



## Famous Rinks

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Global trade starts here.<sup>™</sup>



## Online

## Hockey Tournaments

# Economics Analysis III: Financial and CashFlow

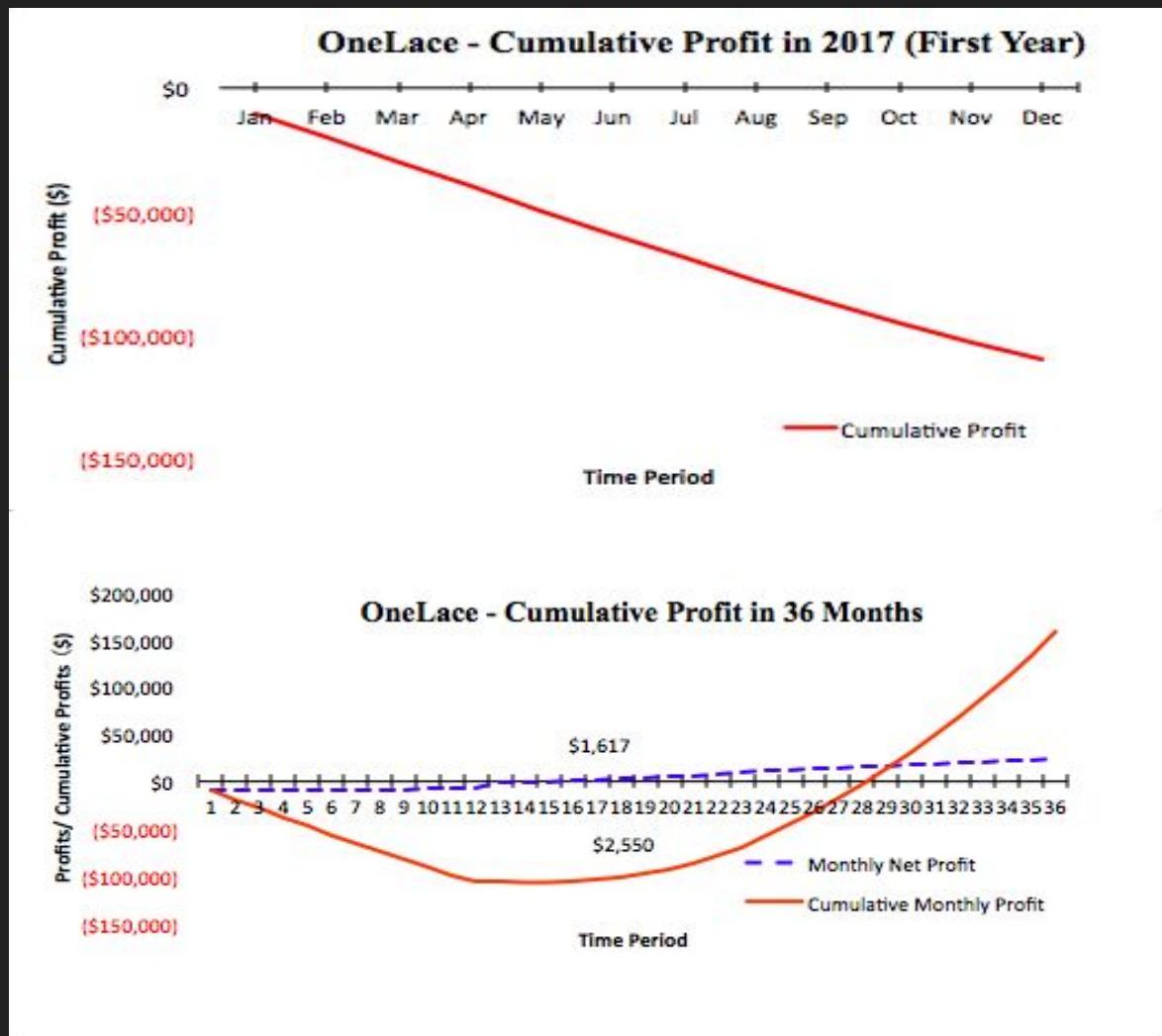
## Market Projection in 2017 to 2019

Source of Funds:
Five co-founders X \$5,000 = \$25,000
\$80,000 from Angel Investor (Interest rate = 10%, length = 24 months)

Starting Date	Jan 2017	Ending Date	Dec 2019
Years	2017	2018	2019
Monthly Growth Rate	25%	15%	5%
Sales in First Month	20	268	1308
Sales in Last Month	233	1246	2237

\*Please see other assumptions (house rental increase, salary increase, etc.) in appendices

# Short-term vs. Long-term Projection and Breakeven Sales



## Observations:

Losing money in the first year

In Feb 2018, most negative cumulative profit = - \$106,855

In May 2019 (29 months later), cumulative profit turns positive

By the end of 2019 (36 months later), cumulative profit = \$158,655

# Conclusions

- We fulfilled our original specifications

Specification	Original Goal	Final Result
Time to Secure	30 seconds for child	25.3 seconds
Force to Tighten	~100 Newtons of force	100 Newtons of force
Traditional Aesthetic	Incorporates original design	✓

- We received positive user feedback supporting our system
  - We developed business plan in which it could sell and become profitable

**We recommend that DCEF pursue our system**

# Next Steps

1. Slim down entire system to make it even sleeker and less conspicuous
2. Improve handle by making it smaller and look at detachable options / removing it altogether
3. Continue to decrease friction in pulleys

