Cellular Lightweight Concrete (CLC)

Al Ruwad LeycoChem LEYDE – Iraq

Tel.: 07813802151; 07708748222; 07504344200
Email: sales.leycochem.iraq@leyde.com
www.leyde.com
What is CLC?

CLC is conventional concrete, where natural gravel is replaced by air, embedded in stable and bio-degradable, organic foam which has no chemical reaction.

NEOPOR® Cellular Lightweight Concrete (CLC) has been developed and used successfully over 40 years, producing more than 600,000 buildings, using lightweight blocks and prefab complete buildings in situ in more than 50 different countries. Many public and private buildings as well as increasing number of complete towns are being constructed almost completely in CLC. NEOPOR® CLC is the only air-cured cellular concrete that has been approved by authorities in different countries for structural, steel-reinforced application. It has been developed in co-operation with different major German chemical and construction companies. A wide scope of new products and applications were developed and patented, the same as new equipment and technologies.

How to produce CLC: Except for the NEOPOR® foam generator to produce and dose the foam by exact volume, and for the necessary foaming agent, CLC is produced like ordinary concrete, even utilizing otherwise traditional (locally available) equipment, such as mixers (even truck), hoppers, concrete pumps and moulds. CLC hardens within the same timeframe. Hardening happens by the temperature developed by the cement used and curing by humidity, just as conventional concrete. Although CLC does not require vibration - at least not to increase the density of the mix-which is liquid anyhow, vibration of horizontally produced panels will show an even better surface, drawing the cement slurry to the mould side.

CLC increases its strength infinitely under atmospheric conditions and therefore does not have to be protected against humidity.
Benefits of NEOPOR® CLC – The Genuine System

As the world leader in Cellular Lightweight Concrete (CLC), the NEOPOR® System offers the construction of maximum houses at minimum cost, simple and fast to produce with manifold benefits compared to conventional concrete, such as:

- Optimum thermal insulation (From 500 to 700 % over conventional concrete) *
- Substantial weight reduction (dead-load)
- Highly increased fire rating
- Maximum sound absorption
- Fast progress in construction
- Saving in raw material (no gravel required)
- Savings in steel reinforcement in high rise
- Savings in transportation (double payload by volume)
- Savings in craning (less re-location, larger panels )

* In hot countries such as Iraq, Thermal Insulation is a MUST. Walls and roofs should be insulated to avoid huge energy waste and at the same time to live in a comfortable cool/warm climate.

Equipment and Foaming Agent needed

- Conventional mixer and truck mixers
- NEOPOR® MFG-A fully automatic foam generator
- Moulds to pour the concrete into
- NEOPOR® Foaming agent

Foaming Agent

Organic and bio-degradable material, which has no chemical reaction but serves solely as wrapping material for the air to be en-capsuled in the concrete. It is supplied in sealed plastic barrels containing 200 kg. of highly concentrated NEOPOR® foaming agent which has to be diluted in 40 parts of water before using it, this will be done automatically by the foam generator. One barrel is sufficient to produce 200 m³ of CLC in density 1,200 kg/ m³.

Major Products and Applications of NEOPOR® CLC

- Void filling for thermal insulation
- Floor & Roof slabs prefab and cast in situ
- Floor Screed
- Partitions pre-cast and in situ
- Vertical walls cast in situ or by NEOPOR® blocks
- Hollow core walls in prefab
- Facades prefab and cast in situ

Demo-House by NEOPOR in New Orleans, USA
NEOPOR® CLC Blocks: Different methods of producing & casting CLC blocks

1. One mould – one block
2. Cutting by wire
3. Cutting by saw blade

Simple NEOPOR moulds, produced locally to desired dimensions. No screws used, hence fast manual assembly stripping, easy cleaning, multiple cycles every 24 hours. Can be “glued” due to accurate measurements given by the mould. Requires releasing agent. No waste.

Large “cakes” of CLC are poured in moulds to be cut to desired dimensions (2) by wires in a soft state and (3) by saw blades in hardened state. Moulds for the large cake are oiled for easy stripping. The skin facing the oily moulds is cut away to safeguard proper adhesion of paint or plaster. No waste as all cut-away is recycled 100%!

