New headquarters for GN Store Nord in Copenhagen
Report from the 2007 Copper Award ceremony in England
Aggtelec – new visiting centre by the Hungarian national park
Editorial

Welcome to a new issue of Copper Forum. In this issue, we hope to give our readers new and fresh examples of architectural creativity, from an international perspective, where copper has been used to give the final important touch of perfection.

Architect Chris Hodson reports from the "Copper in Architecture Award 2007" ceremony, which was held in London at the end of last year. A total of 74 building projects from different parts of Europe had been entered to the contest! The jury had the difficult task to select a winner from the large starting field of high-class design; from large-scale industrial projects to smaller residential-building projects. We will also take a closer look at the winning entry – the Jewish Centre in Munich.

There is a noticeable trend in Europe to use copper as façade material. We have visited a few newly-built projects around Europe where copper was used as façade cladding, often industrially pre-finished modules.

We will also visit the new Aggtelek Visiting Centre in the Hungarian National Park Aggtelek, where only natural materials, such as copper, wood and lime stone, were selected to create a weatherproof surface for the organic main body of the building.

Finally, I would like to take the opportunity to thank all of you who have sent us photos and told us about your work and how you have used copper for both small and large projects. Thanks to your contributions we are able to produce a magazine with breath and international flair. Please continue to keep in touch with our editorial staff when you have comments or exciting projects to tell us about.

Lennart Engström, Editor
# TABLE OF CONTENTS

4  New headquarters for GN Store Nord in Copenhagen
6  New comprehensive school in Joensuu, Finland
8  Wisby Strand – New cultural building in Visby, Gotland
10 WTC Plaza in Helsinki is renovated and gets new façade
12 Expansion of Central Hospital of Lapland
14 Patinated copper facades on new residential building in Tampere
16 FCG builds new head office in Helsinki
18 St Henrik Chapel in Åbo wins the Barbara Coppachin award
21 Corazon – copper tents on Gothenburg’s Avenue
22 Report from the 2007 Copper Award ceremony in England
24 Winner of the Copper Award – the Jewish Centre in Munich
28 Aggtelec – new visiting centre by the Hungarian national park
30 Environmental Developments in the UK
33 St Mary’s Church in Essex is renovated and gets new copper roof
34 Palanga – new residential-building project in Lithuania
36 Mindaugas Apartments in Vilnius, Lithuania
38 Westport County Mayo Cottage, Ireland
GN Store Nord – one of Denmark’s historical companies – has moved into their new, modern headquarters in a Silicon Valley-inspired office area in Ballerup, suburb to Copenhagen. The building was erected in 1995 – originally for another company – and consists of four three-storey buildings, surrounding a courtyard.

Ten years later, 2005-06, the premises were rebuilt for GN. The courtyard has been turned into a large atrium, 40 x 60 m, covered with steel and glass, so that all four wings now constitute a connected entity with 500 work stations in open and flexible open-plan offices. The atrium contains stairs, lifts and walkways, and representative conference rooms and assembly halls.

Visitors enter the building through an airy and elegant reception area with large glass partitions facing the atrium and the front of the building. Both partitions have a pronounced copper frame. The external glass partition, with a revolving door as the main entrance, contributes through its design and material to the change in the building’s character. It gives the otherwise rather ordinary concrete-element building dignity and an air of importance and distinction, which makes it easy to believe that a highly respected firm lives here.

The surrounding framework of copper is put together by perfectly suited fields, and not just flat brown surfaces but a composition of beautiful nuances of green patination. Artist Inge Lindegaard has utilized his painting technique to bring up differences and transitions, so that the result of the patination process is surfaces with constant varying expressions, depending on the changes in the light, its strength and direction.

The overall expression is quite stunning. Just like a guide might say of a dramatic view to a group of tourists – with a grand, sweeping gesture: “This is a truly beautiful area!”

By Henry Voss, architect MAA

Client: GN Store Nord
Architect: NOBEL architects A/S
Contractor: Gladsaxe Tag & VVS, v. Paul Lindegaard
The Mill – New Joensuu Lyseo Comprehensive School building

Townscape

The new Lyseo Comprehensive School building plays a significant role in the series of public buildings on the central axis of the Town of Joensuu. The centre-dominant bulk of the building and its general appearance tie the school as part of this series of freely and openly located dignitary buildings.

The basic solution of the new school building makes it easily accessible from all directions. The functional centre space of the school is visible in four directions, and therefore constitutes an essential part of the townscape.

The selection of façade materials was based on the role of the school as a public building on the central axis. The pre-oxidised copper in dark brown together with glass forms a modern and dignified entity in the townscape.

The external areas of the school have been realised as park-like areas consistent with the role of the building in the townscape.

Architecture

The spatial philosophy in the interior architecture of the new building is based on clarity of space division. The central space with interesting spatial features divides operations in the building into cell units. Colours have been used to facilitate orientation to the four different building parts, in effect the blades of a windmill.

In each cell the rooms are wound round a small cell lobby. The cell lobbies are visually connected to the central space, but functionally they are separate.

The centre-dominant bulk of the building has been based on sculptured distribution of masses and a straightforward, high quality palette of materials.

Building

The building frame consists of copper clad concrete walls, and steel columns in the window wall and in the central parts of the frame. Intermediate floors are built of hollow-core slabs. The basic idea of the frame system is to produce modifiable space entities.

The main façade materials include oxidised copper and a horizontally divided, screen printed glass façade.
View from central lobby.
For many years, the political and wealthy elite of Sweden have gathered in Almedalen during one week in July, to discuss current topics for the future. This tradition, in combination with the uniquely beautiful and historically interesting milieu, has led to an increased demand for Visby as the venue for cultural events and conferences for the entire Baltic Sea region. Because of this, the municipality of Gotland has, in cooperation with the European Union and the Swedish government, built a concert- and conference building in Almedalen.

