Bio-Active Wall Tiles
Lev Levontin, Tel Aviv

In Short

Urban sprawl calls for innovative green solutions that reduce the ecological footprint of concrete based infrastructure like buildings, retaining walls, and acoustic barriers. As opposed to typical green roofs and green wall systems that usually demand elaborate, highly maintained systems, ECOncrete® has developed a Bio-Active concrete tile that doubles as a highly aesthetic decorative façade and a bio-enhanced substrate that supports the growth of mosses, lichens, and climbing vegetation.

The product was chosen to be installed on a high end, mixed-use commercial/residential project at the heart of Tel Aviv called Lev Levontin. The Bio-Active wall composed of tiles and planter units was installed on a south facing wall of the building’s luxurious patio. ECOncrete®’s Bio-Active wall Tile create a highly aesthetic green façade capable of reducing the overall ecological footprint of concrete walls by increasing plant diversity, improving air quality and energy efficiency, and reducing both noise and urban heat pollution.

<table>
<thead>
<tr>
<th>Location</th>
<th>Product used</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lev Levontin</td>
<td>Bio-Active Wall Tiles</td>
<td>2016</td>
</tr>
<tr>
<td>Tel Aviv, Israel</td>
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Figure 1 - Lev Levontin building’s entrance patio
Project Description

The ecological footprint associated with accelerated urban growth is growing rapidly. As a result, in recent years there is a growing demand from developers to incorporate innovative green technologies into their designs. Technologies for green roofs and walls are in demand as they offer an opportunity to provide an environmental uplift to dense urban areas. ECOncrete® has developed the Bio-Active concrete tile to enhance the growth of mosses, lichens, and climbing vegetation. The cumulative effect of a unique chemical composition, increased surface rugosity, and a complex 3D design make the Bio-Active tiles significantly superior to standard Portland cement based concrete tiles commonly used as building facade.

The Bio-Active Wall Tiles and planter units (Figures 2 & 3) have been installed in a high-end, mixed-use commercial/residential project at the heart of Tel Aviv, called Lev Levontin. This exclusive six-story building, was constructed following Green Building Standards in Israel, and utilized the latest construction technologies. The building's entrance patio, planned by Studio Urbanof, which provides a peaceful and green transition from the busy street, includes a 1,100 ft² (ca. 100 m²) ECOncrete® Bio-Active Wall composed of 1 ft² (ca. 930 cm²) wall tiles and planter units (Figure 1). This south facing Bio-Active Wall is predominantly shaded, and supported by drip based irrigation to the planters and along the entire wall top. The planters present the same complex 3D design as the wall tiles, thus integrate perfectly into the wall facade, while enabling integration of a wide variety of plants. They can be applied in any desired density helping to control the amount of plant life covering the wall, and can be used in architectural design to double as a lighting fixture. In the Lev Levontin project, the wall vegetation includes naturally recruited mosses and lichens, and planted with the following species: Ficus pumila, Hedera helix, Viola hederacea, Sutera bacopa, and Parthenocissus quinquefolia.

Figure 2

Figure 3
ECOncrete®’s Approach

The design of ECOncrete®’s Bio-Active Wall Tiles incorporated environmental and structural considerations. The innovative tiles defer from standard concrete units on three levels; concrete chemistry, surface rugosity, and 3D macro-complexity. These three elements work in synergy to mimic features of natural surfaces thus enhancing the wall’s ability to support rich flora of predominantly plants that require little or no soil. With the proper levels of light, moisture, and nutrients these plants can thrive directly on the Bio-Active Wall surface. ECOncrete®’s unique Bio-Active Wall mix was tailored to keep the water accumulating on the concrete surface in appropriate conditions for biological development as opposed to water retained on standard concrete mix. As a result, mosses, lichens as well as climbing plants can effectively utilize the water on the wall and flourish.

