KRUUNUSILLAT

KRUUNUSILLAT

BRIDGE DESIGN COMPETITION

City of Helsinki

WORLD DESIGN
CAPITAL
HELSINKI 2012

More Than Just Bridges

Table of contents

1	**ORGANISATION OF THE COMPETITION**	
1.1	Promoter, purpose and nature of the competition	10
1.2	Competition participants	10
1.3	Fees	10
1.4	Competition jury	11
1.5	Competition rules and approval of the competition programme	13
1.6	Competition stages	13
1.7	Arrival of competition entries	13
2	**GENERAL**	
2.1	Assessment principles	16
2.2	Summary of assessments	16
2.2.1	Economic feasibility	17
2.2.2	Technical feasibility and durability	18
2.2.3	Principles of sustainability, carbon footprint	18
2.2.4	Aesthetics	19
3	**ENTRY-SPECIFIC ASSESSMENTS**	
3.1	Debet semper plus esse virium in vectores quam in onere	22
3.2	Filum Lucis	26
3.3	Gemma Regalis	30
3.4	Hyperborea	34
3.5	Nexu	38
3.6	Occursus	42
3.7	Oculus	46
3.8	Recreatio maritimus	50
3.9	Septem Fratres	54
3.10	Unda Arctica	58
3.11	Ventus	62
4	**RESULTS OF THE COMPETITION**	
4.1	Prizes	69
4.2	Recommendation for further action	69
4.3	Guidelines for further planning	69

1

ORGANISATION OF THE COMPETITION

1.1 Promoter, purpose and nature of the competition

The City of Helsinki was the promoter of the international design competition for Kruunusillat. The competition was held as a single-stage invited competition whose participants were selected through an application procedure.

Kruunusillat is a traffic connection currently being designed between Kruununhaka and Kruunuvuorenranta in Helsinki, the capital city of Finland. Kruunusillat consists primarily of bridges, parts of which are also built on earthfill embankments and land.

The competition task included the conceptualisation and investigation at the outline plan level of the Kalasatama – Korkeasaari island – Kruunuvuorenranta traffic connection. The main emphasis of the task was the design of the connection between Kruunuvuorenranta and Palosaari.

The purpose of the competition was to find in every respect a high-quality solution for an environment extremely demanding from the landscape and cultural-historical perspectives. Kruunusillat was to have a positive effect on Helsinki's image and to be a worthy legacy for future generations.

Helsinki was the World Design Capital (WDC) in 2012. The international design competition for Kruunusillat was one of Helsinki's World Design Capital projects.

1.2 Competition participants

The procurement notification concerning the competition was published on 27 May 2011. The deadline for applications was 3 August 2011, by which date 52 applications had been received.

The jury selected the competition participants on 16 September 2011.

The following teams were invited to participate in the competition:

- Apia XXI S.A., Spain
- Arup, Netherlands
- Carlos Fernández Casado, S.L., Spain
- Insinööritoimisto Pontek Oy, Finland
- Knippers Helbig GmbH, Germany
- Ove Arup & Partners International Ltd, UK
- Roughan & O'Donovan, Ireland
- Schüssler-Plan Ingenieurgesellschaft Berlin, Germany
- Setec tpi, France
- WSP Finland, Finland

1.3 Fees

Each team selected to participate in the competition was paid a fee of EUR 50,000 (VAT 0%) complying with the competition programme.

1.4 Competition jury

The following representatives of the City of Helsinki were appointed to the jury:

- **Pekka Sauri**, D.Phil., M.A. (Psych.), Deputy Mayor, Public Works and Environmental Affairs, Chairman of the jury
- **Hannu Penttilä**, M. Sc. (Tech.), Deputy Mayor, City Planning and Real Estate, Vice-chairman of the jury
- **Jarmo Nieminen**, General Staff Officer, Lieutenant Colonel ret., Chairman of the Helsinki Public Works Committee
- **Tapio Korhonen**, LL.M., B.Sc. (Econ.) Finance Director, City of Helsinki Economic and Planning Centre
- **Maria Jaakkola**, M.Sc. (Landscape Architecture), Head of Office, Environmental Office, Helsinki City Planning Department
- **Raimo K Saarinen**, M.Sc. (Tech.), Helsinki City Engineer, Helsinki Public Works Department
- **Jukka Salo**, Professor, Adjunct Professor of Landscape Ecology, Director of Helsinki Zoo (Korkeasaari)
- **Juhani Tuuttila**, M.Sc. (Tech.), Head of Office, Real Estate Department

Other members of the jury:

- **Anne Stenros**, D.Tech, M.A. (Arch), Vice President, Design, KONE Corporation
- **Pirjo Tulikukka**, M.A. (Applied arts), Executive Director, Helsinki Neighbourhoods Association
- **Ilkka Vilonen**, Lic.Sc. (Eng.) Expert named by the Finnish Association of Civil Engineers RIL
- **Ville Hara**, M.Sc. (Arch.) Expert named by the Finnish Association of Architects SAFA
- **Jyrki Sinkkilä**, M.Sc. (Arch.) Expert named by the Finnish Association of Landscape Architects MARK:

The secretary of the jury was **Ville Alajoki**, M.Sc. (Eng.), Project Manager (bridges), Investment Office, Street and Park Division, Helsinki Public Works Department.

The work of the jury was prepared by a preparatory group.

Members of the preparatory group representing the City of Helsinki

- **Osmo Torvinen**, Head of Office, Investment Office, Street and Park Division, Helsinki Public Works Department, Chairman of the preparatory group
- **Ville Alajoki**, Project Manager (bridges), Investment Office, Street and Park Division, Helsinki Public Works Department, Vice-chairman of the preparatory group
- **Peter Henny**, Project Manager (bridges), Investment Office, Street and Park Division, Helsinki Public Works Department
- **Riitta Jalkanen**, Head of Project, Kruunuvuorenranta, Town Planning Division, Helsinki City Planning Department
- **Tuomas Hakala**, Head of Project, Kalasatama, Town Planning Division, Helsinki City Planning Department
- **Maria Jaakkola**, Head of Office, Environmental Office, Helsinki City Planning Department
- **Ville Lehmuskoski**, Director, Traffic Planning Division, Helsinki City Planning Department
- **Heikki Hälvä**, M.Sc. (Civ.Eng.), Transportation and Traffic Planning Division, Helsinki City Planning Department
- **Hannu Asikainen**, Project Manager, Kalasatama, Development Division, City of Helsinki Economic and Planning Centre
- **Mikko Ahola**, Project Engineer, Kruunuvuorenranta, Development Division, City of Helsinki Economic and Planning Centre, Secretary of the preparatory group

Members of the preparatory group from outside City's organisation

Expert named by the Finnish Association of Civil Engineers RIL:

- **Ilkka Sinisalo**, M.Sc. (Civ.Eng.), (at the participant selection stage)
- **Ilkka Vilonen**, Lic.Sc. (Eng.), (at the competition and assessment stage)

Expert named by the Finnish Association of Architects SAFA:

- **Ville Hara**, M.Sc. (Arch.)

Expert named by the Finnish Association of Landscape Architects MARK:

- **Jyrki Sinkkilä**, M.Sc. (Arch.)

In order to ensure the feasibility of the competition entries, the competitors had to consult a technical expert and a cost expert named by the promoter. Consultation was carried out within the framework of anonymity online. The experts were Ilkka Vilonen, Lic.Sc. (Eng.), Ramboll Oy (feasibility, costs) and Lauri Salokangas, M.A., Professor, Aalto University (feasibility).

The opinion of Gaia Consulting Oy was solicited as an expert in the assessment of environmental impacts and the calculation of the carbon footprint.

Ilkka Vähäaho and Osmo Korhonen from the Geotechnical Division of the City of Helsinki's Real Estate Department acted as geotechnical experts.

1.5 Competition rules and approval of the competition programme

The competition programme followed Finnish laws and statutes, the competition programme and its appendices, the content of the document Rakennusalan suunnittelukilpailun periaatteet (Principles for Design Competitions in Real Estate and Construction) as well as the principles of the competition rules observed by the Finnish Association of Civil Engineers RIL and the Finnish Association of Architects SAFA.

The competition programme and its appendices have been checked and approved by the competition promoter, the jury, the Competition Committee of the Finnish Association of Civil Engineers (RIL) and the Competition Secretary of the Finnish Association of Architects (SAFA).

1.6 Competition stages

The competition began on 1 October 2012.

The competition seminar was held on 23 October 2012.

The competition period ended on 15 February 2013, by which date competition entries were to be submitted.

At the end of the competition period, the entries were on display and available for public comment between 20 February 2013 and 9 March 2013 at the Helsinki City Planning Department's exhibition space Laituri and on the website reserved for the purpose.

1.7 Arrival of competition entries

The competitors submitted by the deadline the entries, which included all the required documents, under the following pseudonyms:

- Debet semper plus esse virium in vectores quam in onere
- Filum Lucis
- Gemma Regalis
- Hyperborea
- Nexu
- Occursus
- Oculus
- Recreatio maritimus
- Septem Fratres
- Unda Arctica
- Ventus

2

GENERAL

2.1 Assessment principles

The competition entries have been assessed in line with the competition programme according to the following criteria: usability, durability and aesthetics. The assessment of the criteria is described in the competition programme as follows:

Usability

- functional attributes such as fluency and safety of tram, cycle, and pedestrian traffic.
- consideration of physical environmental factors (conditions, usability, convenience)
- social attributes of usability
- feasibility (economic and technical feasibility).

Durability

- structural quality factors
- life cycle costs (technical workability, durability, serviceability, maintainability)
- compliance with principles of sustainable development

Aesthetics

- suitability to demanding environment and overall landscape
- architectonic quality, design, and aesthetics
- integration of bridgeheads with terrain and local landscape, particularly adaptation to Kruunuvuorenranta and Korkeasaari
- experiential quality, comprehension of the philosophical meaning and significance of the bridge

Economic feasibility has been assessed on the basis of the cost estimates calculated by the competitors. Guidelines on the method of calculation were provided by the promoter as described below to obtain comparable cost estimates.

Technical feasibility and structural engineering quality have been considered in part as strongly interrelated factors; the assessments have aimed at the avoidance of repetitive factors in different sections.

Because the themes under the heading "durability" all relate to the principles of sustainability, adherence to the principles of sustainable development has also been considered when assessing structural quality and maintainability.

The entry-specific assessments are shown in alphabetical order.

The official version of the minutes is the original Finnish version, which has then been translated into English; both versions will be furnished to competitors.

2.2 Summary of assessments

Instead of summarising every assessment criterion, the focus has been on such criteria with respect to the clear division of the entries into different groups, or where there are clear numerical criteria for the assessments. This summary aims at the explanation of general terms and the clarification of certain aspects of the general principles.

2.2.1 Economic feasibility

Economic feasibility has been assessed with the comprehensive construction cost estimates requested from the competitors.

Additionally, an upper limit on construction costs was set for competition entries, which at the end of year price levels for 2012 was EUR 95 million, exclusive of VAT. According to the competition programme, costs may exceed this limit only by a small amount and only if can be shown that an entry's idea can be developed in line with the cost limit.

Because different calculation methods lead to different cost estimates for the same structure, it must be possible to show an exclusionary criterion according to the same standard, enabling competitors to verify that the criterion has been met during the process. It was endeavoured to ensure this, on one hand, through the calculation method and the unit price specified by the promoter and, on the other hand, by requiring the teams to consult with a cost expert, provided by the City of Helsinki, who is familiar with local price levels.

A cost estimate template, furnished to the competition groups and based on the guidelines of the Finnish Transport Agency, consisted of an Excel spreadsheet showing the unit prices for the construction of the bridge, including material and work costs. Unit prices were provided at the year 2000 level, and they were to be amended to correspond to the cost level at the end of 2012. The given special prices, or prices per unit in the unit price list could be used as unit prices, or the competition groups could submit their own unit prices for approval if the appropriate unit price could not be found among the previous alternatives. By filling in the amounts on the Excel template, the teams had a comparable cost estimate that should remain below the cost limit. In this way, the cost calculation was made commensurable and verifiable during the process to ensure the competitors' equal treatment.

