

Proceedings of the Second International Congress on

Construction History

Queens' College, Cambridge University 29th March – 2nd April 2006

Edited by

Malcolm Dunkeld

James Campbell

Hentie Louw

Michael Tutton

Bill Addis

Robert Thorne

Volume 1

CONSTRUCTION HISTORY SOCIETY

Contents

Volume 1

Introduction

1

Keynote Lectures

Carvais, R. and Nègre, V.	The Conservatoire National des Arts et Métiers and the Preservation, Dissemination and Innovation of Construction Know-How (1794-1971)	7
Clarke, L. and Wall, C.	Omitted from History: Women in the Building Trades	35
Giron, F.J.	Drawing And Construction Analysis: from Piranesi to Choisy	61
Ochsendorf, J.A.	Engineering Analysis for Construction History: Opportunities and Perils	89

Session Papers

Abbate, F.	The Planning and Building Instruments of Architects in the Late Middle Ages	111
Addis, B.	The Use of Scientific Calculations in Design Procedures for Heating, Ventilation, Daylighting and Acoustics from the Eighteenth Century to the Mid-twentieth Century	127
Alonso, P.I.	Diagrams of a Universal System of Construction in the Work of Konrad Wachsmann: between Representation and Technology	153

CONTENTS

Amici, C.	The Basilica of Maxentius in Rome: Innovative Solutions in the Organisation of Construction Process	167
Anaya, J., Azpilicueta, E. and Casinello, P.	See Contents p. x: Jesús, A., Enrique, A. and Pepa, C.	
Antuña, J.	The Evolution of the Eduardo Torroja Work's: Shells with Reinforcement Rings or without	179
Arce, I.	Umayyad Arches, Vaults & Domes: Merging and Re-Creation. Contributions to Early Islamic Construction History	195
Arciniega, L., Juliana, D. and Trescolí, O.	Representation of Architecture in Hispanic Construction during the Modern Age	221
Arellano, J.F.	Earthen Industrial Buildings In The Canal Of Castilla, Eighteenth And Nineteenth Centuries	239
Bachmann, M.	Divine Staging. The Civil Engineering Peculiarities of the Hittite Spring Sanctuary Eflatun Pınar	251
Baker, N. and Agapio, A.	The Production Cycles of the Scottish Construction Industry, 1802-2002	267
Bardati, F.	A Building Site in Early Sixteenth-Century Normandy: the Castle of Gaillon. Organization, Workers, Materials and Technologies	289
Barthel, R., Maus, H. and Jagfeld, M.	Artistry and Ingenuity of Gothic Vaults at the Example of St. Georg in Nördlingen	309
Beckh, M.	Traditional Construction Techniques of the Newars at the Example of Itum Baha Monastery in Kathmandu	325
Bernabeu Larena, J.	The Iron-Wood Composite Section of the Carrousel Bridge in Paris (1834)	341

CONTENTS

Bernabeu, A.	Origin of the Collaboration between Engineers and Architects in Great Britain in the Thirties	357
Bertels, I.	The Contractors' Intellectual Profile: Knowledge and Training of Nineteenth-Century Public Works' Contractors in 19th Century Antwerp, Belgium	379
Bertoncini-Sabatini, P.	Antoine Chrysostôme Quatremère de Quincy (1755-1849) and the Rediscovery of Polychromy in Grecian Architecture: Colour Techniques and Archaeological Research in the Pages of "Olympian Zeus."	393
Bodolec, C.	Uncommon Public Buildings with Vault with Abutments in the Chinese Landscape of Wooden Construction (Sixteenth-Eighteenth Centuries)	409
Bruccheri, A.	Renewal and Tradition in the Teaching of Building Construction in the Ecole des Beaux-Arts of Paris: the Course of Edouard Arnaud, 1920-1934	417
Buonopane, S. G.	The Roeblings and the Stayed Suspension Bridge: Its Development and Propagation in 19th Century United States	441
Bustamante, R.	Similarities and Differences in Barrel Vaults of Traditional and Stately Houses in the Historic Centre of Arequipa, Perú	461
Calderini, C., Canziani, A., Lagomarsino, S. and Pittaluga, D.	Structural Framework Evolution from the 17th to 20th Century in the Genoa Republic's Shipyard. Architectural Archaeology Investigates the Layers of the Structure	473
Calvo López, J.	Sixteenth-Century Spanish Cranes and Lázaro de Velasco's Translation of Vitruvius	493

