



Chapter 7

Examples

7.1. Examples in Latvia

Kristine Fedotova, Ineta Geipele, Janis Zvirgzdins

7.2. Example in Lithuania

Tomas Gecys

7.3. Example in the UK

Carl Mills, David Trujillo

7.4. Examples in Denmark

Roger Howard Taylor, Ole Thorkilsen, Peter Ebbesen

7.5. Example in Finland

Jari Komsu, Anssi Knuutila, Koivula Ilona Mercedes

7.6. International Examples

Carl Mills, David Trujillo, Tomas Gecys



7.1. EXAMPLES IN LATVIA

7.1.1. CASE STUDY 1: Open-air stage in Krimuna

General information

Location: Krimunas, Krimuna parish, Dobele district.

Architects: “RBD” Ltd.

Client: Dobele district municipality.

Year of construction: 2017.

Duration of construction: 2 months.

Height: 7 metres.

Number of floors: One.

Cost: EUR 97469.05 plus VAT 21 %.



Fig. 7.1. External appearance after construction (Gada labākā būve Latvijā 2017, 2018. The best building of the year in Latvia, 2018).

Design and structural principles

The aim of the project is to construct the roof structure on the foundations of the existing stage, making high-quality cultural services available to the residents of Krimuna parish of Dobele district.

The construction of the stage ensures a well-maintained and quality environment for cultural events, promotes a variety of public life activities and makes recreational services available. The stage is designed to partially preserve the platform of the previously built stage. The arched form and wooden architecture are adapted to the environment and artistic events (Figs. 7.1 and 7.2).

Materials and finishes

The load bearing structures of the stage are made using curved glue-laminated wood beams manufactured in Latvia.

The arches are made using variable geometry to obtain the architectural features of the structure. The load bearing structure consists of curved glue-laminated wood arches with a span of 13.72 m and a total building height of 7.20 m. (Figs. 7.3 and 7.4).



Fig. 7.2. Before construction (Gada labākā būve Latvijā 2017, 2018. The best building of the year in Latvia, 2018).



Fig. 7.3. Curved glue-laminated wood arches (Gada labākā būve Latvijā 2017, 2018. The best building of the year in Latvia, 2018).



Fig. 7.4. Construction phase (Gada labākā būve Latvijā 2017, 2018; The best building of the year in Latvia, 2018).

The load bearing structures are made of 21.62 m³ of glue-laminated timber. In Latvian forests, 0.95 m³ grows in 1 second (Latvian State Forests, 2018). The amount of wood used in load bearing structures grows in 22.76 seconds in Latvian forests (Fig. 7.5).



Fig. 7.5. Latvian Forests (Latvian State Forests, 2018).

Resources consumption in the use stage (water, energy, etc.)

Within the framework of the project, the construction of the roof structure ensures the possibility of placing the sound and lighting equipment under the roof covering, thus protecting the equipment available to the community centre from rain and other unfavourable factors.

In addition, rainwater drainage system has been built in the construction of the roof, promoting rainwater drainage from the foundations of the stage, which will ensure the sustainability of the stage.

Additional information

The object serves not only as a venue for local cultural events but also as tourist attraction.

7.1.2. CASE STUDY 2: Rebuilding the barn of Aluksne station

General information

Location: 52 Jankalna Street , Aluksne, Aluksne district.

Architects: “Arhitektes Ināras Caunītes birojs” Ltd.

Client: Aluksne district Municipality.

Year of construction: 2018.

Duration of construction: 2 years.

Number of floors: One.

Design and structural principles

National cultural monument preserves rich history and is unique on the Baltic and European scale (Figs. 7.6, 7.7, 7.8 and 7.9).

The goal is to preserve the luggage barn built in 1902 for future generations, to ensure accessibility and to diversify tourism offerings.

Structural solutions

Soil characteristics: *Simple.*

Foundation: *Shallow (ribbon and pile foundation).*

Object constructive scheme: *Frame.*

Inter-floor covering type: *Wood beam.*



Fig. 7.6. External appearance (Gada labākā būve Latvijā 2018, 2019. The best building of the year in Latvia, 2019).



Fig. 7.7. Internal view (Gada labākā būve Latvijā 2018, 2019. The best building of the year in Latvia, 2019).

Type of roof covering: *Rafter, bundle and brace structure.*

Non-load bearing exterior wall material: *Wooden stands, planking.*

Partitions: *Wood frame, planking.*

Stair construction: *Wooden staircase on concrete foundation.*

Bearing external wall material: *Wood frame, planking.*

The main challenges in the design process: by making the most of the existing structure to construct an insulated building that would still create an impression of the luggage barn inside and outside.

To restore the foundations, the structure of the building was made as light as possible: the roof covering and planking were removed (Fig. 7.10).

The building frame was lifted and based outside the foundation area.

Boulder foundations were built, the crown beam and the damaged wood structures were replaced.

Materials and finishes

Non-load bearing exterior wall material: *Wooden stands, planking.*

Partitions: *Wood frame, planking.*

Stair construction: *Wooden staircase on concrete foundation.*

Bearing external wall material: *Wood frame, planking.*

The paths surrounding the building are covered with ELASTOPAVE cover – it is visually closest to the historical gravel road surface. ELASTOPAVE cover is natural stone (granite) chips interconnected (bonded) with polyurethane binder. It withstands temperature fluctuations, maintains physical properties, and withstands frost/thaw actions.



Fig. 7.8. Before rebuilding (outside)
(Gada labākā būve Latvijā 2018,
2019. The best building of the year in
Latvia, 2019).



Fig. 7.9. Before rebuilding (inside)
(Gada labākā būve Latvijā 2018,
2019. The best building of the year in
Latvia, 2019).

Thanks to the porous structure, water does not accumulate in the pavement, and at the same time there is free space where water can expand when changing the physical state. In winter such cover is not slippery.

Resources consumption in the use stage (water, energy, etc.)

