The Use of Traditional Materials in Modern Houses: Case Study- Alqassim- Saudi Arabia

Introduction to Alqassim Region

Al-Qassim is located at the heart of the Kingdom of Saudi Arabia (KSA) in the Central region. It is located 26.33 latitude and 43.97 longitude and it is situated at elevation 606 meters above sea level. Buraidah is the capital of Al-Qassim. The region is known for its agricultural value to the KSA. Traditional oasis products of dates, oranges and other fruits are still important.

Contemporary Construction Materials

Modern construction materials might be divided into seven groups: Reinforced concrete slab, beams and columns, hollow block, gypsum board.

Conventional Construction Materials

Traditional construction materials might be divided into eight groups:

1. **Dried mud brick**: Used for wall construction.
2. **Mud layers**: Clay lump used to form a layer.
3. **Stone**: Used for foundations and columns.
4. **Wood**: Tamarix aphylla used to construct roof.
5. **Coral**: Used as a construction material.
6. **Reed**: Used as a building material.
7. **Gypsum**: Used in plastering houses surfaces.
8. **Palm leaves**: Used in roof construction.

Simulation input:
A comprehension study of the performance of both, modern and traditional construction materials used in Alqassim City is presented here in form of simulation results.

Location:
A guest house in Alqassim City-Central Saudi Arabia was chosen as a case study. The houses consist of a sitting room, a kitchen, and a bathroom. The house has a rectangular shape with total area of 60.45m (6.5m*9.3m).

Methodology:
Software simulation using Design Builder to understand the performance of a guest house in Alqassim City in Central Saudi Arabia.

Different envelope systems and different construction materials were tested in this research. The construction materials used are showed in the next tables.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Material Description</th>
<th>R-value</th>
<th>U-factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern</td>
<td>Glass</td>
<td>5.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Modern</td>
<td>Insulation</td>
<td>5.0</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Winter Operational Temperature

<table>
<thead>
<tr>
<th>Temperature Type</th>
<th>Temperature Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside</td>
<td>-10°C</td>
</tr>
<tr>
<td>Inside</td>
<td>20°C</td>
</tr>
</tbody>
</table>

Results and discussion

Operative temperature

Operative temperature is the average of the actual indoor air temperature, radiant temperature, and metabolic heat production. It is a good indicator of comfort for human beings.

The average indoor operative temperature is around 25°C, which is considered comfortable for human beings.

Site and Source Energy

A comparison of the energy gathered over 8300.00 hours for both traditional and modern houses is shown in the figure below.

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Energy Consumption (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern</td>
<td>29.42</td>
</tr>
<tr>
<td>Traditional</td>
<td>31.36</td>
</tr>
</tbody>
</table>

Mud brick were removed from frame to be ready after three days.