The following table shows the commensurate cost estimate of the proposals (entries presented in alphabetical order):

ENTRY	**PRICE** (M. Eur)	**OVERRUN**
Debet semper plus esse virium in vectores quam in onere	91,5	
Filum Lucis	68,2	
Gemma Regalis	77,1	
Hyperborea	89,7	
Nexu	94,2	
Occursus	119,2	25%
Oculus	156,7 (EUR 91 million at unit prices proposed by competitor)	65% [1]
Recreatio maritimus	103 (competitor's calculation without index increase EUR 68 million)	8% [2]
Septem Fratres	88,7	
Unda Arctica	97,9	3% [3]
Ventus	228,6	141%

[1] The author of the entry "Oculus" submitted two cost estimates: one with the unit prices provided by the promoter and the other with their own unit prices. For the entries to be comparable with each other and with respect to the cost limit, the unit prices provided by the promoter were to be used. The assessment has been made on the basis of this reference cost based on the promoter's unit prices.

[2] The entry "Recreatio Maritimus" was considered problematic in terms of further design work. For example, costs can be reduced by replacing the steel arch bridge between Sörnäisteniemi and Korkeasaari with a more conventional bridge structure but on the other hand, the proposal's

structural engineering solution would require dimensional changes leading to increased costs. The author of the entry had drawn up the cost estimate without the required index increase that was, however, taken into account when assessing the entries.

[3] The Jury concluded that the entry "Unda Arctica" could be developed to a level in line with the cost limit, for example by replacing the bridge between Korkeasaaari and Palosaari with a causeway. It was thought that this change would not have a negative impact on the basic idea.

The entries "Occursus", "Oculus", and "Ventus" exceeded the cost limit to the extent that their development within the framework of the cost limit would not be possible without excessive alterations to the basic concepts. Consequently, their economic feasibility was regarded as being appreciably lower compared to the other entries, but they have been assessed here with the degree of exactitude.

2.2.2 Technical feasibility and durability

In certain entries, risk-prone structures were found where the technical structure of the bridge or crucial structural solutions were either susceptible to risk in terms of implementation, or contained details distinctively specific to the entry that would be considerably more expensive to build or maintain than proposed. In further design work, it would be necessary to develop these solutions in a direction where the structural solution or increase in dimensions would lead to changes in the solutions' appearance that could be considered decisive. Regarding these solutions, for the most part it has apparently not been possible to examine the ideas sufficiently to ascertain their problems in a structure of this size.

The entries "Recreatio Maritimus", "Occursus", "Hyperborea", and "Debet semper plus esse virium in vectores quam in onere" were regarded as risk-prone structures.

2.2.3 Principles of sustainability, carbon footprint

The carbon footprint of the construction work has been calculated by an outside expert for each of the entries as a basis for the assessment of the principles of sustainable development. The calculation is based on the material quantities submitted by the competitors. The smaller the carbon footprint, the lower the environmental impact. It should also be noted in the results that the teams' varying degrees of accuracy when reporting the material quantities may generate differences in the carbon footprint results

ENTRY	CONCRETE	STEEL	OTHERS	TOTAL
Debet semper plus esse virium in vectores quam in onere	10 115	13 115	4 951	28 182
Filum Lucis	16 242	7 077	608	23 927
Gemma Regalis	10 424	7 864	718	19 006
Hyperborea	13 497	4 428	317	18 242
Nexu	7 372	10 552	1 957	19 882
Occursus	18 304	15 153	1 163	34 620
Oculus	11 209	16 373	441	28 023
Recreatio maritimus	16 644	11 708	2 071	30 423
Septem Fratres	8 413	13 892	2 393	24 698
Unda Arctica	12 612	16 049	605	29 266
Ventus	9 271	39 900	447	49 617

Units in the table: tCO2 e.

2.2.4 Aesthetics

In terms of aesthetics, the most crucial of the assessment criteria was the relationship to the landscape, which, within the framework of the selected approach, is difficult to develop extensively any further. The entries address the landscape either by introducing an entirely new, landmark-like element (Gemma Regalis, Oculus, Unda Arctica), or by adapting to it inconspicuously (Filum Lucis). Uncharted ground nevertheless remained. No group submitted, for example, a dual-pylon suspension bridge, which could have been advantageous in terms of the landscape.

Extremes in terms of elevation were encountered in the bridges spanning the entire distance at a high level (e.g., Unda Arctica), and the bridges that remained as close as possible to sea level (Filum Lucis, Recreatio Maritimus). The former easily began to resemble vehicular traffic bridges, and did not blend in naturally with Korkeasaari. The latter divided into separate bridge connections more effectively, but their challenge was the effect, inherent to a low-lying bridge, of obstructing the landscape.

Respect for the landscape as an intrinsic value has been the starting point in the entries Hyperborea and Recreatio Maritimus, although they have employed contrasting approaches. While Hyperborea aims at preserving the shoreline by freeing the bridge connection to be further away, Recreatio Maritimus boldly shapes the landscape and aims at achieving a better environment with the bridge.

In terms of horizontal alignment, curved or winding bridges proved more interesting from the perspective of bridge users than straight lines, which may even become a tedious experience (Occursus). The competition programme specified the location of the bridge fairly precisely, but a few of the entries exceeded the limits of the competition area without, however, achieving significant added value.

Many entries attempted to import an experiential aspect to the bridge by placing different modes of transportation on different levels (Hyperborea, Occursus), or by raising features above the route (Debet semper plus esse virium in vectores quam in onere). Occasional tram traffic was not considered an interference with pedestrian traffic to the extent that separating the different modes of transportation would be justified. The solution also easily led to problems with views as the height of the cross section increases. In the entry Nexu, pedestrian traffic was set only slightly below the level of tramline traffic. This is justifiable because of windiness, but led to a path that felt cramped. A multi-level solution was addressed most effectively in the entry Filum Lucis, where the protection of the lower level was achieved by utilising the bridge structures. In the entry Oculus, at the central and highest point of the bridge is a viewing platform, an adequate gesture providing a quiet space away from the bridge traffic.

The centralised pylons and cables (Nexu, Septem Fratres) seem to induce a heavy-handed symmetry. The cables at the edges (Gemma regalis, Oculus, etc.), on the other hand, facilitate flexibility with respect to the width of the lanes and the functional cross section. This creates the potential to improve bridge usability, as well as experiential quality for pedestrians and cyclists, in further design work. The advantage of suspension and cable-stayed bridges is their lightness in the landscape and the small number of columns underneath the bridge.

The proposals included interesting ideas for new features for the bridge, or presented a connection from the bridge to sea level (Recreatio maritimus, Occursus). Not all the entries provided a solution for windiness, but wind-breaking railings could be integrated in any of the proposals. Pedestrian traffic flow would have been facilitated by clearer separations. In certain entries, the routes are rather narrow as well. The ideas for illumination were largely commendable, especially in those proposals based on dynamic lighting. In this case, the more striking lighting is only momentary and the bridge can be merged into the landscape in the dark.

3

ENTRY-SPECIFIC ASSESSMENTS

3.1 DEBET SEMPER PLUS ESSE VIRIUM IN VECTORES QUAM IN ONERE

3.1.1 Usability

Pedestrian traffic and cycling are centralised and tramlines run along the edges on both sides of the pedestrian and cycle traffic lanes. An alternative pedestrian traffic lane is on the upper level. The centrally located pedestrian traffic/cycling lane on the basic level is unworkable. The space is cramped owing to the median strip's lighting poles and stairs; in particular, movement by bicycle would be slow if not impossible. The upper level is unnecessarily wide and contains an excessive number of sitting areas, cafes, and other similar amenities. The truss construction hinders the opening of views to those sitting in tram cars, and to pedestrians, and cyclists. Weather protection has been considered commendably.

The covered structure offers protection from the climate, but the lack of space has led to dimensioning problems; neither the required emergency rescue vehicles nor the presented pedestrian traffic fit on the bridge. It would appear that the solution has been prepared primarily according to the dictates of a shopping centre concept, in which case the space left for cycling and pedestrian traffic is insufficient, and the solutions do not respect the prerequisites for smoothly flowing traffic. The service traffic required by the commercial premises has been ignored.

The solution based on a central platform is difficult to implement owing to the right-handed tramcar traffic. Cyclists face the risk of swerving into the track trough; a railing must thus be built at its edge. From the standpoint of the tramline tracks' maintenance, the track trough solution is problematic. The reserve for a possible future light rail has been weakly considered in the design. The raised pedestrian traffic lane placed between the tramline tracks prevents the branching of the tracks. In the raised section there are also pipes and cables that make the branching of the light rail line impossible.

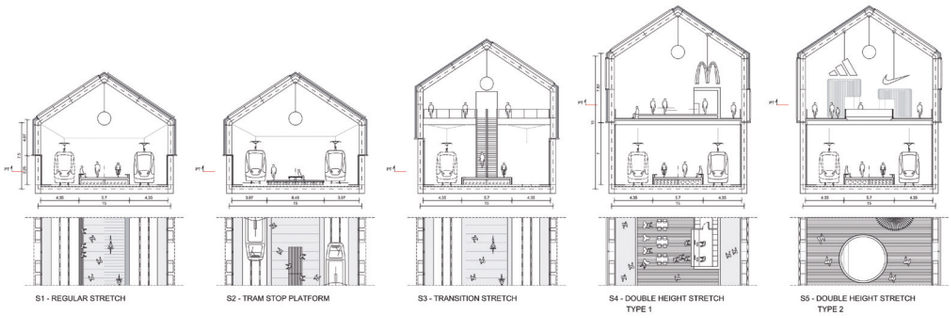
The functionality of the structural solutions could not be determined in all sections owing to the presentation's somewhat indicative materials; only a portion of the required technical solutions have been shown in the documentation.

With respect to the viability of a structure with these solutions and dimensions, in certain sections there is reason to express strong misgivings. The management of the long structure's movements, as well as the requested examination of rail traffic, has not been presented nor has a position been taken regarding the solution required by the closed construction's ventilation or fire class dimensioning.

All required traffic loadings have not been taken into account, nor have ice loads and particularly collision loads been sufficiently considered.

Owing to ice conditions between Korkeasaari and Palosaari, the construction must be raised. In the entry, the alignment in this stretch has been lowered to graze the water line, thus exposing the construction to the loading and wearing effects of ice.

The deck's upper truss construction on the single story section is supported from the cantilevers of the deck slab; its implementation would be difficult with the dimensions presented. The low material thicknesses used in the design are less than required and should be increased in further design. In structures subject to fatigue loads, the shaping of joints and other details is decisive from the standpoint of fatigue strength. Critical locations include the truss connection as well as the joints between the truss and cross-members at the two-level section.



The placement of various types of facilities on the bridge in the manner presented is not necessarily a good idea. In particular, the effects of the vibrations generated by tramline traffic may prove disturbing to persons working in these spaces. As designed, the space will be a resonant structure unless special attention is paid to acoustics. The arrangement of service traffic to commercial premises is difficult, particularly if the disruption of pedestrian traffic is to be avoided. The tramcars' vibrations and echoing construction are incompatible with the operations taking place in commercial premises.

The trusses' fabrication and installation is a challenging task. The design specification takes no position regarding fabrication or installation. The effects of the presented facilities' furnishings, building services, and other similar items are not included in the presented cost estimate.

3.1.2 Durability

Between Korkeasaari and Palosaari, the bridge is a covered, concrete-decked, composite steel girder bridge. The roof construction is supported from the concrete deck's cantilever whose construction appears to be under-dimensioned.

The bridge section between Kalasatama and Korkeasaari has been implemented as a conventional girder bridge. The selected solution and its emphases are justified.

The solution bears a closer resemblance to a railway station's platform construction than a bridge solution and requires the appropriate maintenance.

