IPHA

INTERNATIONAL PRESTRESSED HOLLOWCORE ASSOCIATION

THE HISTORY OF IPHA

1969 - 2019

Marking the 50th anniversary of the International Prestressed Hollowcore Association – a history of the organisation, framed within the development of prestressed hollowcore slabs and associated technology.

Thomas Goosey

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The History of IPHA – 1969-2019

Introduction

The year 2019 will mark the fiftieth anniversary of one of the precast concrete industry's longest running organisations. To mark the occasion, IPHA has commissioned a written history of the association.

The International Prestressed Hollowcore Association has, for fifty years, been championing hollowcore as a building product. By bringing together producers and associated suppliers from across the globe, IPHA has done more than any organisation to encourage international collaboration, driving technical advancements and best practice within the industry.

From its genesis as the International Spiroll Producers Association – with 7 founding members from 7 different countries – right through to the present day, the organisation has been at the forefront of prestressed hollowcore technology.

The purpose of this history is to document the organisation's origins and analyse its development over the years. It will look at contributions of key people and companies, as well as the association's role in making the hollowcore industry what it is today.

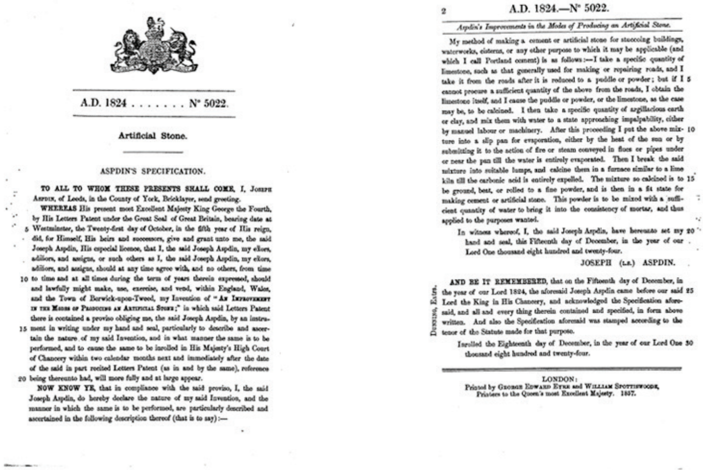
To place the contribution of IPHA within the correct context, this analysis will be introduced by looking at the early development of concrete, reinforcement and prefabrication, and later, prestressed hollowcore slabs, as a building product. This will incorporate methods of manufacture, technical advancements and usage.

Early Usage of Concrete

Whilst the earliest usage of cementitious materials can be traced back thousands of years, it was the Romans who first cast concrete elements using wooden forms, or moulds. Despite these early examples, the structural use of precast concrete did not reappear in Western Europe and North America until the early twentieth century.

Indeed, even the use of concrete itself as a building material was largely lost following the fall of the Roman Empire, and interest did not resurface until the late eighteenth century. Research by engineers and scientists into this missing technology culminated in 1824, when an English bricklayer named Joseph Aspdin (1778-1855) took out a patent for the world's first Portland cement.[1] Named after its resemblance to Portland stone, this early version was vastly different to what is now commonly known by the same name and used around the world.

1. https://en.wikipedia.org/wiki/Joseph_Aspdin#/media/File:Joseph_Aspdin-BP_5022_1.jpg (accessed Nov. 2018).


A.D. 1824 . . . . Nº 5022.

Artificial Stone.

ASPDIN'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Joseph Aspdin, of Leeds, in the County of York, Bricklayer, send greeting.

WHEREAS His present most Excellent Majesty King George the Fourth, by His Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Twenty-first day of October, in the fifth year of His reign, did, for Himself, His heirs and successors, give and grant unto me, the said Joseph Aspdin, His especial licence, that I, the said Joseph Aspdin, my exors, admors, and assigns, or such others as I, the said Joseph Aspdin, my exors, admors, and assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick-upon-Tweed, my Invention of "**An Improvement in the Modes of Producing an Artificial Stone**;" in which said Letters Patent there is contained a proviso obliging me, the said Joseph Aspdin, by an instrument in writing under my hand and seal, particularly to describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, and to cause the same to be inrolled in His Majesty's High Court of Chancery within two calendar months next and immediately after the date of the said in part recited Letters Patent (as in and by the same), reference being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Joseph Aspdin, do hereby declare the nature of my said Invention, and the manner in which the same is to be performed, are particularly described and ascertained in the following description thereof (that is to say):—

2 A.D. 1824.—Nº 5022.

Aspdin's Improvements in the Modes of Producing an Artificial Stone.

My method of making a cement or artificial stone for stuccoing buildings, waterworks, cisterns, or any other purpose to which it may be applicable (and which I call Portland cement) is as follows:—I take a specific quantity of limestone, such as that generally used for making or repairing roads, and I take it from the roads after it is reduced to a puddle or powder; but if I cannot procure a sufficient quantity of the above from the roads, I obtain the limestone itself, and I cause the puddle or powder, or the limestone, as the case may be, to be calcined. I then take a specific quantity of argillacious earth or clay, and mix them with water to a state approaching impalpability, either by manuel labour or machinery. After this proceeding I put the above mixture into a slip pan for evaporation, either by the heat of the sun or by submitting it to the action of fire or steam conveyed in flues or pipes under or near the pan till the water is entirely evaporated. Then I break the said mixture into suitable lumps, and calcine them in a furnace similar to a lime kiln till the carbonic acid is entirely expelled. The mixture so calcined is to be ground, beat, or rolled to a fine powder, and is then in a fit state for making cement or artificial stone. This powder is to be mixed with a sufficient quantity of water to bring it into the consistency of mortar, and thus applied to the purposes wanted.

In witness whereof, I, the said Joseph Aspdin, have hereunto set my hand and seal, this Fifteenth day of December, in the year of our Lord One thousand eight hundred and twenty-four.

JOSEPH (L.S.) ASPDIN.

AND BE IT REMEMBERED, that on the Fifteenth day of December, in the year of our Lord 1824, the aforesaid Joseph Aspdin came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Dunning, Esq.

Inrolled the Eighteenth day of December, in the year of our Lord One thousand eight hundred and twenty-four.

LONDON:
Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1857.

Figure 1 – Patent for "AN IMPROVEMENT IN THE MODES OF PRODUCING ARTIFICAL STONE" - By Joseph Aspdin (British Patent Office) [Public domain], via Wikimedia Commons

Aspdin's initial product was relatively expensive to manufacture, preventing its widescale use as a building material. It was not until the development of superior rotary kilns and firing techniques, that Isaac Johnson (1811-1911) was able to market a much cheaper and improved version of the product, which remains the dominant form of cement used in concrete around the world.[2]

With a few exceptions, concrete was largely used in industrial applications during this period, due to being considered less acceptable as a building material, both structurally and aesthetically.[3] This would all change during the next few decades however, with technological and industrial advancements enabling further development in both reinforcement and prefabrication.

Early Reinforcement in Concrete

As concrete became more easily procured and shaped into desired forms, the idea of introducing reinforcement swiftly followed, both in Britain and France, during the middle of the nineteenth century. It had already been discovered that concrete performed well under compression, however, its weaknesses were exposed under tension. The thinking behind the addition of reinforcement was simple – to both harness the strengths of each material, and also address their deficiencies.

2. https://web.archive.org/web/20150528183822/http://www.theconcreteproducer.com/Images/The%20History%20of%20Concrete%2C%20Part%202_tcm77-1306954.pdf (accessed Nov. 2018).

3. https://www.nachi.org/history-of-concrete.htm (accessed Nov 2018).

The innovation of reinforced concrete is largely credited to a Frenchman, Joseph Monier (1823-1906). Monier was a horticulturalist who, dissatisfied with the available materials used for making flowerpots, developed a process of manufacturing large planters with iron cage reinforcement in 1849. He eventually patented his method in 1867, expanded the application, and was granted patents for other elements such as pipes, panels, bridges and railway sleepers in the following years, including overseas.[4]

Monier was not the only pioneer of this time, however. François Coignet (1814-1888) began experimenting with the use of iron reinforced concrete in 1852, building the first such structure using these methods in 1853 - a four-story house at 72 rue Charles Michels, near Paris, which still stands today.[5] Around the same time, in 1854, an English builder based in Newcastle, William Wilkinson, patented a technique utilising iron hoops as reinforcement in concrete floors.[6] Similar such experiments with reinforcement were also taking place in the United States and Germany, including early forms of prestressing.[7]

Figure 2 – Photo of 72, rue Charles Michels. By MOSSOT [GFDL (http://www.gnu.org/copyleft/fdl.html) or CC BY-SA 3.0 (https://creativecommons.org/licenses/by-sa/3.0)], from Wikimedia Commons

4. http://www.beyond.fr/people/monier-joseph.html (accessed Nov. 2018).