CONTENTS

Camino, S., Llorente, A., Jové, F. and Sánchez, F.	The Subsoil Network of Bridges and Vaults which Cover the Esgueva River Crossing the Town of Valladolid, Spain.	509
Campa, M.R.	“Le Nouvelles Inventions pour Bien Bastir et a Petits Fraiz” by Philibert de l’Orme: a New Way to Conceive Wood Roof Covering	525
Cano de Gardoqui García, J.L.	Juan Bautista de Toledo, Architect and Master Builder at the Monastery of El Escorial (1563-1567)	543
Cantabene, G. , Dodaro, L. and Lippiello, M.	“The Repairs to the Dome of the Chapel of St. Gennaro’s Treasure”: an Eighteenth Century Dispute between F. Sanfelice and G. Lucchese	561
Caston, P.	Historic Roof Trusses between 1500 and 1700 in German-Speaking Central Europe: Documentation, Analysis and Development	579
Ceraldi, C., Ermolli, E.R. and Tempone, V.	The Riding School in the Royal Palace of Naples: Transformations in the Timber Covering Structure	599
Cerutti Fusco, A.	Giuseppe Venturoli (1768 - 1846) Hydraulic Engineer in the Papal State	619
Chamorro, M.A. and Cuenca, B.	Ignasi Bosch Reitg (1910 - 1985). The Construction of Brick Vaults during the Post-War Period	631
Chieti, V.	The Role of the Tridimensional Virtual Model in the “Replica” Project of Architectural Elements: the Case of Athenian Neoclassic Academy by Th. Hansen	641
Chiou, B-S	Traditional Master Carpenter’s Manuals in Taiwan	657
Chrimes, M.	British and Irish Civil Engineers in the Development of Argentina in the Nineteenth Century	675

CONTENTS

Cipriani, B. and Lau, W.W.	Construction Techniques in Medieval Cairo: the Domes of Mamluk Mausolea (1250 A.D.-1517A.D.)	695
Clarke, J.	Cones, Not Domes: John Nash and Regency Structural Innovation	717
Cleary, R.	Lessons in Tenuity: Frank Lloyd Wright's Bridges	741
Como, M., Conforto, M.L., Ianniruberto, U. and Coccia, S.	Historical Static Analysis of the Coliseum	759
Como, M.T.	Analysis of the Statics of the Mycenaean Tholoi	777
Conchon, A.	Road Construction in Eighteenth Century France	791
Condorelli, S.	The Reconstruction of Catania after the Earthquake of 1693	799
Copani, P.	Ancient Wooden Roofs in Sicily: The Heritage of Taormina	817
Corradi, M.	A Short Account of the History of Structural Dynamics between the 19th and 20th Centuries	837
Cossu, G.P.	Technologies in Comparison. Glass Tube Production, Project and Implementation: from the SC Johnson & Son's Research Laboratory Tower by Wright to Today's Experimentations	855
Croizé, J.C.	A Time When France Chose to Use Prefabricated Panel Construction Systems: the "4 000 Logements de la Région Parisienne" Programme (1952-1958)	877
Cross-Rudkin, P.	Centres for Large Span Masonry Arch Bridges in Britain to 1833	887