The covered construction as such protects the interior sections from climatic impacts, but the truss structure employed leads to extremely large and difficult-to-paint surface areas. The servicing of vertical transportation devices such as lifts and escalators is uneconomical and their functioning in semi-heated spaces susceptible to the moisture generated by the sea may prove critical.

The building of commercial and restaurant premises at a location where the organisation of servicing operations generates substantial traffic is incompatible with the principles of sustainable development. No servicing capabilities for the presented construction, except possibly those hoisted from a boat, have been shown, nor has a position been taken regarding the necessary building services. The heating of outdoor spaces is impossible in local conditions. Local environmental conditions have not been sufficiently taken into account and the follow-through of the solution concept fails in this section as well.

3.1.3 Aesthetics

The iconic aspect is too overwhelming in the delicate landscape owing to the fairly dominating external contour resulting from excessively high spaces. The high solid facades substantially obstruct views and bisect the landscape space.

The design of the entry would seem to have developed from the inside out. The vigorous overall configuration is recognisable and imparts a strong individualised identity to the bridge. The section between Kalasatama and Korkeasaari is simplistic. The changes in the bridge's cross sections are exaggerated to make this gesture visible in a long bridge viewed from a great distance. The archetypical form of a house sought by the ridged roof cross section is alien to a bridge. Central Europe's covered bridge tradition is not known in Finland, nor has the entry succeeded in attaining the image of traditional covered bridges created by rustic materials and intimate scale.

The truss construction seems natural and structurally feasible, but may excessively obstruct views, at least for cyclists crossing the bridge. The use of materials is bold and open-minded. The composite panels create a wooden ambience without compromising fire safety and servicing convenience. The form language and ornamentation has aimed at an adherence to Finnish cultural history and its handicrafts traditions, as evidenced by the patterns inspired by sweaters. These references, however, remain superficial and feel glued-on. The entry has been, with respect to its shell and furnishings, carefully studied down to the details. Natural as well as artificial light provides rhythmic contrast to those passing over the bridge. The lighting solution's suspended round lighting fixture is distinctive. The briskness of the entry attracts attention, but is at the same time disconcerting.

The connection to Kalasatama has been implemented according to the competition's objectives as a technical solution without innovations. The tramline track running along both sides of the bridge make the arrangement of junction points more challenging compared to other solutions. The alignment of the bridge from Kalasatama to Korkeasaari is presented straightforwardly and successfully suits the townscape image from the standpoint of Kalasatama's urban structure.

The connection to Korkeasaari implements only a portion of the competition's objectives. In Helsinki, a tramline stop is always located on the right-hand side with respect to the tram's forward direction. The stretch between Korkeasaari and Palosaari has been implemented as a covered solution that is a fairly massive for the fine-grained island milieu and unnecessarily attempts to completely detach Korkeasaari from its through traffic.

The connection to Kruunuvuorenranta has been implemented as a technical solution in which pedestrians and cyclists are forced to negotiate fairly long distances before reaching the next intersection where they can switch to other lanes. The entry does not take into account the end point's connection with the shore, nor does it take a position regarding Kruunuvuori.

Based on the materials presented, those crossing the bridge might sense an unpleasant resemblance to a long railway station hall. Additionally, the visual effect created by what is in effect a row of barns in the large-scale landscape does not convey the promise of an aesthetic experience. Relegating cyclists and pedestrians to the centralised levels between the tramline tracks does not appear to be a natural way to experience the passage over Kruunuvuorenselkä.

A merit of the entry from the experiential standpoint is the objective to provide reasons to pause along the way by implementing indoor amenities that at their best can enrich the experience and provide resting places. The feasibility of their implementation, however, is dubious.

3.2 FILUM LUCIS

3.2.1 Usability

The entry provides two alternative routes for pedestrian and cycle traffic; one runs along the bridge's southern edge on the same level of the tramline tracks, while the other is a "shelf" at the lower level along the bridge's northern edge. Besides the end points, pedestrians and cyclists can also switch lanes at three other locations. The entry commendably offers pedestrians and cyclists choices with respect to views as well as the possibility to be protected from wind. The "shelf" is partially covered and there are sitting areas. The dimensioning of the lower level, however, appears too cramped for a combined pedestrian traffic and cycling route. The bridge's orientations offer changing views to those traversing the bridge.

From the traffic engineering standpoint, the solution is viable, even though attempts should be made in further planning, particularly with respect to the possible light rail line, to minimise the presented crossings between pedestrian traffic and tramline traffic on the main level. The dimensions of the lower deck, as well as the ramps leading to it, are insufficient for normal servicing and emergency rescue vehicles, and would require the use of special equipment.

Presented in the design are solutions for tramline traffic deviating from normal practice, such as a central platform at Korkeasaari, and a wireless electrical feed, that appear to be unfeasible in Helsinki's conditions.

The traditional box girder construction is viably implemented according to the basic concept. The structural engineering attempts to take the fractured rock zone off the shore of Kruunuvuori into account, but the elongation of the bridge resulting from the horizontal geometry's southern arc does not seem justified as presented.

No position has been taken regarding track elongations, but it would appear, however, that the matter can be resolved in future design. Depending on the tracks' support solution, the thickness of the deck may have to be increased to allow for a possible ballast base course. On the other hand, various solutions facilitating direct track connections have been successfully used in the railway world; their applicability to this construction may thus prove sufficient in further planning.

The bridge is founded on bedrock with a few supports where the bedrock is fairly close to the surface. Most of the bridge has been designed to be founded on piles; in the deeper sections, the drilled piles should be replaced by driven piles. Supports have been thinned in foundation areas by increasing the span length.

In the selected solution, the quantity of intermediate supports built in deep water is fairly large compared to the other entries.

3.2.2 Durability

Although the deck's cross section has been adjusted along the length of the bridge by varying the cantilevers and by placing the northern cantilever at the box-structure's bottom level, the solution is routine, but structurally reliable. The only exceptional span dimensions are the three last spans at the Kruunuvuori shore, positioned to avoid the need for foundations in the fractured rock zone. The placement of the shipping lane in the manner presented, elsewhere than at the widest span, appears to be a structurally illogical solution. By using chamfered box-structure cross sections and longer support spans, the external appearance of the solution would have become lighter. The cantilever solution placed on two floors is an innovative solution, but brings with it usability-related problems requiring a larger cross section. In terms of structural heights, a more massive solution with greater attention paid to usability would have facilitated the optimisation of support spans.

The presentation has been made to appear more spacious by omitting railings and the trams' overhead power lines. Even if the entry's proposed electrical feed through the deck – a dubious solution in the local climate – is implemented, the railings will enlarge the structure's visible height.

The bridge section between Kalasatama and Korkeasaari has been implemented with a conventional girder bridge. The selected solution and its emphases are justified.

Several somewhat questionable details include the use of recycled glass, light-reflecting coverings, lightweight concrete, self-cleaning concrete, and the deck's drainage channels, also serving as derailment protection troughs, whose long-term durability and cleanability are dubious.

The placement of district heating pipes and other infrastructure inside the box-structure is, from the standpoint of their maintenance, a double-edged solution. The pipes are protected from the weather, but replacements and servicing works must be carried out from the box-structure's ends; the eventual renewals will thus require an increase in the box-structure's dimensions. On the abutments, the box-structure has been presented as continuing inside an embankment where pipes can be led to the street construction directly through earthfill layers.

From the standpoint of cleaning, the upper level of the bridge features simple construction. Inadequate space has been allocated for servicing vehicles on the lower level.

3.2.3 Aesthetics

The graceful bridge is a dynamic element in the maritime landscape. The abstract presentation provides, however, an exaggeratedly nimble impression; in actuality a heavy-handed concrete substructure rests just above the water level and obstructs the waterfront landscape, particularly at Korkeasaari.

Although the cross section is bulky, the entry is light and elegant in terms of its form. Different levels have been utilised insightfully and the most has been made of conventional construction through modest means. The overall meandering form is extremely dynamic and the detached "strand" makes the overall concept that much more interesting. The meandering concept could have been further exploited in the vertical direction instead of running separate ramps from the deck to Korkeasaari. The low-slung location creates a good connection to the sea, but blocks the views from Kulosaari. The columns supporting the line are fairly ordinary despite their chamfering, which may be justified to emphasise the role of the deck, but the connection between the deck and the columns is nevertheless dubious. A reduction in the number of columns that are grouped too densely as they are, would in turn lead to an undesirable increase in the height of the cross section. The entry proves that a bridge can have a strong identity without high parts or elements. The presentation technique is exquisite, but excessively indicative and leaves too much to the imagination. Such a simplified basic solution would require an uncompromisingly high-quality implementation right down to the details. The question then naturally arises as to whether such a poetic concept would be discernible in the completed structure.

The connection to Kalasatama has been respectfully implemented according to the competition's objectives, but at the same time without innovations. The alignment of the bridge from Kalasatama to Korkeasaari has been presented straightforwardly and successfully suits the townscape image from the standpoint of Kalasatama's urban structure.

The connection to Korkeasaari is interesting and offers many developmental possibilities. The pedestrian and cycle traffic bypass connection shown to the south between Korkeasaari and Palosaari suits the entry as such, but fails to comply with some of the frame conditions set for the area.

The connection to Kruunuvuorenranta has been implemented according to the competition's objectives. The alignment of the bridge winds its way within the urban structure, where it should be able to give the bridge its own identity. The bridge in a sense brushes up against Kruunuvuori with a shallow curve. To achieve a natural encounter between Kruunuvuori and the bridge, particular attention should be paid to this location in the designing.

In terms of its approach, the entry is a poetic interpretation of a bridge connection, and the bridge itself has been presented incandescently as a flowing work of art; the philosophical text also reinforces this impression. The symbolic importance of the bridge has been understood and interpreted visually by reducing the bridge to its essentials. It could be, however, that the reductionist approach is too theoretical if its stylish implementation requires an overhaul of the tram system and/or, for example, the elimination of railings. The treatment of the bridge's levels generates variety, but it also remains to be seen if the longitudinal geometry would work in the large-scale landscape.

3.3 GEMMA REGALIS

3.3.1 Usability

From the usability standpoint, the entry is clear and flexible. Pedestrian traffic and cycling, as well as tramline traffic, has been arranged unpretentiously in a street-like manner separated by kerbstones. Pedestrian and cycle traffic from Kalasatama to Korkeasaari flows along both sides of the bridge, merging in a single lane at the southern edge of the long bridge after its traversal. The space reserved for foot traffic and cycling appears scanty, but the cross section provides opportunities for flexibility in further planning with respect to the lanes' widths.

Where the bridge widens at its highest point, a ribbon-like resting zone presented on both sides of the pylon simultaneously separates the pedestrian traffic and cycling lane from the tramline tracks. The solution appears natural where there are sea views and is an idea worthy of further development.

The solution is adequate from the traffic engineering standpoint, even though crossings of different traffic modes occurring on the same level are presented. At the Palosaari location, an underpass attempts to alleviate this situation; in further planning, the separation of cycling and other pedestrian traffic should be studied.

With respect to boat traffic, the solution has greater clarity than most of the other entries owing to its wide free openings.

In terms of its technology, the cable-stayed bridge has already been tried and solutions such as this one have been utilised previously, but the structure presented in this entry is, however, unprecedented at the Finnish scale with respect to its length and span dimensions. The use of two cable layers, the economical cable angle facilitated by the high pylon, as well as the almost straight stay section, provide the possibilities for the free shaping of the cross section and the arrangement of different traffic modes. The almost symmetrical construction at the cable section leads to easier solutions. This bridge type also facilitates the founding of the pylon at the skerry area's shallow water depths.

The bridges have for the most part been presented as being founded on piles. The pylon is founded on bedrock; an economical location, where the foundation depth is low, has been sought for its placement. At the end of the Kruunuvuori shore side, a dense group of supports have been shown where there are uneconomically deep conditions. The driven piles in the S11 sloped rock surface should be changed to drilled piles.

