SUPER LIGHT STRUCTURES

PROJECT
The project is based on the Veijleford bridge, which is a cantilever concrete bridge, connecting Malmö on the southern side of Veijleford with Narremarken in north. The bridge functions as a part of the highway running from north to south in Jutland, running east of Vejle. It spans 1712m, is 28.7m wide and has 110m between the pillars. The main purpose of this project is to compare the original bridge with a similar bridge constructed in superlight concrete. The comparison is divided into two parts. First we have estimated the bearing capacity for the old bridge. Then we constructed the super light bridge using the same load. The second part is a comparison related to the price, CO2 and weight between the original bridge and the new super-light bridge.

COMPARISON
The overall comparison shows that the superlight concept in our case both has some advantages and concerns. Seen from an architectural point of view the super light bridge looks bigger and heavier. Some dimensions are nearly doubled. This is a concern.

On the positive side we believe that the bridge looks more interesting when seen close up. On the other hand, the price, the CO2 emission and the weight is very profitable.

The super light bridge is advantageous because of the significant lower price (27.7%), lower CO2 emission (18.7%) and lower weight (38.3%) compared to the original bridge. The data for the bridges is listed below.

<table>
<thead>
<tr>
<th>Comparison of the four types of bridges</th>
<th>CO2 emission [ton]</th>
<th>Price [mio.DKK]</th>
<th>Weight [ton]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original bridge (without pillars)</td>
<td>17.678</td>
<td>965</td>
<td>103.040</td>
</tr>
<tr>
<td>Super light bridge (span=110m) (without pillars)</td>
<td>14.542</td>
<td>65.4</td>
<td>60.905</td>
</tr>
<tr>
<td>Super light bridge (span=220m)</td>
<td>20.430</td>
<td>95.311(WF)</td>
<td>100.332</td>
</tr>
<tr>
<td>Super light bridge (span=340m)</td>
<td>27.843</td>
<td>136.18(WF)</td>
<td>130.529</td>
</tr>
<tr>
<td>Super light bridge (span=340m)</td>
<td>8.652</td>
<td>44.27(WF)</td>
<td>41.479</td>
</tr>
</tbody>
</table>

CONCLUSION
The conclusion for the comparison between the bridges is that it is possible to build a greener and cheaper bridge when using super light concrete. The biggest advantage comes when optimizing the dimensions of the arches as makes it possible to build a bridge with only half the cost, half the CO2 emission and half the weight.

LESS CONCRETE
CHEAPER
OPTIMIZATION
SUBSTAINABILITY
LESS CO2 EMISSION

SUPER-LIGHT
The basic idea of super-light structures is to build a skeleton of a strong material interacting with a stabilizing layer of a light material.

The light material is usually much cheaper than the strong. It shapes the shape of the structure and applies the load on the skeleton, which is often curved to be optimized. It protects the strong material of the skeleton from impacts and fire, and it prevents it from buckling, which typically increases the load-bearing capacity of the skeleton 4 times. [1]