A Holistic Ranking of Construction Materials for Marine Environments in the Long Term Future

Steve Kappenthuler¹, Stefan Seeger¹
¹Department of Business Chemistry, University of Zurich

1. Introduction

- Development of new cities and growth of existing cities into megacities
- Rising sea levels threaten major coastal cities and entire island nations
- Global Warming Effects
- Population Growth and Urbanisation

2. Ranking Methodology

**Goal:**
Identify structural materials that are most suitable for sustainable marine construction in the long-term future and identify research areas that may provide significant improvements.

- Durability assessed for materials in splash zone without additional protection methods
- Functional unit for material comparison related to compressive strength

**Ranking Categories:**
- Durability in the Marine Environment
- Economics & Costs
- Life Cycle Events
- Sustainability & Resource Impact
- Future Availability

**Ranking Score:**
- Individual attributes ranked 1-5.
- Values precisely defined for each attribute
- Individual scores aggregated using weighting factors

**Selected Materials:**
- Concrete
- Timber
- Metals
- Composites

**Data Acquisition:**
- Discussions with experts
- Literature research
- Database calculations

3. Material Ranking

<table>
<thead>
<tr>
<th>Attribute Weighting Factors</th>
<th>Highest Ranked</th>
<th>Lowest Ranked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Tropical Materials</td>
<td>Reinforced Concrete</td>
<td>Steel GFRP</td>
</tr>
<tr>
<td>Reinforced Concrete</td>
<td>AAC</td>
<td>Blended Cement</td>
</tr>
<tr>
<td>Steel</td>
<td>DUPP</td>
<td>AAC</td>
</tr>
<tr>
<td>Durability</td>
<td>Steel</td>
<td>Blended Cement</td>
</tr>
<tr>
<td>Resistance to Biological Degradation</td>
<td>Duplex Steel</td>
<td>Blended Cement</td>
</tr>
<tr>
<td>Resistance to Bio-corrosion</td>
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4. Conclusion

Timber as a promising renewable resource may become more important

- Development of strategies for protection of timber from biological attack is essential
- Expansion of managed forests required to ensure sufficient availability of sustainably harvested timber.
- Reinforced concretes and steel are promising materials with widespread availability
- Development of environmentally friendly methods for corrosion protection of steel necessary
- Increased funding and adoption of regulations may enable more widespread application of alternative cement and reinforment types
- Increasing recycling rates is essential to guarantee long-term availability of all materials
- Policy measures required to improve waste collection processes and recycling infrastructure
- Technological developments necessary to allow for separation of individual material constituents

5. Outlook

Application of framework to materials including protective coatings

- Evaluation of sustainability and long-term potential of different approaches
- Prioritize proposed R&D projects
- Addition of newly developed materials to the ranking
- Compare overall performance with established materials
- Assess competitive potential early in development process
- Adoption of framework to other cases and environments
- Expansion of holistic method to other types of construction