3.3.2 Durability

Since it is a question of Finland's longest bridge location, the construction of record-breaking span dimensions is also ambitiously proposed. Based on solid structural engineering the solution can be considered fairly conventional, but the objective has been to achieve a stable structure. A single pylon solution, where the pylon is founded in shallow water, is also justifiable from the standpoint of waterborne traffic safety. In solutions based on multiple supports, the risk of collisions with substructure construction increases. The shallow water depth effectively protects the critical pylon from collisions.

A fairly large pylon height has been chosen. At the selected dimensions, the cables' angles remain fairly straight; this means that the structural action of the outermost cables is also efficient. The cables placed in two layers also provide the solution with stability for heavy loads. Dealing with the ice forming on the cables as a result of maritime conditions, as well as any threats posed to traffic, must be taken into consideration in further planning.

The bridge section between Kalasatama and Korkeasaari has been implemented with a conventional girder bridge. The selected solution and its emphases are justified.

In terms of its construction, the bridge section between Kalasatama and Korkeasaari is easily maintained, and the cable-stayed construction is also a tried and true solution. Although the dimensions are larger than usual, a sustainable solution can be achieved with the proper and correctly timed servicing measures, also with respect to the infrastructure placed in the bridge. Several additional measures aimed at achieving protection from the adverse effects of the local climate have also been presented in the entry.

At the cable-stayed section, running district heating pipes and other infrastructure through the cross beams under the deck in the open air is a reasonable solution from the maintenance standpoint. Servicing can be carried out wherever required, although the pipes are naturally more susceptible to weather stresses compared to encased solutions. At the girder bridges, the placement between the main girders is a good solution; servicing can be freely performed at the required location.

With the correct servicing measures, tenable long-term solutions can be achieved for the presented proposal. The open cross section requires that all service painting must be carried out from below. Any ice forming on the cables will require maintenance and care to ensure that no ice will fall on the traffic passing below. The cleaning of the deck is easily arranged with normal methods.

3.3.3 Aesthetics

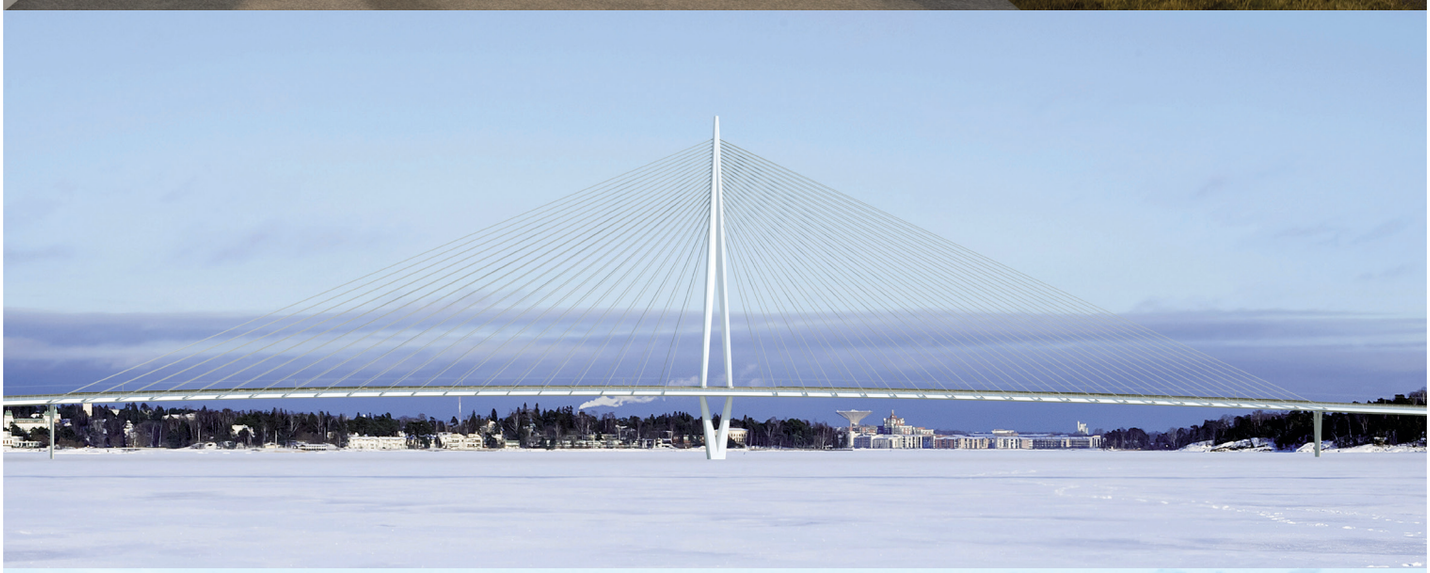
The entry has the potential to form a landmark for eastern Helsinki. The bridge deck supported from above forms an impressive maritime gateway to the open sea. An undeniable merit of the entry is the openness of the underside of the bridge, which diminishes its intrusive effects on the landscape. The bridge's alignment curves beautifully and with the semblance of grace over the open part of the sea bay. The cable-stayed construction has achieved an extremely light and spacious bridge. The columns under the bridge, as well as the high pylon, have been shaped with care. They are slim and stylish, and the pylon's open centre lightens its appearance even further. With further planning in mind the symmetrically positioned single pylon, however, invokes conflicting emotions; it "spears" the main water surface and alters the proportions of the landscape. A more unsymmetrical positioning of the pylon would perhaps impart a greater sense of dynamism to the bridge. The visual density of the cables increases when the bridge is viewed obliquely; the cables may collect snow and ice during the winter, at which time their visual importance will increase.

The connection to Kalasatama has been implemented according to the competition's objectives, primarily as a technical solution without innovations. The alignment of the bridge from Kalasatama to Korkeasaari has been presented straightforwardly and successfully suits the townscape image from the standpoint of Kalasatama's urban structure. The connection from Kalasatama is perceived as part of the bridge owning to the consistent shaping of its columns.

The connection to Korkeasaari has been integrated into the terrain with an urban touch to create a local landscape that will be fairly pleasant to its users. The connection to Korkeasaari has been implemented according to the competition's objectives and to a great extent adheres to the solution provided as the competition's source data. The stretch between Korkeasaari and Palosaari has been implemented as a narrow embankment that appears to be technically feasible, but fails to exploit the possibilities offered by the area in its entirety. The entry implements what is strictly necessary, but in this section it is hindered by a lack of innovative thinking. The earthfill embankments are unfinished from the landscape design point of view but are capable of further development.

The connection to Kruunuvuorenranta has been implemented according to the competition's objectives and feasibly without innovations.

The high pylon dominates the landscape and articulates the user's experience of the bridge. Except for the pylon, there are not many elements to see when passing over the bridge; the landscape assumes the primary role. The solution facilitates expansive, unobstructed views and a fully-nuanced enjoyment of the landscape for the bridge's users. The landscape also opens on both sides of the pylon for those passing under the bridge; they are also able to experience the landscape's variety. The significance of the bridge is underlined boldly, even if fairly conventionally. The curve of the bridge also has a horizontal transition that enhances the interest of the crossing and facilitates the viewing of the bridge's starting and ending points from either end.



3.4 HYPERBOREA

3.4.1 Usability

Hyperborea is the only entry in which tram traffic and pedestrian and cycle traffic run along the bridge completely separated from each other on different levels. This total separation between trams and pedestrian and cycle traffic is uncalled for and weakens, for example, social control. It also needlessly exaggerates the "conflicts" between different traffic modes that in reality do not exist; there is only a tramcar running at scheduled intervals, not a more heavy-duty transport mode such as a train or automobile. Elevating the pedestrian and cycle traffic above the tramline forms lengthy and fairly steep ramps along the edges of the bridge that are extremely arduous for cyclists. At the higher section, the ramps join to form a relaxation area. The views are good from the upper platform, but the users are completely at the mercy of the wind and rain. Pedestrian traffic and the cycling connections to Korkeasaari are difficult.

From the traffic engineering standpoint, the solution, despite its sound idea, has turned against itself. The placement of pedestrian traffic 10 metres higher forms the starting point for a greater susceptibility to wind. In the solution presented, an emergency rescue vehicle would be unable to access the lower level, but would be forced to switch to the upper level that has not, however, been appropriately dimensioned.

At Korkeasaari, the pedestrian traffic connections from the bridge to the island have been solved only with lifts and stairs, making cycling impossible. The construction of a light rail line and its requirements for the bridge has not been presented in the entry.

The presented prefabricated concrete element construction fully deviates from the Finnish concrete industry's production methods; the elements' assembly sequence is multiphased and complicated. The assembly takes place in several stages and the installation sequence has not been unambiguously explained in the presented materials. Even a more careful study of the presentation could not confirm the feasibility of the solutions. The concrete casting technology and installation requirements will propably increase the costs per volume compared to the costs used in the cost estimate. The placement of prestressed steel anchors in the construction requires increased wall thickness at the anchors' location.

The presented solution is based on the use of fibre-reinforced high-strength concrete that, it is assumed, will also bear tension. This does not conform to the required design practices, nor is it even possible in the structural joints. The quantity of tension cables proposed in this solution would most likely be unable to carry the structural loads, necessitating increased quantities of prestressed steel-concrete in the construction.

With respect to the box structure, the endurance of the cross section at the dimensions presented, particularly its resistance to distortion, requires bending moment capacity at the corners' element joints. When the joints are already subjected to tension from longitudinal action, their ability to absorb the transverse loading during the bridge's long service life is questionable.

The bridges have been presented as being founded on piles. The entry features a considerable number of piled foundations uneconomically located in deep water areas.

3.4.2 Durability

The structure is extremely innovative and sleek in terms of its construction. There remain, however, a considerable number of unsolved locations whose dimensions would most likely have to be increased in further planning.

In terms of its construction, the entire bridge section between Kalasatama and Palosaari is a concrete-decked steel girder bridge; in the transition area, the height of the beams rises above the deck. The slab sections of the girder bridge's cantilevers rise and form their upper flanges until they are above the tram tracks. The solution requires a degree of stiffness, whose attainment in the construction presented is questionable, in the elements' joints.

The quantity of elements, their presented construction method, and the hollow shape do not appear to be a technically reliable solution in local conditions.

The construction consists of an extremely large number of short members whose intermediate joints are, with respect to the durability of the prestressed construction, an extremely risky solution. The hollow casings within the members collect moisture and may lead to the prestressing steel's susceptibility to corrosion. From the standpoint of the prestressed steel's long-term durability, a respect for local environmental conditions is essential; high-strength steel is extremely susceptible to moisture problems. The hollow construction has achieved a lightweight structure, but in Helsinki's local climatic conditions, this kind of solution lacks long-term viability and would lead to extremely high maintenance costs.

The concept of minimising dimensions is not completely realistic; the actual implementation would most likely increase the structure's dimensions.

Fatigue has erroneously been assumed as being a trivially minor problem for speeds falling under 200 km/h; the instructions in question meant dynamic impacts. Fatigue must also be taken into account in this construction. In particular, the presented partially stressed corner connections would most likely fail to withstand the fatigue stresses accumulating over the bridge's long service life.

The placement of district heating pipes and other infrastructure under the bridge is a good solution. All renewal and servicing procedures can be carried out locally.

3.4.3 Aesthetics

The entry has successfully considered the bridge's relationship to the landscape and presented detailed solutions for the connection to its surroundings. Natural shorelines have been preserved where the bridge passes Korkeasaari and Palosaari from a distance. A problem with the two-level solution is, however, the growth in the bridge's total thickness that further increases its coverage in the landscape. The truss construction hovering over the water imparts a restless impression in the landscape, even though the alignment is impressive.

