

A DUCTILE MATERIAL IN A BRITTLE INDUSTRY

GOLD MEDAL ADDRESS 2007

Joe Locke MBE FEng, MSc, CEng, FStructE, FWeldI

The Association was honoured to hear an address by Joe Locke, former Managing Director of Watson Steel, a fabrication company based in Bolton. Joe was brought up and educated locally and throughout his career has been associated with many significant buildings: Joe is a passionate advocate of his chosen medium, structural steelwork and via his links with it, rose to become highly respected in the structural engineering world. This culminated in 2007 by him being awarded the Institution of Structural Engineer's highest honour, their Gold Medal. He repeated his award address for the local branch in a joint meeting with MAE. The following text is a précis

Introduction

Joe started by stating expressing his honour and delight at the Institution's Award, noting wryly that whereas most recipients had come from a background of consultancy, research or academia he was almost unique in having spent most of his life in contracting and frequently as a specialist sub-contractor.

Why am I a structural engineer?

He began by reflecting on his early introduction to engineering, recalling how his fascination was kindled on a journey to school when he saw a Lancashire cotton mill being altered. The structure was steel and included a riveted plate girder fabricated at John Booth's works close by (Bolton is a traditional centre for the structural steelwork world). Thereafter his captivation with steel structures was born and his career path determined – perhaps not surprisingly since his father had been an iron moulder and grandfather the blast furnace man on the first Bessemer converter in the UK, also located in Bolton.

Early education and training

Joe attended technical college and claimed comfort in this environment being at ease with mathematics. Then at 17 he became an Indentured Technician Apprentice and began a life long association with Robert Watson and Company where he trained in the fabrication shops, drawing and design offices and on construction sites. His early years in the design office were stimulating since staff with highly competent engineers who seemed able to answer all of his questions whilst producing competitive steelwork designs of the highest quality. The office ethos was that you had to aspire to become a Chartered Structural Engineer, so Joe's day time training was supplemented by part-time day and evening study at Bolton Technical College. Aged 23, he had already satisfied the Institution's examination

Work as a steelwork designer

As his knowledge of structural steelwork increased, Joe spent more time working on competitive designs and revelled in the stimulus of winning orders by developing innovative engineering schemes rather than cutting prices. As time progressed, Joe began to understand that light weight steel structures did not automatically equate with minimum cost and he developed a keen interest in the cost of fabricated steel. In 1960, it was possible to obtain 5kg of steel for one hour of a man's time whilst by 2005, this had risen to 21kg and continues to rise. Achieving minimum weight is a science but achieving minimum cost has not yet developed to the same level and can only be realised by deploying the craft skills of an experienced engineer having a thorough understanding of the required amount of fabrication labour.

After 5 years in the design office, Joe accepted a lectureship at Bolton Technical College specialising in the theory and design of steel structures and then moved on as a Research Assistant to UMIST for one of the

happiest periods of his life. The UMIST atmosphere was conducive to research and however great the problem seemed, there would always be someone convinced that obtaining a resolution would not be at all difficult. Eventually, this attitude became a way of life and was by far the greatest benefit he took away from his tenure.

Joe's research was on the flexural torsional buckling of I-sections with a restrained axis of rotation. This involved theoretical analysis combined with experimental testing and the work revealed how difficult it was to replicate theoretical assumptions made in analysis and design, even under controlled laboratory conditions. During his time researching, the relatively new topic of computation emerged and Joe worked on the Atlas computer then the largest in the world housed in three huge laboratories. The Atlas's cpu had a capacity of 64k and departmental time allocation was heavily restricted. Such computational restraints forced those writing software into highly convoluted routines. Joe's base skills on programming were used shortly after in commerce. In later years, Joe became a Visiting Professor in his old department.

Mid career life

After leaving UMIST, he returned to Watson's to write software and developed programmes for the rapid design and cost optimisation of portal framed sheds. His system was effective and reduced design, estimating and drawing time from the status of many man-days to minutes. Despite his enthusiasm for such automation, Joe expressed reservations about current software use which seemed to him frequently inappropriate. Joe regretted the demise of older skills since, as he put it, when drawing at 1:100 it is almost impossible to miss potential difficulties so allowing them to be resolved before manifestation later on in workshop drawings.

