

University of Idaho

College of Engineering

Design Review

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Problem Statement

• Develop a carriage damping system to reduce/eliminate carriage bounce and vibration.



Value Proposition



Design requirements

- Effective on a variety of surfaces
- Within hydraulic pressures forklift is capable
- Work within ~\$2300 budget
- Scalable
- Manufacturable

Previous Design Concepts





Hydraulic Brake



- Simple
- Easy to service
- Low complexity



Spring Mass Damper

- Simple implementation
- Cheap and effective
- Functions at all heights







Hydraulic Accumulator

- Long Life
- Low complexity
- Off the shelf



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Fork Clamps

- Easy to implement
- Simple
- Easy to Service
- Low complexity







Decision IVIa	τηχ	Hydraulic Accumulator	Brakes	Clamped Forks	Spring Mass Damper
Ease of Maintenance	20%	1	4	4	2
Life	10%	4	3	3	3
Ease of implementation	20%	2	3	4	2
Cost	10%	2	3	4	3
Complexity	15%	1	4	4	2
Effectiveness	25%	3	4	1	3
Score	100%	2.166666667	3.5	3.3333333333	2.5

• Pursuing both ideas



Previous Brake Designs







Previous Brake Designs







Previous Brake Designs







Current Design







Current Design

• FEA validates design





Current Design





Data Collection

- What?
 - Inertial load
- Why?
 - Design Validation
- How?
 - Accelerometers
 - Strain Gauge





Data Collection

Limitations:

- I2C protocol noise
- Collisions

Advantages:

- Fast, easy data
- All components on-hand





Data Collection

Preliminary Results



Relative Carriage Acceleration



Data Collection: Current progress



Determining proper gauges and materials



data

Pursuing strain gauge



LOTS of research

Validation

- Build a Full-scale prototype
- Full functionality
- Limited options for free forklifts





Project Budget

5	
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Capstone Project Budg	get Templa	te - Fall/	Spring					_		_			
Project:			_	_				_		_			
Last Updated	11/8/2020												
			1		Yea	t.					Item		
Expense Items	Sept	Oct	Nov	D	ec	Jan	Feb	Mar	Apr		Total		
Equipment/Tools:			1										
Strain Measurement		\$ 43	-							Ş	43		
Equipment/Tools			-										
Travel:	-		-										
			-	-	-					Ş	-		
5				-	1					Ş	3	-	
Supplies / Parts / Services:	2	5	1					2					
			i							\$	2		
Supplies / Parts / Services			1						a	Ş	-		
Fittings			1	Ş	50					Ş	50		
Hoses			1	\$	200					\$	200		
Metal Stock			1	Ş	600					Ş	600		
Hardware			1	\$	75				J	Ş	75		
Nuts and Bolts			1	\$	50					Ş	50		
Hydraulic Pump			-	\$	200					\$	200		
			-							Ş	-		Expenses
												\$ 1,218	Subtotal
Shop Usage (est. Hrs):							22			. 3	Hours		
Shop time		J			1	0-50		1	[]		0		
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		9 0	i		1	i i		8			0		
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			1								0		
			1				Graduate Student Support				1,021	including	fringe
								Shop	Overhead	\$	500		1.000
		1					University Overhead				137	5% of all e	xpenses
									Totals	\$	2,876	\$ 4,000	\$ 1,124
												Budget	Excess



Project Schedule

Capstone Project Schedule																																								
		Project:	Hyste	er Yale	e Carr	iage I	Bound	e Cor	ntrol S	vsten	n																													
— i	Las	t Updated:	10/	10/4/20																														-						
		Year									2020																			2021		_								
		Month		Se	ept			C)ct			Nov				Dec				Jan						Feb			Mar			Apr						May		
Task Description	Duration	Assigned	9/4	9/13	9/20	9/27	10/4	10/11	10/18	10/25	11/1	11/8	11/15	11/22 11	l/29 1	2/6 12	2/13 12	2/20 12	2/27	1/3 1	/10 1	/17 1	/24 1/	31 2,	/7 2/	14 2/	21 2/2	8 3/	7 3/1	4 3/2	1 3/2	8 4/4	4/11	1 4/18	4/25	5/2	5/9	5/16	5/23	5/30
Team Contract			x																												+	+	+						+	
Budget		Conner																																						
Product Requirements																																								
Approval of Requirements							X																																	
Project Schedule							Х																																	
Finalization of Idea																																								
Design Validation Plan									Х																															
Focused Research																																								
Value Proposition										х																														
Basic Mockups																																								
Wikipage											Х																													
Concept Design Review												х																												
Team Member Citizenship													Х																											
Rapid Prototyping																																								
EPO order of Long Lead Parts															Х																									
Detailed Design Review															Х																									
Initial Prototype																																								
Design Expo Registration							1															X																		
Engineering Release of Drawings																									Х												<u> </u>			
Team Member Citizenship																										Х														
Portfolio																												Х												
Wikipage																												х												
Final Prototype																																								
Validation and testing																																								
Complete Prototype Build																																			Х					
UI Design EXPO																																			X					
Booth Display																																			Х					
Technical Presentation																																			X					
Final Reports and Drawings to client																																				x	1			



Questions?