This first comprehensive overview of the work of engineer Laurent Ney is published on the occasion of the exhibition Laurent Ney - Shaping Forces, at the Centre for Fine Arts, Brussels, April 22nd - June 20th, 2010.

This monograph examines more than 25 projects Laurent Ney has designed over the last twelve years: a footbridge in Knokke-Heist, a roof over the courtyard of the Dutch Maritime Museum in Amsterdam, the Oosterweel link in Antwerp, a roof for Rogier Square in Brussels, a canopy at Kiel in Antwerp, a 1200-metre-long 'city' bridge in Nijmegen and a new stadium for the RSC Anderlecht football club. This includes Ney's own infrastructure projects and also his notable joint ventures with architects. The projects give an impression of his highly individual approach, which involves constant research into structure and form. Context, geometry, connections and materials are combined in a design vision that questions familiar typologies and gives coherent form to the forces within each structure.

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2. INTRODUCTION

Introduction for the book by John Ochsendorf (Associate Professor of Civil Engineering and Architecture, Massachusetts Institute of Technology, Cambridge, USA):

Laurent Ney’s structures are among the most technically and visually exciting designs ever created. Each structure is highly original, with moments of creative brilliance from the smallest connection details to the interaction with the surrounding landscape. Yet his structures are exemplified by their simplicity. This simplicity does not come easily – it is the result of asking the right questions, seeking elegant solutions, and paring away the inessential. In Ney’s designs, each individual element solves multiple problems, and the combined whole is a lesson in engineering efficiency. He represents the very best of the creative engineer: disciplined, yet playful.

Ney approaches each problem with fresh eyes. Old forms are not pulled from a drawer and dusted off for the problem at hand. He studies the site carefully and defines the relevant boundary conditions. The final design emerges from the site constraints and requirements. Though his designs are occasionally inspired by great works from the past, Ney’s structures are built with the leading engineering tools available today. His design team uses structural optimization software to refine the form and reduce material. Advanced fabrication methods create precise geometries in steel plate, reducing costs further. Fabrication and construction are integral to the designs and the final form demonstrates the construction process.

By creating unprecedented forms in steel, Laurent Ney demonstrates that the pursuit of creative structural design is an endless frontier. Here is a master engineer whose designs will endure and inspire for generations to come.

3. CURRICULUM VITAE LAURENT NEY

Laurent Ney (*1964, Thionville) is a civil structural engineer trained at the Université de Liège, Belgium, and at the Rheinisch-Westfälische Technische Hochschule in Aachen, Germany. From 1987 to 1989 he was a student and research assistant for the MSM administration of professor Cescotto in Liège. He was a lecturer on Construction stability from 1995 to 2001 at the Institut Supérieur d’Architecture Lambert Lombard in Liège. Since 2005 he is a lecturer at the Université Libre de Bruxelles. From 1989 to 1996 he worked as an engineer at Bureau d’études Greisch in Liège. In 1998 he founded the engineering firm Ney & Partners in Brussels and Luxembourg.

Distinctions / 2001 / Sint-Lukas Archive Award, Brussels (B) / 2002 / Winner of the Steel Prize 2002 for the Tachkemoni canopy (B) / Winner of the Steel Prize 2002 for the Denis House (B) / Belgian Architecture Award for the Elena House, Brussels (B) / 2nd prize Energy Awards 2002 for the Elena House, Brussels (B) / Winner of the Awards for Mobility for the footbridge of Woluwe (B) / Honorable mention Steel Prize 2002 for the tower of Gedinne (B) / Nomination Steel Prize 2002 for the footbridge of Woluwe (B) / 2003 / Winner Belgian Architecture Award for the Sports hall Rempart des Moines (B) / 2004 / Nomination Steel Prize 2004 for the Collective housing Place Liedts (B) / Patrimony Prize TrendsTendance (B) / Nomination Belgian Steel Prize for the footbridge over the Stokkelse Steenweg (B) / Winner of the Steel Prize 2004 for the footbridge over the Ourthe river at Hotton (B) / Winner of the Steel Prize 2004 for the House Buelens-Vanderlinden (B) / Winner of the Steel Prize 2004 for the Umbrella’s at Alden Biesen (B) / Winner Belgian Architecture Award for House 2 (B) / 2005 / MIPIM Award for Institut Pasteur (B) / Winner Belgian Architecture Award for the Intercom school at Liège (B) / 2006 / Nomination Steel Prize 2006 for the Thuin Bridge (B) / Nomination Steel
4. ABOUT THE AUTHORS

Sigrid Adriaenssens (°1973, Antwerp), is a Professor at Princeton University, USA and is affiliated with Vrije Universiteit Brussel, Belgium. She holds a Ph.D. from the University of Bath, UK and worked as project engineer for Jane Wernick and Laurent Ney. Her fields of interest are form finding and optimisation techniques, structural surfaces, digital fabrication, historic structures and sustainable design.