5. https://www.britannica.com/biography/Francois-Coignet (accessed Nov. 2018).

6. http://www.jfccivilengineer.com/reinforced_concrete.htm (accessed Nov. 2018).

7. T. Y. Lin & Ned H. Burns (1981), Design of Prestressed Concrete Structures, 3rd edition, pp. 2-3.

It was another French engineer, François Hennebique (1842-1921), who was credited with applying these early reinforcement techniques to structural concrete. Having seen Monier's work, Hennebique began reinforcing concrete floor slabs in 1879, and by 1892 had patented a complete building system.[8] His system was quickly adopted elsewhere, including in Britain and the USA, and is essentially similar to methods still used today.

Early Prefabrication

Following the developments in concrete construction of the late nineteenth century, it was not long before engineers and architects started to realise the benefits that could be harnessed by pre-casting concrete elements off-site. Principally, these were higher product quality and speed of construction.

It was John Alexander Brodie (1858-1934), City Engineer for Liverpool, who first started experimenting with the use of large, reinforced precast concrete panels as a solution for housing shortages, in 1905 (amongst his other inventions can be counted the nets used in football goals).[9] Although this method of prefabricated construction did not become widespread in Britain until later in the 20th century, it quickly spread throughout Europe (particularly Scandinavia) and elsewhere.

Figure 3 - Photograph of JA Brodie, civil engineer from May 1906 edition of The Guild Gazette (magazine of the Liverpool Municipal Officers' Guild)

8. https://web.archive.org/web/20150528183822/http://www.theconcreteproducer.com/Images/The%20History%20of%20Concrete%2C%20Part%202_tcm77-1306954.pdf (accessed Nov. 2018).

9. https://web.archive.org/web/20071013154609/http://www.mersey-gateway.org/server.php?show=ConWebDoc.144 (accessed Nov. 2018).

Brodie's pioneering work attracted much attention, and proved inspirational for, amongst others, American architect, Grosvenor Atterbury (1869-1956). Atterbury then applied similar techniques in the United States, most notably at the Forest Hill Gardens project in New York during 1910-1917.

Each house was constructed from approximately 170 standardised precast concrete panels, manufactured off-site and assembled on-site by crane. Utilising a sophisticated system, even by modern standards, the panels were cast with integral hollow insulation chambers. The casting formwork also incorporated an internal sleeve, allowing the moulds to be removed before the concrete had cured. The finished panels were then transported to site via a two-stage operation – formwork to truck and truck to crane.[10]

Figure 4 - Forest Hills Gardens, Queens, NY. By Complicated from ATHENS, GEORGIA, USA (Flickr) [CC BY 2.0 (https://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons

Early Precast Flooring

Whilst early applications for prefabricated concrete focused on walls, precast flooring came into existence shortly after the First World War (1914-1918). Indeed, some of the original techniques were a result of inventions made during the conflict.

Bison Concrete, which was later to become one of the largest precast flooring producers in Europe, was founded in 1919 by commercial partner, Mr J.G. Ambrose M.C., O.B.E., M.I.C.E, and Mr C.B. Matthews M.B.E., M.I.C.E., an innovator in concrete technology. The company was in fact originally named Concrete Ltd. The tradename of Bison was adopted with the motto "speed and strength" as typifying the principal benefits of precast concrete, and this became virtually a generic term in the context of precast concrete floors from this time.

10. https://en.wikipedia.org/wiki/Grosvenor_Atterbury (accessed Nov. 2018).

Both men had served as officers in the Royal Engineers and saw the potential for military applications of precast concrete, for example; the ‘Pillbox’, which was mass produced in France during the war. Later, during the Second World War, Concrete Ltd. were to apply their knowledge of concrete in a number of ways, including the form of mobile pillboxes.

Figure 5 - “Bison” mobile pillbox, used by the Home Guard during the Second World War, with a fighting compartment protected by a layer of concrete. This example (with unoriginal chassis) is situated at the Tank Museum, Bovington, UK.

Concrete Ltd.’s first factory, located in Stourton, Leeds, specialised in the production of reinforced precast concrete floors. At this early stage units were principally solid slabs, cast in fixed moulds. Increased sales and demand led to further expansion and development. Subsequently, 4 other factories were opened in geographically strategic locations to economically serve the whole of the UK.

1935 was a key year in the development of hollowcore, as Concrete Ltd. introduced an innovation by creating the pneumatic core. This revolutionised the manufacture of hollow floors and was a patented design. A forebear to later machine manufacture, voids were shaped by pneumatic withdrawable cores or even permanent formers. The introduction of hollow cores not only reduced the quantity of raw material used, but also the self-weight of slabs, and both developments would give hollowcore distinct advantages over other flooring methods.[11]

11. http://www.bison.co.uk/about-us/heritage/ (accessed Nov. 2018).

Bison would also later play an important part in the formation of IPHA, however, it was yet another French engineer who was to develop the techniques that would be central to prestressed hollowcore as we know it today.

Early Use of Prestressing

Prestressing introduces compressive force to the concrete, preventing cracking that may otherwise occur by reducing tensile stresses at critical points in the element.

Eugène Freyssinet (1879-1962) was a French structural and civil engineer. Widely known as the pioneer of prestressing, Freyssinet did not in fact invent the technique. Its early uses in concrete are recorded as far back as 1888, when C. W. Doehring of Germany obtained a patent for prestressing slabs with metal wires.[12] Simultaneously in the United States, P. H. Jackson had applied for a patent related to the strengthening of concrete pavements.

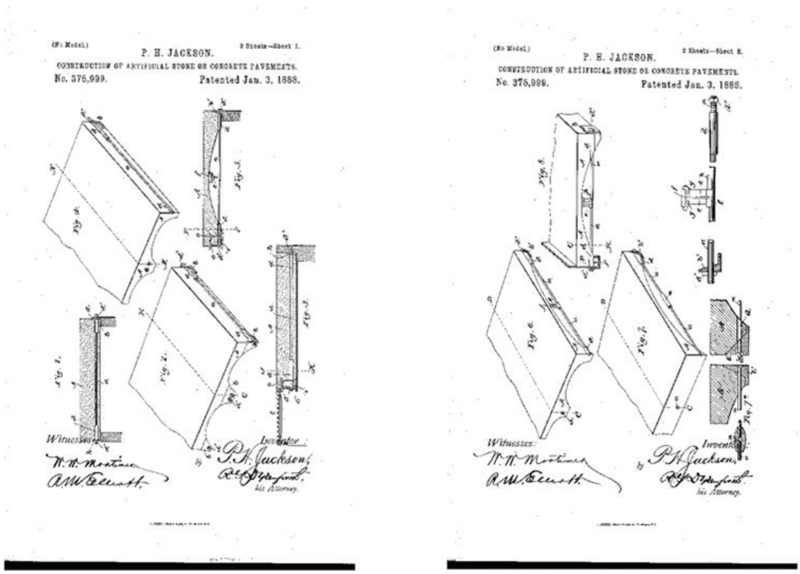


Figure 6 - US Patent No. US375999A (1888).

12. Edward G. Nawy (2009), Prestressed Concrete, Fifth Edition: ACI, AASHTO, IBC.

Nonetheless, early forms of prestressing were largely unsuccessful due to loss of tension, and "creep" of the concrete over time. It was Freyssinet's determination to overcome these problems and develop methods to suit manufacture on an industrial scale, which ultimately led to the widespread adoption of prestressed concrete in construction.

A key factor in prestressed elements is the bond between the reinforcing members and the concrete itself. Freyssinet not only recognised that this required a much higher quality of raw materials, but also pioneered the use of vibration to increase compaction. Traditionally achieved by hand with wood or metal tampers, Freyssinet had investigated the effects of mechanical vibration whilst making ships using reinforced concrete in 1917.[13]

His more well-known contribution was of course his patent of 1928, covering prestressing itself. Freyssinet took the technique further by realising that only high-strength prestressing wire, tensioned almost to its limit, would counteract the effects of creep and relaxation. His other key contribution was to create a system of anchorage, flexible enough to be applied to a range of elements and structures.