The building faces the sea. Two walls, placed at an angle, shape the building around the large auditorium, the foyer and the main entrance facing Almedalen. Suspended over the walls is a levelled, copper-clad dome. The building has a modern form language but is broken up in rhythm and scale to conform to Visby’s unique urban environment.

Classic, timeless materials were used: limestone from Gotland, refined copper, hand-carved maple wood and untreated white concrete. The bright light reflecting from the surface of the sea in the west is filtered and softened by transparent curtains and awnings and sharply protruding eaves. The upper-level glass surfaces of the foyer lean slightly outwards, and create a mirror image of the horizon for people strolling down Strandvägen. Seen from the inside, the leaning glass surfaces present an unbroken view of the sunset over the Baltic Sea.

The auditorium, which is lit by daylight, has room for 1000 people, and can be divided by using two block walls into one hall seating 600 people and two smaller halls seating 150 people each. The building also houses exhibition space, seminar halls and a big restaurant.

The building follows the municipality of Gotland’s environmental program and heat pumps supply sea water for both cooling and heating. Thus, the energy use per square metre has been radically lowered compared to similar buildings on this latitude.

Wisby Strand, Almedalen Gotland Sweden

In the middle of the Baltic Sea, on the Swedish island of Gotland, lies Visby, a one-thousand-year-old medieval, fortified Viking- and Hansa town, today included on UNESCO’s World Heritage list. Just outside the surrounding wall, facing west and the sea, was once the old harbour, today turned into a beautiful seaside park – Almedalen.
WTC Plaza
Helsinki, renovation project

The building acts as an important element in the centre of Helsinki. The Town Museum considered its original appearance from the 1960s so important as a background building for the Ateneum Art Museum, that only minor changes were permitted.
Architecture

The starting point in the renovation project was the poor condition of the façade, due to water having gained access through the multi-layer façade sheet metal into the external wall structures. Another objective was to improve heat insulation in the external wall. The adaptation of museum and technical requirements proved a complex design task. The façade was renovated as a weather-resistant combination of steel construction and aluminium windows, covered with patinated brass that will not change the appearance of the building. Special attention has been paid in both design and implementation to galvanic isolation of different metals. Heat insulation is improved by utilising new glass technology in the large glass surfaces.

Several repair requirements in terms of functionality and technology were also found inside the building. The most significant functional change is the steel staircase built through the office floors to facilitate traffic between the floors. The interior quality is improved by means of new space arrangements, surface structures, sanitary facilities and cooling systems. Plumbing, drains and electric systems are also replaced.

Eero Valtiala, architect SAFA
CJN Arkkitehdit Oy

Structural design

Thermal movements and corrosion, as well as fire issues in the atrium and the penetrations for new technology through old beams, the suspension of the new interior staircase and the closing of the old staircase with an EIR60 steel structure were the greatest challenges in the renovation project. The issue of thermal movements was carefully considered with the design-build supplier Teräselementti, and the conclusion was to support the frame on every floor to every intermediate floor slab. This also improved the safety of the building as fire insulation was improved on the intermediate floors. The double-height fire-rated glass walls by the glass roof of the atrium required special expertise in fire protection.

The new staircase built inside the building between the fourth and seventh floors eventually had to be suspended from a fireproofed steel beam supported onto the existing intermediate floor beams and slab on the eighth floor. The beam could not be placed into the ceiling of the third floor because the operation of the medical clinic on that floor continued throughout the project.

Ri Jyri Laurinantti, RI-Plan Oy
EXPANSION OF CENTRAL

MARKUS AALTONEN, ARCHITECT SAFA

The extension is located on the east side of the main entrance to the Central Hospital of Lapland, in front of the old building. In addition to the actual extension a new entrance shelter that covers both the ambulance entrance on the first floor and the existing main entrance of the hospital was also added.

Outdoor areas
The expansion project significantly changes both the appearance and the functions of the entrance courtyard of the Central Hospital. The extensive shelter over the main entrance protects the entrance area. The glass walls of the shelter protect the ambulance entrance from sideways rain and the grates improve the privacy of patients arriving in ambulances by limiting direct visibility down from the main entrance ramp.

A new maintenance courtyard enclosed by a wall is built at the east end of the expansion, below the parking area.

Building architecture
Despite its small size, the extension changes the appearance of the whole hospital building due to its central location. The facade solution was selected to display a modern hospital image. The eaves line of the facade is at the same height with the lower section of the existing hospital building. This makes the expansion a part of a pedestal for the central tower, which remains the dominant feature of the building. The common long eaves line of the extension and the main entrance shelter emphasises this impression.

The material is pre-patinated copper cassette, which is practically maintenance-free and thanks to excellent weather resistance has low life cycle costs. The copper creates a contrast to the existing expanded-aggregate concrete facade. The strongly profiled concrete of the old section was the starting point for the design of the facade. The openings and the profile of the extension respect the themes of the existing facade.

Functions
The first floor of the extension is reserved for emergency reception, new magnetic imaging facilities, lounges for meetings, rooms for pastoral carers, a patient hotel and administrative offices. The patient hotel offers accommodation services to out-of-town patients. In the future, the emergency reception facilities will become part of the common emergency area. The oncology unit, as well as facilities for general hospital psychiatry, nutrition therapy and administrative functions are located on the second floor. The lower so-called hillside floor contains the pharmacy storage, and facilities of the central warehouse, technical staff, appliance maintenance and equipment maintenance.

Atrium
The full-height atrium between the expansion and the existing building is covered with a curved lantern that hints at the shapes of the Lappish hills. The solid roof of the lantern creates a ruled surface, and the vertical north side of the lantern is glass, allowing natural light into the atrium.

The atrium is in effect an empty space in the middle of the various functions. If left as an outdoor area, it would be very difficult to maintain. A covered atrium was considered a worthwhile solution, as it results in savings, making the building envelope smaller and both building and operating costs lower. The atrium also serves as a recreational area for the staff and the patients, which can be considered an additional bonus. A Japanese rock garden and a retreat area are built in the atrium, and it can also be used as a venue for small gatherings. The staff use it as a place for relaxing and a meeting point.