CONTENTS

D’Amato Guerrieri, C. and Fallacara, G.	Helicoidal Construction Geometry and Oblique Architectural Arrangement. The Spiral Staircase of the Belvedere and the Argument between de l’Orme and Bramante: Digital Models Compared	903
Dahmen, J.	Moorish Bridges of Andalucia	917
De Villanueva, L. and Vela, F.	The Horseshoe Arch in Toledo	935
Defilippis, F.	Architecture and Stereotomy. The Relation between “Construction Apparatus” and “Decorative Apparatus” in the Cut-Stone Vaults and Domes of Philibert de l’Orme and Andrés de Vandelvira	951
Delemontey, Y.	The MRU Experimental Building Competitions (1947-1951): the Birth of Industrialised Building in France	969
Durbin, L.	Nineteenth Century Tiles. Industrial Mass Production and Construction Methods of Interior Tile Schemes in the Nineteenth and Early Twentieth Centuries	989
Durmuş Arsan, Z.	The Use of Saint-Gobain Glass Roof Tile in New Urban Districts of Turn-of-the-Century Izmir	1007
Eggemann, H.	Simplified Design of Composite Columns – Based on a Comparative Study on the Development of Building Regulations in Germany and the United States	1023
Emmanuelle, G.	Jean Simon Bonnemain (1743-1830) and the Origins of Hot Water Central Heating	1043
Ewen, S.	The Problem of Fire in Nineteenth Century British Cities: the Case of Glasgow	1061

CONTENTS

Fallacara, G.	Digital Stereotomy and Topological Transformations: Reasoning about Shape Building	1075
Fedorov, S.G.	Construction History in the Soviet Union - Russia: 1930-2005 Emergence, Development and Disappearance of a Technical Discipline	1093
Ficarelli, L.	Town Morphology: the Relationship between Form and Building. Preservation and Recovery of Dwelling Houses in Historical Centres and in Particular the Double-Reservoir Building Type of Corato (Bari)	1113
Fleury, F. and Lacroix, A.	Analysis of the Sub-Rafter (Sous-Arbalétrier) in French Medieval Timberworks	1125
Fontana, L.	Molding Earth Outline: Typology, Technology and Morphology of Earth Building	1137

Volume 2

Franco, J. A., Valcárcel, J. P., Freire, M. J. and Tarrío, S. B.	Vaults and Other Constructive Singularities in the Monastery of San Martín Pinario	1155
Friedman, D.	Building Code Enforced Evolution in Early Skeleton Buildings	1171
Gallo, E.	See Contents p. vi: Emmanuelle, G.	
García, R.	Concrete Folded Plates in the Netherlands	1189
Gargiulo, M.R. and Bergamasco, I.	The Use of Earth in the Architecture of Hassan Fathy and Fabrizio Carola: Typological and Building Innovations, Building Technology and Static Behaviour	1209

CONTENTS

Gasparini, D.A.	The Prestressing of Structures: a Historical Review	1221
Giacomini, L.	The Management of Private Building Yards in Milan between 1550 and 1650: a History Reconstructed through Building and Supply Contracts	1233
Giglio, A.	The Decorative Use of Concrete in an “Other” Modernism: Italian Architecture of the Dodecanese (1912-1943)	1251
Giustina, I., Tomasoni, E. and Giuriani, E.	The Early Dome of Sant’Alessandro in Milan (1627): a First Study on the Behaviour of the Structural Core with Dome Resting on Four Free-Standing Pillars	1271
Godier, P. and Tapie, G.	The Contemporary French Model of Architecture and Construction Professions (1970-1990)	1293
González Tascón, I., Bestué Cardiel, I. and Velázquez Soriano, I.	The Organization of Building Work and Construction of Siphons in Roman Aqueducts in Hispania	1305
González, J.L.	The Square Cube Law: from Vitruvius to Gaudi	1323
Gonzalez-Longo, C.	Giacomo Boni at the Museo Forense: Construction History as a Source for Architectural Innovation	1341
Gouzouguec, S. and Rapin, T.	Architecture in Paris in the Second Half of the 14th Century. The Middle Ages Seen through the Eyes of Accountants	1363
Graciani, A. G.	Notes on ‘Tapia Walls’ in Seville (Spain) during the 16 th Century in the Modern Age	1375
Graf, F.	History and Conservation of Contemporary Buildings. Curtain Wall Structures in Geneva (Switzerland) (1945-1975)	1387