It is worth noting, such was his contribution to the science of concrete technology, he also pioneered the use of steam to shorten curing times, by forcing it around the side of moulds used for casting.[14]

Figure 7 - Photograph of Eugène Freyssinet (1879-1962), courtesy of https://alchetron.com/Eugène-Freyssinet.

13. Association pour la mémoire et le rayonnement des travaux d'Eugène Freyssinet (2004), Eugène Freyssinet – A revolution in the art of construction.

14. https://alchetron.com/Eugène-Freyssinet (accessed Nov. 2018).

Post-War Construction and Machine Manufacture

Whilst concrete was largely used for fortification and defensive structures during the Second World War, the obvious requirement for it after the war ended, was in rebuilding.

To meet the housing boom and infrastructure demands of the post-war period, precast concrete clearly had a number of attractive features, not least in speed of construction. Aside from elements such as railway sleepers[15], in this initial period, prestressing was predominantly used in bridge structures – designed and applied on a case-by-case basis.

During the late 1940s and early 1950s, from the competing and conflicting prestressing systems of Freyssinet, and those being developed by the Belgian engineer Gustaaf Magnel, amongst others, eventually emerged the barrel and wedge system still in use on prestressed casting beds today.

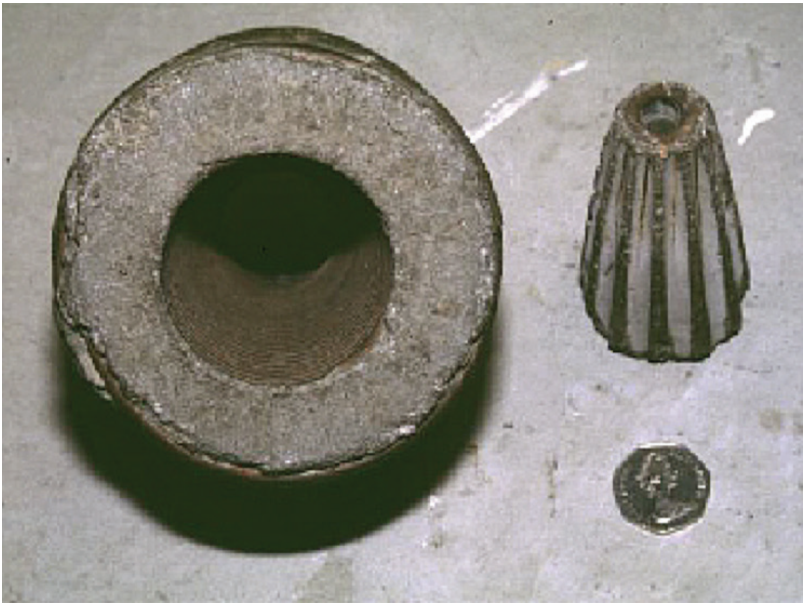


Figure 8 - "Freyssicone" an early example of a prestressing anchorage system, courtesy of http://www-civ.eng.cam.ac.uk/cjb/4d8/public/history.html.

15. http://www-civ.eng.cam.ac.uk/cjb/4d8/public/history.html (accessed Nov. 2018).

At the same time, the increasing availability of higher quality concrete, as well as high strength, low relaxation steel wire and strand, would begin to make prestressed concrete a commercially attractive solution. The next key developments therefore, were in standardisation, and the application of these newly available materials and prestressing techniques to mass produce precast concrete elements such as flooring.

With increasing mechanisation and mass production lines revolutionising industry in the United States of America, it was here that the first hollowcore production machinery was put to use. It didn't originate there however, and was brought to the USA from Germany, by a Hungarian called Henry Nagy, as the history of current IPHA members, Spancrete, relates:

"After seeing a small piece of extruded hollow core concrete at a trade show exhibition, Nagy quickly recognized the potential of this new precast concrete manufacturing process. Nagy learned that the inventor of the concrete extrusion process in 1934 was a German engineer named Otto Kuen… Nagy orchestrated an overnight wire of $50,000… (to pay for the machine). By the end of 1952, Nagy began manufacturing the first precast, prestressed concrete hollow core slabs ever produced in the United States."[16]

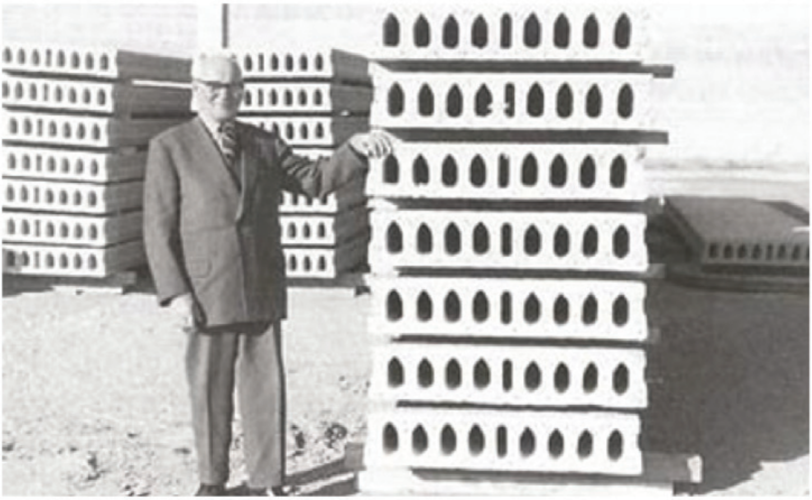


Figure 9 - Otto Kuen and Spancrete Prestressed Hollowcore Slabs - courtesy of Spancrete.

The Spancrete machine used a casting technique later to become widely known as slipforming, and it was elsewhere in North America that the next phase of hollowcore machine development would take place.

16. PCI Journal, issue 50, January – February (2005), The History of Spancrete – Bringing Excellence to the Construction Industry for Sixty Years, pp. 16-18.

Spiroll and the ISPA

Whilst many producers around the world were still making hollowcore via the labour-intensive wet cast process in moulds, using either pneumatic cores (in the case of Bison, UK) or even inflatable rubber tubes, to shape the voids, a quite different technique was being developed.

In 1962, the Spiroll extrusion process was invented by Glen C. Booth, of Building Products and Coal Ltd., in Winnipeg, Canada.[17] The machine's design was based upon the use of rotating augers and forming tubes to shape the cores of the slab. Zero slump concrete, in conjunction with high frequency vibration, facilitated excellent bond with the pretensioned tendons. Additionally, the machine used the build-up of concrete and auger drive system to do away with the need for a separate driving mechanism.

Figure 10 - Early Spiroll high frequency vibration extruder.

The system was very successful, and machines were sold widely throughout the world, aided by the opening of the Spiroll International office in London, in 1964. As the popularity of the production system grew, it prompted a need for manufacturers to share their experiences and knowledge on things such as the wear and tear of the augers, material types, mix designs and application for the product.

17. John R. Fowler, CPCI (2000), Prestressed Concrete in Canada – 1952 to 2000.

Thus, in 1969, the International Spiroll Producers Association, or ISPA, was born. Initially formed by seven companies from seven different countries, ISPA membership was open to any manufacturer using Spiroll extruders, and associate membership to any company whose membership was deemed to be of benefit to the organisation.

Figure 11 - ISPA logo - from the Constitution and By-Laws of the Association

Initial objectives of the association were set out as follows:

a) *To promote the interchange of information between members on such matters as design, production techniques and other related matters which assist the development of Spiroll products.*

b) *To institute and maintain an effective Information Service.*

c) *To maintain an effective liaison and exchange of information between the Spiroll Producers Association and I.S.P.A. and to advise on behalf of its Members the Spiroll Corporation and/or Spiroll International on all matters of general interest and importance to the Industry and to the members and to act on behalf of the Members when asked to do so in matters of general interest to the Members in their relationship with Spiroll Corporation and/or Spiroll International.*

d) *To promote better appreciation of the Spiroll Product by users and potential users and professional bodies generally.*

e) To assist Members to maintain a high quality of Spiroll Products and Professional Service to the Construction Industry.

f) To assist Members in Marketing techniques generally and to encourage Members to find new outlets for Spiroll Products.[18]

By 1974, Spiroll had started manufacturing machines at premises in Derby, UK. This decision was largely based on the proximity to the large hollowcore factory situated in Weston Underwood (Derbyshire), operated by Richard Lees Ltd. (and later Tarmac Topfloor Ltd. as part of the Tarmac Group). This connection would eventually play a huge role in the development of IPHA as it is known today, as it was here that Managing Director of Richard Lees and future Chairman of the association, Bob MacPherson, would work alongside Terry Treanor, his production manager.