The entry has boldly striven to align the bridge with a smoothly flowing arc that as such differs from the alignment shown in the competition programme. The justification is convincing and point of departure acceptable; the natural shoreline is preserved when the bridge connection is clearly detached as a bridge. The resulting connecting island is still indicative, but it does not diminish the value of the basic solution. Initially, the concept of bypassing the islands would seem to respect the existing environment, but upon further consideration raises questions. One would assume that the purpose of a bridge is to connect locations, not meander over the water as a detached structure. By deviating from the competition area, an elegantly curved alignment has been achieved, but other entries demonstrate that a dynamic alignment is also possible within the competition area. Structurally the bridge is natural; its shaping is not contrived. The design references are fairly conventional; the aesthetics recall industrial railway bridges. From further away, particularly when viewed perpendicularly, the filigree structure almost disappears into its surroundings. For passengers sitting in trams, the flickering visual effect of the construction may feel restless, even if the landscape is viewed in the transverse direction. In the local landscape, the basic solution generates the experience of a "sea of sticks" from above, as well as for those passing under the bridge. If implemented, the truss could create detrimental visual obstructions in several directions; the lightweight truss construction forms a surprisingly covered and opaque tube in the longitudinal direction.

Concrete as a material may be justified on the basis of its minimal maintenance needs, but in further planning, it should be determined if this concrete construction can be realistically implemented to facilitate the bridge's lightness. From the standpoint of aesthetics, the thickening of structural components is undesirable; owing to its construction, the structure is more readily perceived as a steel bridge.

The connection to Kalasatama has been implemented according to the competition's objectives. The shaping of the bridge's junction points and high quality design of the environment has resulted in a specific "place" that forms a part of the waterfront path encircling Kalasatama. The bridge's alignment from Kalasatama to Korkeasaari has been presented as partially curved at the Korkeasaari end. The solution does not fully support the views shown through the Kalasatama area.

The alignment of the bridge bypasses the northern sides of Korkeasaari and Palosaari. At the location of the Korkeasaari bridge, an artificial island has been created to serve the connection to Korkeasaari. This three-level solution is unnecessarily pretentious and fairly demanding technically. The bridge attempts to avoid heavy-duty construction in Korkeasaari, but is in itself such a heavy-handed structure that the fine-grained archipelago is completely subordinated.

The connection to Kruunuvuorenranta is fluent and uncontrived. The solution has successfully internalised the possibilities offered by the rocky shore, thus generating significant added value for the location.

3.5 NEXU

3.5.1 Usability

The basic solution is street-like: tramlines are centralised, with pedestrian traffic and cycling on both sides of the tramline. Placing pedestrian and cycle traffic in a depression lower than the level of the tramline makes the crossings monotonous. Railings separate pedestrian and cycle traffic from the tramlines for the entire distance. Although the solution could be considered justified from the standpoint of windiness, the limited space seems somewhat oppressive. Separate stopping or resting places have not been arranged in the entry. Elegant views open to passengers in trams as well as pedestrians and cyclists. There is no wind and rain protection. The viewing platform oriented towards Palosaari is a feasible idea worth developing further, but the more extensive development of the area as a place to relax has remained incomplete.

From the traffic engineering standpoint, the solution is justified and successfully takes pedestrian traffic into consideration. At the main bridge section, the lowered pedestrian traffic lanes combined with the high railings provide on one hand wind protection but on the other hand lead the traffic to a narrow trough whose cleaning is not as easy as the levels in the cross sections. The placement of traffic modes is not particularly free in the cross section; cables should be protected from collisions.

Multi-span variants of the proposed cable-stayed bridge have been implemented primarily in foreign locations. The basic structure is workable, although the solutions presented in details should be studied in further design. The centrally located cables lead to a box-structure, whose cross section provides torsional resistance, and where district heating pipes and other infrastructure are placed inside.

In the selected solution, the quantity of intermediate supports requiring construction in deep water is less compared to other solutions, but these piled pylon foundations are more robust that the foundations for conventional columns. Piled supports have generally been used for foundations; some rest on bedrock, as in other presentations. The sole dependence on vertical piles only raises doubts; if necessary a portion of the piles can be changed to inclined piles.

3.5.2 Durability

Although the selected pylon height is fairly low, the structural type is, in terms of its proportions and functionality, primarily a conventional cable-stayed bridge, as opposed to the other multi-pylon solution. The cables aligned with the centreline of the deck require the implementation of a box-section providing sufficient stability. The municipal engineering placed within the box-structure will lead to increased maintenance and servicing costs, even though the external appearance is stylish. On the other hand, minor servicing tasks and inspections are easily realised inside the box-structure protected from weather.

The functioning of the concrete deck at vertical surfaces is somewhat dubious; with respect to the concrete components, the solutions often rely on the use of elements. The proposed forms require an element implementation, which in turn is a potential problem from the long-term structural standpoint. The entry also has other details, such as the used of granulated surfaces and anti-graffiti protection, that should be more successfully solved in further design. Any ice forming on the cables will require maintenance and care to ensure that no ice will fall on the traffic passing below.

The bridge section between Kalasatama and Korkeasaari has been implemented with a conventional girder bridge. The selected solution and its emphases are justified.

In the more challenging cable-stayed bridges' traffic- and maintenance-related solutions, pedestrian traffic lanes have been placed at a lowered position on the side of the box-structure to form their own corridors.

In both solutions with the middle cable configurations, the placement of infrastructure within the cross-section's closed box-structure is an aesthetically justified solution, but requires the arrangement of the box-structure's interior space to ensure the transferability of replacement pipe elements from the abutments to the locations requiring repairs within the box-structure. The solution is problematic at the locations of supports and transverse stiffeners. The dimensions of the box-structure should be checked in further design to ensure the transferability of replacement pipe elements at locations requiring repairs. This means that space allocations and transfer systems must be considered within the box-structure. At the locations of the girder bridges the placement between the main girders is, from the standpoint of serviceability a good solution; servicing tasks can be carried out locally.

3.5.3 Aesthetics

The bridge sinuously arcs its way over the open part of the sea bay; six pylons spaciously divide the rise without creating a strong visual barrier in the north-south direction. The bridge at Sompasaari is massive; the embankment at Korkeasaari is bleak and insensitive to the environment.

The use of six pylons has kept the bridge at a moderate height. The general appearance is light and facilitates the bridge's integration with the landscape. The columns under the bridge are shaped with a pleated motif, but the articulation makes the columns appear bulkier. Above the bridge, the connection between the cables and delicate columns seems exaggeratedly technical. Although appropriate and optimised constructions are usually also aesthetically pleasing, this joint assumes too important a role and can be noticed even when viewing the bridge from afar.

The connection to Kalasatama has been implemented according to the competition's objectives as a technical solution without innovations. The alignment of the bridge from Kalasatama to Korkeasaari has been presented straightforwardly and successfully suits the townscape image from the standpoint of Kalasatama's urban structure.

The connection to Korkeasaari has been implemented according to the competition's objectives and to a great extent adheres to the solution provided as the competition's source data. The stretch between Korkeasaari and Palosaari has been implemented as a narrow embankment that appears to be technically feasible, but fails to exploit the possibilities offered by the area in its entirety. The entry implements what is strictly necessary, but in this section it is hindered by a lack of innovative thinking.

The connection to Kruunuvuorenranta has been implemented viably according to the competition's objectives without any significantly innovative solutions. A shorter connection from the bridge to the shore would have been desirable.

The interpretation of the bridge connection is balanced, but rigid in its symmetricalness.

3.6 OCCURSUS

3.6.1 Usability

Pedestrian and cycling traffic runs along both sides of the tramline tracks, while a more protected alternative route has been designed under the long bridge. The possibility to choose the route enhances user comfort. The weather protection provided under the bridge is, however, imperfect in a windy environment. At the highest point, ramps link the lower level with the upper level designed to serve as a traffic corridor as well as a generously dimensioned urban space for relaxation, viewing the landscape, and other activities along the edges of the bridge. The long arrow-straight bridge does not offer variable views and as such may prove to be an exhausting experience, particularly for pedestrians. From the lower level there is a connection down to the water's edge.

The geometry of the main bridge is optimal for tramline traffic, but the connection to Korkeasaari, as well as the linkage of the light rail reserve to the bridge, is problematic. At Palosaari the height of the bridge's underpass is too low, and the width of the lower level is insufficient for servicing and emergency rescue vehicles. At Korkeasaari, the pedestrian traffic connection based on a lift solution weakens the prerequisites for cycling and emergency rescue, and an inadequate underpass height has been specified for service traffic.

Insufficient attention has been paid to the light rail connection at Korkeasaari.

The cost estimate clearly exceeds the cost limit, by approximately 25%. Changing the bridge at the stretch between Korkeasaari and Palosaari to an embankment and realigning the main bridge in the designated design area would likely get the costs under the given cost limit. On the other hand, the lower pedestrian traffic lane solution does not support this kind of solution particularly well.

The construction consisting of reinforced concrete box girders and steel truss substructure is a questionable solution on one hand owing to the long-term durability of an element construction box girder, and on the other hand the steel truss structure's feasibility and material strength characteristics.

Because district heating pipes must be renewed through the ends of the superstructure, the sufficiency of the box girder's dimensions must be checked in further design. The arrangement of adequate space for the transfer of replacement pipes to the renewed position will lead to the need for additional space within the box-structure and an increase in the superstructure's dimensions, particularly at the location of cross beams.

The collision resistance of the superstructure truss seems inadequate and the behaviour of the structure in collision situations is questionable. Only the substructure's dimensioning for collision loads has been presented.

The functional performance of the transparent wind protection barrier at the lower level is questionable; the structure's thermal elongations cause problems for these kinds of surfaces. The taking into account of the extensive surfaces' wind loads is not clarified in the calculations. The wind load is transferred to the deck construction through the verticals from below. In the transverse direction, the truss thus acts as a kind of rocking construction, primarily owing to the types of connectors at the hinged lower deck and the lower truss chord. The presented wind barrier itself requires further planning, but the effects of its loading on the truss's verticals will lead to an increase in their dimensions. Owing to the magnitude of the wind surface, the solution's viability at the dimensions presented is dubious.

The lower level's capacity to accommodate emergency rescue and servicing vehicles is questionable. The surface is also slippery and it should be replaced by a sturdier deck, which in turn increases the construction's own weight and dimensions. Snow removal from the lower level requires special equipment because the load-carrying capacity of the presented construction is inadequate for conventional vehicles. Snow drifts will accumulate on the lower level; their removal over the high wind barriers using small-scale equipment would appear to be difficult if not impossible.

The bridges have been presented as being founded on piles. The principles of the structural supports' construction method are outlined in the design specification. At the stretch between Korkeasaari and Palosaari, the bridge has been designed to bear on bedrock. A considerable number of piled foundations have been placed uneconomically in deep water areas.

3.6.2 Durability

Despite the indisputable structural innovativeness, the proposal has left many significant technical details unresolved. At the main bridge section where the steel truss is a bearing section, the over 11-metre-high construction extends almost to sea level. The superstructure's durability, required to withstand the required 1.0 MN collision load, is questionable. The structural action at the continuous compressed lower truss chords at the location of the supports will generate movements at the pedestrian level. The suitability of the lower truss chords as a platform for pedestrian traffic is, for example, limited with respect to servicing measures.

The long-term durability of a deck constructed with prefabricated elements is questionable, particularly when the quantity of the structural joints is extremely large, and most of the joints are positioned uneconomically in the upper surface. A leaking joint allowing the penetration of rain water into the box-structure will lead to structural deterioration and steel corrosion. The low material thicknesses, demanding manufacturing requirements, tension rods' durability, and connections are details that must be solved more successfully than has been presented if the 200-year service life is to be attained.

The truss construction's large quantity of different details susceptible to fatigue requires maintenance. Painting as such is possible, but the fatigue resulting from traffic loads and wind may become problematic, particularly when attempting to attain the 200-year service life.

From the standpoint of infrastructure serviceability, the adequacy of the deck construction's dimensions is questionable; at least the dimensioning required for pipe replacements must be checked.

3.6.3 Aesthetics

The angular truss takes the most direct route through Kruunuvuorenselkä, generating an extremely vigorous dialogue with the landscape. The blunt configuration recalls old railway bridges, but the overall impression is heavy-handed and fragmented.