CONTENTS

Grau, J. and García, J.	Technological and Industrial Colonisation	1409
Guardigli, L.	Ildebrando Tabarroni Ingegnere. Construction in Bologna between the Two World Wars	1419
Guerrero Vega, J.M. and Romero Bejarano, M.	The Origins of the Wine House Architecture in Jerez de la Frontera. Analysis of the <i>Bodegas</i> Built in the Sixteenth and in the Seventeenth Centuries	1441
Gulli, R. and Mochi, G.	The Oblique Bridges in Italy	1455
Guy, J.	Building Construction Practice in the Colony of New South Wales from the Arrival of the First Fleet to the End of the Primitive Era and Its Influence in Later Time	1475
Hahmann, L.	How Stiff Is a Timber Curved Plank? Historical Discussions about Curved Plank Structures	1501
Haseley, A.	Masonry Construction in Olympia, Greece, during the Roman Imperial Period – Mapping, Classification and Dating	1517
Heijden, J.J. van der, Visscher, H. and Meijer, F.	Shifting Responsibilities in Building Control in the Netherlands: a Historical Perspective	1541
Heres, B.	The Iron Roof Trusses of the New Hermitage in St. Petersburg - Structural Survey, Analysis and Assessment of a Masterpiece of Structural Steelwork from the 1840s.	1555
Heyman, J.	Timber Vaults	1569
Holton, A.B.	The Working Space of the Medieval Master Mason: the Tracing Houses of York Minster and Wells Cathedral	1579
How, C.I.	Translated Tradition in the Portland Bay Settlement. Traditional Timber Framing Techniques in a Cultural Development - Some Features Revealed in the Steam Packet Inn, Portland, Victoria, Australia	1599

CONTENTS

Huerta, S. and Ruiz, A.	Some Notes on Gothic Building Processes: the Expertises of Segovia's Cathedral	1619
Hurst, L.	The Rise and Fall of the Use of Bond Timbers in Brick Buildings in England	1633
Iori, T.	See Contents p. xi: Lori, T.	
Isohata, H.	Construction History in Education - Why and How It Should Be Learned	1655
Izquierdo, S.	International and Universal Exhibitions; Spanish Pavilions' New Building Construction Techniques	1673
Jackson, M.D., Kosso, C., Marra, F. and Hay, R.L.	Geological Basis of Vitruvius' Empirical Observations of Material Characteristics of Rock Utilized in Roman Masonry	1685
Janssen, J.	On Construction in the Rise of Wage Labour 1349-1563	1705
Jesús, A., Enrique, A. and Pepa, C.	Historical Patents and the Evolution of Twentieth Century Architectural Construction with Reinforced and Prestressed Concrete	1719
Jost, H.U.	The Introduction of Reinforced Concrete in Switzerland (1890-1914) : Social and Cultural Aspects	1741
Kahlow, A.	Johann August Röbling (1806-1869): Early Projects in Context	1755
Kazāks, V. and Kazāk, K.	Development of a National Program for Identifying, Investigating and Preserving of 'Endangered Handicrafts'	1777
Kierdorf, A.	Early Mushroom Slab Constructions in Switzerland, Russia and the U.S. A Study in Parallel Technological Development	1793