New Machinery and the IECA

So popular was prestressed hollowcore in meeting global construction demand, that by the early 1980s, Spiroll machines were operating in more than 28 countries around the world. During the early years of machine manufacture, prestressed hollowcore was largely limited to depths of 250mm and less. However, increasing demand for longer spans and lightweight construction would see the development of machines to make deeper elements – increasing the span/depth ratio.[19]

This demand also paved the way for other machine manufacturers to enter the market, either with similar machines under license to Spiroll, or their own machines based on a similar design. In Europe, these included Weiler (Germany), Lohja Parma Engineering, Partek and Elematic (Finland). This included developments in extrusion of a different nature to the Spiroll method, utilising a technique known as shear compaction.

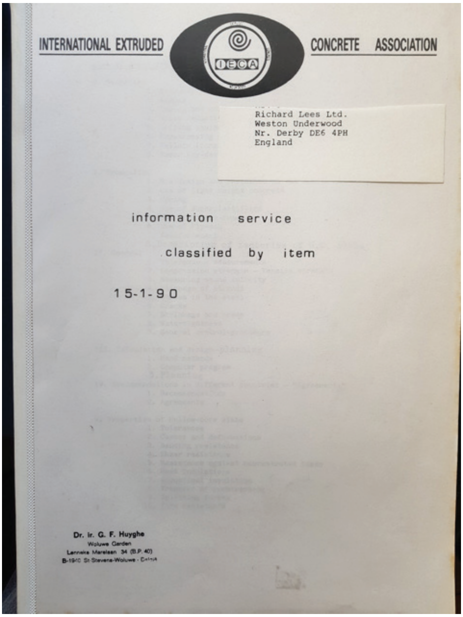
Meanwhile, in 1984, Spiroll International Ltd. had purchased the brand's manufacturing rights and trademark, and began operating entirely out of the UK. The remnants of the company in Canada would also go on to form other companies and develop their own extruders – Dy-Core for example.

With the proliferation of different extrusion machines, existing Spiroll producers agreed then that the time was right to extend the remit of ISPA, allowing membership of other extruded concrete producers and machinery manufacturers. Thus IECA, the International Extruded Concrete Association, was formed in 1986.

18. Constitution and By-Laws of the International Spiroll Producers Association (1977).

19. Kim S. Elliot and Zuhairi Abd Hamid (2017), Modernisation, Mechanisation and Industrialisation of Concrete Structures, Wiley-Blackwell. Chapter 1, pp. 1-2.

The introduction of new producers and associate members added to the wealth of knowledge and experience that had been built up in the preceding years. The efforts to achieve the initial objectives of promoting information exchange, as well as instituting and maintaining an effective information service, can be seen in this document, dated 15th January 1990:


INTERNATIONAL EXTRUDED CONCRETE ASSOCIATION

IECA

Richard Lees Ltd.
Weston Underwood
Nr. Derby DE6 4PH
England

information service

classified by item

15-1-90

Dr. ir. G. F. Huyghe
Woluwe Garden
Lenneke Marelaan 34 (B.P. 40)
B-1940 St-Stevens-Woluwe

Figure 12 - IECA Information Service, Dr. ir. G. F. Huyghe, 15/01/90

This comprehensive library of documents, available to all members, included the following categories:

0. Machinery

1. *Extruder*
2. *Augers*
3. *Sawing and other methods of cutting*
4. *Noise reduction problem for extruders and saws*
5. *Lifting equipment*
6. *Prestressing equipment*
7. *Pallets (construction)*
8. *Shear key-device*

I. Production

1. *Mix design and influence on the characteristics*
2. *Use of light weight concrete*
3. *Curing*
4. *Use of Superplastifiers*

5. *Use of Silica-fume*
6. *Use of Fly-ash*
7. *Reinforcement*
8. *Description of factories of H.C. slabs*

II. Control

1. *Tolerance – measurements*
2. *Compression strength – Tensile strength*
3. *Measuring sound velocity*
4. *Slippage of strands*
5. *Stress in the steel*
6. *Cracks*
7. *Shrinkage and creep*
8. *Watertightness*
9. *General control-procedure*

III. Calculation and design-planning

1. *Hand methods*
2. *Computer program*
3. *Planning*

IV. Recommendations in different countries - "Agreements"

1. *Recommendations*
2. *Agreements*

V. Properties of Hollow-core slabs

1. *Tolerances*
2. *Camber and deformations*
3. *Bending resistance*
4. *Shear resistance*
5. *Resistance against concentrated loads*
6. *Heat Insulations*
7. *Acoustical insulation*
8. *Transfer of prestressing*
9. *Splitting forces*
10. *Fire resistance*

VI. Use of hollow-core slabs in buildings

1. *Connections*
2. *Transmission of vertical forces through joints*
3. *Transmission of horizontal forces through joints*
4. *Resistances against earthquakes*
5. *Electrical ducts in in cores*
6. *Heating and cooling through cores*
7. *Openings in floors*
8. *Fixations to floors*
9. *Fixation of partition walls*
10. *Flooring*

11. *Ceiling*
12. *Composite action*

VII. *Use of hollow-core slabs for different applications*

1. *Floors in one-storey buildings*
2. *Floors in multistorey buildings: offices, schools, hospitals, industrial buildings*
3. *Floors in houses*
4. *Floors in apartment buildings*
5. *Walls*
6. *Retaining walls*
7. *Reservoirs*
8. *Tunnels*
9. *Marine structures* [20]

As can be seen from the sheer breadth and scope of topics covered, IECA was, by this point, a rich source of information relating to the design, production and usage of prestressed hollowcore technology. The catalogue itself lists more than 570 separate resources, including articles, research, reports and training. Of particular note are items covering: early usage of CAD; research on the reduction of noise for workers; shear key units and testing of hollowcore with seismic action; introduction of lightweight aggregates and materials such as fly ash and silica fume; testing on shear capacity and fire resistance; the TermoDeck system; the use of hollowcore in a wide range of structures, and in non-flooring applications such as wall panels.

The influence of IECA is evidenced further by the role it played in advancing quality assurance in the prestressed hollowcore industry throughout the world. In *Quality Control of Concrete Structures: Proceedings of the Second International RILEM/CEB Symposium (1991)* – a book detailing the latest information on the applied methods and techniques being used for quality control of concrete construction worldwide – G. F. Huyghe, IECA executive, wrote:

"As with all precast construction elements, quality is a fundamental factor for extruded prestressed hollow core slabs, since they may be used equally as load-bearing elements with varying functions in the building, and their aesthetic qualities contribute to promoting their own use.

To achieve this requires not only quality control, but also a complete programme of quality assurance. Whereas quality control involves relatively few people, this programme involves everyone in the company, everybody's responsibilities must be defined if good product quality is to be guaranteed.

The International Extruded Concrete Association (IECA) encourages its members to maintain company procedures to provide quality assurance, based on the FIP document…

This is one of the important aims of the International Extruded Concrete Association, which brings together 30 producers from 15 different countries…

20. Dr. ir. G. F. Huyghe, IECA Executive (1990), IECA Information Service.

The first step towards this is for the Managing Director of the company to sign a document declaring that he will adhere to the specifications laid down by the IECA and that all extruded slabs sold will satisfy the technical stipulations set out…"[21]

As the number of companies producing prestressed hollowcore around the globe increased, so did the variety in the methods of manufacture. In parallel to the development of extrusion technology, other manufacturers such as Prensoland (Spain), Roth (Germany), Nordimpianti (Italy), and Echo (Belgium), were developing their own machines based upon the slipform method.

Figure 13 - Nordimpianti slipformer, 1988.

Despite differences in manufacturing techniques, the product and its potential applications were essentially identical. The need to bring together as many parties as possible and share information in the common cause was as strong as ever, and this idea was at the heart of the next big development in the organisation.

IECA becomes IPHA

As mentioned earlier, it was the connection between Terry Treanor and Bob MacPherson which would lead to the formation of IPHA, as it is known today. Following his time at Richard Lees, and experience using Spiroll machines, Terry had moved on to Bison Concrete, where he would eventually become Managing Director.

By this time, Bison were now manufacturing hollowcore using slipform machinery from Roth and then subsequently, Prensoland. As there was currently no separate association for slipform

21. Dr. ir. G. F. Huyghe, IECA Executive (1991), Quality Control of Concrete Structures: Proceedings of the Second International RILEM/CEB Symposium IECA Information Service, CRC Press, pp. 113.

manufacturers, Terry recognised the potential value of an association that could represent the interests of all hollowcore producers, whatever system they were using.