Use of energy-efficient solutions:

- Double-skin walls and roof structures filled with eco-wool ensure the thermal stability of the building – heating costs account for EUR 90 per month.
- The heating system of the building is connected to the district heating networks.
- The heating unit is located above the cashier's desk covering and hidden behind the exposition.
- To achieve the impression of unheated space, the heating elements are integrated into the floor.

Additional information

Conservation of cultural heritage and ensuring its accessibility.

A multimedia exposition has been created that allows visitors to get acquainted with the creation and history of narrow-gauge railway.

Renewed infrastructure is an important resource for popularizing the industrial heritage of Latvia and promoting tourism development.

High quality cultural environment has been created.



Fig. 7.10. Wooden stands and planking before rebuilding (Gada labākā būve Latvijā 2018, 2019. The best building of the year in Latvia, 2019).

7.1.3. CASE STUDY 3: Construction of covered roof of the open public skating rink on Pasta island in Jelgava

General information

Location: 1 Pasta sala, Jelgava.

Architects: "Igate Būve" Ltd.

Client: Jelgava Municipality.

Year of construction: 2018;

Duration of construction: One year.

Number of floors: One;

Cost: EUR 305,482.02 plus VAT 21 %.



Fig. 7.11. Outside view (construction phase) (Gada labākā būve Latvijā 2018, 2019. The best building of the year in Latvia, 2019).

Design and structural principles

The task of designing the construction project is to protect the existing hockey area from rain and snow (Figs. 7.11–7.14).

The greatest challenge is to design the existing communication in “the jungle”.



Fig. 7.12. External appearance (final view) (Gada labākā būve Latvijā 2018, 2019. The best building of the year in Latvia, 2019).



Fig. 7.13. Internal view (final view) (Gada labākā būve Latvijā 2018, 2019. The best building of the year in Latvia, 2019).



Fig. 7.14. Wood structure materials (Gada labākā būve Latvijā 2018, 2019. The best building of the year in Latvia, 2019).

The most important challenges in the construction project are related to the moment node and the design of suitable foundation.

Materials and finishes

The roof of the skating rink is made of glue-laminated wood frames covered with a membrane-type roofing. Between the columns, mesh structures are secured to prevent rain and wind (Fig. 7.15).

The structure consists of a three-threaded frame of curved and variable cross-section elements with a common span of 22.60 m.

In addition, different size steel pipe-profile beams have been designed for membrane type roofing reinforcement and additional support.

The roof bearing structures are made of 112 m³ of glue-laminated timber. In Latvian forests, 0.95 m³ grow in 1 second (Latvian State Forests, 2018).

The amount of wood used in load bearing structures grows in 2 minutes in Latvian forests.

Additional information

The surrounding area is one of the most popular footpaths of residents of Jelgava as well as the central venue for organising events in Jelgava.



Fig. 7.15. Three-threaded frame (Gada labākā būve Latvijā 2018, 2019. The best building of the year in Latvia, 2019).

7.2. EXAMPLE IN LITHUANIA

CASE STUDY: Universal sports complex in Palanga, Lithuania

General information

Location: 3 Sports Street, Palanga, Lithuania (Figs. 7.16–7.18).

Architects: Matas Jurevičius, Gediminas Jurevičius.

Client: Palanga city Municipality.

Year of construction: 2014.

Duration of construction: Two years.

Height: 11.3 m.

Number of floors: Two.

Cost: EUR 4.4 million.



Fig. 7.16. The outside view of the completed building (www.sporthall.palanga.lt).

Design and structural principles

The load bearing structure of the multifunctional sports hall is reinforced concrete columns and curved axis glulam beams and arches. The main cross section of the building is shown in Fig. 7.19 in which all load bearing structures are shown. The rectangular shaped reinforced concrete columns are rigidly connected to the foundation; while curved axis glued laminated timber beams are flexibly supported on the reinforced concrete columns and foundation.



Fig. 7.17. Internal view of the completed building (www.sporthall.palanga.lt).

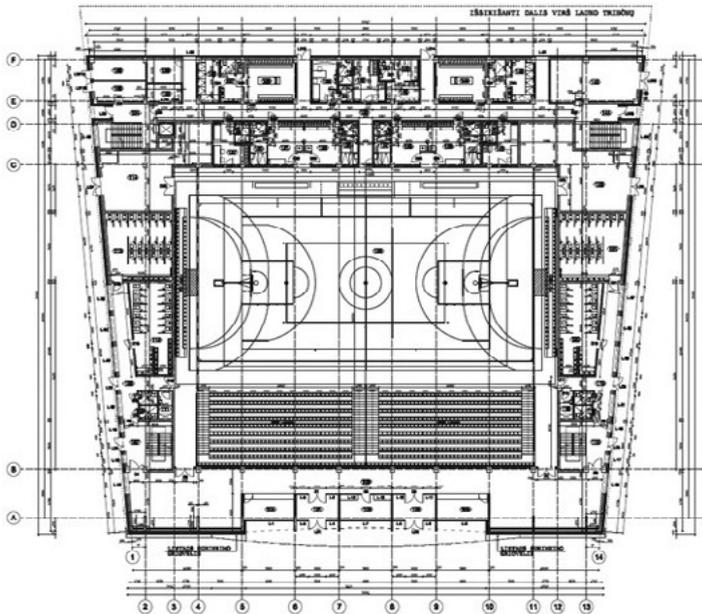


Fig. 7.18. The plan of multifunctional sports hall.

The maximum span (the maximum distance between supports) is 34.55 m. This span is overlaid using the entire glued laminated timber beam. The transportation of the glued laminated timber beams (36 metres long, 180 mm wide; 1960 mm high) to the construction site is shown in Fig. 7.20.

One 36 m long glued laminated timber beam weighs around 10 tones. The mass is relatively small, as timber has a very good strength / mass ratio, especially if compared to heavy material such as reinforced concrete. Views from the construction process are shown in Fig. 7.21 in which main structural materials are shown -, glued laminated timber and reinforced concrete in combination with masonry walls.