CONTENTS

Kurrer, K.E.	On The Relationship between Construction Engineering and Strength of Materials in Gerstner's "Handbook of Mechanics"	1809
Lancaster, L.C.	Large Freestanding Barrel Vaults in the Roman Empire: a Comparison of Structural Techniques	1829
Langenbach, R.	Saga of the Half-Timbered Skyscraper: What Does Half-Timbered Construction Have to Do with the Chicago Frame?	1845
Larson, N.	Building a Stone House in Ulster County, New York in 1751	1867
Lavigne, O.	Tool Marks and Construction in Ancient Tanis	1883
Lennie, L. and Banfill, P.	A Heritage of Shops: an Investigation into the Evolution of Historic Shopfronts in Perth and Perthshire	1901
Leslie, T.	"Buildings without Walls": Curtain Wall Development in Chicago Architecture of the 1890s	1921
Lewis, M B	Puncheons and Dragons: Renaissance Carpentry and Semantics	1937
López, G.M.	Poleni's Manuscripts about the Dome of Saint Peter's	1957
Lori, T.	Engineers in Italian Architecture: the Role of Reinforced Concrete in the First Half of the Twentieth Century	1981
Louw, H.	Greeks, Romans & Goths in an Age of Iron	1997
Lynch, G. C. J., Watt, D. and Colston, B.	An Investigation of Hand Tools Used for English Cut-and-Rubbed and Gauged Brickwork	2017

CONTENTS

Macdonald, A J	The Aestheticisation of the Steel Framework: the Contribution of Engineering to a Strand of Modern Architecture that Became Known as High Tech	2037
Malvezzi, R., Alessandri, C. and Mallardo, V.	On the Seismic Vulnerability of a Renaissance “Palace with Loggia”: a Limit Analysis Approach	2055
Marconi, N.	Machine and Symbol: the Erection of the Marian Column in Piazza Santa Maria Maggiore in Rome (1613-1614) between Tradition in the Execution and Technical Progress	2077
Marín-Palma, A., Trallero, A., López-Tercero, A. and García, E.	The Ceiling Panelwork of the Hunters' Lounge in the Infantado Palace in Guadalajara	2095
Martens, P.	Construction and Destruction of Military Architecture in the Mid-16th-Century Low Countries: Some Observations on Labour Force	2111
Mateus, J.M.	The Science of Fortification in Malta in the Context of European Architectural Treatises and Military Academies	2125
May, R.	Paul Bonatz and the Search for an "Art-Form" for Motorway Bridges	2139
Mende, M.	The Crucial Impact of Improvements in Both Steelmaking and Rolling on 19th and Early 20th-Century Building Construction	2159
Menghini, A.B.	Building Traditions and Technical Innovations in the Mediterranean. Architecture in the 1930s in Apulia: Gaetano Minnucci's Accademia Marinara in Brindisi	2171
Mileto, C., Vegas, F. and García, J.A.	Stratigraphic Study of Hernando de Zafra Arab Baths in Granada (Spain)	2189

CONTENTS

Miquel, M., Montero, E. and Serra, A.	Factors of Technical Innovation in Valencian Architecture during the Medieval and Modern Ages: Learning, Know-How and Inspiring Admiration	2203
Mislin, M.	The Planning and Building Process of Two Paris Bridges in the 16th and 17th Century	2223
Mongelli, A.	A New Wood Roofing System: Marac's Barracks and Colonel Armand Rose Emy's Innovative Supply	2241
Monni, G.	Traditional and Modern Building Materials. Autarkical Lodging Houses in Carbonia.	2261
Montemurro, M.	The Operating Tradition of the Compagnonnage du Devoir du Tour de France	2277
Mornati, S.	The Montecatini Building in Milan: an Original Union between Internationalism and Italian Constructivist Traditions	2293

Volume 3

Mouterde, R.	The Stiffening System of Medieval Timberwork in the Cathedral of Saint Pierre de Poitiers	2311
Neder, F.	Flying House. Archaeology of the Construction of Buckminster Fuller's Dymaxion House	2327
Nikolinakou, M.A. and Tallon, A.J.	New Research in Early Gothic Flying Buttresses	2347
Orihuela, A.	The Use of Wood in Morisco Houses in 16th Century Granada (Spain)	2363
Orsel, E.	Brickwork in Leiden: a Survey of Sixteenth and Seventeenth Century Characteristics	2379