He proposed this idea to Bob MacPherson, then Chairman of IECA, and it was agreed that Terry and Tony Crane, the Chief Engineer from Bison, would attend the 7th annual conference of IECA (18th April – 21st April 1993) to be held in Malta, and hosted by the local hollowcore manufacturer General Precast Concrete Ltd., in order to present the case for inclusion of slipform manufacturers.[22]

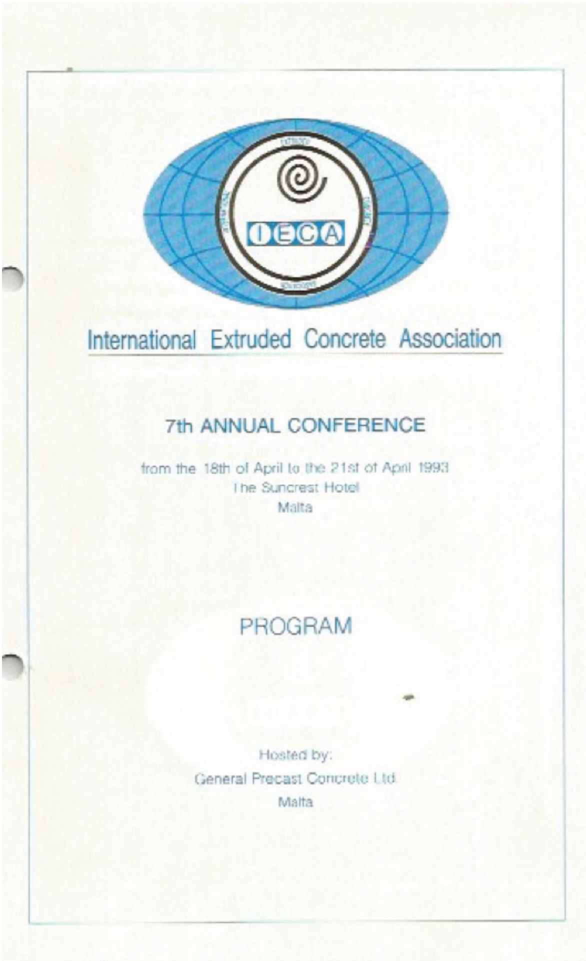


Figure 14 - 7th Annual IECA Conference Programme, held in Malta, 1993.

.22 Interview conducted with Tony Crane, 24th October 2018.

Other items of note from the conference programme include:

Session 1 – Research and Development

- *Bond behaviour in transmission zone of hollow core slabs*
  Prof. Gyltoff (University of Göteborg)
- *What more to do in the research on load distribution*
  Prof. Walraven (University of Delft)
- *Negative moments with continuous slabs*
  Mr. Gunnar Rise (Strängbeton)
- *Flexible supports*
  - *Recommendations when?*
    Mr. Gunnar Rise (Strängbeton)
  - *Test on the support of hollow core slabs on steel beam*
    Prof. H. W. Bennenk (Schokbeton)

Session 2 – Products and Connection Details

- *Hollow core as a standard product on the stock-yard and the financial consequences*
  Mr. Robbens (Echo Belgium)
- *Organisation of the stock-yard in relation with transport*
  Mr. Lappalainen (Parma Oy)
- *Details of connections (new manuals in different countries and tests at the University of Göteborg)*

  Dr. ir. Björn Engstrom (University of Göteborg)

Session 3 – Machine Producers

Automation and new development

- *Spiroll International (Mr. Alan Glasgow)*
- *Partek Concrete Engineering (Mr. E. S. A. Enqvist)*
- *Weiler (Mr. M. Holzberger)*

Automatical (sic) production machine for H.C. in reinforced concrete
Mr. Magriet and Robbens (Echo Belgium)

Session 4 – Codes and Quality Assurance

- *The CEN Code for hollow core slabs and the differences with the other codes*
  Prof. Walraven (University of Delft)
- *Evaluation of the document on quality assurance*
  Mr. T. Hamilton (Richard Lees
- *Cost of screed and topping on H.C. slabs*
  Mr. Ålgars Reiner (Vetonit)[23]

The programme offers further evidence on integration of other machine manufacturers and updates on the latest technological developments. The presence of speakers from higher educational institutions, talking on pertinent technical research matters, also shows the importance of the organisation in bringing together the foremost experts within the industry.

23. IECA 7th Annual Conference Programme, Malta (1993).

The programme also included a presentation on Bison's proposal, and at the AGM held at the end of the conference, it was agreed that slipforming would be included and the name of the association would be changed from IECA to IPHA – the International Prestressed Hollowcore Association.

It was also agreed that the next annual conference, which would be the inauguration of IPHA, was to be hosted by Bison in the UK. Coincidentally, 1994 also marked the 75th anniversary of the formation of Bison Concrete. The company therefore offered to combine the celebration of the event with hosting of the conference in Stratford-upon-Avon, the historic birthplace of William Shakespeare.

In addition to the various joint celebrations in the hotel, the conference dinner was held in the historic splendour of the medieval Warwick Castle. At the AGM at the Welcombe Hotel, the revised constitution and by-laws were approved by the membership, and IPHA was officially born. Bob MacPherson and Dr G. Huyghe retired from their respective positions as Chairman and Executive, with Terry Treanor and Tony Crane elected to the roles.

Figure 15 - IPHA Logo

IPHA – 1995-Present Day

In the years following its inauguration, the general administration of IPHA was carried out at the offices of Bison, with board meetings being held at their Iver site close to Heathrow airport, this being convenient for the attendance of board members from various European countries.

The association continued to grow, and new members joined from Europe, USA, Japan and elsewhere around the world. Over the next few years, annual conferences would be held in Chicago (USA, 1996, hosted by the Associate Members), Santiago de Compostela (Spain, 1997, hosted by Grupo Castelo & Pujol), Berlin (Germany, 1998, hosted by Echo Group) and Perugia (Italy, 1999, hosted by Generale Prefabbricati S.p.A.). Of particular note from this period are the increased prominence of marketing topics within the conference programme, as well as the ongoing development of the first IPHA website, headed by Tony Crane and Olli Korander.[24]

24. IPHA 6th Annual Conference Programme, Perugia (1999).

In addition, the first recorded technical seminar took place in Hasselt, Belgium, in 1998. Organised by IPHA's technical committee, which according to its articles of association:

"…will act as a principal advisory committee to the Board of Directors on all matters connected with the technical matters of products, production, fixing and design."[25]

Figure 16 - IPHA website (2000), accessed via Wayback Machine internet archive on 17/11/18.

In 2000, the annual conference would travel across the Atlantic Ocean to be held in Florida, USA, in conjunction with the Prestressed/Precast Concrete Institute (PCI). The PCI predates even IPHA, having been formed in Tampa, Florida, in 1954. As the introduction to the conference programme states:

"This year we are honoured and delighted to hold our conference in conjunction with PCI and hope that the conference will contribute to the knowledge and experience of members of both organisations."[26]

The conference included round table discussions on various issues, both technical and commercial, and serves to show once again, the spirit of international collaboration and free exchange of information that had been fostered by the organisation over the previous decades.

With no conference in 2001, it moved back to Europe in 2002, and was jointly hosted in the Netherlands by VBI and Dycore. On the morning of the first day of the conference, a group photograph of all participants was taken, which can be seen below:

25. IPHA Articles of Association.

26. IPHA 7th Annual Conference Programme, Orlando (2000).

Figure 17 - Group Photograph, 8th Annual IPHA Conference

Items of note from the programme include the development of European standards for hollowcore flooring and presentations focused on health and safety, in production and on site. Alongside other technical and commercial issues, these would become a core area for the organisation, both in terms of promoting best practice within the hollowcore industry, and in remaining at the forefront of key discussions and developments.

In 2003, IPHA Chairman Terry Treanor sadly and suddenly died, aged 58. He was also chief executive of Bison Concrete Products at the time. His Bison deputy Alan Clucas took over the chairmanship of IPHA. The 9th annual conference was held in Barcelona (Spain, 2004, jointly hosted by Prensoland and Prefabricats Pujol).

