Lones Saw Shoe – Project Summary

• We use sensor equipped gloves to measure the forces associated with cutting concrete with and without the 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 Lones Saw Shoe
• The forces translated to the operators back can be reduced by 53% by using the Lones Saw Shoe
• The overall work is reduced by 46% when using the Lones Stone 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 Shoe
- Then the test was conducted using a standard saw with a Lones 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 Lones Saw Shoe
- The data output from the pressure sensing gloves shows exactly how much less force is needed to cut with the Lones 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 Lones 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 Lones 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 Lones Saw Shoe
Results of Cutting Experiments

- The Lones Saw Shoe reduces the grip pressure in both hands during the operation of a hand held 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 Lones Saw Shoe.

<table>
<thead>
<tr>
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<th>Average Force Experienced During Cut</th>
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<tbody>
<tr>
<td></td>
<td>No Shoe (lbf)</td>
</tr>
<tr>
<td>Right Hand</td>
<td>22.93</td>
</tr>
<tr>
<td>Left Hand</td>
<td>20.06</td>
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</tbody>
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Table 1. Average forces generated during cutting. This is a comparison of forces of cutting with and without a Lones Saw Shoe.
Lones 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 Lones Saw Shoe is used the force induced on the back is significantly reduced to 9 lbs Lbf which is a 53% reduction in force.
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 Lones 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%.

<table>
<thead>
<tr>
<th>Sample Calculation: Work required to make long cuts</th>
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<tbody>
<tr>
<td>Without Shoe</td>
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<tr>
<td>Total Average Force = 43 lbs</td>
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<tr>
<td>Cut Length = 24 ft</td>
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<tr>
<td>Cut Speed = 0.25 ft/sec</td>
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<tr>
<td>(\frac{24 \text{ ft} \times 43 \text{ lb}}{96 \text{ sec}} = \frac{ft \text{ lb}}{sec} = 14.62 \text{ Watts})</td>
</tr>
</tbody>
</table>

46% less work required when using Lones Saw Shoe
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Contact Us
Occam Technology Group
124 South Franklin Street,
Tampa, FL 33602
Email: info@occamtechgroup.com
Phone: (844) 622-2663
Fax: (888) 755-7585
www.occamtechgroup.com