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– Project Summary

- We use sensor equipped gloves to measure the forces associated with cutting concrete with and without the Saw Shoe
- The results show that the overall force experienced in the hands can be reduced by up to 60% in the left hand and 35% while using the Saw Shoe
- The forces translated to the operators back can be reduced by 53% by using the Saw Shoe
- The overall work is reduced by 46% when using the Saw Shoe to cut 6 foot by 6 foot concrete sections

Test Procedure

- A Stihl 510 Concrete Saw was used to cut slabs of poured concrete
- First the test was conducted using a standard saw without the Saw Shoe
- Then the test was conducted using a standard saw with a Saw Shoe Attachment
- Data was collected using a glove outfitted with sensors

Figure 1. Video of the test procedure for the Lones Stone Saw. Cuts were made into a poured concrete driveway both with and without the Lones Saw Shoe.

Data Acquisition

Pressure Mapping Gloves

- Work gloves lined with pressure sensors were worn while cutting with and without the Saw Shoe
- The data output from the pressure sensing gloves shows exactly how much less force is needed to cut with the Saw Shoe
- Data acquisition software generates both visual representations of the forces in each hand as well as numeric data for duration of the cut

Figure 2. Pressure sensors used to line work gloves

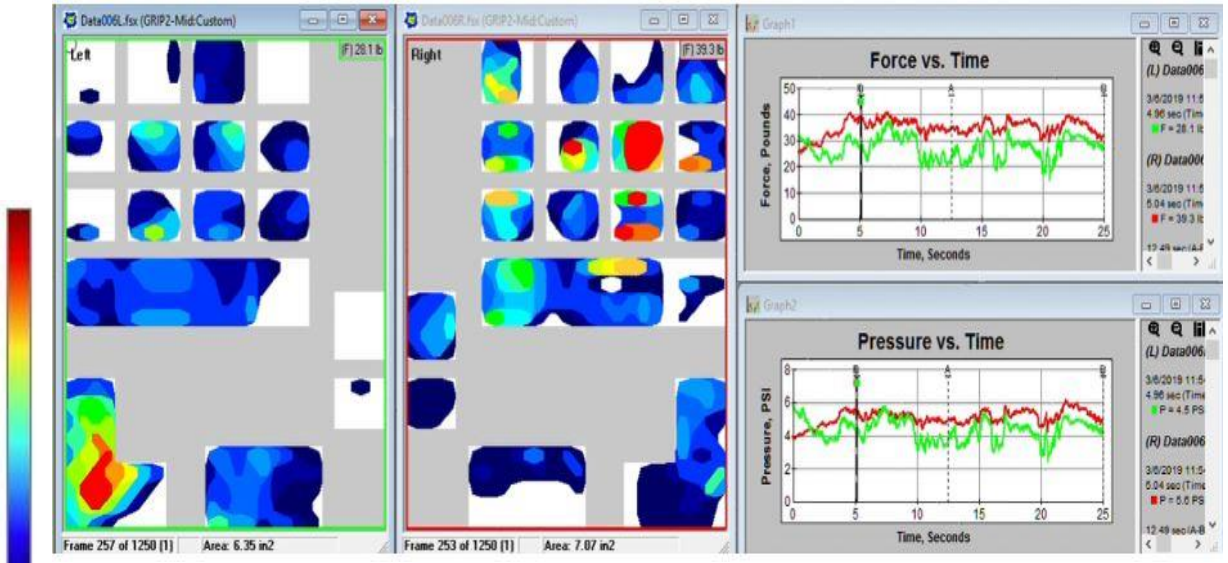
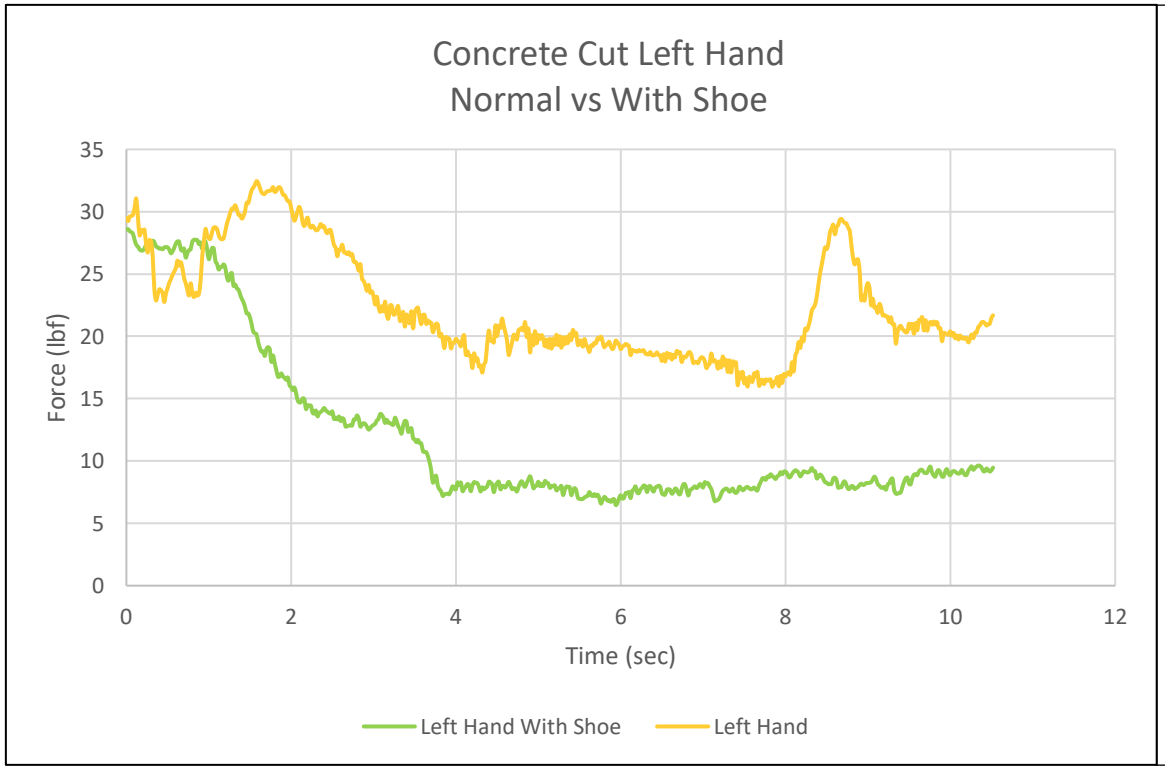