Materials and finishes

As the previous figures show, the timber in the interior has its natural appearance, it is covered only with translucent lacquer. Other structural materials (reinforced concrete and masonry walls) are plastered or covered with plasterboards. Some parts of glulam beams are extracted to the outside of the building, so these parts were covered with thin-walled steel canopies, for protection from rain, snow and sun.

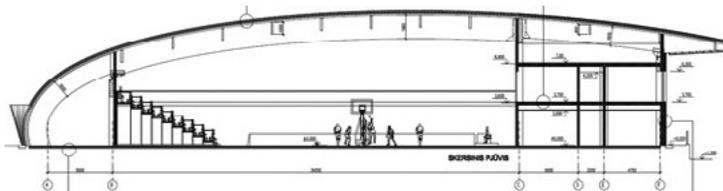


Fig. 7.19. The cross section of the multifunctional sports hall in Palanga city, Lithuania.



Fig. 7.20. Transportation of 36 m long glulam beams for the multifunctional sports hall in Palanga city, Lithuania (www.veidas.lt).

Additional information

The multifunctional arena is used for both commercial and non-commercial purposes. Some TV shows are filmed in this arena. Also, Lithuanian national basketball team usually trains in this arena for the championships.



Fig. 7.21. The construction process of sports hall in Palanga city, Lithuania (www.sporthall.palanga.lt).

7.3. EXAMPLE IN THE UK

CASE STUDY: Rievaulx Abbey Visitor Centre

General information (Figs. 7.22–7.24)

Location: Helmsley, U.K.

Architects: Simpson & Brown.

Client: English Heritage.

Year of construction: Completion date July 2016.

Number of floors: One.

Cost: Contract value: £ 1.2 m.

Design and structural principles

Simpson and Brown Architects were appointed by English Heritage for an improved visitor centre at Rievaulx Abbey. The initial aim of the project was to upgrade the existing visitor facilities, upgrade the museum building, improve staffing facilities and attract more visitors to the Abbey (Figs. 7.25–7.27).

The most significant section of the project for this case study is the new central hall within the existing L-shaped building that previously existed.



Fig. 7.22. External appearance (www.ribaj.com).



Fig. 7.23. Internal view (www.architecture.com).

This new central hall contains a series of engineered glulam timber arches of Scandinavian spruce painted in stunning white gradually splay to reveal site lines to the abbey and presents itself as a modern mirroring and connection of the historic stone columns and arches beyond. These spruce glulam columns and rafters are joined with epoxy bonded-in rods, and steel flitch plates conceal the join.

Site plan of car park, visitor centre and abbey



Key

- 1 car park and entrance
- 2 visitor centre
- 3 views to abbey
- 4 Rievaulx Abbey
- 5 museum
- 6 original building containing plant, WCs and kitchen
- 7 servery
- 8 glazed glulam arch enclosure with display
- 9 line of glulam arches with inset information panels
- 10 café seating area
- 11 line of splayed glulam arches with glazing between
- 12 glazed screen giving access to terrace
- 13 original building containing shop
- 14 main entrance with timber canopy and screen

Ground floor plan of visitor centre

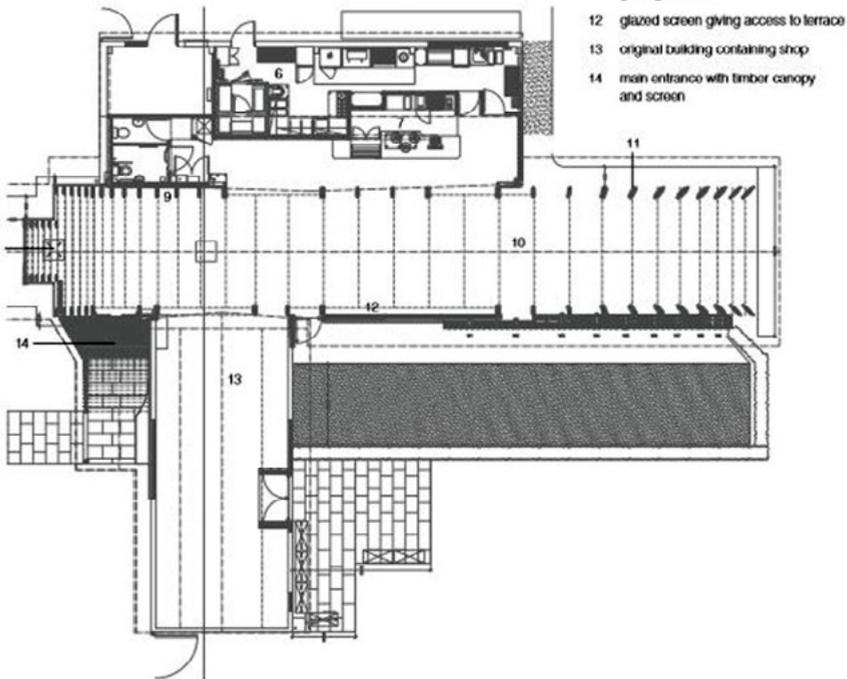


Fig. 7.24. Site and ground floor plan (TRADA, 2019).

Although only single storey, this double height space provides a sense of height that is flooded by natural light, creating a stunningly beautiful space fitting for a site of historical purpose.

Structurally the engineered glulam frames are joined at roof level with CLT sheeting. Concealed services (including lighting) are within a perimeter edge beam, and the panels are visible where feasibly possible.

Materials and finishes

The main materials used for the project include engineered timber, zinc and polished concrete. A ruin from the abbey is also used, it is exquisitely carved and bears the abbey's name.