Terry's outstanding contribution to IPHA was later to be honoured in the form of the Terry Treanor Award, inaugurated at the 10th annual conference, which was held in Prague, Czech Republic, in 2005 (hosted by Dywidag Prefa Lysa). Entry for the award was opened to all members of IPHA, with the winner having demonstrated the best and most innovative use of hollowcore, either in its application or production – as voted by fellow members. Since 2005, the winners have been as follows:

Year	***Winner***	***Project***
2005	*Echo*	*DrainDeck*
2006	*VBI*	*Climate floor*
2007	*Prefabricats Pujol*	*Innovative Marketing*
2008	*Echo & Scia*	*Making Hollowcore the standard floor solution by a good partnership*
2009	*Echo & Generale Prefabbricati S.p.A.*	*Lifting loops in Hollowcore & Euroma2*
2010	*VBI*	*New developments of the climate floor*
2011	*Bobcrete*	*Accurately casting in of stud anchors*
2012	*Prefabricats Pujol*	*Buildings ready to install*
2013	*-None awarded*	*N/A*
2014	*Generale Prefabbricati S.p.A.*	*Shopping Mall in Rome - Design, tests and erection*
2015	*United Precast Concrete Dubai LLC*	*Sharjah Cement – Clinker Shed*
2016	*VBI (Consolis*	*Re-usable activated geopolymer based hollowcore slabs*
2017	*Gruppo Centro Nord*	*Prefabrication of Tunnels with Hollowcore Slabs*
2018	*Gruppo Centro Nord*	*Noise Barrier with Hollowcore Slabs*

Figure 18 - Table showing winners of the Terry Treanor Award, since 2005.

Over the next few years, there were a number of developments on the marketing front, including a new IPHA logo and website, introduced in 2006. Between 2004 and 2011 the chairmanship of IPHA was occupied by Paul Hobson of Tarmac Topfloor (and later Milbank Floors), Alan Clucas again (both UK), and Sebastian van Droogenbroeck of Echo Belgium.

Figure 19 - IPHA logo, 2006.

Conferences during this period included Windsor (UK, 2006, hosted by Bison Concrete Products Ltd.), Verona (Italy, 2007, hosted by PCN and Plan S.r.l.), Stockholm (Sweden, 2008, hosted by Strängbetong), and Belfast (Northern Ireland, 2009, hosted by Creagh Concrete and Techmart International). Particularly noticeable during this period are the inclusion of presentations covering software, CAD and 3D modelling within the hollowcore industry. In both design and production, this was a key area of development as the industry moved into the 21st century, and continues to be so, through the increasing use of automation, and movement towards adoption of Building Information Modelling (BIM) practices.

Another issue facing the hollowcore industry at the time, as with many others, was the global financial crisis and recession. The organisation addressed this during the annual conference of 2009 (Belfast, Northern Ireland – hosted by Techmart International and Creagh Concrete Products), by providing professionally led workshops aimed at helping members tackle issues such as factory capacity and falling demand.[27] Guest speaker at the conference was Arlene Foster, then Minister for Enterprise and Investment, who would later go on to serve Northern Ireland as First Minister.

The economic downturn was to claim some casualties within the hollowcore industry however, and most notably within the context of IPHA, Bison Concrete Products in the UK. It was at this time that the office blocks at Bison's Iver site, where the IPHA library had been stored since the head office of Bison had relocated to Burton-on-Trent in 1998, would be demolished, and unfortunately the large library of documents was lost in this process.[28]

27. IPHA 14th Annual Conference Programme (2009).

28. Interview conducted with Tony Crane, 24th October 2018.

Figure 20 - 2009 IPHA Conference, Belfast - delegates with Arlene Foster.

The 15th annual conference in 2010 was hosted in Belgium, by Echo Floors and Echo Engineering, and continued the commercial focus, being titled “Growing Sales After Recession”.[29] This year would also see another change in IPHA’s branding and logo, as well as continuing developments on the website and digital marketing presence.

IPHA

INTERNATIONAL PRESTRESSED
HOLLOWCORE ASSOCIATION

Figure 21 - IPHA logo

29. IPHA 15th Annual Conference Programme (2010).

In 2010 Sebastian van Droogenbroeck left the concrete industry, and therefore resigned from the chairmanship of IPHA. At a meeting of the board, Seamus McKeague of Creagh Concrete was elected to take over as Chairman, a position which he still occupies today.

In the following years, the invitation of prominent guest speakers from outside the hollowcore industry was continued. Members of IPHA would benefit from presentations relating to leadership and management at conferences in Oslo (Norway, 2011, hosted by Contiga), and Split (Croatia, 2012, hosted by Mucić & Co, part of Mi Grupa).[30]

Tony Crane continued as Executive Director throughout this period but stepped down in 2013 (at the 18th annual conference in Berlin, Germany, hosted by DW Systembau) and Carsten Friberg was recruited into the role, which he remains in to the present day. As the only current Honorary Member of IPHA, Tony's considerable contribution to the organisation over many years of service was recognised.

Figure 22 - Tony Crane (L) & the DW Systembau hostess (R) - 18th Annual IPHA Conference, Berlin, 2013.

30. IPHA 16th & 17th Annual Conference Programmes (2011/2012).

The year 2013 also saw an important marker for IPHA's technical seminars, a platform for discussing important technical issues affecting the hollowcore industry since their inception in 1998. At the seminar, hosted in Epernon, France, a presentation was given to members about Holcofire, a project completed by IPHA in cooperation with BIBM – the European Federation for Precast Concrete – with the objective of fully understanding the behaviour of prestressed concrete hollowcore slab floors under fire conditions.

The Holcofire project consisted of meta-analysis, laboratory fire tests, finite element simulations, and calculations conducted by experts in the field of precast hollow-core floor construction and fire testing.[31] The Holcofire report was also published in a book - *Structural behaviour of prestressed concrete hollow core floors exposed to fire* (W. Jansze, A. van Acker et al., 2014). 162 fire test results on hollow core slabs and floors executed between 1966 and 2010 were analysed against design rules from European standards EN1992-1-2 and EN1168, finding:

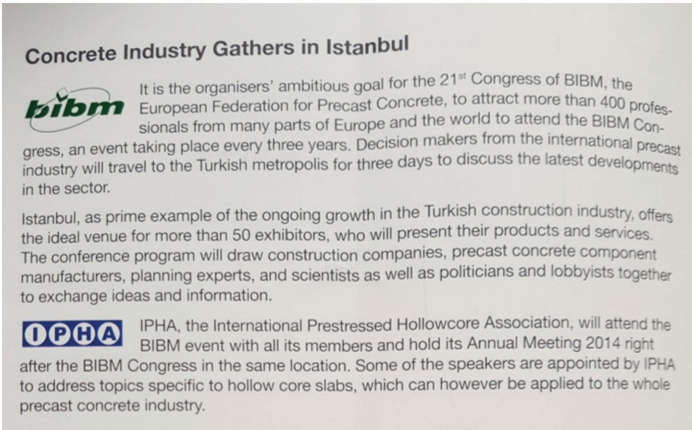
"…firstly that the product meets regulations and requirements, secondly that the product performs well exposed to fire, and thirdly that the scale of real fires in car parks in specific cases is more severe than the standard fire." [32]

Following Carsten Friberg's appointment as Executive Director in 2013, one of the first tasks undertaken was to officially register IPHA as a legal entity. This was accomplished with the assistance of Deloitte, and on 23rd April 2014, IPHA's articles of association was published in French in the Moniteur Belge. IPHA was hereby legally registered as a non-profit association (Association Internationale Sans But Lucratif – aisbl).

In the same year, the Board of Directors decided that the annual conference would be held in conjunction with the annual congress of BIBM – the European Federation for Precast Concrete – with which the association has close ties. This combined conference and exhibition was hosted in Istanbul, Turkey.

31. http://www.hollowcore.org/holcofire/ (accessed Nov. 2018 – members only area).

32. W. Jansze, A. van Acker et al (2014) Structural behaviour of prestressed concrete hollow core floors exposed to fire, Uitgeverij BOXpress B.V.



Concrete Industry Gathers in Istanbul

It is the organisers' ambitious goal for the 21st Congress of BIBM, the European Federation for Precast Concrete, to attract more than 400 professionals from many parts of Europe and the world to attend the BIBM Congress, an event taking place every three years. Decision makers from the international precast industry will travel to the Turkish metropolis for three days to discuss the latest developments in the sector.

Istanbul, as prime example of the ongoing growth in the Turkish construction industry, offers the ideal venue for more than 50 exhibitors, who will present their products and services. The conference program will draw construction companies, precast concrete component manufacturers, planning experts, and scientists as well as politicians and lobbyists together to exchange ideas and information.

