

Further information
Skanska AB
www.skanska.com

Contact
Noel Morrin,
SVP Sustainability &
Green Support
noel.morrin@skanska.se

Puuvilla Shopping Center, Finland

Case Study 132

Aspects of Sustainability

This project highlights the following:

Green Aspects

- Energy
- Carbon
- Materials
- Water
- Local Impacts

Social Aspects

- Human Resources
- Corporate Community Investment
- Business Ethics
- Health and Safety

Puuvilla is a large shopping center and commercial development in Pori, southwestern Finland, which uses around half the energy and water of a typical newly built Finnish retail building. The development is designed to LEED Gold and won a prestigious global BIM award for its innovative use of modeling during design and construction.



Photo by Johanna Sjövall



“I am extremely proud of what we have accomplished on this unique project that has created a town center for public services, shops, culture, education, administration and leisure. The project combined historic industrial buildings with energy efficiency and state-of-the-art technology. Puuvilla is of outstanding quality and the way the project partners worked closely together was a key to the project’s success.”

- Niina Rajakoski, Construction Manager, Ilmarinen

Project Sustainability Highlights

Economic

- Financial savings due to 50% energy and water savings

Green

- 50% **Energy** savings compared with Finnish Code
- 95% of construction waste was diverted from landfill
- Extensive use of Finnish M1 standard (low emission) materials
- 50% **Water** savings compared with conventional retail development in Finland

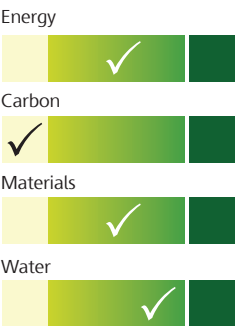
Social

- No Lost Time Accidents on site

Project Introduction

Puuvilla is a shopping center and commercial development in the southwestern Finnish city of Pori. The development is situated to the north of the Kokemäenjoki River in central Pori, and has created a lively new urban quarter that offers various services and amenities. Puuvilla was once a large cotton mill, and the project has incorporated some buildings dating from the late 1800s that are on the Finnish National Board of Antiquities’ list of Nationally Important Built Environments. The vision is to develop Puuvilla into a new neighborhood for living and working in the wider Satakunta region that offers high quality facilities, not only for retail but also for office space, educational activities, cultural events and government functions.

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Skanska was the general contractor of the US\$ 140 million project, which was developed in close cooperation with the clients Renor Oy property investment company and the Ilmarinen Mutual Pension Insurance Company. Puuvilla is a three-story 76,400 m² development that includes 32,000 m² of retail premises, a 6,000 m² supermarket, a 5,400 m² health center (not renovated during the project), 3,400 m² of office space and 2,200 m² of restaurants. The remaining floor area includes 22,000 m² of common and technical spaces. The project renovated and combined 11,300 m² of existing old cotton mill buildings with 59,700 m² of new buildings of modern Scandinavian character. The retail premises include many smaller specialist stores, cafes and galleries set in pleasant promenades, which creates a rich shopping atmosphere. Offices of various sizes are located on the second and third floors, and include spacious loft spaces. The development also includes a 14,100 m² car park with 2,000 car parking spaces. Puuvilla was built on 3,000 reinforced concrete piles, and the frame consists of reinforced concrete pillars with interconnecting steel pillars and beams. The shopping center was completed in the autumn 2014, and attracts around 15,000 daily visitors and employs around 800 people.

BIM (Building Information Modeling) was used throughout the design and construction of the development to integrate the existing structures, manage the tight construction schedule and develop the complex design over time. Laser scanning was used to accurately model existing structures, and create a base for the design. A mobile application was used with electronic tablets to help the various project partners visualize and develop the project. BIM will also be an important facilities management tool throughout the operation of the shopping center as the model contains a vast amount of information about the specific materials, systems and fittings installed within the building.

The project was designed to meet LEED (Leadership in Energy and Environmental Design) Gold certification (Core & Shell). LEED is a voluntary U.S. Green Building Council (USGBC) certification process intended to encourage and guide the construction of green buildings. The project won the “Best BIM Project” award at the Tekla Global BIM Awards in 2013. The Puuvilla project was also awarded the “piling project of the year award” by the Finnish Concrete Industry Association for the project’s excellent organization and cooperation between project partners.