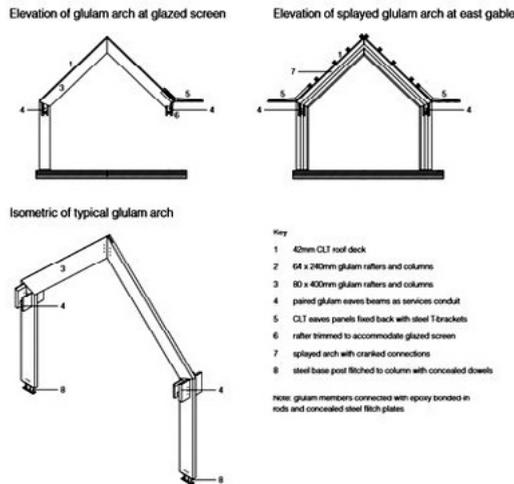


Fig. 7.25. Structural and detail representation (TRADA, 2019).



Fig. 7.26. The central hall (www.e-architect.co.uk).



Fig. 7.27. 6 Carved stone from the ruin (www.e-architect.co.uk).

Due to the restricted site and tight construction programme off-site fabrication was used. Slot windows were set inside the vertical CLT panels. Both gable ends of the centre are fully glazed, providing the visitor to key views towards the museum and more importantly the ruin itself (as show in Fig. 32).

The arches (varying in size but consistent heights and pitch) are connected with 42 mm CLT panels at roof level, these protrude the exterior glazing on the gable ends and are fixed with profiled steel T-brackets. These are stained to match the appearance of the arches. The roof is finished in zinc sheet with insulation below.

Resources consumption in the use stage (water, energy, etc.)

The building has a gross internal area of 469 m² and uses as much of the original fabric and timber structure as possible. By using prefabricated components, the construction speed was increased, material waste and the need for materials to be transported to site was reduced. This included the two-stage glulam structure.

The design includes a substantial overhang aiding to direct sunlight overheating in summer and entirely naturally ventilated to all key zones. The latest energy saving devices are used in lighting (LED) and controls.

Simple thoughtful design delivers simple maintenance whilst delivering excellent life cycle costs.

Additional information

- Awards Wood Awards Commercial & Leisure Winner 2017.
- RIBA Yorkshire Award, Winner 2017.

7.4. EXAMPLES IN DENMARK

7.4.1. CASE STUDY 1: Wadden Sea Centre

General information (Figs. 7.28–7.33)

Location: Okholmvej 5, Vester Vedsted, 6760 Ribe, Denmark.

Architects: Dorte Mandrup A/S.

Client: City of Esbjerg.

Year of construction: 2017.

Duration of construction: September 2015 – February 2017.

Number of floors: Two floors, in total 2500 m².

Cost: EUR 6,000,000.



Fig. 7.28. External appearance (Photo: Adam Mørk).



Fig. 7.29. External appearance (Photo: Adam Mørk).



Fig. 7.30. Internal view (Photo: Adam Mørk).



Fig. 7.31. Internal view (Photo: Adam Mørk).

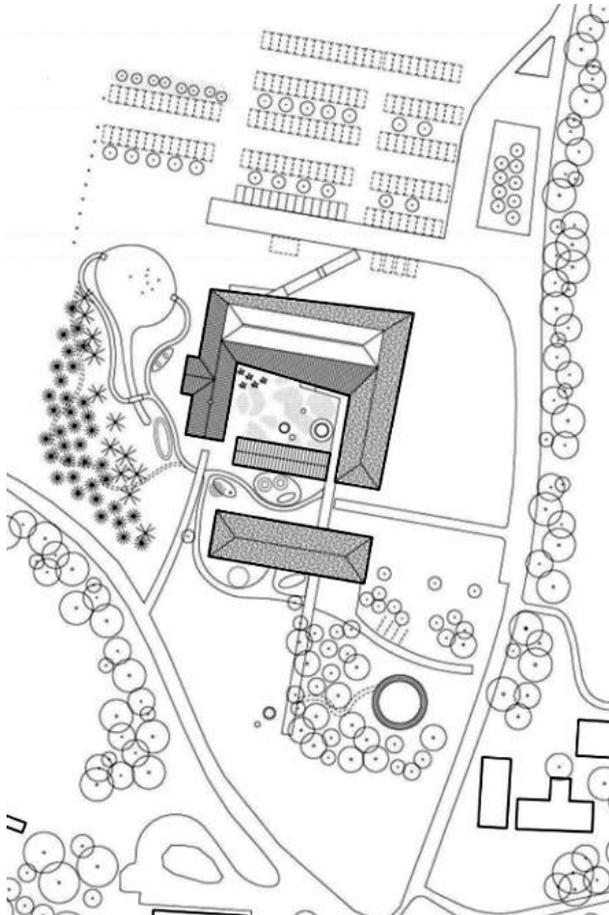


Fig. 7.32. Site plan (Illustration: Dorte Mandrup).

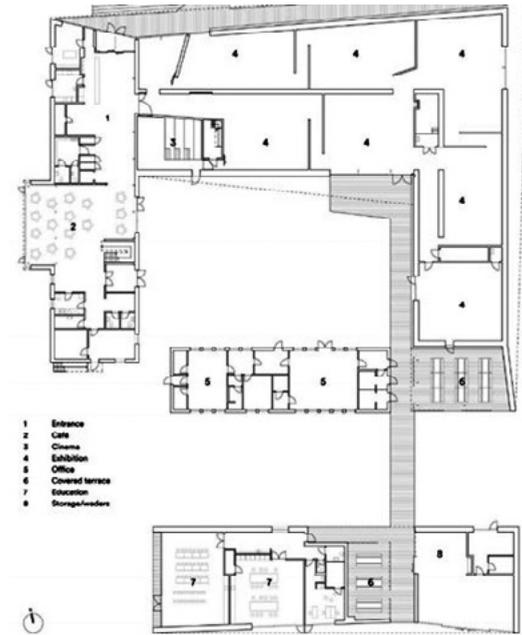


Fig. 7.33. Site plan (Illustration: Dorte Mandrup).