The gross area of the extension is ca. 3500 m² and the area of the shelter is ca. 650 m².

Markus Aaltonen, Architect SAFA
Main designer/Tähti-Set Oy
Johanna Kaikkonen, Architect SAFA
Coordinating architectural designer/Tähti-Set Oy
A view from the lowest level of the atrium. The photo shows the staircase between the first floor and the second floor, covered with brown pre-patinated copper.

A view from under the new entrance shelter. The new facade [to the left] is covered with pre-patinated copper cassettes.
In terms of the townscape, the starting point was to adapt the building to the redbrick tradition found on the banks of River Tammerkoski. The building delimits Nalkalan tori square as a block-wide redbrick entity identifiable in scale with the old redbrick factories in Tampere, with a curved building mass in green pre-patinated copper towering over it. The solid block-like nature of the main façades has been emphasised by replacing apartment balconies with semi-warm conservatories located behind the building façades.

The building faces east, the main viewing direction being towards Ratina backwater. The apartments could not be designed to face west due to the parking house that borders the building plot on the west side.

Functionally the building is a twin-block residential facility for the elderly, with various services and stores on the ground floor, such as a restaurant, a gym and an assembly room, as well as physiotherapy facilities. Two sheltered housing units are located on the ground floor and the first floor, and apartments on the upper floors vary from bedsits to 3 bedroom apartments. Most of the apartments are single and double bedroom flats. Parking space is provided in a basement parking garage.

The building has been implemented utilising highly versatile technical systems: floating floor structures ensure good sound insulation, the heating system is a radiant in-floor heating system, and ventilation is completely mechanical and equipped with a heat recovery system. An automatic fire extinguishing system covers all the areas of the building.

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<thead>
<tr>
<th>Architect</th>
<th>QUAD arkkitehdit Oy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Arkkitehtitoimisto Ilkka Laitinen, design stage</td>
</tr>
<tr>
<td>Building</td>
<td>Arkkitehtitoimisto Ilkka Laitinen, building stage</td>
</tr>
<tr>
<td>Developer</td>
<td>YH Länsi Oy</td>
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<td>Contractor</td>
<td>Lujatalo Oy</td>
</tr>
</tbody>
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- Floor area   7 200 m²
- Volume       34 900 m²
FCG Centre
Käpylä, Helsinki, Finland
The five-storey office block near the Käpylä station is the first building stage of FCG Centre. The core of the building is the full-height entrance lobby, which is delimited by a tall glass wall stiffened with tension reinforcement. The lobby continues as an assembly terrace between the buildings. Both office wings utilise the floor-specific functions and conference rooms located in a six-storey “tower” suspended from the roof structures of the lobby.

The central solution of the office wings is based on dividability, efficiency and flexibility. The number of load-bearing structures and fixed installations has been minimised. Separate lanes are reserved in the suspended ceiling for building services. The floor levels are supported on beams in the external wall line without any columns that would restrict the modifiability of the central area.

The attic floor contains sauna facilities, meeting rooms and a roof terrace.

**Structures and materials**
The façades towards Osmontie Road and Tuusulanväylä Road are primarily built of thermo profile panels with pre-patinated copper cladding installed on the site. The continuous façades are plastered sandwich panels. The appearance of the lobby area is dominated by wooden veneer cladding.

The load-bearing columns and beams are precast concrete units, and the intermediate floors are hollow-core slabs.
St Henrik’s Chapel was completed in 2005. It is located in Hirvensalo on the west coast of Finland. During its short existence it has aroused wide interest and won several awards. This year the chapel was also presented with the renowned International Barbara Coppachi Architectural Award. The exceptional appearance of the building and the sculptural use of wood indoors are stunningly beautiful.

The “Ikhtys” Chapel Symbolizes Fish
Garbi Architect Matti Sanaksenaho and his team consisting of Pirjo Sanaksenaho and Enrico based the design on fish, the symbol of Christianity. Therefore the chapel is called “Ikhtys”, which is Greek and means fish. The layout as well as the appearance of the chapel imitates a fish. However, some also see it as a boat turned upside down. The building is located on a wooded hilltop with a hospice and an oncological hospital nearby. Thus the chapel serves the distressed as well as those seeking for peace and tranquillity.

Natural Materials Play a Key Role
The materials used in the chapel are wood and copper. Their abundance gives the building a peaceful and stately appearance. Oxidization has already turned the initially clear copper cladding dark. The chapel may gradually acquire a patina on its surface due to the vicinity of the sea and the surrounding conditions. The use of copper was a conscious decision by Architect Matti Sanaksenaho as copper is such a vivid material, in fact, art designed by Mother Nature. Technically speaking, the curved shapes of the walls and working on a man lift were a real challenge to Sheet Metal Worker Jari Lehtinen, who was alone responsible for the copper installations. The same fish theme is repeated in the rhythm of the seams of the banded material. Finnish pinewood is used inside the chapel, where evenly spaced massive beams make the interior an impressive work of art. A long aisle leads to a simple altar, onto which daylight is filtered beautifully through high windows. The altar was designed by the late Kain Tapper.