Figure 3. Color mapping of pressure in each hand accompanied by Force and Pressure vs. Time Graphs. This data then used to calculate average forces, remote forces and work.

Example of Raw Data

Average Force With and Without Saw Shoe



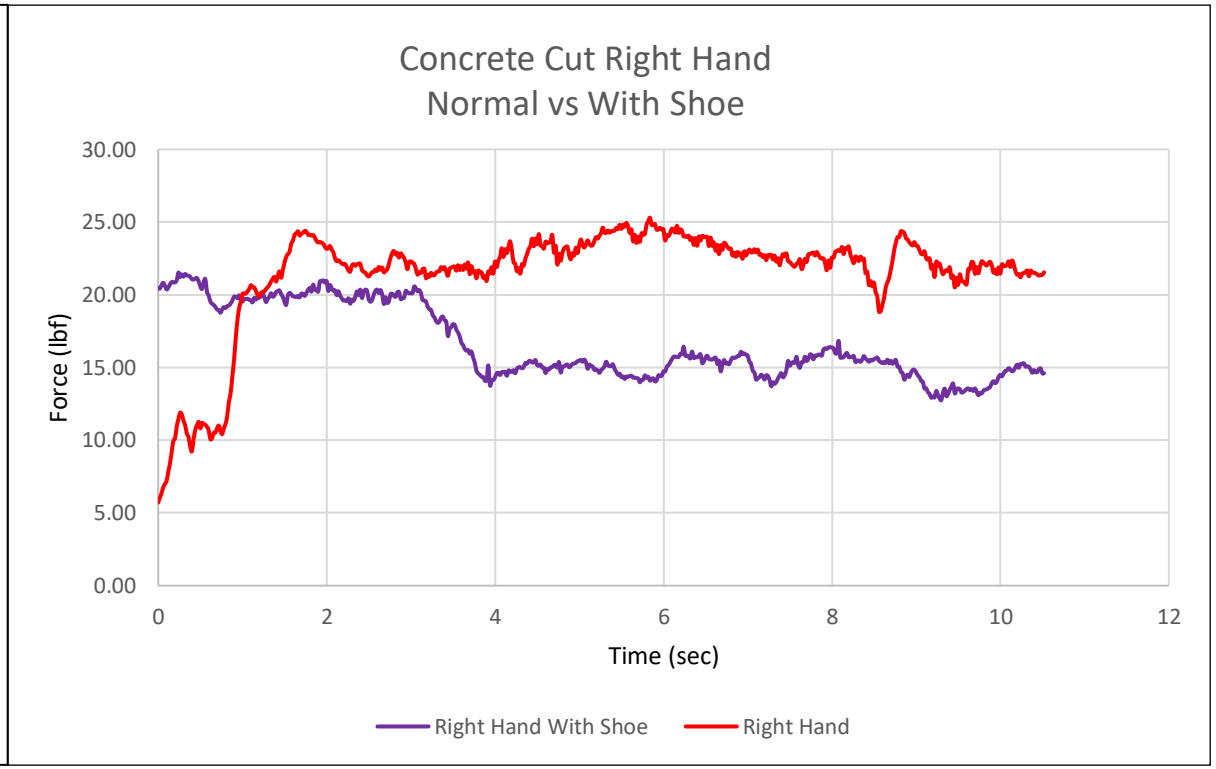


Figure 4. Left hand raw data from testing. Raw data was collected from sensors and used to calculate forces, remote forces and work. Raw data confirms that Left Hand forces are reduced significantly by Saw Shoe

Figure 5. Right hand raw data from testing. Raw data was collected from sensors and used to calculate forces, remote forces and work. Raw data confirms that Right Hand forces are reduced significantly by Saw Shoe

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Results of Cutting Experiments

- The Saw Shoe reduces the grip pressure in both hands during the operation of a handheld concrete saw
- Reduction in that grip pressure results in an overall decrease of force experienced by the back making cutting easier
- The results show that the overall force experienced at the hands can be reduced by up to 60% for the left hand and 35% for the right hand while using the Saw Shoe

Table 1. Average forces generated during cutting. This is a comparison of forces of cutting with and without a Saw Shoe.

Average Force Experienced During Cut			
	No Shoe (lbf)	With Saw Shoe (lbf)	Percent Decrease
Right Hand	22.93	14.96	34.8%
Left Hand	20.06	8.15	59.4%

Saw Shoe

Physical Impact

- During saw operation user is bent over and walking along cut distance
- All the force needed to make the cut translates through the hands into the back
- High strain in this position can potentially cause back pain
- When the Saw Shoe is used the force induced on the back is significantly reduced to 9 lbs Lbf which is a 53% reduction in force.

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Impact in the Field

Less work needed for longer cuts