IPHA, the International Prestressed Hollowcore Association, will attend the BIBM event with all its members and hold its Annual Meeting 2014 right after the BIBM Congress in the same location. Some of the speakers are appointed by IPHA to address topics specific to hollow core slabs, which can however be applied to the whole precast concrete industry.

Figure 23 - Note from BIBM congress programme, Istanbul, 2014.

The registration of IPHA could not be completed in Belgium without an official address. It was therefore also agreed with BIBM that IPHA could rent room in their offices, and the official address of the organisation became: Rue d'Arlon 55, B-1040 Brussels, Belgium.

Until around 2012, IPHA's accounts had been looked after by Dick Ros, who was also the chief accountant for members – VBI. Accounting and auditing of the organisation is now carried out by Deloitte, and on their advice, it was also registered for VAT in Belgium in 2015.

The annual conference would return to Italy, and Perugia, in 2015, with Generale Prefabbricati as hosts once more. The theme of the event was 'Getting it Right After the Depression', and continuing the spirit of previous events, there would be a focus on ways in which members could learn from others, both outside and inside the industry. 2015 would also mark another update to the IPHA website and a new brochure, with the aim of attracting new members and showcasing hollowcore as a construction product.

At the technical seminar of 2015, held in Malmo (Sweden), the topic covered was 'Hollowcore Design and BIM.' With views from architects, contractors and market-leading software providers, the association's focus on helping members to deal with current and future technological developments within the wider construction market was evident.

In 2016, IPHA became an associate member of *fib* (federation international du béton), formed in 1998 following a merger of the CEB (European Committee for Concrete) and FIP (International Federation for Prestressing), founded in 1953 and 1952 respectively.[33]

33. https://www.fib-international.org/federation/history.html (accessed Nov. 2018).

In 2016, the 21st annual conference was held in Budapest, Hungary, and hosted by Ferrobeton, of the CRH group. That year also saw the inaugural IPHA production seminar, hosted in Mollerussa (Spain), by Prefabricats Pujol. The aim of the event was to give members the opportunity to understand the latest developments in hollowcore machinery, how to improve production efficiency, and the application of best practice in product quality, health and safety, and other key areas.

Figure 24 - IPHA members at the 2016 Production Seminar in Mollerussa, Spain.

The most recent, 22nd and 23rd annual conferences, were held in Madrid (Spain, 2017, hosted once again in cooperation with BIBM) and Helsinki (Finland, 2018, co-hosted by Peikko, Trimble and Elematic) respectively.

In 2017, a technical seminar was hosted in Tallinn, Estonia. In co-operation with the International Federation for Structural Concrete *(fib)*, this was the first such event to be open for attendance by those who are not members of IPHA. It was targeted at structural engineers – bridging the gap between theory and practice – with examples of calculations and intended to deepen their knowledge of new approaches in the field of hollowcore design.

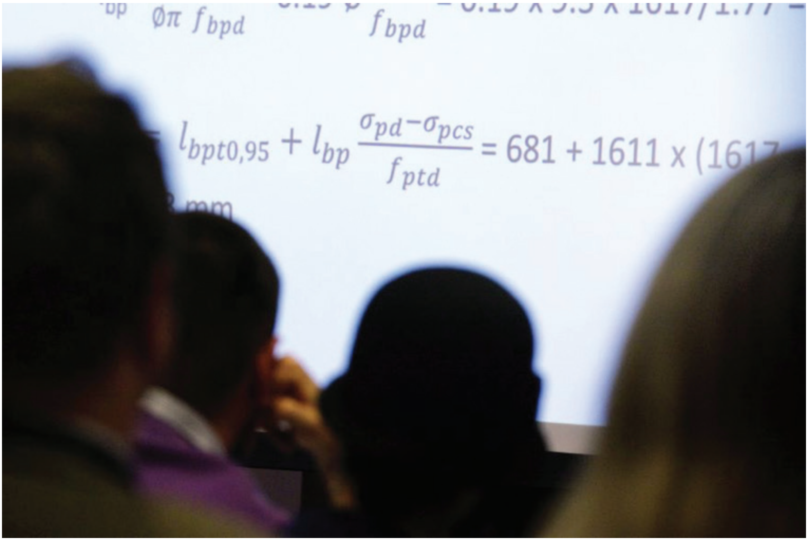


Figure 25 - Attendees at the 2017 Technical Seminar in Tallinn are presented with practical examples of calculations for hollowcore design.

Figure 26 - IPHA members visit a construction site as part of the annual conference, Helsinki, 2018.

2018 also saw the first dedicated sales and marketing seminar, hosted in Barcelona (Spain), with attendees able to gain insight on techniques and strategies from leading sales people in different regions. Assessments of the strengths and weaknesses of members' websites were also carried out, with the aim of assisting members to compete in an ever-changing digital marketing landscape.

As has been traditional with IPHA events over the years, there was also time set aside for attendees to experience some local culture, history and gastronomy. In many cases, it is these parts of the event programme that allow IPHA members to network, socialise with one another and share their experiences.

Figure 27 - Olli Korander (previous president of IPHA's technical committee) delivers a presentation on sales arguments for hollowcore, Barcelona, 2018.

The seminar, organised by IPHA's marketing committee, was a resounding success, with more such events sure to follow. It also further evidenced the committee's contribution in assisting members with the marketing of hollowcore, and fulfilment of its purpose:

"…as a principal advisory committee to the Board of Directors on all matters connected with marketing and promotion of the Association and of hollowcore." [34]

34. IPHA Articles of Association.

Conclusion

From its inception in 1969 as the ISPA, right through to the present day, IPHA has continued to serve its members' interests by promoting prestressed hollowcore to the construction market and facilitating the regular exchange of knowledge between the foremost experts within the industry.

Technical seminars – currently under the guidance of President of the Technical Committee, Wim Jansze – have enabled discussion on best practice, and helped to drive forward standards in the industry. Meanwhile, forums for marketing and commercial discussion – overseen by President of the Marketing Committee, Jordi Pujol – have assisted members in surviving difficult markets and economic conditions.

The efforts of the board of directors, and members themselves, has also seen membership grow from those initial 7 producers, to an organisation that can now count on the cooperation of over 80 companies, spread across more than 35 different countries.

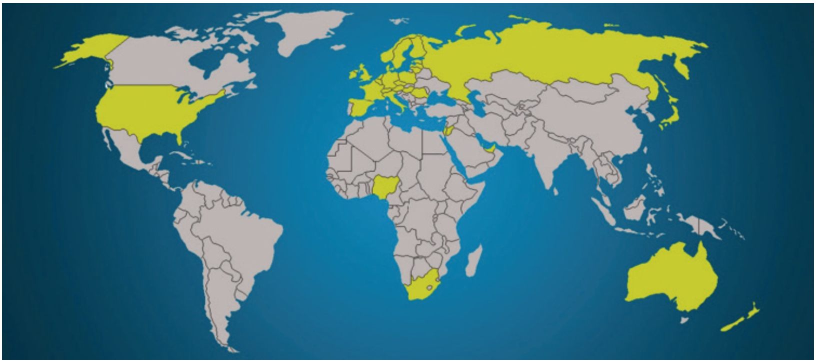


Figure 28 - Map showing countries where IPHA members companies are located.

Without the time and dedication of many individuals over the years, this would not have been possible. IPHA brings together a truly diverse range of companies, even competitors, but has always fostered the same spirit of international collaboration. A spirit and culture that promotes discussion, and the sharing of experiences to the benefit of all concerned.

The year 2019 will mark the 50th anniversary of IPHA. The annual conference, to be held in Sønderborg, Denmark, and hosted by Contiga, will undoubtedly be a fitting event for such a long-running and influential insititution within the global prestressed hollowcore industry. As new members join, they will be able to benefit from an organisation that brings together a huge number of brilliant minds, and that is still holding true to the objectives set out half a century ago.