Contributing Toward Sustainable Development

Puuvilla is designed to use approximately 50 percent less energy and water than a conventional newly built Finnish retail building built to national regulations, which ensures significant financial savings throughout its lifetime. A geothermal system provides around 80 percent of the development’s total heating and cooling demand. The building promotes healthy indoor environments and environmentally responsible materials were used throughout the building, including the use of Finnish M1-classified materials. The project contributed toward sustainable urban development by redeveloping an old industrial site in central Pori into a new urban quarter and by promoting more sustainable modes of transport. During construction, the team carried out a comprehensive stakeholder communication program, and thorough safety planning and procedures ensured that no accidents occurred on site. 95 percent of construction waste was diverted from landfill and demolition waste was minimized by reusing existing structures and materials on the site. The project benefitted the regional economy by contracting workers, contractors and suppliers from the Pori area.



Green Aspects

Energy

Energy efficiency

The development is designed to annually use around 123 kWh/m², which is approximately 50 percent less primary energy than the Finnish requirement for retail buildings (240 kWh/m²). The building has a well-insulated envelope and the renovated buildings were made more energy efficient, including the installation of windows with a U-value of 0.8 W/m²K. The ventilation system is optimized by carbon dioxide and temperature sensors, and is automatically switched off during the night. The air handling units automatically switch to nighttime cooling mode when conditions allow, which uses relatively cool outdoor air to cool the shopping center. The shopping center's air handling units recover around 75 percent of the energy from outgoing air on average. The BIM model was used as the basis for the energy simulations.

Puuvilla's HVAC (Heating, Ventilation and Air Conditioning) equipment, including the heat pumps, refrigeration equipment, Air Handling Units and the district heating plant, underwent three phases of thorough commissioning to ensure their optimal operation. Individual pieces of equipment first underwent factory testing, before being installed and tested together with the Building Management System to identify and mitigate any defects, and verify they worked correctly. The third phase of commissioning involved real operation situations to fine-tune and ensure the systems functioned optimally together. Following commissioning, the project team organized optimal building management training for the property staff.

In addition, the automation contractor will work to optimize the equipment during operation over an initial 2-year period, together with other project contractors, in order to ensure the system operates as efficiently as possible.

Geothermal energy system

The development has a geothermal energy system that provides approximately 80 percent of its heating and cooling. The system consists of 94 energy wells that are around 300 m deep, and includes 140 km of geothermal piping in total. The system is connected to three heat pumps that provide space heating and cooling, and a separate heat pump that produces hot water. During the summer, the geothermal system sources cooling from the relatively cool energy wells. The system provides heating during the winter by sourcing energy from the relatively warm energy wells.

Materials

Environmentally responsible materials

All adhesives, sealants, paints and coatings were low-emitting and low-VOC materials according to LEED criteria. The majority of the materials used indoors were also M1-classified, which is a voluntary Finnish standard for low emissions that demands less than a total VOC (Volatile Organic Compound) value of 200 micro g/m²/hour. Around 7 percent of the total construction materials (by cost) were recycled materials, including the use of foamed glass in the foundations, steel structures and the insulation. Existing buildings and structures were retained and incorporated into the project where possible, which promoted resource efficiency.

Waste management during construction

Around 95 percent of construction waste was diverted from landfill. Skanska worked closely with the local waste management company to identify opportunities to divert waste from landfill. For example, plasterboard off cuts were sent back to the local plasterboard supplier to be reused back into their manufacturing, which was the first such initiative in Pori. The waste management company also carefully sorted mixed construction waste.

Demolition waste was reduced by reusing existing structures on the site where possible, including buildings, walls and existing wooden piles.

Demolition waste was also diverted from landfill by directly incorporating it into the project where possible, for example by reusing bricks, and crushing and using demolition waste as fill material on site.

Water

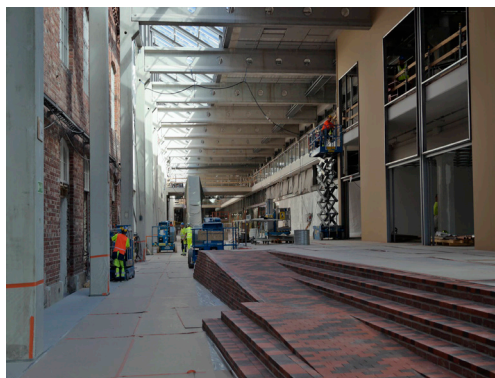
Water efficiency

Puuvilla uses around 50 percent less water than a conventional newly built shopping center in Finland. Low-flow faucets and showers, waterless urinals and dual flush toilets were installed throughout the building. In addition, faucets are equipped with sensors to avoid unnecessarily wasting water, and the project uses no water for landscape irrigation. Skanska Finland has used Puuvilla as a pilot project for its new water baseline tool, which will be used to make water efficiency savings on future projects.

Other Green Aspects

Minimizing environmental impacts of construction

Good practice measures included special attention to monitoring the cleanliness of the site to reduce the risk of environmental damage. The site was divided into housekeeping sections, which were routinely inspected to ensure that contractors maintained site standards.