Stefan Devoldere (°1973, Ghent) is an engineer-architect (Ghent University) and urban planner (University of Leuven). He is currently working as a critic and curator of exhibitions on architecture. Since 2004, he is the editor in chief of A+, the Belgian Review on Architecture. He is co-curator and co-author of the exhibition and publication “Robbrecht en Daem. Pacing through Architecture” (Center for Fine Arts, Brussels, and WhiteChapel Gallery, London).

Iwan Strauven (°1974, Brussels) is curator of the architectural programme of the Centre for Fine Arts in Brussels (BOZAR) and teaches history of urban planning at the architecture school of La Cambre in Brussels. He is preparing a PhD at Ghent University on the work of the modernist architect Victor Bourgeois. He is co-curator and co-author of the exhibition and publication “Robbrecht en Daem. Pacing through Architecture” (Center for Fine Arts, Brussels, and WhiteChapel Gallery, London).

5. SAMPLE PAGES
is defined not by its form but by its use of material. Materiality gives coherence to a city. If you visit the pavements in a European city, you immediately know where you are, and it is important to know where you are. The use of materials is linked not only to a tradition of craftsmanship and social responsibility, and therefore also a quality that withstands the test of time. Here, a project is a part of history, a history of craftsmanship built on a well-considered use of materials. But the use of material is linked not only to a tradition of craftsmanship, but just as much to a particular place. On an urban scale, a built object is no more than built and refined geometry is too simplistic. The traditional importance of classical geometry is overestimated. The idea that architecture ports antiquity, our architecture has always been intended to be the material reflection of the craft is a major source of inspiration. We look at the way workers in precious metals made connections in the past, with great craftsmanship, and based on lifelong experience, and we interpret it. When two lines in precious metals made connections in the past, with great craftsmanship, and based on lifelong experience, and we interpret it. When two lines in

Connections

The way the separate elements of a structure are joined is a determining factor in the language of the engineer. The basic elements and the form of the alphabet, and the complete structure like a piece of paper. The articulation of the two, the way the virtual elements relate to each other, their connection and their assembly, are the fundamental means by which an engineer communicates. The first and most important point of connection in a structure is where it touches the ground. This is where we move from one world to another, changing from one scale to another. The connection with the ground is the climax of an infrastructural project of art. It is the threshold of a building, the entrance in the object. It is the place where you can touch the structure, where time and construction come down to the human level of scale, and where they can be entered, used and experienced. A connection needs to be designed with great care. And the tradition of the craft is a major source of inspiration. We look at the way workers in precious metals made connections in the past, with great craftsmanship, and based on lifelong experience, and we interpret it. When two lines in precious metals made connections in the past, with great craftsmanship, and based on lifelong experience, and we interpret it. When two lines in

Geometry

Geometry is inseparably linked to architecture and engineering. Since antiquity, our architecture has always been intended to be the material reflection of great geometry and mathematical principles. The known-known examples are the Greek Parthenon forms such as the sphere, rectangle, cube, and box. In addition, there are for example also the applications of projection and grid. With this desire for a recognisable, harmonious' formal idiom, the question arises of whether geometry comes before architecture. Is it to be considered as a source of inspiration, or is it actually brought in afterwards as an aid to the description of the idea? It is clear that there is no ready answer to these questions. But we see it as just as clear that the importance of classical geometry is overestimated. The idea that architecture in no more than built and refined geometry is too simplistic. The traditional role of geometry in engineering is a description one, a way of putting particular forms into recognisable formulae. In addition to using this descriptive geometry, we carry out research into the generative value of geometry. This means that both plane and solid (two- and three-dimensional) geometry have to be understood in the more global context of what are called potential systems. This point of view is not merely theoretical, but purely a conclusion drawn from the direct consideration of the world around us. Classic geometry defined architecture and engineering until the 1960s and '70s. That is why the form appeared and geometry was primogenitor. So what extent is classical descriptive geometry still used and what extent is this new geometry? Geometry helps manage the multitude of forms and helps us to find new forms. It offers us the opportunity to tackle old complex problems and to work on it. Geometry is the basis of parametric design, in which a simple geometric model is adjusted countless times. The geometric study is an eternal promise of a better-adapted object, a potential system which repeatedly culminates in a different optimum solution. In this way, simple geometry can undertake complex and inconceivable forms, such like a DNA helix. But geometry not only generates new forms, it can also be employed aesthetically by means of patterns. By using complex patterns, geometry becomes a source of communication and an integrated part of the design. Introducing geometry as a means of expression heralds a new sort of crystallisation in an architectural idiom from which it had been banned. Patterns are, after all, the new crystallisation.

