Selection of raw material for a demanding wooden façade and the quality control of timber from harvesting to construction site

Introduction

- How wood material properties develop in respect to growth site specific variables?
- What are the possibilities of optimizing raw material selection for timber façades?
- How is the high quality retained throughout the production process – from production to installation?

Background of study

- Largest timber cladding project in Finland: Central Library of Helsinki
  - Problem: Straining factors in claddings are well studied; timber selection and properties against strains not precisely known
  - Development for quality control process for high quality timber claddings was required

Raw material selection

- Timing the felling season provides only limited benefit
- Optimal growing rate multivariable problem:
  - Too narrow year growths causes high cracking tendency
  - Too wide year growths indicate more knots and grain direction distortions
  - Semi-wide year growths decrease cracking tendency: suggestion 1.5 – 5mm

Timber production

- Drying procedure is crucial for quality formation
- Radial sawing is an effective method to promote the quality of cladding timber (see Figure 1)

Quality control

- Quality control process was developed (Figure 2 and Table 1)
- Moisture management in the supply chain is crucial, especially in on-site operations

Figure 1. Checking performance of radially (R) and tangentially (T) sawn Scots pine and Norway spruce wood. (Venäläinen et al. 2016)

Figure 2. A schematic overview of the quality control process for manufacturing a timber façade.

Table 1. An example of quality controlled parameters in façade manufacturing process.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Control document</th>
<th>Inspector</th>
<th>Supervisor</th>
<th>Control parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber production</td>
<td>1.0 &quot;Production quality control QC&quot;</td>
<td>Manufacturer</td>
<td></td>
<td>Drying, sorting, moisture control, packing and storing</td>
</tr>
<tr>
<td>Timber procurement</td>
<td>2.0 &quot;QC of procurement QC&quot;</td>
<td>Recipient</td>
<td></td>
<td>Packaging and sorting, handling defects, timber species, quality class, drying result, moisture control, grading, average width and angle, profile, fibre cells, dimensions, knots, cracks and checks, deformations</td>
</tr>
<tr>
<td>Coating / preservation</td>
<td>3.0 &quot;Coating QC&quot;</td>
<td>Surface finisher</td>
<td></td>
<td>Coating / preservation procedure, color and tone, fire resistant application, thickness and penetration of coating, chemical compatibility, coating of cut surfaces, stabilization, moisture control, packing and storing</td>
</tr>
<tr>
<td>Assembly of façade (unit or element)</td>
<td>4.0 &quot;Manufacturing QC&quot;</td>
<td>Assembler / Installer</td>
<td></td>
<td>Packaging and sorting, handling defects, moisture control, coating / preservation, color and tone, fire retardant, chemical compatibility, coating of end surfaces, stabilization</td>
</tr>
<tr>
<td>Installation of element</td>
<td>5.0 &quot;Installation QC&quot;</td>
<td>Element installer</td>
<td></td>
<td>Type of connectors, fastening and fastener distances, fastener induced cracks, fastener groups and rows, mounting, board extensions, accessories, tolerances, lifting round and span, moisture control, packing and storing</td>
</tr>
<tr>
<td>Acceptance inspection</td>
<td></td>
<td>Independent QC of the client</td>
<td></td>
<td>Installation, coating, defects</td>
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</tbody>
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