Text and pictures by Hannele Numminen
THE BARBARA COPPACHI ARCHITECTURAL AWARD WAS GIVEN TO

St Henrik’s Chapel in Finland

Architectural design by Architects’ Office Matti Sanaksenaho Oy Design Firm Narmaplan Oy
Sheet metal contracting by Peltisaari Oy in Salo, Sheet Metal Worker Jari Lehtinen
Altar and interior by Kain Tapper
Glass materials by Hannu Konola
Over the past few years St Henrik’s Art Chapel has won several awards. In 2005 the chapel was awarded the annual Wood Prize by a popular vote. The prize was received by Kalevi Narmala of Design Firm Narmplan Oy. In the same year the chapel also won the Roof of the Year competition. This year Architect Matti Sanaksenaho received the 60 000-euro Barbara Cappochi International Grand Prix Architectural Prize, which is given in Italy every other year. The prize particularly focuses on architecture that maintains the message of hope, optimism and peace. All these properties are combined in a very special way in the Turku Ecumenical Art Chapel. The prize was awarded to Matti Sanaksenaho in Padova in October 2007.
The largest shopping and strolling area in Gothenburg, Sweden, is called the Avenue. Here, small, cosy restaurants can be found in every block along the boulevard. On warm summer evenings, when Gothenburg’s night life is starting up, cafés and restaurants are quickly filled. This is where people go to meet old friends and make new acquaintances. One of the many restaurants along the Avenue, the Corazon, recently opened a brand new outdoor section, where the concept is a number of copper tents. The “tents” are constructed of flat copper sheet that has been perforated, which allows the guests to look out through the walls and yet be protected from the elements. The concept gives people the comfort of being in an enclosed area, and at the same time be part of the nightlife on the Avenue. Our guess is that the Corazon copper tent will be one of the most popular “watering holes” along Gothenburg’s main boulevard during the coming summer.
AWARD WINNERS ANNOUNCED

In the last issue of Copper Forum (23/2007) we featured all the projects short-listed for the 2007 Copper in Architecture Awards. Now we are able to highlight the winners, announced at a presentation ceremony in London last autumn. This ceremony proved to be a particularly lively event – with an exhibition and project presentations by their designers - bringing together architects, contractors and their clients from around Europe and reaffirming the popularity of copper as a modern architectural material.

The Copper in Architecture Awards programme considers architectural projects from around Europe using copper in all its forms. The team of experienced architect judges - led by Paul Finch, Editor of Architectural Review magazine and joined for the first time this year by the winner of the last European Award Kari Jarvinen from Finland – focused on the quality of architectural design. The 2007 entries revealed an exceptional diversity of important buildings from various countries – many not yet widely known or published – amongst the 74 entries received. This year, the judges’ task was made particularly difficult by the exceptional quality of entries but, after much deliberation, awards were made from the six projects short-listed for the European category.

The European Winner was the Jewish Centre in Munich designed by Wandel Hoefer Lorch Architekten. This impressive project – discussed in more detail in the building feature on page 24-27 – includes a veil of woven bronze mesh surmounting the rusticated stone base of the synagogue building. The choice of materials has symbolic relevance informed by Jewish culture but is also particularly effective architecturally. This deceptively simple elegance and use of materials won the judges over.

Three other contrasting projects were also Highly Commended for their exceptional qualities. The judges were particularly impressed with the careful, crafted design of Jarmund/Vigsnæs AS Architects’ Svalbard Science Centre with its long, low, faceted copper profile. To find architecture of the highest standard in such a remote, arctic location and successfully meeting such major technical challenges is exciting. All those involved in the design and construction of this beautiful building deserve congratulation for this achievement. Also rewarded for its exceptional quality was the Theatre in Vicar, Spain, by Carbajal + Solinas Verd Arquitectos. This design takes a radical approach to cladding flat surfaces, using a combination of brass, bronze and plain copper strips which also led to it winning an Innovation Award. But the judges considered its design as more than innovative and, in the strong Spanish sunlight, the visual effect is simply stunning.

Also Highly Commended, the Kumu Art Musem in Tallinn, Estonia was designed by Vapaavuori Architects. Unlike many other entries, the form of copper cladding is straightforward but nonetheless essential to the overall composition. The judges regarded this major cultural building, with its clear national identity, as an elegant solution to the complexities presented by buildings of this type.
The judges also wanted to acknowledge the excellent standard of entries generally—and two other short-listed projects in particular. Lands Architecture’s Une Boîte Moirée is a modest scale copper box in the Swiss countryside, using rich combinations of copper cladding and perforated screens. In contrast, the Skive CHP Station in Denmark—showcasing the new biomass technology with sustainable copper cladding—designed by C. F. Møller Architects, is an exemplary utility building designed with a real architectural response.

Separately from the European category, the Copper in Architecture Awards continue with recognition of the best UK projects. Winner of the UK category was Keith Williams Architects’ Unicorn Theatre in London. The cool, calm approach taken with this landmark building and a careful use of materials singled it out for the Award. In addition, two other projects were Commended. Allies and Morrison’s landmark Planetarium in Greenwich incorporates beautiful surface treatments to the smooth bronze cone, while Feilden Clegg Bradley’s Formby Swimming Pool gives an elegant understated solution to a public building. Finally, the Awards programme does not forget about our future designers—with special Awards for Students of Architecture, or those who help make architects’ concepts a reality—with Awards for Craftsmanship of the highest standard.

Planning has already started for the next Copper in Architecture Awards, so look out for further announcements in future issues of Copper Forum and the copper industry websites below. More images and information about all the short-listed projects can be found in issue 23/2007 of Copper Forum or at: www.cda.org.uk/arch but many of the other buildings submitted will also be of interest to architects, so all the Award entries from around Europe are featured at www.copperconcept.org.
ARCHITECTURE AND SYMBOLISM

This building study takes a closer look at the design of the new Jewish Centre in Munich, Germany – winner of the 2007 European Copper in Architecture Awards.

Munich’s new Jewish Centre unites a wide range of facilities, scattered throughout the city during the post-war period, in a single, central location. It was inaugurated on the anniversary of the 1938 ‘Kristal Nacht’ the ‘night of the broken glass’ when Nazi thugs moved through German cities burning synagogues and attacking Jewish people and their properties. At its heart is a synagogue whose design is rich with symbolic meaning and which is surmounted by a unique translucent woven bronze mesh veiled lantern.

Designed by Wandel Hoefer Lorch Architekten, the primary concept for the Jewish Centre was its natural integration with the city structure by utilising public space. This skilful integration signals a renaissance of public Jewish life in Munich. The Centre’s public nature and openness is experienced in a succession of squares, paths and passageways between the buildings and their neighbourhood.