Any non-conformances were reported using a mobile application and the contractor was requested to quickly remediate the issue.

Raising awareness of more sustainable buildings

The team held numerous site visits for a variety of stakeholders to raise awareness of more sustainable buildings, including schools, local businesses and the local Chamber of Commerce. Prior to the completion of the project, the annual Suomiareena discussion forum was organized by Skanska and was held at Puuvilla. In 2014, the main themes were living and environment.

Social Aspects

Stakeholder communication during construction

The Puuvilla shopping centre is situated in central Pori and several businesses and services in the neighborhood continued to operate as normal during construction. There are also over 100 households close to Puuvilla.

The team regularly communicated with the various local stakeholders during construction to advise them of potential disturbances. Information, including potential noise disruption and road changes for traffic, was posted on the project's website and an information board on the site perimeter. Web cameras on the project website were updated in near real-time to show construction progress. Information meetings and discussion groups were also held with local businesses and residents about forthcoming site activities and events, and new tenant agreements. An open day was held for stakeholders during construction, which was attended by around 2,500 local people.

Project team cooperation

Close cooperation between Skanska, the clients and other project partners was a key to the success of the project. As a large project that involved several actors simultaneously working on the design, the team's extensive use of BIM enabled project partners to cooperate closely on the design and integration of the building's systems in a single model. The BIM model also evolved over time as negotiations with potential future users of the premises were ongoing during the design and construction. BIM was crucial in allowing project partners to visualize the project and ensured that the entire project team always worked with the latest design.

Occupational health and safety

There were no accidents on site during construction and the lost Time Accident Rate was zero.

The site induction had a special focus on safety and project contractors participated in web-based Safety School courses. Weekly safety rounds were conducted on site and electronic tablets were used to report non-conformances to all involved partners. Skanska awarded a safety prize of US\$ 250 to a particular sub contractor each month, which was donated to a charitable cause of the contractor's choice. Stretch & Flex sessions were held to warm up teams prior to starting work.

BIM was used in safety planning during construction, such as to identify and mitigate fall risks. The BIM safety planning models were also used during site discussions and contractor meetings, such as when talking through framework casting procedures, which allowed teams to easily visualize safe working practices.

Healthy indoor environments

Puuvilla has a fresh air ventilation system that is controlled by carbon dioxide sensors to ensure that the indoor spaces are sufficiently ventilated. The ventilation system in the parking garage is controlled by carbon dioxide and carbon monoxide sensors to properly ventilate the spaces. Low VOC materials have been used throughout the development and large windows were incorporated to allow natural daylighting and exterior views.

Flexible premises

The retail units and restaurants were customized for the initial tenants prior to completion, and can easily be modified to meet the needs of future tenants. Similarly, the office units are open planned and can accommodate a variety of uses and tenants. Puuvilla offers a wide variety of commercial units that are intended to suit various tenants, from small specialist shops to a large supermarket tenant.

Contributing toward sustainable urban development

The project remediated and reused an old industrial site in central Pori, and has created a new urban quarter in the city that offers various services and amenities.

Promoting more sustainable modes of transport

Puuvilla is situated in central Pori, 800 m from the city center, and is easy to access on foot, bicycle and bus. There are 100 outside bicycle racks for visitors and staff, and showers and changing facilities to encourage staff to cycle to work. Around 120 buses per day serve the adjacent bus stops. The 91 most accessible spaces in the parking garages are reserved for low-emitting vehicles.



Economic Impacts

Regional construction workforce and materials

Many of the 2,450 site workers were from the Pori area. Around 40 percent of the contractors and around 50 percent of the material suppliers were based in the Pori area. The largest local contractors included the HVAC (Heating, Ventilation and Air Conditioning) and piping installation, civil works, electrical and steel structure companies.

Efficiency financial savings

The Puuvilla Shopping Center uses around 50 percent less energy and water compared with a conventional newly built retail development in Finland. These resource savings correspond directly with utility bill savings.

Efficient facilities management through BIM

The Puuvilla BIM model contains information that can promote efficient Facilities Management, including information on the materials, fixtures, fittings and equipment installed throughout the shopping center. The model will allow facilities management staff to quickly make accurate calculations and planning decisions from their desk. Additional information can be easily added to the model as the building is modified and upgraded over time.

Learning From Good Practice

BIM proved to be a vital tool during the design and construction of the Puuvilla project. It was used to provide the basis for the energy simulations and to promote worker safety, whilst also helping the team to integrate existing structures, meet the tight construction schedule and allow good cooperation.