Table of Figures

Appendix A – List of Annual Conference Venues and Hosts (1993-2019)

Year	Location	Hosts
1993 (IECA)	Qawra, Malta	General Precast
1994 (1st as IPHA)	Stratford-upon-Avon, UK	Bison Concrete Products
1995	Dublin, Ireland	Breton Group
1996	Chicago, USA	Associate Members
1997	Santiago de Compostela, Spain	Prefabricados Castelo & Prefabricats Pujol
1998	Berlin, Germany	Echo Group
1999	Perugia, Italy	Generale Prefabbricati
2000	Orlando, USA	Associate Members
2002	Heelsum, Netherlands	VBI & Dycore
2004	Barcelona, Spain	Prefabricats Pujol & Prensoland
2005	Prague, Czech Republic	Dywidag Prefa
2006	Windsor, UK	Bison
2007	Verona, Italy	PCN & Plan
2008	Stockholm, Sweden	Strängbetong & Consolis
2009	Belfast, Northern Ireland	Creagh Concrete Products & Techmart International
2010	Brussels, Belgium	Echo
2011	Oslo, Norway	Contiga (Consolis)
2012	Split, Croatia	Mucić & Co (Mi Grupa)
2013	Berlin, Germany	DW Systembau (Consolis)
2014	Istanbul, Turkey	Co-operation with BIBM
2015	Perugia, Italy	Generale Prefabbricati
2016	Budapest, Hungary	Ferrobeton (CRH)
2017	Madrid, Spain	Co-operation with BIBM
2018	Helsinki, Finland	Peikko, Elematic & Trimble
2019	Sønderborg, Denmark	Contiga Tinglev

Appendix B – List of Technical, Production, and Sales & Marketing Seminars

Year	Location	Seminar Type
1998	Hasselt, Belgium	Technical Seminar
2000	Helsinki, Finland	Technical Seminar
2001	Copenhagen, Denmark	Technical Seminar
2003	Leuven, Belgium	Technical Seminar
2005	Delft, Netherlands	Technical Seminar
2007	Chalmers, Sweden	Technical Seminar
2011	Aachen, Germany	Technical Seminar
2013	Epernon, France	Technical Seminar
2015	Malmo, Sweden	Technical Seminar
2016	Lleida/Mollerussa	Production Seminar
2017	Tallinn	Technical Seminar
2018	Barcelona	Sales & Marketing Seminar
2019	Warsaw	Technical Seminar

Appendix C – List of Board Members (1993-2018)

N.B. prior to 2004, records for serving board members are incomplete.

Year	Board Members	Company
1993	Bob MacPherson Dr. ir. G. Huyghe Prof. ir. H. W. Bennenk	Richard Lees Schokbeton
1994	Terry Treanor (Chairman) Tony Crane Prof. ir. H. W. Bennenk Gunnar Rise Gerd Vermeiden	Bison Bison Schokbeton Strängbeton
1995	Terry Treanor (Chairman) Tony Crane Prof. ir. H. W. Bennenk Gunnar Rise Gerd Vermeiden	Bison Bison Schokbeton Strängbeton
1996	Terry Treanor (Chairman) Tony Crane Prof. ir. H. W. Bennenk Gunnar Rise Gerd Vermeiden	Bison Bison Schokbeton Strängbeton
1997	Terry Treanor (Chairman) Tony Crane Prof. ir. H. W. Bennenk Gunnar Rise Luciano Marcaccioli Pujol	Bison Bison Schokbeton Strängbetong Generale Prefabbricati
1998	Terry Treanor (Chairman) Tony Crane G. Vermeiden Olli Korander Nordy Robbens	Bison IPHA Addtek Echo NV
1999	Terry Treanor (Chairman) Tony Crane G. Vermeiden Olli Korander Nordy Robbens Massimo Ferrari	Bison IPHA Addtek Echo NV Generale Prefabbricati
2000	Terry Treanor (Chairman) Tony Crane Olli Korander Nordy Robbens Stephen Carr Lambert Teunissen	Bison IPHA Addtek Echo NV Tarmac Topfloor VBI
2001	Terry Treanor (Chairman) Tony Crane Olli Korander Nordy Robbens	Bison IPHA Addtek Echo NV

2002	Terry Treanor (Chairman) Tony Crane Olli Korander Peter Kelly Nordy Robbens	Bison IPHA Addtek Bison Echo NV
2003	Terry Treanor (Chairman) Tony Crane	Bison IPHA
2004	Paul Hobson (Chairman) Alan Clucas Tony Crane Olli Korander Charles Nicholson Nordy Robbens Jan de Wit	Tarmac Topfloor Bison IPHA Consolis Tarmac Topfloor Echo NV Dycore BV
2005	Paul Hobson (Chairman) Alan Clucas Tony Crane Olli Korander Charles Nicholson Jordi Pujol Nordy Robbens Jan de Wit	Tarmac Topfloor Bison IPHA Consolis Tarmac Topfloor Prefabricats Pujol Echo NV Dycore BV
2006	Paul Hobson (Chairman) Alan Clucas Tony Crane Olli Korander Charles Nicholson Jordi Pujol Nordy Robbens Jan de Wit	Tarmac Topfloor Bison IPHA Consolis Tarmac Topfloor Prefabricats Pujol Echo NV Dycore BV
2007	Alan Clucas (Chairman) Tony Crane Sebastien van Droogenbroeck Paul Hobson Olli Korander Charles Nicholson Jordi Pujol Jan de Wit	Tarmac Topfloor IPHA Echo Bison Consolis Tarmac Topfloor Prefabricats Pujol Dycore BV

2008	Sebastien van Droogenbroeck (Chairman) Tony Crane Olli Korander Seamus McKeague Charles Nicholson Jordi Pujol Jan de Wit	Echo Bison Consolis Creagh Concrete Products Tarmac Topfloor Prefabricats Pujol Dycore BV
2009	Sebastien van Droogenbroeck (Chairman) Tony Crane Olli Korander Ed McAleer Seamus McKeague Charles Nicholson Jordi Pujol	Echo Bison Consolis Techmart International Creagh Concrete Products Tarmac Topfloor Prefabricats Pujol
2010	Seamus McKeague (Chairman) Tony Crane Olli Korander Stef Maas Ed McAleer Jordi Pujol	Creagh Concrete Products Bison Consolis Echo Techmart International Prefabricats Pujol
2011	Seamus McKeague (Chairman) Axel Baumann Tony Crane Olli Korander Stef Maas Ed McAleer Jordi Pujol	Creagh Concrete Products Contiga Bison Consolis Echo Techmart International Prefabricats Pujol
2012	Seamus McKeague (Chairman) Axel Baumann Tony Crane Wim Jansze Stef Maas Ed McAleer Jordi Pujol	Creagh Concrete Products Contiga Bison Consolis Echo Techmart International Prefabricats Pujol
2013	Seamus McKeague (Chairman) Carsten Friberg Axel Baumann Wim Jansze Holger Karutz Ed McAleer Marco Pecetti Jordi Pujol	Creagh Concrete Products IPHA Contiga Consolis CPI – ad media Techmart International Generale Prefabbricati Prefabricats Pujol

2014	Seamus McKeague (Chairman) Carsten Friberg Axel Baumann Wim Jansze Ed McAleer Marco Pecetti Jordi Pujol	Creagh Concrete Products IPHA Contiga Consolis Techmart International Generale Prefabbricati Prefabricats Pujol
2015	Seamus McKeague (Chairman) Carsten Friberg Axel Baumann Szilárd Dubrovszky Wim Jansze Ed McAleer Marco Pecetti Jordi Pujol	Creagh Concrete Products IPHA Contiga Ferro Beton Consolis Techmart International Generale Prefabbricati Prefabricats Pujol
2016	Seamus McKeague (Chairman) Carsten Friberg Wim Jansze Holger Karutz Ed McAleer Marco Pecetti Jordi Pujol Karsten Rewitz Pieter van der Zee	Creagh Concrete Products IPHA Consolis CPI – ad media Techmart International Generale Prefabbricati Prefabricats Pujol Contiga Tinglev CRH
2017	Seamus McKeague (Chairman) Carsten Friberg Wim Jansze Ed McAleer Topi Paananen Marco Pecetti Jordi Pujol Karsten Rewitz Pieter van der Zee	Creagh Concrete Products IPHA Consolis Techmart International Peikko Generale Prefabbricati Prefabricats Pujol Contiga Tinglev CRH
2018	Seamus McKeague (Chairman) Carsten Friberg Wim Jansze Ed McAleer Topi Paananen Marco Pecetti Jordi Pujol Karsten Rewitz Pieter van der Zee	Creagh Concrete Products IPHA Consolis Techmart International Peikko Generale Prefabbricati Prefabricats Pujol Contiga Tinglev CRH

"IPHA is a result of the efforts of many busy people that have given, and continue to give, their time to the organisation. Through shared experiences, every member has the chance to benefit from others, and come away richer in their knowledge for it."

Tony Crane
Honorary Member, IPHA

"IPHA has been a formative part of the hollowcore industry over the years. It has pre-empted potential problems within the market and helped its members to address them, increasing confidence in hollowcore as a construction product."

Steve Carr
Former Board Member/Associate Member, Tarmac & Spiroll

IPHA

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