Design and structural principles

The building, which was initiated in February 2017, is an interpretation of the local building tradition and the rural farmhouse typology significant in the area.

The centre is erected with pre-paginated robin wood and thatched roofs and facades, hereby underlining the tactile qualities and robustness that can be found in traditional crafts and materials of the region.

The combination gives a unique experience and the impression of a building that blends into nature (Figs. 7.34–7.35).

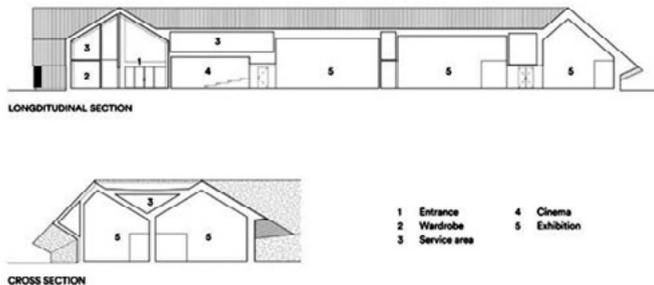


Fig. 7.34. Site plan (Illustration: Dorte Mandrup).



Fig. 7.35. External appearance (Photo: Adam Mørk).

Materials and finishes

A combination of pre-patinated robin wood and straw used for the exterior facades and roofs makes this building blend well into the surrounding nature of the area that has been used. Great craftsmanship has been carried out in connection with the construction of the building, which makes the building itself a great experience (Fig. 7.36).



Fig. 7.36. External appearance (Photo: Adam Mørk).

Resources consumption in the use stage (water, energy, etc.)

- The building is heated with geothermal heat, which has 3.4 km of pipes buried in the outside terrain for the actual geothermal heat.
- There are solar cells hidden on the roof that give 40 % of the annual energy.
- The building is illuminated with led light.
- The building is equipped with water-saving toilets, showers and taps.
- The building is insulated in accordance with the Danish legislation.

7.4.2. CASE STUDY 2: "Næste Skur"

General information (Figs. 7.37–7.38)

Location: Holbergskolen KBH N.

Architects: Krydsrum A/S.

Client: Københavns Komune.

Year of construction: 2019.

Duration of construction: 2018–2019.

Height: 3.2 m.

Number of floors: One.

Cost: EUR 46,900.



Fig. 7.37. External appearance (Photo: Jonathan Weimar).



Fig. 7.38. Internal view (Photo: Jonathan Weimar).

Design and structural principles

The idea is to unite the traditional Danish building custom – timberwork and large roofs with overhangs that protect the facade, with prefabrication and fast assembly (Figs. 7.39 and 7.40).

It is attractive to recycle the large quantities of rafters, laths, floorboards and roof tiles that today are thrown out as building waste during renovations in Denmark. The sheds are durable, functional and should inspire increased resource awareness when building.



Fig. 7.39. Module facade (Photo: Jonathan Weimar).



Fig. 7.40. Module facade (Photo: Jonathan Weimar).

Materials and finishes

Beams, rafters, floorboards, newer rafters, roof tiles, smoking tiles, gutters and mirrors. All recycled from demolitions in the Copenhagen area.

Resources consumption in the use stage (water, energy, etc.)

Recycled lighting fixtures with new LED inserts and motion sensor.

The solar panels are prepared to be installed in the facade so that the shed becomes self-sufficient.

Additional information

The idea is to develop a circular business model that can be scaled and thus have a great impact on the environment. A lot of CO₂ can be saved each year if you switch to building with recycled materials.

7.5. EXAMPLE IN FINLAND

CASE STUDY: Nature Centre Haltia

General information (Figs. 7.41–7.43)

Location: Nuuksio, Espoo, Finland.

Architect: Rainer Mahlamäki, Lahdelma & Mahlamäki Architects.

Client: Timo Kukko, Nuuksiokeksus Oy.

Year of construction: 2013.

Duration of construction: Autumn 2011 – spring 2013.

Number of floors: 2–3.

Cost: EUR 16.7 million.

Nature Centre Haltia is located on the shore of Lake Pitkäjärvi and right next to Nuuksio National Park in Espoo, Finland. It is an exhibition, restaurant and conference building with estimated 200 000 visitors per year (Mahlamäki, 2013, p. 10).



Fig. 7.41. Outside appearance of Nature Centre Haltia (Huisman, n.d.).

Haltia is the first public building made of CLT-elements in Finland (Haltia, 2019).

The total floor area of the building is 3 534 m², and it was completed in 2013. The client is Timo Kukko who is the manager of Nuuksiokeskus Oy. The project manager was Juha Välikangas from Pöyry CM Oy. The architectural design was made by Professor Rainer Mahlamäki, M.Sc Architect, from Lahdelma & Mahlamäki Architects. The structural design was made by Insinööritoimisto Tanskanen Oy. The main contractor was YIT Rakennus Oy and the wood structures were made by Stora Enso and Eridomic Oy. The costs of the building were EUR 16,7 million (Mahlamäki, 2013, p. 13).



Fig. 7.42. Inside view of Nature Centre Haltia (Huisman, n.d.).

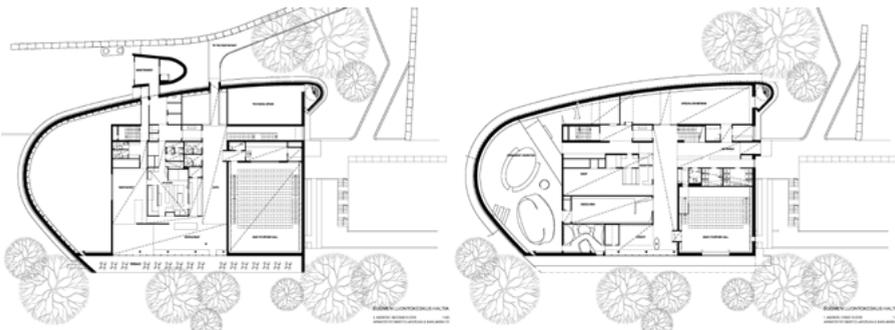


Fig. 7.43. The floor plans. Starting from the top left: second floor, first floor, and ground floor (Mahlamäki, 2013, p. 11).