The clear-cut solution suspends its protected pedestrian and cycle traffic lanes under the deck. The structures are extremely light and the aesthetics are derived naturally from the structural logic. The surprising arrow-straight "line is the shortest distance between two points" connection also feels long and seemingly endless. The impression has been softened by varying the shape of the cross sections and successfully importing various types of activities into the bridge. The ship route crossing breaks the monotony at a suitable location and provides the opportunity for level changes. The cohesion of the upper level facilitates its perception as a cohesive urban space undisturbed by the occasional passing tram. Although the lightness of the lower level enchants, the excessively uncompromising nature of the entry unavoidably conjures up associations with a runway or aircraft carrier.

The connection to Kalasatama has been implemented with a disregard for the competition's objectives and the bridge design's point of departure. The entry ignores Kalasatama's design principles and imparts no added value to the Kalasatama area.

The connection to Korkeasaari has not been implemented according to the competition's objectives, nor does the entry adhere to the solution that served as the competition's source data. The entry bypasses Korkeasaari as a detached structure that subordinates the fine-grained environment.

The connection to Kruunuvuorenranta has been presented according to the terms of a bridge's straightforward technical solution. Completely ignoring Kruunuvuorenranta's urban structure, the entry only collides directly into Kruunuvuori. The bridge's technical solution appears to have been the point of departure for the entire design, after which its applicability to different situations was no longer possible.

The arrow-straight solution deviates from the competition programme's alignment, but whether any added value has been attained is questionable. Varying the width and its possibilities at different locations could achieve a pleasant location for intimately scaled amenities such as small terraces and sitting areas. The merits of the proposal in this respect would not, however, require an arrow-straight and harsh concept whose point of departure is experientially exhausting and breaks Palosaari's connection to Korkeasaari.

Photographic illustration of connection between Kalasatama – Kruunuvuorenranta
Day View • Plan view

3.7 OCULUS

3.7.1 Usability

Pedestrian traffic and cycling paths have been placed in a street-like configuration on both sides of the tramline. Although they are light, the fences bordering both sides of the pedestrian and cycle traffic lanes affect the experiences of those moving along the lanes. The railings dominate the experiencing of the pedestrian and cycle traffic lanes, and being suspended "over nothing" can be frightening. The strong separation between the tramlines and pedestrian and cycle traffic is unnecessary.

At the central section of the bridge, pedestrian and cycle traffic is momentarily led to the lower level that is protected from the weather, naturally dimensioned, and an airy relaxation and viewing location. As a total entity the bridge thus offers good views for everyone as well as momentary weather protection. The lower level inviting the bridge's users to pause enriches the experience by introducing variety and a welcome resting place.

From the traffic engineering standpoint, the solution is for the most part workable, even though the implementation of the presented viewing platforms at tram stops can be considered questionable. As shown in the entry, the plaza level is the only pedestrian traffic route in the centre of the bridge, unfortunately forcing emergency rescue vehicles to move along the tramline tracks.

The suspension bridge is an expensive solution and its use is generally reserved for locations spanning deep water channels and busy ship traffic. In these cases, the construction of intermediate supports generally increases the risk of collisions. Because there is no regularly scheduled ship traffic of any kind in the planning area, and the specified passage opening need is only 50 metres, a single 550-metre span is overdimensioned with respect to the actual conditions. Water depths in the building area are reasonable, obviating the need for a special solution such as the one presented.

The suspension bridge proposed is substantially more expensive than the other entries. With respect to all competitors, the entry's comparable cost estimate with a common unit price is EUR 156.7 million, exceeding the given limit price by approximately 65%. The working group has presented its own interpretation of the unit costs used according to which the unit price cost estimate would have been EUR 91 million. Costs conforming to the competition programme have to be calculated with the unit prices given by the organisers and in that case the upper cost limit is EUR 95 million.

Very few double span suspension bridges have been built worldwide. The span dimensions of the Taizhou Bridge spanning the Yangtze River in China are double the length of the dimensions in this entry. In terms of their costs, these types of bridges are substantially more expensive than the other presented entries. It was assessed that the entry's cost pressures would only increase in further planning. If the suspension bridge would have been planned with a single opening between the skerries and Kruunuvuorenranta, and the end bridge replaced by a girder bridge, the entry's cost estimate would have also been closer to the acceptable level.

In terms of its functionality, the presented stabilisation of the suspension bridge's outermost pylons with cables is a solution with which there has been little experience. The basic structure of a workable suspension bridge leads to large movements in the construction that are problematic with respect to tramline tracks and pipes running along the bridge. Here cables have been used in an attempt to minimise the deformations taking place at expansion joints.

At the Kruunuvuori end, the placement of the massive foundation designed for anchoring close to

the adjoining site creates challenges for land use and building schedules.

The suspension bridge's dynamic design should be studied carefully in further design, for example with wind tunnel testing.

With respect to its foundations, the solution is one of the easiest entries to implement because it contains no intermediate supports requiring construction in deep water.

3.7.2 Durability

The relaxation area designed under the deck at the location of the central pylon can be as such good from the standpoint of the solution's users, at least in good weather, but with respect to maintenance and servicing the traffic lanes are problematic and require special equipment. Because the plaza level is the only pedestrian traffic route in the middle of the bridge, its cleaning must also be managed in winter. The ramps leading to the level may be problematic with respect to slipperiness.

In terms of their construction and maintenance costs, the steel bridges between Kalasatama and Korkeasaari, as well as between Korkeasaari and Palosaari, are expensive compared to conventional concrete alternatives. Instead of a bridge solution, the section between Korkeasaari and Palosaari could be designed as an embankment integrating Korkeasaari with the rest of the design.

With the right servicing measures, the structure as such is sustainable, but the suspension bridge's large-scale mechanised movements easily create problems, at least with respect to the durability of tramline track equipment. Certain of the presented detail level solutions are unsuitable to the local climate.

The placement of district heating pipes and other infrastructure within the deck's box-structure is, from the standpoint of their maintenance, a double-edged solution. The pipes are protected from the weather, but replacements and servicing works must be carried out from the box-structure's ends; the eventual renewals will thus require an increase in the box-section's dimensions.

3.7.3 Aesthetics

The bridge alignment "swings" rhythmically in the landscape. Overall, the bridge conveys an extremely airy, almost ethereal impression even though the pylons, reaching a height of + 67 metres above sea level, are quite massive in the landscape.

Although the sleek and structurally logical solution blends in with the landscape, its maritime flavour remains strong and identifiable. The pylons and arc formed by the connecting cables set up a rhythmic pattern for the bridge's users. The viewing platform formed in the centre also works as a relaxation area; even additional amenities could be accommodated. The pylons' placement is appropriate from the landscape design and techno-economical standpoints. Dividing the deck into sections and narrowing the edges lightens the impression. The price of the light construction of the mesh railing is the windiness of the crossing. The success of the solution will to a great extent depend on the final construction's structural elegance.

The connection to Kalasatama has been implemented according to the competition's objectives as a technical solution without innovations. The alignment of the bridge from Kalasatama to Korkeasaari has been presented as a partially curved solution at the Korkeasaari end. The solution does not fully support the views shown through the Kalasatama area, but in its tranquillity is fairly successful.

The connection to Korkeasaari has been implemented according to the competition's objectives and the entry adheres to the solution provided as the competition's source data. The stretch between Korkeasaari and Palosaari has been presented as a bridge structure that, compared to the competition's other entries, does not appear to be the most natural solution.

The connection to Kruunuvuorenranta has been implemented according to the competition's objectives calmly and straightforwardly. No particularly innovative solutions have been proposed for the junction areas, but they would have perhaps only disrupted the bridge's restrained and declarative linkage to the urban structure. At Kruunuvuorenranta, the bridge pylon is located extremely close to the new urban structure and in front of Kruunuvuori; the solution is technically comprehensible, but from the visual and townscape image standpoints, it is the entry's Achilles' heel.

The sleek and stylish bridge is balanced and landmark-like, but without excessive posturing. A comparative analogy could be, for example, phrase of a song that has a beginning, middle, and end, whereas a single pylon solution is in a way a solitary shout in the wilderness, and the multiple pylons irritatingly chatter all at once. A weakness can be considered the competitive posture between the pylon close to Kruunuvuorenranta and the Kruunuvuori bedrock if the desire is to maintain the latter's dominance in the landscape. With two pylons, this problem location would have possibly been avoided, at the same time perhaps achieving a more cost-effective solution. On the other hand, a pylon can form an elegant technical contrast to the natural bedrock.

SOUTH ELEVATION TOWARDS HELSINKI
OCULUS

3.8 RECREATIO MARITIMUS

3.8.1 Usability

Tramlines and pedestrian and cycle traffic have been completely separated from each other structurally. Pedestrian traffic and cycling have been combined in their own wide lane at the southern edge of the bridge. A generous quantity of space has been reserved for pedestrian and cycle traffic and viewing the landscape. Pedestrians and cyclists are protected from wind and rain along approximately one-half the length of the bridge. The experience of crossing the bridge has been segmented with functionally diverse ideas, for example at Korkeasaari, and by providing a connection to two platforms at the water's edge where, for example, a summer cafe could be located.

From the traffic engineering standpoint, the solution is feasible even though different traffic modes cross on the same level and emergency vehicle access has been designed to only take place on the tramline tracks.

The partially covered pedestrian traffic lanes have been placed at the bridges' southern edges well separated from the tramlines. The generously dimensioned width of the lane leaves adequate space for snow removal, and wind protection has been taken into account commendably.

From the structural engineering standpoint, the solutions are not sufficiently justified; there is also reason to doubt the main bridge's structural behaviour.

The structure of the main bridge has been designed like hollow core slabs that are typically structures bearing in a single direction. The joining of the cantilevers functioning as traffic lanes to the load-bearing beam construction, particularly in the open section, is not convincingly presented; problems arise specifically with the unilaterally loaded structure's transverse, torsion, and shear capacities that have not been sufficiently addressed in calculations.

A lightened concrete deck formed like an inverted letter T has been selected as the structure for the section between Palosaari and the skerries. At the deck's centreline is a prestressed concrete beam whose height increases at the supports closest to the longest span. The structure's torsion resistance as an open cross section is, according to an executed comparative calculation, critical or even insufficient.

A tied arch bridge has been presented between Kalasatama and Korkeasaari. The bridge is refined and high-quality. The bridge's cross section components and curved sections will generate structural complications and manufacturing technique-related difficulties affecting the bridge's construction costs and external appearance. The aesthetic feasibility of the arched bridge's horizontal stiffening truss is questionable. The bending of tubes with large cross sections into curves may prove impossible, particularly when the tubes' compression will require augmented wall thicknesses. Regarding detail implementations, there are questionable locations requiring study in further planning.

The anchoring of piles in water deeper than 30 metres should be relinquished; anchoring should not be used for piles in the weakness zone. Achieving sufficient support leads to the use of inclined piles.

3.8.2 Durability

The connection of the inclined intermediate supports' prestressed columns to the prestressed foundation slabs at the water surface's range of fluctuation area is critical from the standpoint of the structural components' preservability. The prestressed steel anchors for the main bridge's inclined intermediate supports have been presented at locations susceptible to the wear and loading of ice. The concealment of these anchors would lead to the covering of the entire column, resulting in the collapse of the deck. When assessing the construction's robustness, isolated load-bearing components essential with respect to the entire structure have been placed in locations extremely susceptible to environmental impacts; if they fail the entire structure fails.

The arched bridge solution can be maintained with correctly timed servicing measures, even with the large quantity of surfaces requiring painting. The placement of district heating pipes and other infrastructure along the pedestrian traffic lanes is a poor solution from the standpoint of maintenance, but servicing works can, however, be carried out.

Structures based on lightweight tubes are problematic in the local climate; implementing the lightness requires airtight construction. With respect to casting techniques, the implementation is delicate. With respect to long-term durability, particularly in thin shell construction, an unsuccessful pour will lead to problematic empty cavities.