CONTENTS

Ortueta Hilberath, E. de	The National Devastated Regions Service in Tarragona: Building Techniques in House Rehabilitation	2395
Palacios, J.	The Gothic Ribbed Vault in Rodgrio Gil de Hontañón	2415
Pearson, L.	In the Latest London Style: Decorative Tile and Terracotta Exports by British Manufacturers, 1840-1940	2433
Pedreschi, R.	The Structural Behaviour and Design of Free-Standing Barrel Vaults of Eladio Dieste	2451
Pelke, E.	The Development of the Prestressed Concrete Bridge in Germany after World War II	2469
Peñalver Martínez , M. J. and Maciá Sánchez, J.F.	Underwater Construction in the 18th Century. The Royal Arsenal in Cartagena - an Extraordinary Case	2493
Pepper, S. and Yeomans, D.	Working Class Flats in the 1930s: Steel versus Concrete	2515
Pieper, J. and Schindler, B.B.	Concept and Reality. Different Technical Variations of the Geometrical Construction of Maulnes Castle	2527
Powell, C.G.	Genesis of a General Contractor: a Georgian Vernacular Builder Transformed	2547
Quagliarini, E.	Earth Constructions in the Marche Region (Italy): Building Techniques and Materials	2559
Ranaweera, M. and Abeyruwan, H.	Materials Used in the Construction, Conservation, and Restoration of Ancient Stupas in Sri Lanka	2573
Ranzetta, K.E.	The Dating of Tobacco Barns in St. Mary's County, Maryland: Experimenting with the Archaeology of Architecture	2587

CONTENTS

Rimmer, J.A.E.	A Re-assessment of the Use of Building Accounts for the Study of Medieval Urban Houses	2599
Ringbom, A., Hale, J., Brock, F., Heinemeier, J. and Lindroos, A.	Mortar Dating in Medieval and Classical Archaeology	2613
Riorden, E. H.	A Hadrianic Theater at Ilion (Troy): a Paradigm Shift for Roman Building Practice and Its Aesthetic Aftermath	2635
Roberts, T. J.	Hodkin and Jones: a Legacy Cast in Stone? An Investigation into the Significance of Concrete in Domestic Buildings in Britain during the Late Nineteenth and Early Twentieth Centuries	2653
Robinson, D.	Traditional Becomes Modern: the Rise of Collegiate Gothic Architecture at American Universities	2673
Rociola, G.F.	The “Salt Landscape” of Margherita di Savoia. Traditional Characters and Technical Evolution of the Coastal Saltwork in Relation to the Development of the Settlement	2695
Rodríguez-Camilloni, H.	The Survival of Gothic Rib Vaulting in the Viceroyalty of Peru	2709
Romba, K.	Aesthetics and the Professional Identity of the Modern German Engineer	2727
Rozhko, M.F.; posthumously edited and prepared by Rozhko, V.M. and Stachiw, M.O.	Defining the Ninth to Thirteenth Century Fortress Tustan’: Building Archaeology of a Log, Cliff-Side Structure	2743
Sagaydak, M.	Building Archaeology of the Secular Architecture of the 10th – 11th Century Kyivan Rus’ Town	2759
Sakarovitch, J.	Construction History and Experimentation	2777

CONTENTS

Sanjurjo, A.	<i>The Vis Saint Gilles Quarrée</i> or the <i>Caracol De Emperadores Cuadrado</i> : a Model Frequently Encountered in Spanish-French Architectural Treatises from the Modern Period	2793
Sanjust i Latorre, C.	The Construction of the Royal Monastery of Santa Maria de Pedralbes (Barcelona)	2815
Sanna, A.	Construction and Building Yard in an Autarchic “Company Town”	2833
Schlimme, H.	Construction Knowledge in Comparison: Architects, Mathematicians and Natural Philosophers Discuss the Damage to St. Peter’s Dome in 1743	2853
Seraphin, M.	The Influence of the German Railways on the Birth of Modern Timber Engineering	2869
Sheppard, R.J.	Standing in the Corn Field, Talking to the Walls, and Peeling Back the Layers: Using Fieldwork to Discover the Construction of Vernacular Architecture	2891
Silva, M.E.	Foreign Iron in Venezuelan Architecture: Modern Building Technologies at the End of Nineteenth Century	2907
Simons, E.	Life on the Edge: the Rock-Cut Dwellings of Kinver Edge	2927
Soler Verdú, R., Alonso, A. and Martínez Boquera, A.	The Eighteenth Century Brickwork Domes in Valencia	2945
Stigliano, M.	“The Trompe of the INCIS Building of Saverio Dioguardi, Mediterranean Architect of the XX Century”	2965