A CONSIDERED USE OF MATERIALS

Three interrelated buildings – the Community Centre, the main synagogue and the Jewish Museum of the City of Munich - form a balanced ensemble while clearly retaining their own autonomy. Each building is differentiated through individual use of materials while setting up relationships between them. For example, travertine is used in different shapes and forms: rusticated natural stone forms the rugged base of the synagogue, contrasting with polished stone used for the museum and the cut slabs which reflect light and shadow onto the facades and around the patios of the Community Centre.
DEFINING THE SYNAGOGUE
Named ‘Ohel Jakob’, or Jacob’s Tent, after the original synagogue destroyed in 1938, the new synagogue is oriented towards the east and stands unattached within the public space. One of the main challenges facing the architects was to derive a typology for the built form of synagogues, as architect Andrea Wandel explains: “The absence of a defined tradition for this particular building type at first meant that there were few coherent guidelines that might influence our design. Nevertheless, we used as a starting point two elements that could be described as the core experiences of Judaism: the temple and the tent of epiphany. In the 1920’s, the Viennese art historian Max Eisler – during an architectural competition for a synagogue – mentioned the tent as an appropriate building form. Subsequently, Salomon Korn highlighted the contrasting pair ‘temple’ and ‘tent’. The first ‘Lord’s house’ of the Jews was an interim solution: the tent of epiphany. This formed an ephemeral cover for the portable ‘ark of the covenant’, ready for dismantling and moving at any time. In contrast to this portable sanctum the second Jewish church was a massive structure: the temple of Solomon. With links to Mount Zion and supported by an immense substructure, the temple clearly represented permanence and durability.”

DEVELOPING A BUILDING TYPOLOGY
“We could see that, in general, synagogues exhibit elements of both the temple and the tent of epiphany, in each case with more of an accent on one or the other. So, the architectural concept of the synagogue is typified by an interplay of permanent and transitory states. In our design, the massive stone base represents the permanence of the temple, contrasting with the woven bronze veil which suggests the fragility of the tent.”
This concept translates into a deceptively simple composition of two contrasting, stacked cuboids: an almost impenetrable eight metre high rough stone base with a taller filigree glass and steel construction rising form its centre, cloaked in a woven bronze translucent veil. During the day, the bronze veiled lantern brings light into the interior and in the dark it shines.
TRANSPARENCY AND PATTERN

The lantern is built with three overlapping layers of materials that flow into each other like fabric but, at the same time, appear to separate, drawing the eye upwards. Steel triangles form the supporting structure, with glass at the centre and the flowing bronze mesh outside. The interaction of the spirals of bronze mesh - widened to create the optical impression of an equilateral triangle - with the similarly triangular construction of the glass façade behind the mesh, generates patterns clearly suggesting the Star of David symbol but without directly replicating it. The realisation of this concept demanded a special solution for the mesh and the lantern construction.

MAKING CONCEPTS A REALITY

The bronze wire mesh was developed by metal weave experts GKD – Gebr. Kufferath AG. Usually, a mesh covering of this scale would require a substrate for support and to accommodate wind loadings. But to avoid such a substrate and enable the required transparency, the façade mesh is suspended from the top, fixed to the steel substructure using inserted bronze flat profiles, then in the middle screwed to a bronze pipe construction and at the bottom stretched tight to the substructure with springs. Extensive technical trials were required to gain approval from the local building authorities for this innovative and flexible solution. The decision to use bronze was influenced not only by the aesthetic qualities of the material but also by its performance advantages. As time passes, the bronze will oxidise and lend the building a unique patina of its own. And, of course, the long service-life, non-flammability, minimal maintenance and recyclability of the woven bronze mesh make it a singularly attractive solution. The roof and façades of the glass lantern are clad in a total of 1,300 m² of bronze mesh.

The selection of materials has particular symbolic significance with the rough stone base and translucent bronze mesh characterising opposites of the synagogue – stability and fragility. Terra firma and transcendence or darkness and light are in balance. And this architectural intensity continues with the interior. Although considerably smaller than many churches and other places of worship, the synagogue’s deceptively simple design, utilising Lebanese cedar paneling, generates an impressive space. The veil of bronze mesh around the glass lantern disperses the sunlight falling onto it and bathes the interior in a warm light. This sensitive interplay of light, transparency and shadow gives the space a unique atmosphere.

Looking up into the translucent bronze mesh ‘tent’ roof intensifies the experience of transience.
The Aggtelek Visiting
A splendid new visitors’ centre enhances the experience of penetrating subterranean space into a dramatic cave.

My aim was to create a special gate to express the fine transitions between the shining surface of the earth and the deep, romantic, interior space of this wonderful cave.

This shaped the final structure of the space and gave the landscape its remarkable character.

What I am trying to say now is that this project was aimed to create a portal into the bowels of mother earth, exploring all its drama.

The unstable rocks were taken out of the limestone cave, and eventually incorporated into the building’s base. This local stone became the project’s dominant material.

The carpentry was completed by the best carpenters in the world, those from Transylvania.

The “skin” of the building is copper, with double roof covering.

The curved structure of the building is stuck to the crater shaped earth surface.

The ground floor is the main space with 4 areas of different functions:

From the 1000 sqm veranda you can get access to the cash desk, the bistro, the gift shop and the lavatories and a second function place.

The real cave entrance is in the basement. Here, I returned to the original man-made entrance-concept.

The first floor comprises an exhibition room, a rest room with sanitary space for tour guides, and a flat for the caretaker.
ENVIRONMENTAL DEVELOPMENTS IN THE UK

The last twelve months has seen the implementation of a new ‘Code for Sustainable Homes’ in the UK. Although initially voluntary, it will become a firm regulation soon and likely to be followed up by similar measures for buildings other than homes. The Code covers various issues including energy use and CO₂ emissions, pollution, water use, waste and surface water run-off (discussed later), as well as building materials. To assess building materials, the Code will use a Life Cycle Assessment (LCA) method developed and implemented by the Building Research Establishment (BRE), called ‘The Green Guide’. This Guide will rate roof, wall, floor and other complete constructions – not just the individual materials – probably from A (very good) to G (poor). It is intended that these straightforward ratings will provide architects with helpful, easy to use guidance based on up-to-date data.