Blocks on Tsunami project in Thailand  Manhandling and sawing blocks  Easy application & proper masonry work

CLC Blocks used for voids filling
## Recommended Mix Design to produce 1 m³ of CLC

**Oven Density in KG/m³**

<table>
<thead>
<tr>
<th></th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
<th>1400</th>
<th>1600</th>
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</thead>
<tbody>
<tr>
<td>Sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td>300</td>
<td>310</td>
<td>320</td>
<td>350</td>
<td>360</td>
<td>380</td>
<td>400</td>
</tr>
<tr>
<td>Water in Mortar</td>
<td>110</td>
<td>110</td>
<td>120</td>
<td>120</td>
<td>140</td>
<td>150</td>
<td>160</td>
</tr>
<tr>
<td>Quantity in Foam</td>
<td>800</td>
<td>715</td>
<td>630</td>
<td>560</td>
<td>460</td>
<td>370</td>
<td>290</td>
</tr>
<tr>
<td>Water in Foam</td>
<td>64</td>
<td>57</td>
<td>50</td>
<td>45</td>
<td>37</td>
<td>30</td>
<td>23</td>
</tr>
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**2350 Conventional Concrete**

<table>
<thead>
<tr>
<th></th>
<th>1950 (gravel+sand)</th>
<th>320</th>
<th>180</th>
<th></th>
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</thead>
</table>

| Wet Density | kg/m³ | 474 | 687 | 890 | 1075 | 1287 | 1510 | 1683 | 2400 |
| Foaming Agent | kg | 1.5 | 1.4 | 1.2 | 1.1 | 0.9 | 0.7 | 0.6 |     |
| Water/Cement Ratio | 0.58 | 0.54 | 0.53 | 0.47 | 0.49 | 0.47 | 0.46 | 0.56 | 0.56 |
| Maximum Strength | N/mm² | \~1 | \~2 | \~3 | \~4 | \~8 | \~12 | \~18 | 25 + |
| Average Lambda | W/m x K | 0.096 | 0.18 | 0.21 | 0.32 | 0.405 | 0.45 | 0.55 | 2.1 |

Achieved strength at the lab with optimum sand and cement qualities. More cement will increase strength.

**General Remarks**

- **Recommended weight of Foam:** Minimum 80 g/ltr.
- **Water to process foam:** Potable, if possible below 25° C
- **Recommended Cement:** Portland CEM I 32,5R or higher grade
- **Recommended Sand:** Washed river sand, Density/Sieve: Up to 1000/ up to 2 mm
  Up to 1200/ up to 4 mm
  Up to 1400/ up to 5 mm
  Up to 1600/ up to 6 mm

Crushed Sand might mechanically destroy part of the foam.

1 kg of NEOPOR® agent, yields approx. 510 liters of foam at 80 grams/liter.
The Ideal Roofing Solution in Iraq…… Neopor® CLC for Floor Screeding & Leyco Tile System

Heavy concrete tiles are being used in Iraq long time ago as a conventional, simple and economical solution for buildings roofing. Yet, the practical experience shows a number of disadvantages related to using the conventional concrete tiles for roofing. Such as:

1- High cost on the short term as well as the long term due to the annual maintenance needed for this type of buildings roofing.
2- No heat insulation with high loss of energy.
3- Mastic is used for the joints and must be replaced annually.
4- Buildings are exposed to high and continuous humidity.
5- Extra and unnecessary loads on the construction due to the heavy concrete tiles used.
6- Poor quality of concrete tiles available in local markets.

Any alternative solution?

International researches conducted during the past years, led to producing new materials for building and roofing through which all the disadvantages occur by using the conventional roofing materials have been eliminated for the beneficiary of Human beings and also the improvement of construction field.

Leyco Tile is one of the newly produced materials used instead of the concrete tiles as the most ideal solution for roofing in Iraq and the Middle East where temperature varies extremely.
A Leyco Tile consists of two layers: 1 cm topping of high strength special mortar and a lower layer of 3-5 cm high density extruded Polystyrene. Extruded closed-cell Polystyrene is used for more than 50 years in construction. It does not absorb water, does not rot and is ideally used for inverted roofing.

NEOPOR® CLC is the best completion to this type of roofing system if used as a screed layer underneath the Leyco Tile system. It saves up to 72% energy in winter and summer seasons.

Advantages of Leyco Tile roofing System:

1- Heat Insulation in hot and cold seasons.
2- Accessible Roof: The topping of Leyco Tile is made of high strength polymeric concrete laminated to extrude polystyrene foam which accepts a load of 6000 kg/m2. You can use your roof as before.
3- Light weight of Leyco Tiles to avoid extra loads on the buildings’ roofs.
4- Fast and easy application and replacement.
5- Annual maintenance is not required, unlike the conventional Concrete tiles.
6- The use of Mastics or any sealants for joints between tiles is not required.
7- Small and appropriate size of Leyco Tile (30x30) cm.
8- Leyco Tile protects against UV-radiation which shortens the life time of other roofing materials.
9- Drainage channels in Leyco Tile allow quick drying and aeration

For more details about the Leyco Tile roofing system, please review our (Leyco-Tile) brochure