Design and structural principles

The inspiration for the Haltia architecture came from the Kalevala, the national epic of Finland and Karelia (Haltia, 2019) (Asplund & Mettomäki, 2017). The whole structure is designed by one architect, so it has a uniform design. The cornerstones for Haltia are ecology and environment, functionality, and technical advancement (Haltia, 2019).

Haltia is the first public building in Finland where everything is made of cross laminated timber (CLT) (Haltia, 2019). Also, the load-bearing structure is made of CLT panel elements (Mahlamäki, 2013, p. 15).

The curving lines that meet rectangular shapes symbolize the encounter between nature and human environment. With these different shapes Haltia shows the possibilities of wood construction, which are shown with different wooden joints, on site and prefabricated elements, and traditional and modern wood treatment methods (Haltia, 2019) (Fig. 7.44).



Fig. 7.44. Three different kind of shapes in Haltia (Huisman, n.d.).

Materials and finishes

The CLT-elements have been supplied from Stora Enso's Austrian factories as raw plates. The boards are made of Austrian spruce because CLT was not produced in Finland during Haltia's construction. They are glued together with an emission free M1 grade urethane adhesive. They were finished in Pälkäne, where, for example, the insulations were added (Haltia, 2019).

The facade is made of pine saturated with quartz sand. It does not contain any harmful substances and it is fire resistant and as durable as wood saturated

with arsenic. Haltia is the first building in the world where this material has been used for exterior trim (Haltia, 2019) (Figs. 7.45–7.47).



Fig. 7.45. Facade (Haltia, 2019).



Fig. 7.46. Different sized panels to create a rhythmic design (Siparila, 2018).



Fig. 7.47. Surface treatment gives the possibility to achieve harmonious colours (Siparila, 2018).

Resources consumption in the use stage

The whole building is designed to consume as little energy as possible (Fig. 7.48). The round shape of the building makes the building envelope small in relation to its volume. Also, the lowest floor is underground, which makes the heat loss smaller. The terrace is located so that it shades the lower floors, which keeps them cool during summer. The number of windows is small, so the heat loss is smaller (Haltia, 2019).

The aim in heating Haltia is that it is 75 per cent self-sufficient in heating and 100 per cent self-sufficient in cooling. This is reached by a ground source heat pump with 15 bore wells, which reach a depth of 250 metres. They contain geothermal pipes that are 11 kilometres long. These are used for both heating during winter and cooling during summer (Haltia, 2019).

There are evacuated tube collectors on the roof of Haltia. The transfer fluid, which is heated with the rays of sun, is used to support the ground source heating. When the collectors give more heat than needed, it is directed to the base rock (Haltia, 2019).

The ventilation and water use are controlled by automatic systems. This makes sure that no water is wasted and that the ventilation is on only in spaces that are in use. The water is mainly heated with the sun collectors and the geothermal energy (Haltia, 2019).

Additional information

Haltia was given the first sustainable development award by European Museum of the Year competition in 2015 (Haltia, 2019).



Fig. 7.48. Solar panels on the roof (Kuvataivas, n.d.).

7.6. INTERNATIONAL EXAMPLES

7.6.1. CASE STUDY 1: Children's Village, boarding school

General information (Figs. 7.49–7.52)

Location: Formoso do Araguaia, TO, 77470-000, Brazil.

Architects: Aleph Zero, Rosenbaum.

Design Team: Adriana Benguela, Gustavo Utrabo, Pedro Duschenes, Marcelo Rosenbaum.

Client: Fundação Bradesco.

Year of construction: 2017.

Number of floors: Two.



Fig. 7.49. Exterior appearance (Leonardo Finotti – www.archdaily.com).



Fig. 7.50. Interior view (Leonardo Finotti – www.architecture.com).

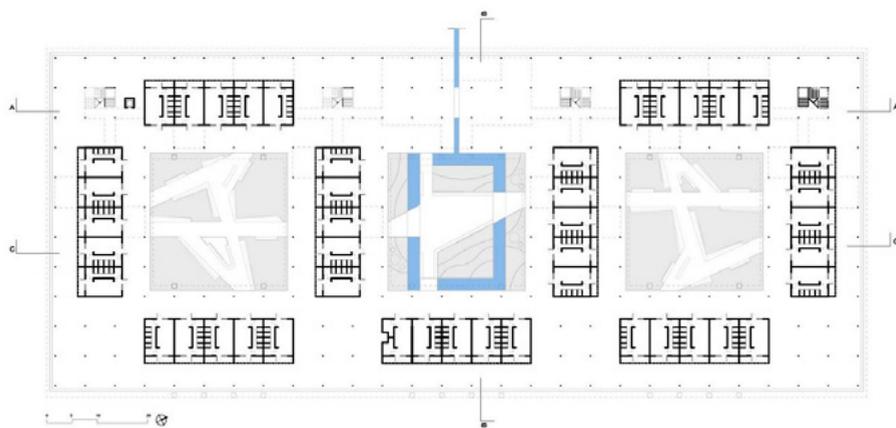


Fig. 7.51. Ground floor plan (Leonardo Finotti – www.archdaily.com).

Design and structural principles

Two identical structures (one for boys and the other for girls) are set at each side of the main school buildings. A large timber roof sloping from west to east is supported by glulam columns and beams. Sculptural stairs rise above these units to walkways, recreational use space and balconies separated with slatted timber screens (Figs. 7.53–7.54).