CONTENTS

Sturrock, N.S. and Lawson-Smith, P.	The Grandfather of Air-Conditioning – the Work and Influence of David Boswell Reid, Physician, Chemist, Engineer (1805 – 1863)	2981
Swenarton, M. C.	Breeze Blocks and Bolshevism: Housing Policy and the Origins of the Building Research Station 1917-21	2999
Taín-Guzmán, M.	Fifteen Unedited Engraved Architectural Drawings Uncovered in Northwest Spain	3011
Tamborero L.	The “Vis Saint-Gilles”, Symbol of Compromise between Practice and Science	3025
Tavares, A.	The Effects of Concrete in Portuguese Architecture. The Moreira de Sá & Malevez Case (1906-1914)	3041
Taylor, P.	A Last Fling in Local Distinctiveness	3061
Theodossopoulos, D.	Technology and Geometry in the Design of Gothic Vaults in Britain	3079
Thomson, N.	A Study of Early Corrugated Iron Buildings in Rural Scotland	3097
Tragbar, K.	“De Hedificiis Communibus Murandis ...” Notes on the Beginning of Building Regulations in Medieval Tuscany	3117
Turnbull, J.	The Architecture of Walter Burley Griffin: Concrete Applications	3133
Tussenbroek, G. van	‘To Provide the Old Church with Good Foundations to Prevent Subsidence’. Builders' Specifications in Amsterdam	3155
Van de Vijver, D. R. E.	“Mesurer la Solidité”. The Art of Measuring Buildings in Belgium, 1451-1960	3171

CONTENTS

Van den Hurk, J.	Origins and Survival of Netherlandic Building Traditions in North America	3191
Vignoles, M.J.P.	Kiev Suspension Bridge. (1846 – 1853)	3211
Voyatzaki, M.	Construction History in the Architectural Curricula in Europe	3233
Vries, D.J. de	Brickwork-Related Innovations in the Seventeenth and Eighteenth Century	3247
Wells, C.	Dendro-Dating the Domestic Architecture of Colonial Virginia: Exploring the Potential of Certainty	3267
Wendland, D.	A Flat Vault in the "Crac Des Chevaliers" and Some Considerations on the Development of Vault Geometry and Stereotomy in Mediaeval Masonry Structures in Syria	3279
Wermiel, S. E.	Norcross, Fuller, and the Rise of the General Contractor in the United States in the Nineteenth Century	3297
Werner, G.	John August Roebling – the Niagara Railway Suspension Bridge	3315
Wetzck, V.	Bridge Bearings – a Historical Survey	3333
Wilkinson, D.	The Significance of the Former Bryant & May Match Factory, Garston, Liverpool	3357
Wood, J.J.B.	The Defences at Saint-Bertrand-de-Comminges: Some Observations on the Mechanics of the Late Roman Building Trade	3379
Wouters, I., De Bouw, M. and Nieuwmeijer, G.G.	Nineteenth-Century Iron Suspension Footbridges in Flanders (Belgium)	3389

CONTENTS

Yilmaz, E.	Using Constructional Records as Alternative Sources for Historical Writing	3403
Zotsenko, V.	A Wooden Church of the Twelfth Century in Podil, Kyiv, Ukraine	3413
Additional Papers		
Utrero Agudo, M.A.	Reinforcement in Early Medieval Hispanic Architecture	3431
List of Contributors		3447