Aren’t helmets hotter than hard hats?
Objective

- To evaluate the internal air temperature for new safety helmets when exposed to a sunny summer day. Evaluation criteria includes: helmet color, helmet air vents, and internal foam liner.
Test Samples

Vented

No Vent

Original

With Foam Liner

Foam Liner Removed
Test Setup

- Test performed from 9:41am until 4:05pm
- Helmets under evaluation were placed on foam head forms
- Temperature readings:
  - Recorded every 1 minute using data acquisition system
  - Type K thermocouples used
  - Placed in the air void between helmet and head form
  - Between strap webbing and foam head form
Test Conditions

- Mostly sunny day
- Max temperature = 92°F
- Average temperature = 88°F
Test Results
Max & Average Temperatures

<table>
<thead>
<tr>
<th>Helmet Type</th>
<th>Max Temperature</th>
<th>Average Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST_Original</td>
<td>94.2</td>
<td>91.2</td>
</tr>
<tr>
<td>White_Foam_No Vent</td>
<td>99.1</td>
<td>99.4</td>
</tr>
<tr>
<td>White_Foam_Vent</td>
<td>87.4</td>
<td>93.2</td>
</tr>
<tr>
<td>Blue_No Foam_No Vent</td>
<td>91.4</td>
<td>97.8</td>
</tr>
<tr>
<td>Blue_No Foam_Vent</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Blue_Foam_No Vent</td>
<td>91.4</td>
<td>97.8</td>
</tr>
<tr>
<td>Blue_Foam_Vent</td>
<td>108.7</td>
<td>108.7</td>
</tr>
</tbody>
</table>

Graph showing temperature readings for different helmet types.
Conclusions

**Foam liners are effective**
- Helmets with a foam liner have a 8-12% lower inside air temp.
- 7-8°F difference for blue
- 7-8°F difference for white

**Air vents are somewhat effective**
- Helmets with an air vent have a 2-3% lower inside air temp.
- 1-2°F difference for blue helmets
- 2-3°F difference for white helmets

**White colored helmets are cooler than blue**
- White colored have a 3% lower inside air temp. (both with foam liner)
- 3°F difference for white helmets
Head Protection Temperature Study

Testing Protocol

- Six Quest Temp 34 Heat Stress monitors (WBGT)
- Six different head protection models
  - 4 helmets
  - 2 hard hats
  - Sponge saturated with 50 mL of water to simulate perspiration and water loss was measured at the end of each testing cycle.
- Internal and external temp. measured over 3 day period
Head Protection Temperature Study

Georgia Tech Enterprise Innovation Institute: Safety, Health and Environmental Services Group

- Results

<table>
<thead>
<tr>
<th>Average Ambient WBGTo - Control</th>
<th>Average External Surface of HH/Helmets</th>
<th>Average Globe - Under HH/Helmets</th>
<th>Average Dry - Under HH/Helmets</th>
<th>Average WBGTo - Under HH/Helmets</th>
<th>Average Grams Water Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>86.3 °F – 87 °F</td>
<td>89.9 °F – 94.7 °F</td>
<td>89.2 °F – 93.4 °F</td>
<td>87.6 °F – 89.4 °F</td>
<td>79.8 °F – 81.6 °F</td>
<td>20.8 g - 32.8 g</td>
</tr>
</tbody>
</table>

![Day 2 - WBGTo graph]

<table>
<thead>
<tr>
<th></th>
<th>Average external Surface</th>
<th>Average Globe internal</th>
<th>Average Dry Internal</th>
<th>Average WBGTo Internal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>94.7</td>
<td>91.3</td>
<td>87.6</td>
<td>79.8</td>
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<tr>
<td>B</td>
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<td>88.7</td>
<td>79.9</td>
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<td>93.4</td>
<td>88.0</td>
<td>81.6</td>
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