3.8.3 Aesthetics

In terms of its landscape effect, the bridge collage consisting of different types of episodes is heavy-handed. Kruunuvuorenselkä is spanned by a heavy capsule construction that appears to be a fairly alien element in the maritime landscape.

Dividing such a long bridge into different themes is, at least from the standpoint of pedestrians walking across the bridge, a workable idea. A mental image of different bridges is created and the connection to Korkeasaari at ground level is natural. Emphasising the section between Kalasatama and Korkeasaari can be justified as a gateway to the zoo, but the role of this section is exaggerated compared to the section spanning the sea area. The proposed new buildings at the entrance to Korkeasaari would successfully enhance the arrival experience. The bridge has been divided into various functions and a connection to sea level is provided through the artificial islands. The shaping of the islands is, however, rigid and creates the image of a structure supported by symmetrical paws. The second island is too close to the avifauna.

A problem with the bridge is its excessively diversified design motifs that inhibit the creation of a natural overall entity. The form language is simply too strong, and appears not to have logically developed from a bridge's functional and aesthetic requirements. In particular, the form language of the tube section feels alien in the delicate landscape.

The connection to Kalasatama has been implemented according to the competition's objectives. The shaping of the bridge's junction area and high quality design of the environment have resulted in a specific "place" that forms a part of the waterfront path encircling Kalasatama. The straightforwardness of the bridge's northern edge strengthens Kalasatama's view axis.

A high-quality connection to Korkeasaari has been implemented based on the competition's objectives. The traffic area is extensive at the Korkeasaari location, but it is a high-quality design. The section between Korkeasaari and Palosaari has been designed as a wide isthmus where traffic passes through a maritime-flavoured park environment. The water area remaining in between has been developed as a water theme in the park. The solution is one of the best in the competition and the principle could work well as a basis for further planning.

The connection to Kruunuvuorenranta has been implemented fairly successfully taking into account the competition's objectives. The junction area has been developed as a square sloping towards the sea that reinforces the area's own high-level identity.

The entry's undeniable merit is the experientially rich perception of the bridge as a series of distinct episodes. Owing to the length of the bridge, the implementation of this approach could generate an adventurous and richly nuanced world of experience. The integration of ecological information content with the overall entity also enhances the bridge's experiential significance. Instead of technical necessity, the connection to Korkeasaari and Palosaari has been made a "place" that one could imagine as being pleasant. This is the only entry in which the water remaining in between has been taken as part of the composition and shaped to achieve a new landscape. A weakness is, however, the long bridge section's "retrofuturistic" form language that more closely resembles a bullet train instead of a new kind of bridge connection, thus forming an experientially risky local landscape.

3.9 SEPTEM FRATRES

3.9.1 Usability

The basic solution is street-like. The tramlines are centralised; cycling and pedestrian traffic is separated on both sides of the tramline tracks by kerbstones. Backing walls and seating areas located at scattered areas reserved for trams and cycling paths offer recreational possibilities and articulate the bridge's comings and goings in a welcome manner. The direct connection to the cycling path may, however, lead to conflict situations; the driving speed of commuting cyclists is often fairly high. The curving bridge opens variable views to the surrounding landscape.

From the traffic engineering standpoint, the solution is sufficiently workable, even though crossings of different traffic modes on the same level are presented, particularly with respect to Korkeasaari's service traffic.

The underpass for pedestrian traffic presented at Palosaari facilitates transfers to the bridge's northern edge between Palosaari and Korkeasaari if a light rail line is built. A sufficient underpass height for the tunnel must be checked.

The proposed cable-stayed bridge as a multi-span construction has been implemented primarily in foreign locations. The basic structure is workable and details were assessed as being more reliably implementable than the other similar cable-stayed solution; concrete construction has been applied more logically. The centrally located cables lead to the deck's box-structure, whose cross section provides torsional resistance, and where district heating pipes and other infrastructure are placed inside.

The placement of traffic modes in the cross section is not particularly flexible.

In the selected solution, there are several pylon foundations requiring construction in deep water such as in Nexu, but the quantity is larger. The bridges have been for the most part presented as being founded on piles. From the standpoint of foundations, a considerable number of piles in uneconomically deep sections have been presented, but the solutions would appear to be feasible because anchoring has not been proposed for these locations. The driven piles in the S11 area should be changed to drilled piles.

3.9.2 Durability

The selected pylon height is fairly low. Compared to a conventional cable-stayed bridge, the entry is primarily a stiffened girder, or so-called "extra dosed" type bridge. The municipal engineering placed within the box-structure will lead to increased maintenance and servicing costs, even though the external appearance is stylish. On the other hand minor servicing tasks and inspections are easily realised inside the box-structure protected from weather.

The bridge section between Kalasatama and Korkeasaari has been implemented as a conventional girder bridge. The selected solution and its emphases are justified.

Unlike in the other similar entry, the concrete deck and its details, with respect to long-term durability, are based on more reliable in-situ casting techniques.

With the correct servicing measures, the steel pylon and composite construction steel box girder deck are durable structures. Any ice forming on the cables will require maintenance and care to ensure that no ice will fall on the traffic passing below.

The single-level cross section is, from the standpoint of cleaning, easier than the other similar cable-stayed solution. At the main bridge section, the placement of district heating pipes and other infrastructure within the deck's box-structure is, from the standpoint of their maintenance, a double-edged solution. The pipes are protected from the weather, but replacements and servicing works must be carried out from the box-structure's ends; the eventual renewals will thus require an increase in the box-structure's dimensions. At the girder bridges, the placement between the main beams is a good solution; servicing can be freely performed at the required location.

3.9.3 Aesthetics

The alignment spanning Kruunuvuorenselkä curves gracefully and the seven pylons do not create a strong visual barrier. The earthfill embankments off the shore of Korkeasaari are incomplete from the landscape design point of view.

In terms of its form, the bridge seems appropriate and structurally logical. By distributing loads with cables over seven pylons, the height of each individual pylon has been kept low. The relationships between the deck, pylons, and sea seem imbalanced; it is as if the pylons are standing on their toes. The excessively expressive and clumsy shaping of the pylons attracts too much attention in what is otherwise a fairly simplified entity. The crossing lacks surprise; the pylons and sitting areas admittedly set up rhythmic variety for the trip, but the repetition begins to create monotony. The ground level connection at Korkeasaari is a workable solution.

The connection to Kalasatama has been implemented according to the competition's objectives as a technical solution without any innovations. The alignment of the bridge from Kalasatama to Korkeasaari is presented straightforwardly and successfully suits the townscape image from the standpoint of Kalasatama's urban structure.

The connection to Korkeasaari has been implemented according to the competition's objectives and to a great extent adheres to the solution provided as the competition's source data. The stretch between Korkeasaari and Palosaari has been implemented as a narrow embankment that appears to be technically feasible, but fails to exploit the possibilities offered by the area in its entirety. The entry implements what is strictly necessary, but in this section it is hindered by a lack of innovative thinking.

The connection to Kruunuvuorenranta has been implemented according to the competition's objectives and feasibly without innovations.

The bridge derives its significance with literary references related to the Finnish identity. The even row of pylons remains a prisoner of its conceptual content. The shaping of the pylons with the colouring of the Finnish flag seems somewhat heavy-handed and forced. The same applies to the resting places, unshielded against the main wind direction, intended for relaxation.

3.10 UNDA ARCTICA

3.10.1 Usability

Tramlines run along the northern edge of the long bridge, while cycling and pedestrian traffic has been combined on the southern edge. Kerbstones separate tramlines from pedestrian and cycle traffic, as on a street. By combining cycling and pedestrian traffic into a 4-metre-wide lane at the southern edge of the bridge, the space reserved for pedestrian and cycle traffic has been reduced by 50% compared to solutions in which pedestrian and cycle traffic is on both sides of the tramline. The space reserved for pedestrian and cycle traffic seems scanty, and it should be widened. The narrowness of the lane may also cause conflicts between high-speed cycling traffic and pedestrians. Additional space is also required for resting and viewing the landscape.

From the traffic engineering standpoint, the solution is perhaps the most thoroughly thought out of the entries, even though in this alternative as well a crossing of cycling and tramline traffic occurs. The possible light rail has been presented as connecting to the bridge separately on both sides, increasing the entry's costs; the section between Korkeasaari and Palosaari has been presented as a high bridge.

The tied arch bridge is a conventional solution and as such reliable. The supports' innovative inverted arch is not an optimal structure for the distribution of forces, but appears to be justified with respect to the arch construction's overall visual impact. The dimensions of the inverted arch's section may slightly increase in more detailed design.

The basic structure is stable and the cross section allows for the flexible placement of traffic modes.

The bridge section between Korkeasaari and Palosaari has been designed as being founded partially on bedrock and partially on stiff moraine. The main bridge has been presented as being founded on piles, as has the bridge linking Kalasatama and Korkeasaari. According to existing information, the supports have been placed outside the weakness zone.

3.10.2 Durability

The linking of several Tied Arch -type spans is an interesting and innovative solution. As presented, however, the placement of the special bridge seems unjustified. In view of the bridge location's seafloor conditions, a more natural alternative would have been to place the arched bridge, for example as a series of arches in the manner proposed, between Kruunuvuorenranta and the skerries, and implement the other section with a conventional girder solution. In the solution now presented the arch combination begins and ends in the middle of the sea before it has reached the Kruunuvuori shore. In the final design, a solution like the one presented cannot be applied to the bridge location without altering the solution essentially. In the selected solution, the quantity of intermediate supports requiring construction in deep water is fairly low compared to the other entries, but the arched bridge's supports are clearly heavier than a girder bridge's supports.

The bridge section between Kalasatama and Korkeasaari has been implemented with a conventional girder bridge. The selected solution and its emphases are justified.

Maintenance must be carried out using normal procedures. The solution contains no structural types that would have posed any unreasonably high cost risks. With the proper maintenance, the steel arches will be sustainable. In the final design, the shaping of the joints at the main beam's and transverse beams' lower flanges must be taken into account to avoid fatigue damage. Repaintings of the steel construction deck must be carried out from below; the deck's cleaning is easily arranged with normal methods.

At the arched bridge section, the running of district heating pipes and other infrastructure through the deck's transverse beams is a reasonable solution from the maintenance standpoint. The pipes' replacement and repair works can be carried out at the required locations, even though the transverse beams will to a certain extent hinder the work. At the locations of the girder bridges the placement between the main girders behind the cladding is a good solution as long as the design of the cladding takes servicing into account. Servicing works can be carried out at the required locations without the transverse beams disturbing.

3.10.3 Aesthetics

In the form language appropriateness is linked to gracefulness; the undulating shape conveys a maritime ambience. The entry contains one strong formal idea that in all its clarity is enough to give the bridge its own recognisable identity. The entry has succeeded in creating a clear character for the bridge that sets it apart from other Finnish bridges. The question arises, however, as to whether the symmetricalness of the undulating motif is even too formalistic an element.

Although the undulating form follows the archipelago landscape's silhouette, the bridge competes with it and obscures the clarity of the landscape's contours. In many views the bridge directly overlines its background landscape. The concept works best when the bridge is viewed from the sideways direction with a foreshortened perspective. As a steel structure the bridge is light and spacious. The columns are simple but successful in terms of their well-considered form. The arches divide a fairly monotonous bridge. The initial section is too unassuming and passes over Korkeasaari by constantly remaining at the upper level. The connection to Korkeasaari results in an under bridge landscape that is difficult to activate and experientially enliven. In terms of its unidimensionality, the bridge seems to have been reserved for highway traffic instead of pedestrian and cycle traffic connections. The curved section seems to start from a random location after the water's crossing has already begun. A more rhythmically varied composition would have loosened up the static configuration. There are mental associations with the arched bridges of the 1960s, and the solution does not seem particularly innovative.