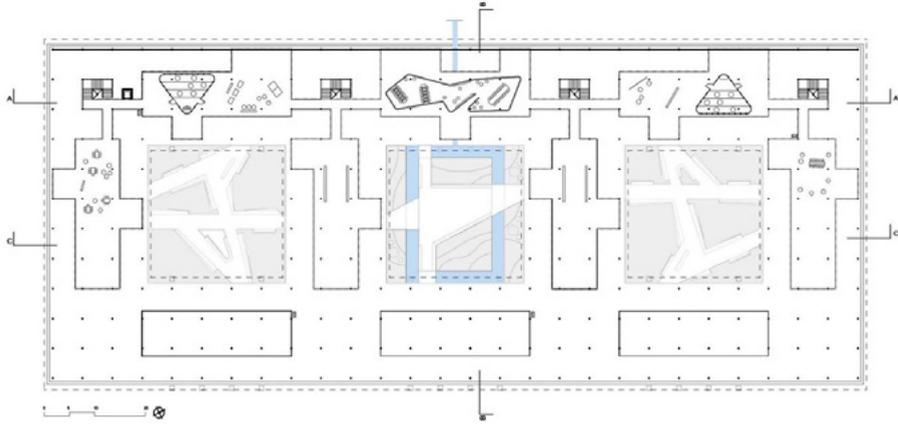


Fig. 7.52. First floor plan (Leonardo Finotti – www.archdaily.com).



Fig. 7.53. Column with ground detail (Leonardo Finotti – www.archdaily.com).

The natural cross-ventilation throughout the building with breathable walls, expansive shade results in no air conditioning in temperatures well over 40 °C. However, control of low temperatures at night is a problem, with extra blankets needed in the dorms.

Materials and finishes

The materials used for the project include white metallic roof supported by 5.9 m × 5.9 m lightweight eucalyptus glulam grid on local eucalyptus glulam structural columns.

The accommodation uses solid form stabilised local earth blocks; to provide natural ventilation these blocks were perforated for the wash rooms.

Resources consumption in the use stage (water, energy, etc.)

The main aim is providing a cool environment across the internal area of 23,344 m² during uncomfortable daily temperatures, which is well achieved as previously discussed.



Fig. 7.54. Columns and roof structure
(Leonardo Finotti – www.archdaily.com).

Due to the rural location of the school it was important to use as much pre-fabrication as possible. This also accelerated the construction speed which limits the disruption to school activities. Local materials were used with the timber frame elements as well as local earth for the blocks. For other timber elements computer numerical control (CNC) cutting provided highly accurate cutting.

Additional information

Awards:

- *RIBA Award for International Excellence 2018.*
- *RIBA International Emerging Architect for Aleph Zero.*

7.6.2. CASE STUDY 2: Lookout restaurant Al Nahham in Banana island Doha, Qatar

General information (Figs. 7.55–7.57)

Location: Banana Island, Doha, Qatar.

Architects: Project Management and Supervision Consultants Hill International.

Client: Private Engineering Office, Doha, Qatar (the current governing manager: Anantara).

Year of construction: 2014.

Duration of construction: Two years.

Height: 12.8 m.

Number of floors: One.



Fig. 7.55. The outside appearance of the lookout restaurant in Banana Island, Doha, Qatar.



Fig. 7.56. The inside view of the lookout restaurant in Banana Island, Doha, Qatar (www.anantara.com).

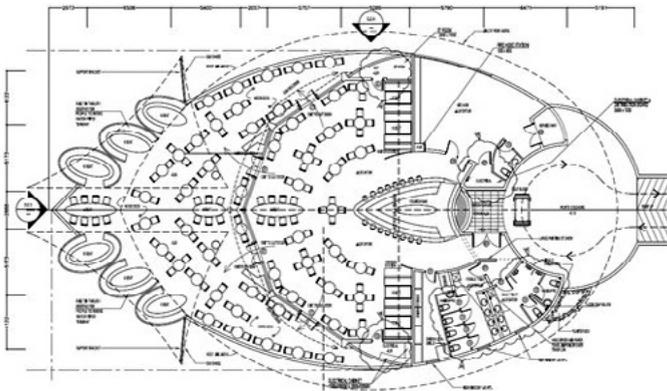


Fig. 7.57. The plan of the lookout restaurant in Banana Island, Doha, Qatar.

Design and structural principles

The dimensions of the lookout restaurant are 43 m in length and 25.6 m in width. The three-dimensional view of the whole load bearing structure is shown in Fig. 7.58. The load bearing structure consists of rectangular and circular cross section reinforced concrete columns, circular hollow steel supporting struts, and the load bearing curved glued laminated timber arches. The reinforced concrete columns are rigidly supported to the foundation and struts are flexibly connected to the top of reinforced concrete columns. The load bearing glulam arches are supported by the steel struts. The whole roof

structure is supported only by 8 reinforced concrete columns. The cantilever of glulam arches is up to 7–8 metres.

The process of construction is shown in Fig. 7.59. Close to the construction site there are no factories which produce glued laminated timber load bearing structural elements. For this reason, the main arches with length up to 60 metres were cut into 5 separate elements with maximum dimensions up to 13 metres with the aim to fit these elements in sea containerships. For

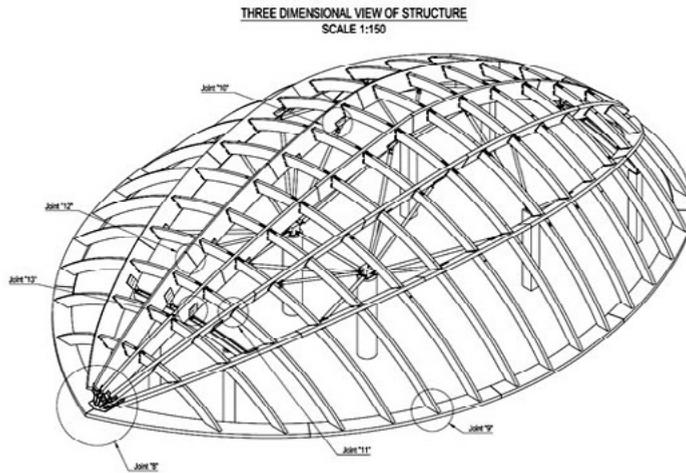


Fig. 7.58. The 3-dimensional view of the lookout restaurant in Banana Island, Doha, Qatar.