Hierarchy

In the course of our formal and conceptual research, hierarchy, and above all its reduction, has been a central theme. In all our projects, both civil and architectural, we pursue extreme structural integration. Hierarchy in building is as old as the discipline itself. This strategy divides a complex problem into a series of simpler problems with solutions that are already known or easily to be found. In the realm of civil engineering, this strategy originates in the 19th-century polytechnic schools. Together with industrial development, this strategy has contributed to the rapid rise of build structures. In all our projects, we pursue extreme structural integration. Hierarchy in building is as old as the discipline itself. This strategy divides a complex problem into a series of simpler problems with solutions that are already known or easily to be found. In the realm of civil engineering, this strategy originates in the 19th-century polytechnic schools. Together with industrial development, this strategy has contributed to the rapid rise of build structures. In all our projects, we pursue extreme structural integration. Hierarchy in building is as old as the discipline itself. This strategy divides a complex problem into a series of simpler problems with solutions that are already known or easily to be found. In the realm of civil engineering, this strategy originates in the 19th-century polytechnic schools. Together with industrial development, this strategy has contributed to the rapid rise of build structures. In all our projects, we pursue extreme structural integration. Hierarchy in building is as old as the discipline itself. This strategy divides a complex problem into a series of simpler problems with solutions that are already known or easily to be found. In the realm of civil engineering, this strategy originates in the 19th-century polytechnic schools. Together with industrial development, this strategy has contributed to the rapid rise of build structures. In all our projects, we pursue extreme structural integration.
The Gedinne Millenium Tower dominates the plains of Croix-Scaille, a 9,000 hectare area covered with Douglas fir forests near the Belgian-French border. The idea of using local materials and their associated economy set out the basis for the design concept. The choice of materials resulted in a ‘reverse engineering’ approach. Firstly the tree trunks were selected for their geometry and load-bearing capacity. Afterwards the most appropriate structural systems were searched and tried, finally the most efficient system was found. The resulting system, two tripods fitted together (one upright, one upside down) with three viewing platforms, was designed and conceived around them. This object shows how important it is for a designer to free himself of predefined structural systems. The new type of tensegrity tower expresses visual and structural clarity; the compression members are in timber, the tension ones in steel. Due to the inaccessibility of the site to large cranes, the construction procedure posed another engineering problem. It took the specially-designed lifting system more than eight hours to pivot the horizontally assembled tower around the ends of two of the masts into the final vertical position. The tower’s highest point rises 60m above the highest point in the Ardennes region.
Choice of path in space related to the two connected dikes and the two lighthouses.

Bending moments

Material needed to withstand the bending moments

Optimization of the cut-out form for bending moments

Knokke-Heist Footbridge

1. Handrail: Ø 48.1/2 stainless-steel
2. LED-line
3. 20mm stainless-steel post
4. stainless-steel net
5. 8mm PU coating
6. Reference point
7. 12mm steel sheet
8. NCS2 S0505-B painting (light blue) underside
  NCS2 S1505-Y painting (whitesand) upperside
9. 80/15mm steel plate @2000
10. Ø 16mm shear connector, L=175mm
11. Structural concrete C30/37
12. Polystyrene concrete 350kg/m³
From a classical rectangular cross-section to a nonclassical cross-section:

1. It can be demonstrated that the transverse bending moments of a box girder are not proportional to the depth of the flanges. The classical rectangular cross-section is not optimal. An elliptical shape reduces the effort and the material needed despite its longer perimeter.

2. On the hypothesis of a cable-stayed bridge, it can be shown that the almond shape is optimal and eliminates the transverse bending moment.

3. Sketch of an optimal cross-section for a cable-stayed bridge.

4. Design steps towards an optimal cross-section:

   a. Topological definition of the bridge for the formfinding process.
As part of the renovation of a school in the centre of Antwerp, Laurent Ney designed two canopies in collaboration with architect Christiaan Poulissen: one for the kindergarten and one larger one for the primary school. The client’s brief stated that the canopies, envisaged as traditional transparent roofs, had to cover part of the playground. The design of a glazed or transparent roof is far too often conceived as the addition of a series of elements, fulfilling only one function. In this analytical design approach, the glass shelters people from the rain and lets the light in, the glass slats connect all the elements together, the beams carry the weight and transfer the loads to the columns and further to the foundations. The Tachkemoni canopies were not conceived to be yet another accumulation of horizontal and vertical sub-elements but to be a quest for an object that expresses structural unity. One element – the canopy – should fulfill all the functions at the same time. This holistic approach is in line with the structural design of a canopy, which is based on the interaction between the form and the forces.

### Tachkemoni Canopies

**Location:** Antwerp (B)  
**Client:** Vzw Tachkemoni  
**Programme:** Two Canopies  
**Architect:** Poulissen & Partners bvba (design)  
**Structure:** Ney & Partners  
**Project date:** 1998  
**Execution:** 2001  
**Contractor:** Moeskops  
**Subcontractor steel:** Emosteel

### Form & Forces

Form: C1: Curve in space, section with compression and bending moments  
C2: Modifies the shape of the form

Forces: The structure is based on the interaction between the form and the forces. The membrane is pretensioned against a looped tubular frame. The shape of the canopy is determined by the forces and the shape of the membrane. The interaction between the form and the forces is crucial for the design of the canopies. The design of these canopies brought Ney to an awareness of the importance of tools and strategies when looking for correct structural shapes.