The connection to Kalasatama has been implemented according to the competition's objectives. The attempt has been made to develop the bridge's starting point as a location that brings added value to the shore route encircling Kalasatama. The connection in the presented form is a fairly developable solution. The alignment of the bridge between Kalasatama and Korkeasaari is, when viewed from Kalasatama, curved towards the north, and fails to support the principles of Kalasatama's urban structure; a straight alignment would appear to have been more workable at this location.

The connection to Korkeasaari is arrogant and too pretentious in its entirety. The entry aims at being a solution detached from the island. The size of the structure is, however, so large that Korkeasaari and Palosaari are forced into subordinate positions.

The connection to Kruunuvuorenranta has been implemented according to the competition's objectives with restraint and straightforwardly. The junction area contains no particularly innovative solutions, but they would have perhaps only disturbed the bridge's calm and declaratory linkage to the urban structure. The connection is fairly successful at this location.

This entry is a clear expression of the bridge as artefact, demonstrating a bridge's potential to form a new horizontal landmark for the Helsinki skyline. A strong vision has been made visible, an approach that is both the entry's weakness and its strength.

The experience of crossing the bridge has been rhythmised by a structure that at the same time attempts to achieve visual variation. The bridge is a separate element hovering over, and partly attached to, the landscape. This approach is emphasised by the fact that the bridge is one continuous element.

3.11 VENTUS

3.11.1 Usability

Tramlines run along the long bridge's northern edge, while pedestrian traffic and cycling have their own wide lanes along its southern edge. The entry's pedestrian and cycle traffic lane has been separated from the tramline with a light railing. The wide pedestrian and cycle traffic area also makes it possible to provide separate lanes for high-speed cycle traffic and pedestrians; there are also areas for sitting and viewing the landscape. Views have been well considered, but bridge offers no weather protection.

From the traffic engineering standpoint, the solution is in principle workable, even if the centralised platforms would have to be changed to a solution suiting the Finnish system. The crossing of the various traffic modes at certain locations also hinders the possible light rail solution.

In terms of its cost estimate, the working group's presentation is the most expensive in the competition, exceeding the cost limit given for the solution by 140%.

The use of steel in the manner presented is inefficient, and the application of the same uneconomically repetitive solution over the entire distance has proven to be extremely expensive. The massive and asymmetrically shaped structural elements collect unnecessary stresses that in turn lead to their overdimensioning. There will be pressures to continuously increase implementation costs owing to the complicated shapes and extremely large quantity of welds.

The bridge functions as a structure collecting stresses for its supports. The bent structural components appear massive; as members with only tension they could be replaced with noticeably more slender members. The asymmetrical structural deflections lead to the twisting of the cross section.

The feasibility of the special construction seems challenging at the very least owing to, among other factors, the various types and large quantities of welded connections.

Piling for the most part has been selected as the foundation method. The presented drilled piles in deep water areas should be changed to driven piles in further design.

3.11.2 Durability

The solution is based on a repetitive module applied to the entire design interval. The module is formed from the pylon and the deck's upper and lower steel truss frames, on which the stiffening girders running along both sides of the deck rest. Between the stiffening girders are the deck's transverse girders. The structural components are massive and costly. The structure contains a considerable number of locations where the cross section changes suddenly, forming the potential for the occurrence of fatigue phenomena. The large wind surfaces and lightweight, extensive, and angular cross-sections may, when subject to stiff ocean winds, cause swirls and wind resonance leading to structural vibrations. Although it is highly unlikely that this phenomenon would occur in such rigid construction, there should be a vibration analysis in any possible structural engineering processes.

Although the steel surface is clear and easily accessed from the standpoint of repainting, there is a great deal of surface area owing to the wasteful use of material.

The solution's high steel content binds a considerable amount of energy and as such fails to adhere to the principles of sustainable development. The principles of sustainable development are cited as the reason for the material selection, but the uneconomical use of the material contradicts this idea. The entry's poor showing in the carbon footprint calculations is primarily due to its uneconomical quantity of steel.

3.11.3 Aesthetics

The low-slung and sculptural bridge heavy-handedly drags its way through the landscape. In terms of its scale the entry would be better suited to heavy duty traffic.

The clear-cut and consistently executed concept has resulted in a bridge that forms an excessively prominent diamond-like landmark. The inappropriate use of structural components in certain locations has led to the somewhat heavy-handed general appearance, but modularity effectively articulates the bridge rhythmically. Compared to the truss construction, the overall appearance from the perspective of those crossing the bridge is tranquil and spacious. The authors' empathetic abilities are revealed through many details such as the taking into account of birds, the heating of the pedestrian and cycle traffic lane, the connection to Korkeasaari directly from the pedestrian level, and even in the specification of the paints' degree of gloss. The lighting concept has succeeded within the framework of the selected stylistic orientation.

The connection to Kalasatama has been implemented according to the competition's objectives. The shaping of the shoreline has aimed at the creation of a distinctive appearance for the junction area, but the solution as presented is fairly modest. The alignment of the bridge from Kalasatama to Korkeasaari has been presented straightforwardly and successfully, and suits the townscape image from the standpoint of Kalasatama's urban structure.

The connection to Korkeasaari has been implemented according to the competition's objectives and respects the solution that served as the competition's source data. At this location, however, the entry is fairly heavy-handed and makes the tramline stops an excessively dominating element for Korkeasaari. Implementing the stretch between Korkeasaari and Palosaari with the same bridge construction used for the other sections is simply too heavy-handed for a fine-grained archipelago and places the islands in a completely subordinated position.

The connection to Kruunuvuorenranta has been implemented viably according to the competition's objectives without any significantly innovative solutions. A shorter connection from the bridge to the shore would have been desirable.

The overall impression is sturdy yet clumsy; the bridge user is forced to pass through the truss's framework for the entire duration of the journey across the bridge. At its worst, the density of the construction achieves a heavy-handed and oppressive ambience whose monotony is emphasised by the perception that the entire bridge connection has been designed with the same concept. The additional cost resulting from the excessive use of materials does not appear to have generated any added value.

4

RESULTS OF THE COMPETITION

4.1 Prizes

The Competition Jury unanimously decided to distribute the prizes as follows:

- 1st Prize: Entry **Gemma Regalis**
- Shared 2nd Prize: Entries **Filum Lucis** and **Unda Arctica** (mentioned in alphabetical order)

Other entries were not ranked in order of superiority.

4.2 Recommendation for further action

The Competition Jury decided to recommend that entry Gemma Regalis be used as the basis for further design, and that negotiations be initialised with the authors of the entry for the design commission. The Competition Jury also decided to recommend the payment of the competition compensation covering the costs incurred by the entries' preparation to all entrants according to the scope specified in the competition programme.

4.3 Guidelines for further planning

During the evaluation period, giving each of the three bridge sections its own separate identity was discerned as an effective way to lighten the total. The stretch between Korkeasaari and Palosaari is most naturally implemented as landfill, provided that the landscape treatment is high-quality, and that the area becomes an integral part of Korkeasaari instead of resembling a highway embankment. At Korkeasaari the bridge should be lowered and linked to the island at ground level, enabling the zoo to be approached through an imposing entrance square instead of the dark underside of a bridge. The treatment of the Korkeasaari section in further planning should make use of the results of the 2008 landscape architecture competition and the general plan 2012–2022 for Korkeasaari.

In further planning, the location of the high pylon should be studied with an eye to its relocation in a less centralised and dominating position in relation to the open part of the sea bay. Its position as a unique landmark should be further developed by studying, among other things, the possibilities offered by dynamic lighting.

The dimensioning of pedestrian and cycle traffic lanes should be checked to the extent that high-speed cycling can be clearly separated from pedestrian traffic.

The locations of foundations should be assessed more precisely with respect to ground conditions, particularly if the alignment has to be adjusted in further planning.

4.4 Verification of the minutes of the Competition Jury

Pekka Sauri
D.Phil., M.A. (Psych.), Deputy Mayor,
Public Works and Environmental
Affairs, Chairman of the jury

Hannu Penttilä
M. Sc. (Tech.), Deputy Mayor,
City Planning and Real Estate,
Vice-chairman of the jury

Jarmo Nieminen
General Staff Officer, Lieutenant
Colonel ret., Chairman of the
Helsinki Public Works Committee

Tapio Korhonen
LL.M., B.Sc. (Econ.) Finance Director,
City of Helsinki Economic
and Planning Centre

Maria Jaakkola
M.Sc. (Landscape Architecture),
Head of Office, Environmental Office,
Helsinki City Planning Department

Raimo K Saarinen
M.Sc. (Tech.),
Helsinki City Engineer,
Helsinki Public Works Department

Jukka Salo
Professor, Adjunct Professor of
Landscape Ecology, Director of
Helsinki Zoo (Korkeasaari)

Juhani Tuuttila
M.Sc. (Tech.),
Head of Office,
Real Estate Department

Anne Stenros
D.Tech, M.A. (Arch),
Vice President, Design,
KONE Corporation

Pirjo Tulikukka
M.A. (Applied arts),
Executive Director, Helsinki
Neighbourhoods Association

Ilkka Vilonen
Lic.Sc. (Eng.) Expert named by
the Finnish Association of
Civil Engineers RIL

Ville Hara
M.Sc. (Arch.) Expert named by
the Finnish Association of
Architects SAFA

Jyrki Sinkkilä
M.Sc. (Arch.) Expert named
by the Finnish Association of
Landscape Architects MARK

Ville Alajoki
M.Sc. (Eng.), Project Manager
(bridges), Investment Office, Street
and Park Division, Helsinki Public Works
Department, Secretary of the jury

Opening of the name envelopes

The name envelopes of the competition entries were confirmed to be closed.

Pekka Sauri
Deputy Mayor, Public Works and Environmental Affairs
Chairman of the jury

Ville Alajoki
Project Manager, Investment Office, Street and Park Division, Helsinki Public Works Department
Secretary of the jury

Mikko Ahola
Project Engineer, Economic and Planning Centre, Development Division
Secretary of the preparatory group

Ilkka Vilonen
Expert named by the Finnish Association of Civil Engineers RIL

Ville Hara
Expert named by the Finnish Association of Architects SAFA

The authors of the competition entries

The authors of the entries were determined based on the name envelopes.
(Entries presented in alphabetical order)

Debet Semper Plus Esse Virium In Vectores Quam In Onere

Apia XXI S.A., Spain
Head designer, bridge design: Oscar Ramon Ramos Gutierrez
Head architect: Joan Roig i Duran

Filum Lucis

Ove Arup & Partners International Ltd, United Kingdom
Head designer, bridge design: Ed Clark
Head architect: Amanda Levete

Gemma Regalis

WSP Finland, Finland
Head designer, bridge design: Sami Niemelä / Pekka Pulkkinen
Head architect: Martin Knight

Hyperborea

Knippers Helbig GmbH, Germany
Head designer, bridge design: Thorsten Helbig
Head architect: Rob Torsing (Partner/Architect - Zwarts & Jansma Architects)

Nexu

Roughan & O'Donovan, Ireland
Head designer, bridge design: Tony Dempsey
Head architect: Bruno Dumetier

Occursus

Setec tpi, France
Head designer, bridge design: Jean-Bernard Datry
Head architect: Jean François Blassel

Oculus

Schüssler-Plan Ingenieurgesellschaft Berlin, Germany
Head designer, bridge design: Wolfgang Strobl
Head architect: Dietmar Feichtinger

Recreatio Maritimus

Carlos Fernández Casado, S.L., Spain
Head designer, bridge design: Javier Muñoz-Rojas
Head architect: Javier Manterola

Septem Fratres

WSP Finland, Finland
Head designer, bridge design: Pekka Pulkkinen
Head architect: Martin Knight

Unda Arctica

Pontek Consulting Engineers Ltd, Finland
Head designer, bridge design: Juhani Hyvönen
Head architect: Hanna Hyvönen

Ventus

Arup, the Netherlands
Head designer, bridge design: Sander den Blanken
Head architect: Ben van Berkel (UNStudio)