COPPER INDUSTRY INITIATIVE

The copper industry has been in discussion with BRE from the start and is seeking to replace the out-of-date information on the material currently being used by them. Recognising that LCA is an important scientific tool for assessing the environmental impacts of materials, some years ago the European Copper Institute set up a ‘European Competence Life Cycle Centre’ to study this for the metal. After 3-years work, the most accurate copper life cycle data is now available from this most authoritative of sources via a dedicated website www.copper-life-cycle.org. For metals, a typical “cradle to grave” study covers the mining and extraction of raw materials, fabrication, transportation, use and recycling or disposal - including energy and all other material supplies required. Discussions with BRE revealed that they have been using much older data that fails to reflect major environmental improvements made by the copper industry over recent decades, amongst other factors. These improvements are clearly demonstrated in the graph.

DEMONSTRATING SUSTAINABILITY

Pressures to use ‘sustainable’ materials require robust assessment methods. In the absence of definitive Green Guide ratings or other up-to-date guidance from BRE, the latest LCA information for copper cladding, roofing and other applications can be found at www.copper-life-cycle.org. Another useful environmental measure of a material, ‘Embodied Energy’ is the total energy consumed during every phase of each life cycle from cradle to grave. The latest comparisons for typical roofing and cladding metals (taken from a recent, German study), considered over ‘whole of life’ provide helpful guidance. This study is based on material thicknesses typical for fully supported roofing techniques: 0.6mm for copper; 0.4mm for stainless steel and 0.7mm for stainless steel.
for aluminium - but the same principles hold for thicker cladding materials. Life spans of 200 years or more for copper are justified by experience, while both aluminium and stainless steel industries claim 100 years each. This independent study clearly shows that copper offers the lowest embodied energy of the three metals (103 MJ/m² compared with 157 MJ/m² for stainless steel and 115 MJ/m² for aluminium) as well as the lowest CO₂ equivalent emissions.

**MATERIAL IMPLICATIONS**

Even without detailed scientific support, many architects feel instinctively that copper is a sustainable architectural material. It has, of course, been used since the dawn of man in numerous applications and as a building covering for centuries: a 13th century copper roof remains intact today on a German church. It has been estimated that only 12% of known copper reserves have been mined throughout history and the recycling of copper is a well-established practice. This is due to the relative ease - compared with other metals – of re-using both process waste and salvaged scrap from eventual demolition, as well as the incentive of copper’s value. Today, copper scrap is re-used ad infinitum and more than 55% of copper used in architecture comes from recycled sources. And, of course, as a natural element within the earth’s crust, incorporated into living organisms throughout the evolutionary process, copper is an essential nutrient required by all higher life forms.

**SAFE TO SPECIFY**

Sometimes concern is expressed about the possible effects of copper in rainwater run-off from roofs and cladding, often fuelled by out-dated laboratory experiments involving conditions never encountered in the field. As a result, significant scientific research has been carried out to understand the complex processes actually taking place. This has demonstrated that the use of copper in external building applications is not harmful to the environment. Through natural processes of binding to organic matter, adsorption to particles and precipitation, the copper run-off finally comes to rest in a mineral state as part of the earth’s natural background of copper material, continuing the natural extraction/mineralization cycle.

In any event, copper in run-off comes to rest very early in current drainage regimes. In the UK, the issue of rainwater run-off and recent flooding around the country are being addressed with new planning regulations demanding Sustainable Drainage Systems (SUDS). The techniques used in SUDS include permeable (or pervious) paving, soakaways (or ‘inverted wells’) and swales (or ‘wadis’). The most definitive guidance on SUDS design shows that all these techniques arrest the major part of copper material in runoff: for example, permeable paving detains 60-95% within its construction. If released to the soil, the remaining available copper is taken up by organic matter in soil or at sewage treatment plants, or by other chemicals. This forms compounds with minimal, if any, amounts ultimately joining the natural background presence of copper in aquatic environments. In any event, copper does not bio-accumulate and, of course, no harmful effects have occurred with the extensive use of copper plumbing in homes throughout the world. Detailed, authoritative supporting information is available via the European Copper in Architecture Campaign for anyone encountering misplaced concerns sometimes encountered from planners or other regulators.

**Comments from the designers of some of the short-listed projects from the UK Copper in Architecture Award on the environmental aspects of their buildings.**

*The Collection, Lincoln (Awards Short-listed)*

Panter Hudspith Architects

Inge Laursen says: “This museum building was conceived as a fragment of the existing medieval city, made from limestone quarried less than 20 miles away. Openings in the stone are cut from blades of bronze, which frame windows and entrances. The material is carried through the whole building to form canopies, doors, vents, gutters and ironmongery. The client’s brief required that the building stand for at least 125 years and this was instrumental in the selection of durable materials.”

“The historic resonance of bronze, a copper alloy used as far back as the 4th millennium BC, was fitting for our desire to create a timeless building. Bronze has a high material efficiency due to its robustness and density, and its recycling quota is reported to be almost 80%, saving up to 92% of the energy required to extract the metal from ore. Minimising the consumption of energy and resources wherever possible, coupled with the longevity of the construction, were important sustainable goals for us as a practice.”
The Roland Levinsky Building, University of Plymouth (Awards Short-listed). Architects: Henning Larsens Tegnestue with BdP.

John Palmer of BDP, Bristol, says: “Copper was chosen for the roof and wall cladding primarily because of its associations with quality and with an historic copper roof in the locality which had clearly stood the test of time in this harsh marine environment. We also looked at the benefits that could be obtained from the possible high-recycled content, long life of the material and its detailing, low maintenance requirements and the eventual recyclability of the material.”