# Citations

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<http://www.usahockey.com/page/show/839306-membership-statistics>
2. Bauer Skate History - <http://www.iceskatehistory.co.uk/bauer.html#thumb>
3. Bauer Traditional Skate -  
[http://www.amazon.com/Bauer-Senior-Supreme-Skate-Black/dp/B00JXLLU6K/ref=sr\\_1\\_1?ie=UTF8&qid=1456888893&sr=8-1&keywords=bauer+hockey+skates](http://www.amazon.com/Bauer-Senior-Supreme-Skate-Black/dp/B00JXLLU6K/ref=sr_1_1?ie=UTF8&qid=1456888893&sr=8-1&keywords=bauer+hockey+skates)
4. Velcro (Option B) - <http://www.chooseoptionb.com/>
5. Boa Lacing System on K2 Skate -  
[http://ecx.images-amazon.com/images/I/81FQfrt3ETL.\\_SX425\\_.jpg](http://ecx.images-amazon.com/images/I/81FQfrt3ETL._SX425_.jpg)
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7. Buckle Ice Skate - <http://northwoodsice.net/ice/public/rental/>
8. Pulley -  
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9. Trade Show -  
<http://thirdstringgoalie.blogspot.com/2012/03/2012-lets-play-hockey-expo-minnesota.html>
10. Department Store - <http://www.blogto.com/upload/2015/01/201511-hockey-shops-toronto.jpg>
11. Famous rinks - <http://www.unitedcenter.com/chicago-blackhawks/>



# Appendices

# Specifications

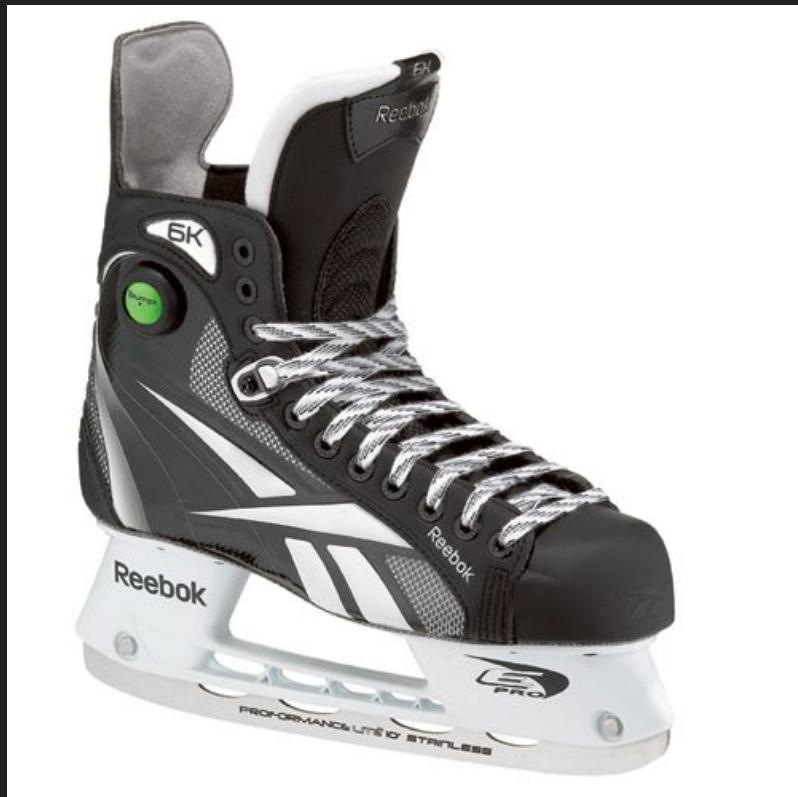
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“Cool” look	We want a design that children would want to wear	Are children willing to wear our skate? (y/n)	Survey children
Originality	The project is uninteresting if solutions of that type already exist	Has our design been thought of before? (y/n)	Research state of the art
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# Traditional Lacing System



Wide, flat shoelaces, pull each lace and knot to tighten.

## Problems:

- Takes a long time to tighten.
- Difficult to maintain tightness throughout the laces while tightening
- Tightening requires more force than children can pull
- Painful on frozen hands

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# Boa Lacing System



Dial used to adjust wire that tightens laces

## Problems:

- Lacks traditional look
- Dial susceptible to damage
- Requires effort to repair

# Velcro



Velcro has been used in some children's skates

## Problems:

- tightest where velcro is located
- Lacks traditional aesthetic
- may not remain secure

# Buckles



Buckles have been used in plastic skate designs

## Problems:

- few options to adjust
- lacks traditional aesthetic
- heavy and inflexible

# Fixed Cost and Breakeven Sales Volume

**TABLE III: BREAKEVEN SALES VOLUME**

Total Market Size	500,000	*	
Price per System	Contribution	Breakeven Volume	Percent Market
\$25.00	\$12.51	5388	1.08%
\$35.00	\$35.00	1926	0.39%
\$40.00	\$40.00	1685	0.34%
\$50.00	\$50.00	1348	0.27%

\* Total Market Size is retrieved from total number of registered hockey players  
in the US

# Business Plan Key Assumptions

- Based on US inflation rate, House rental will increase by 10% each year
- Heat and Electricity will increase by 5% each year
- Market cost will increase by 10% each year
- Insurance cost will increase by 5% each year
- Salaries will increase by 10% each year according to the job market statistics
- House rental includes annual payment to Brandt's parents for their basement and cookies
- A new machine is purchased at the beginning of each year
- Computers are collected from donors