Open ventilated booths: which air flow pattern for stone working?

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Content

Air flow patterns
Working operations
Method of assessment
Results
  - Vertical / horizontal
  - Vertical / oblique
Method for guiding selection
Conclusion
Vertical air flow

Open side

Outdoor air
Air exhaust
Horizontal air flow

Air from workshop

Air exhaust
Oblique air flow
Cutting-off
Polishing
Chiselling
Test conditions

- Experimental studies in the field
- 5 booths, supply air velocity > 0.4 m/s
- Soft limestone and marble
- Position of the operator
- Average dust concentrations over 12 or 20 min
  - using a photometer
  - in the breathing zone
Assessment criterion

\[ au = \frac{1}{T} \int_{t_1}^{t_2} (u - u_r) \, dt \]

- \( u \): tension delivered during test
- \( u_r \): tension resulting from ambient dust
- \( t_1, t_2 \): starting and ending times of test
- \( T \): duration of test \( T = t_2 - t_1 \)
Horizontal / vertical flow (1)

The diagram illustrates the analysis of signal (ua) in relation to the position of the operator (1-4) for both soft and hard stone conditions. The x-axis represents the position of the operator, while the y-axis shows the analyser signal. Two types of flow are depicted: horizontal and vertical.

- **Hor. flow**: Represented by red squares.
- **Vert. flow**: Represented by blue diamonds.

The diagram shows a comparison between soft stone and hard stone conditions, with soft stone conditions having a higher signal range compared to hard stone conditions.
Horizontal / vertical flow (2)

- Results for polishing, with a single operator
- Vertical flow more efficient (20 to 200 times)
- Effect of position of the operator
  - V flow: quasi no effect
  - H flow: best position: profile
    - but in front of source or behind ~ equivalent
- Higher dust release with soft and dry stone
Vertical / oblique flow (1)

Analyser signal (ua)

Vert. flow  Obl. Flow # 1  Obl. Flow # 2

Configuration #
Vertical / oblique flow (2)

- Vertical flow: still most efficient solution
- Oblique flow:
  - different for #1 and 2 (2 operators?)
  - higher scattering of results for each booth
  - globally poorer efficiency
  - but far better than horizontal flow
  - more sensible to position and machining procedures
Conclusion

booth with vertical flow more efficient than with horizontal flow in proportion ranging between 20 and 200. In case of large quantities releases,
Method for guiding selection

- Types of flow classified according performance
  - Large number of combinations of 5 parameters
  - Contribution of each to exposure
  - Need of modelling

- “scoring model” based on experimental data
  - Estimated performance rating
  - Compared to threshold limit values
Conclusion

<table>
<thead>
<tr>
<th>Type of flow</th>
<th>Field of application</th>
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<tbody>
<tr>
<td>vertical</td>
<td><strong>Except</strong> for soft dry stone with silica</td>
</tr>
<tr>
<td>oblique</td>
<td><strong>Except</strong> for dry stone with silica</td>
</tr>
<tr>
<td>horizontal</td>
<td><strong>Only</strong> for humid stone without silica</td>
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