“The copper was used as a weathering to a composite insulated panel substrate which, overall, provided a highly insulated envelope with low air leakage rate, reducing energy use. Investigation on rainwater harvesting for the flushing of toilets revealed that the copper would probably provide the benefit of inhibiting bacterial or algal growth in the water. These aspects all made positive contributions to the University’s sustainability aspirations and requirement for a BREEAM ‘Very Good’ rating.”

Peter Harrison Planetarium, Royal Observatory, Greenwich (Awards Commended)

Allies and Morrison Architects

Project architect Andrew Dean says: “The geometry of the planetarium reflects key astronomical concepts. Above ground it is manifested as a tilted bronze cone aligned with the north star at 51.5 degrees. The cone was prefabricated in sections then welded together on site and welds grounded down to give a seamless surface. The bronze was specially treated to build up a surface of rich reds and browns finished with green splashes resonant of nebulæ seen in space.”

“While bronze was chosen largely for its unique visual characteristics which have such an impact on this project, the positive ageing process of patination and its indefinite lifespan are also important to buildings of this type. It is also reassuring to know that the material is 100% recyclable at the eventual end of the building’s life. Finally, as all the rainwater runoff from the building is disposed of on-site via soakaways in the adjacent park, external materials needed to be suitable for sustainable drainage systems.”


Keith Williams says: “Compositionally, the new building is an asymmetric pavilion. The main Weston Theatre sits some 7 metres above the main foyer and the Clore Theatre which have been inserted beneath. The Weston is the cultural and creative heart of the Unicorn and has been treated like a special casket, enwrapped in a random length strip rain screen system using pre-oxidised copper of three different standard widths. The random strips create a laminar, striated, and massive quality to the main façade, which sits in deliberate contrast to the curved amphitheatre form of the auditorium nesting at its heart, heightening the audience surprise on ascending to their seats.”

“The strip copper is carried into the interior of the building to celebrate the presence of the main theatre hovering overhead the foyer, and to ensure that it is legibly ever present. The larger architectural gestures of projecting copper clad main auditorium and the iconic corner tower with its eroded base, signal the new building at an urban level, yet the designs are also rich in small scale detail. Copper was chosen for its longevity, its architectural appearance, and its high degree of sustainability in that it is almost endlessly recyclable.”


Architect Andy Couling says: “The client’s brief was for a sustainable, beautifully crafted building for the whole community. Sustainability was a key driver for both client and architect. Environmental issues, our previous experience of pool buildings and a love of natural materials led us to the principle of a timber framed building clad in materials which will weather gracefully over many years without the need for regular maintenance, notably copper. The building takes the form of two linked volumes.”

“The dominant form clad in oak and roofed in copper sits next to a lower, longer copper box. The roof structure gradually changes towards the high street and creates a double curvature roof visible from several angles. We needed a material which could cope with the complex geometry and would enhance the appearance of the building. Copper was an obvious choice because of its longevity, sustainability credentials and beauty. One of the principle attractions of copper in this instance was that it will continue to change over the years, developing its own unique patina in the salty coastal air.”

The Peter Harrison Planetarium, Royal Observatory, Greenwich (Awards Commended). Peter Harrison Planetarium, Royal Observatory, Greenwich (Awards Commended)
St Mary’s Church at Theydon Bois

When the original spire of this picturesque village church in Theydon Bois in Essex had to be replaced it was essential that the original natural green patina and the detailed workmanship be kept.

The original spire failed, albeit after 80 years, due to over-fixing of the traditional panels in the most vertical sections of the spire, the resulting cracking being due to the lack of any allowance for thermal movement. A team including the architect, Ronald Wylde, the director of the roofing contractor (Full Metal Jacket) Paul Rawlinson and their most experienced coppersmith; re-designed the spire so that the mid section now includes a more modern long strip system while keeping the original appearance of the spire and with proper allowance for thermal movement. The long strip section includes eight highly detailed dormer style vents. The lower section has a double herringbone design.

Every aspect of this spire displays the high standard of workmanship and careful attention to detail. Particularly the intricate workmanship of the vents and the herringbone standing seams at the base.

These images clearly show the quality and consistency of the workmanship and the lack of damage to the patina at the points of most demanding detail.

Paul Rawlinson Director – Full Metal Jacket commented:

“The spire’s existing copper cladding had failed due to over-fixing of the panels, which restricted thermal movement. The copper sheet had cracked at the junctions. Our coppersmith Chris Johnson, director of Full Metal Jacket, Paul Rawlinson, and surveyor Ronald Wylde re-designed the new copper sheet detailing allowing thermal movement to take place without changing the appearance of the finished panels.

We introduced a double herringbone standing seam detail to the base of the spire. The 8no dormer vents were traditionally finished with the mid-section being installed in a modern long strip system. The finial, cross and ball were traditionally formed with welted joints and the weather vane was existing and was repaired. The copper sheet supplied by Luvata with its pre-patinated surface was ideal to form and fit all details of the spire.”

Ronald Wylde, Ronald Wylde Associates: “St Mary’s Church at Theydon Bois in Essex with its distinctive spire is a very popular local landmark. When a decision was taken to replace the copper coverings to the spire, the client stipulated that the characteristic green colour was to be maintained.

The pre-patinated copper supplied by Luvata and fitted by Full Metal Jacket Ltd of Loughton, Essex was able to meet this requirement precisely and the finished results are aesthetically pleasing and have been well received by the church and local community.”

Project: St Mary’s Church of England – Theydon Bois, Essex Approx 200 m²
Nordic Green Plus pre-patinated copper
Architect /Surveyor: Ronald Wylde, Ronald Wylde Associates
Roofing Contractor: Full Metal Jacket
A resort town on the Baltic Sea coast in Lithuania, Palanga, is now going through the drastic changes under the swirl of the new market economy. The town was formed as a typical resort of the XIX century – peaceful and romantic place with beautiful English-style park, The Tyszkiewicz palace, Neo-Gothic church and tiny wooden houses buried in verdure. Considered to be an object of collective desire, a “different” resort with a sweet taste of prohibited freedom by the citizens of USSR, Palanga, thanks to the local architects, managed not to loose its harmonic coexistence with nature during the Soviet times.