ECOncrete®’s Bio-Active wall helps decrease the ecological footprint of urban development by:

- Promoting high plant diversity and coverage on the structure’s façade.
- High foliage cover captures pollutants from the air.
- Contributing to air quality through oxygen production of enhanced plant coverage.
- Absorption and reduction of atmospheric CO₂.
- Acting as a passive acoustic insulation.
- Enhanced foliage cover serves to absorb solar radiation.
- Increasing energy efficiency of the structure’s envelope.
- Increasing the overall aesthetics of the structure.
Key Findings

Approximately a month after planting, the wall started developing noticeable plant coverage surrounding the planter units. As little as three months post planting, mosses started colonizing the wall, covering from few centimeters up to over half a tile in certain cases (Figure 5). The wall’s contribution to reducing diurnal temperature changes is significant, with the surface temperatures on dry ECOncrete® Bio-Active Wall Tiles lower by an average of 7.6° C than a control wall (Graph 1, Table 1). This trend is more significant with plant covered, moist ECOncrete® wall tiles (Graph 2, Table 2), which present temperatures of up to 13.2° C lower than the control wall. As the project monitoring continue, farther studies are preformed, aimed at quantifying percent plants cover, thermal effect, contribution to air quality, and the diminishing of noise pollution.

Table 1. Summary the data from graph 1

<table>
<thead>
<tr>
<th></th>
<th>Average Temp (°C)</th>
<th>ECOncrete®</th>
<th>Control</th>
<th>Δ (°C)</th>
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<td>28.1</td>
<td>0.4</td>
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Table 2. Data summary from Graph 2.

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<th>ECOncrete®</th>
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<tbody>
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Facilitating Green Certifications:

The first Israeli office building to receive a Gold LEED certificate, the Azouri Eco-Tower (2012, Tel Aviv, Israel), gained LEED innovation points for its ECOncrete®’s Bio-Active Wall installation.

Bringing concrete to life:

An installation that utilized ECOncrete®’s Bio-Active tiles for the construction of a biological pond and fountain at commercial project (BIG mall, Ashdod, Israel), demonstrated the ability of the tiles to receive rich and diverse foliage, and mimicking natural waterfall/spring plant life in an urban setting.

Secret Sunken Garden:

In a closed to the public governmental building, a 250 m² installation of ECOncrete®’s Bio-Active Wall Tiles transformed the building’s library, confined one floor below the street level and surrounded by featureless gray concrete, into a vertical sunken garden. This allowed readers and users to enjoy a beautiful, low maintenance green space.

Carbon Footprint Reduction

Due to a combination of ECOncrete®’s proprietary admix integrating by-products and recycled materials, and the unique ability to enhance biological processes such as photosynthesis which facilitate CO2 assimilation, the carbon footprint of ECOncrete®’s Bio-Active Wall Tiles is reduced by up to 86%, compared to Standard Portland cement based concrete.
**ECOncrete® Company Profile**

ECOncrete® offers a suite of environmentally sensitive concrete solutions designed to encourage biological productivity on urban and coastal marine infrastructure, such as coastal and riverine erosion control structures, urban waterfront developments, marina’s and ports. ECOncrete® provides; bio-enhanced concrete admixtures suited for different aquatic environments; custom forms & form liners for creating complex textures and science based design features; as well as a unique line of precast ECOncrete® elements. All of ECOncrete® products serve to elevate the functionality of local ecosystems, while providing the structural performance required of urban, coastal, and marine infrastructure. To date, ECOncrete®’s innovative technologies have been implemented towards the design and fabrication of precast seawalls, armoring units, tide pools, marine mattresses, terrestrial bio-active wall tiles, and on-site casting. ECOncrete®’s extensive and continuous R&D efforts, coupled with expert environmental and technical consulting allows for the creation of unique solutions for the development of all types of urban, coastal and marine infrastructure projects. ECOncrete® personnel have the capability and expertise to tailor products and designs based not only on the project’s specific needs, but also for optimal ecological performance in different marine environments. As such, ECOncrete® provides complete project services, from initial planning and site assessment, through detailed design and product fabrication and supply, as well as installation procedures and post installation monitoring.

**ECOncrete® Services**

- **PR services**
  - Assistance with and development of project ecological collaterals
  - Community outreach and education
  - Publications (scientific/popular)

- **Project Specific Product Development**
  - Product Customization following structural and biological requirements
  - Schematic design and full product specifications

- **Consulting and Design**
  - Preliminary environmental assessment
  - Conceptual design for ecological enhancement
  - Support in working with regulators and permit facilitation

- **Supply of Materials and Products**
  - Precast units
  - Form and form liners
  - Admixtures

- **Installation supervision**
  - Guidance and installation coordination with contractors
  - Quality assurance of fabricated units, and site placing

- **Post Installation Monitoring**
  - Biological monitoring of flora and fauna
  - Scientific project reports