- Concrete saws are commonly used to make long cuts of 24 ft or longer
- The use of the Saw Shoe significantly reduces the amount of work done while making a cut of the same length

Table 2. Calculating work to cut industrial scale sections. Typical job sites require long cut sections. This work creates significant exposure to injury. Using a Lones Stone Saw reduces the work (force x distance) by 46%.

Sample Calculation: Work required to make long cuts			
Without Shoe		With Lones Saw Shoe	
Total Average Force = 43 lbs		Total Average Force = 23 lbs	
Cut Length = 24 ft	Cut Speed = 0.25 ft/sec	Cut Length = 24 ft	Cut Speed = 0.25 ft/sec
$\frac{24\ ft\ \times 43\ lb}{96\ sec} = 10.75\ \frac{ft\ lb}{sec} = 14.62$ Watts		$\frac{24\ ft\ \times 23\ lb}{96\ sec} = 5.75\ \frac{ft\ lb}{sec} = 7.82$ Watts	
46% less work required when using Lones Saw Shoe			

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Lones Stone Saw: TK000105, Dated April 4, 2019

The Big Picture

Overall Impact on a Day of Work

- When the saw is being used for an entire shift the operator is making 6 hours worth of cuts (8 hours minus lunch, 2 breaks, and efficiency loses)
- During that shift the impact of the Saw Shoe increases

Table 3. Calculating work done in a day. Over the course of a work day an operator will cut up to 5400 feet. The longer a saw is used, the greater difference it makes in the amount of work (force x distance) an operator has to put in.

Sample Calculation: Work required to make long cuts			
Without Shoe		With Lones Saw Shoe	
Total Average Force = 43 lbs		Total Average Force = 23 lbs	
Cut Length = 5400 ft	Cut Speed = 0.25 ft/sec	Cut Length = 5400 ft	Cut Speed = 0.25 ft/sec
$\frac{5400\ ft\ \times 43\ lb}{2160\ sec} = 107.5\ \frac{ft\ lb}{sec} = 146.2\text{Watts}$		$\frac{5400\ ft\ \times 23\ lb}{2160\ sec} = 57.5\ \frac{ft\ lb}{sec} = 78.2\ \text{Watts}$	
46% less work required when using Lones Saw Shoe			

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SAW SHOE