The new, mostly brutalist structures which appeared at that time, at least in the center of the city, tended to hide between the trees retaining the forestlike impression of the town. Even a comparatively massive structure from the 60’s, a summer theatre with its huge double-winged concrete roof still seems to be unnoticeable in the summer disappearing almost entirely in the pines. Today, however, the delicate balance between the city and surrounding landscape is gradually fading away. Palanga is turning out to be a coastal resort of a mass tourism era whose population swells up in several times during the season. The urban topography is changing not only because of the rising amount of tourists and, consequently, the growing demand for the new construction, but also due to the changes in leisure patterns: people who increasingly tend to come to resort only for few days aim to buy or rent private apartments in contrast to the collective and long-term type of rest in the bygone soviet sanatoriums.
The recently built copper house in the center of Palanga designed by Lithuanian architect Donatas Rakauskas could be seen as a new type of architecture which keeps strong ties with intelligent local traditions of dealing with nature and at the same time satisfies the new dynamics of the contemporary coastal lifestyle. The project beginning was a typical example of the current trends of privatization: four owners of the smallish adjacent land pieces wanted to build four different private houses. The architect managed to persuade them to build only two buildings and at the same time – meet all the individual needs. In the result, the shared reality appeared to be two almost identical three-floor houses while inside everybody got whatever he wanted: spacious apartment for big family; small cozy flats for renting; bachelor’s suite with separate rooms for friends.

The buildings, which differ in area (approximately 600 and 800 m²) but have the same volume configuration and scale, were mirrored and turned towards each other so that the master plan allowed to save maximum amount of the existing trees. Their perception could remind a kind of exciting game in recognizing twins if not the difference in façade materials. Both houses were aimed to imitate the foliage of larch but using different means – fibro-cement and copper. To realize the copper façade Luvata (the company-producer) developed non-standard strips of 6 green patina tones in 4 different widths from which the architect chose 12 combinations used for the production. The panels identical to Luvata’s standard model FPAN 402, due to the variable tolerances of the building, were produced at the site by a local tinsmith. Installed to the façade in irregular order, the copper panels generate a special graphic code very close to the color and tactile characteristics of the local nature.

It seems to be not a mere coincidence that exactly the copper house stands on the corner of Kestucio and Birutes alley, named after the heroes of the legendary love story from the XIV century about priestess Birute and the Grand Duke of Lithuania Kestutis.
Mindaugus Apartements
- a Contrast to the Old Town architecture in Vilnius, Lithuania

Sometimes façade is referred to as ‘a face of a building’ able to tell an entire biography of the house. Final façade finish is always aimed at two purposes: protection of the building against negative outside impact and also providing a certain luxury appearance. With ventilated façade systems getting more and more popular, architects and constructors recently often apply modern solutions to satisfy both the aforementioned requirements. As is turned out, they didn’t have to go too far: materials known for ages, copper, for example, could also provide stability and solidness to a façade.

In Lithuania, so far, we have a few buildings containing copper façades. One of the recent samples is Karalius Mindaugas’ center of commercial premises and apartments erected at the very center of Vilnius, in the place of former Zalgiris swimming pool. According to Architect K. Pempe, the Design Project Manager, in selection of façade finish for this five-storey building, cultural heritage protection experts recommended the use of the highest quality materials, contrasting to the building finish on the other side of the river Neris, at the heart of the Old Town. After a long period of search and even a few trips to Finland, designers refused initially chosen stone and settled on copper straps well-matching to the Trespa panels, aluminum louvers and glass structures (see Article Facing the Royal Palace of Lithuania). It is interesting how architects have managed to persuade their customer, whose business is related to natural stone working, in correctness of such a solution! Their arguments have been simple, but logical: only copper straps can fully convey the entire plastic solution of the building volume (also its rounded corners) and, besides, the solid-looking though light patina-covered planes can retain their color and original structure without demanding any special care.

As soon as the solution was passed, its implementation works began. 0.8 mm thick copper sheets produced by Finnish company Luvata were carried to Lithuania in rolls and bent into 2-3.5 m length and 28 cm width profiled panels according to the designers’ supplied data. Exterior planes for walls and floor-separating straps were shaped out of such panels. On the construction site, they were fastened to aluminum guides mounted on
Karalius Mindaugas’ apartment building makes a contrast to the Old Town architecture.

the wall heat protection layers. Copper was oxidized straight at the factory and covered with special mix by its composition corresponding to natural, 30 year-old patina. Therefore assembled walls did not require priming or painting. According to experts of Elias ir Partneriai representing Luvata in Lithuania, the façade will change its appearance neither in 15 years, when the manufacturer’s coating is replaced by natural copper oxides, nor in a half of century. Thanks to a noble look of its copper coating, Karalius Mindaugas’ center has obtained the sort of cosines common to the Old Town spirit, and probably claims to become one of the first architectural monuments of the 21st century in the capital.
When Tarla MacGabhann of MacGabhan architects was presented with the commission to double the size of this 1920s built neo-Georgina cottage in West Mayo, Ireland for a young growing family his decision was to do nothing with the extension which would detract from its pretty classic lines, but rather to do something towards the opposite, to produce some organic form which could not be seen as an attempt to copy the original form.

The extension needed some form of flexible wrapping which would cope with its multiple forms and facets. There are no right angles in the plan of this extension that is capped with a low-pitched roof. The roof design is for a straightforward long-strip standing seam, the facade surfaces have been treated with small diamond shaped shingles the size of which have been chosen to complement and harmonize with the scale of the building.

Natural copper was chosen as the material as it was felt important to be able to recognise the age of the separate areas of the cottage and to be able to watch the progressive development of oxidation and patina reflecting the client’s family maturing.

The roofing contractor, G G Roofing hand made these small shingles on site, particular credit should be given for the thought and effort that has been given to the way the shingles have been fabricated and fixed to ’wrap’ around the many facets of the building.
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