Fig. 7.59. Construction process of the lookout restaurant in Banana Island, Doha, Qatar.

this purpose, special connections with self-tapping screws were developed. This type of connection is able to transfer bending moments, axial and shear forces. The main issue of the design of this load bearing structure was very high wind speed - 42 m/s. As timber structures are relatively light there should be some special anchoring details to fix the roof structure to the below load bearing structure.



Fig. 7.60. Self-tapping screws used for timber beam-to-beam connection of main glulam roof arches (www.rothoblaas.com; www.sfs.biz).

The beam-to-beam connection of the main roof arch was installed using the self-tapping screws, shown in Fig. 7.60. This type of self-tapping screws does not require any predrill holes in timber and in steel plates with thickness up to 15 mm. The initial strip of the connection is avoided by using this type of screws.

Materials and finishes

The roofing material was chosen a natural thatch. This roofing represents the traditional architecture in tropical countries.

As it was shown previously, the glued laminated timber elements were left unpainted, only several layers were covered with antiseptics and flame retardants. The interior of the building shows the natural view of roof timber elements.

The steel strut elements were painted with fire resistant paint.

Additional information

The Al Nahham Restaurant was awarded in 2018 - World Luxury Restaurant Award. Dine in the comfort of the eye-catching restaurant designed in contemporary Arabic style (source: <https://www.luxuryrestaurantawards.com/listings/al-nahham-restaurant>).

References

- Abrahamsen, R. (2017). *Mjøstårnet - Construction of an 81 m tall timber building*. Moelv, Norway: Internationales Holzbau-Forum IHF 2017.
- Archdaily.com. (2018). *Children Village by Aleph Zero and Rosenbaum Wins 2018 RIBA International Prize*. <https://www.archdaily.com/906258/children-village-by-aleph-zero-and-rosenbaum-wins-2018-riba-international-prize>
- Architecture.com. (2017). *Rievaulx Abbey Visitor Centre and Museum*. <https://www.architecture.com/awards-and-competitions-landing-page/awards/riba-regional-awards/riba-yorkshire-award-winners/2017/rievaulx-abbey-visitor-centre-and-museum>
- Architecture.com. (2018). *Children Village*. <https://www.architecture.com/awards-and-competitions-landing-page/awards/riba-international-prize/2018/children-village>
- Asplund, A., & Mettomäki, S.-L. (2017). *Kalevala: The Finnish National Epic*. <https://finland.fi/arts-culture/kalevala-the-finnish-national-epic/>
- Blindkilde, T. (2015). byensejendom.dk. *Nu-udbygges-vadehavscenteret-for-53-millioner*. <https://byensejendom.dk/article/nu-udbygges-vadehavscenteret-for-53-millioner-16528>
- Cik ātri aug mežs. (2018). *Latvian State Forests*. <https://www.youtube.com/watch?v=yeXYhN5SeH0&feature=youtu.be>
- Dorte Mandrup. (2017). *Work/wadden-sea-centre*. <https://www.dortemandrup.dk/work/wadden-sea-centre>
- e-architect.co.uk. (2017). *Rievaulx Abbey Visitor Centre & Museum Building*. <https://www.e-architect.co.uk/leeds/rievaulx-abbey-visitor-centre-museum-helmsley>
- Enemærke & Pedersen. (2019). *Genbrugskonkurrence resulterede i Danmarks smukkeste affaldsskur*. <https://eogp.dk/nyheder/genbrugskonkurrence-resulterede-i-danmarks-smukkeste-affaldsskur/>
- Gada labākā būve Latvijā 2017. (2018). *Rīga: Tipogrāfija “Dardedze hologrāfija”*.
- Haltia. (2019). *Arkkitehtuuri*. <https://www.haltia.com/fi/haltia/arkkitehtuuri/>
- Haltia. (2019). *CLT Cross laminated timber*. <https://www.haltia.com/fi/haltia/puurakentaminen/clt/>
- Haltia. (2019). *Ekoteknologia*. <https://www.haltia.com/fi/haltia/ekoteknologia/>
- Haltia. (2019). *LVI-tekniikka*. <https://www.haltia.com/fi/haltia/ekoteknologia/lammitys-ja-jaahdytys/>
- Haltia. (2019). *Puurakentaminen*. <https://www.haltia.com/fi/haltia/puurakentaminen/>
- Huisman, M. (n.d.). *Luontokeskus Haltia*. <https://www.woodarchitecture.fi/fi/projects/luontokeskus-haltia>
- Keiding, M. (2017). *Arkitekten.dk*. <https://arkitekten.dk/2017/11/vadehavscentret/>
- Krydsrum. (2019). *Krydsrum*. <http://krydsrum.dk/projekter/reskur/>
- Kuvataivas. (n.d.). *Suomen luontokeskus Haltia*. <http://www.kuvataivas.eu/-/galleries/ilmakuvat/-/medias/30cb2ed9-733a-4f65-bd70-6297f4045ebb-suomen-luontokeskus-haltia>

Gada buve. (2019). *The best building of the year in Latvia (Gada labākā būve Latvijā)*. <http://gadabuve.lv/index.php/2019/04/01/gada-labaka-buve-latvija-2018-laureati/>

Mahlamäki, R. (2013, 3). *rakennettu | projects | HALTIA*. PUU, 3/13, 8–15.

Naeste. (2019). *Næste*. <https://naeste.dk/>

Trada. (2019). *Rievaulx Abbey Visitor Centre*. <https://www.trada.co.uk/case-studies/rievaulx-abbey-visitor-centre-helmsley-yorkshire/>

Siparila. (2018). *Luontokeskus Haltia*. <https://www.siparila.fi/projektit/luontokeskus-haltia/>