Over the course of the next few years Joe became responsible for Watson's overseas business especially in the Middle East. He recalled projects being carried out using very basic labour with concentration on constructing safely rather than perfectly. The office adopted a project principle that 'simple' was difficult to achieve and the 'difficult' impossible'. Many projects were carried out in Kuwait, Bahrain, Dubai, Saudi Arabia, Libya, Egypt, Iran and Iraq and. A particular triumph – much enjoyed – was the sale of a building to a Kuwaiti client for storing sand! Joe had many scary anecdotes and related one example of a north light factory building provided on a delivered only basis which had been constructed south facing by a local contractor! The resulting heat was resolved by the Lancashire tradition of whitening the windows.

In 1980, Joe was appointed to the Watson Board and became responsible for all aspects of engineering and design. He subsequently became the Deputy Managing Director, a post which was one of his best appointments since whilst working under the umbrella of the MD, it was possible to share the acclaim of good decisions, whilst always having someone to take the ultimate responsibility for the less successful ones. Eventually Watson's was acquired by AMEC and Joe promoted to Managing Director and the umbrella cover which he had enjoyed so much as deputy MD evaporated. Joe was quickly introduced to the AMEC philosophy of: do a good job; do it on time; make a profit. All simple in theory, but the reality was rather different as the financial controls exercised by a plc demanded strict adherence to budgets, generally more rigorous than those found in a family business. Nevertheless, as he put it, the ability to read, comprehend and manipulate the company's accounts should hold no terrors for those weaned on a diet of strain energy and moment distribution. Balance sheets and profit and loss ledgers generated by accountants only involve the addition and subtraction of columns of numbers, whilst engineers have the further functions of multiplication and division within their armoury!

Being the MD was in some respects quite frightening, since employees looked to you for leadership and decision making which needed to be dispensed with confidence and authority. There were many occasions when the inner man was much at variance with the public image. Joe believed in the importance of being seen and that required daily tours of the workshops, weekly visits to the design and drawing offices and regular visits to construction sites. But his official work load was heavily biased towards winning contracts and that meant more time spent in international travel than he was really comfortable with yet in view of the 'ups and downs' of the UK market, a strong profitable overseas business was an absolute necessity.

Joe became the President of the British Constructional Steelwork Association (BCSA). And a major part of the job was achieving co-operation on a range of topics of common concern to steelwork contractors who were

in reality more comfortable competing fiercely with each other. However, it is possible to obtain consensus, a fruit of which is now the high market share enjoyed by the industry for multi-storey buildings all as a result of innovation and the efforts of BCSA and the wider industry. Following his BCSA Presidency, Joe became President of the ECCS (European) and found this an extremely difficult forum. Whilst the common language was English, this still left communication difficulties and problems related to the differing cultures and philosophies of individual European countries, collectively making progress very slow. Nevertheless many European friendships were forged and there were many compensations and opportunities to meet interesting people. Certainly, his favourite was Princess Anne (the Princess Royal), who had been a great industry supporter and patronised both BCSA's and ECCS's London Guildhall Dinners. She was a delightful dinner companion and certainly well briefed on industry activities.

Having been Managing Director for over a decade and by company rules, Joe had to retire from Watsons at 60 but he was flattered to remain in a consultancy capacity. Looking back over his time, it was a period of a few 'lows' but many 'highs' largely linked to the achievement of a number of exciting projects made possible by many wonderful colleagues. Joe finished by showing some of his favourites

Sub millimetre telescope housing – Hawaii

The telescope housing was constructed on the top of Mauna Kea, an extinct volcanic peak 4,500m above sea level on Hawaii. The structure was 30m diameter × 30m high complete with sliding doors and a sliding roof all mounted on 12 bogeys to provide 360° powered rotation. Any thoughts of sandy beaches and warm seas are certainly not relevant since the site environment was hostile with wind velocities of 200 kph and 1.5m deep snow falls real occurrences. The difficulties of working in this environment and at such altitude could only really be appreciated by having experienced them. Working at 4,500m in low levels of oxygen is extremely debilitating, both mentally and physically. All of the construction teams were trained to work purposefully and steadily since even running up a 4m-high ladder would render you gasping for breath. A major concern was evacuating anyone in the event of an accident, since the summit was well beyond the working altitude of a helicopter. Hence provisions needed to be made at all times for evacuation by 4-wheel drive vehicles, an eventuality which was fortunately never required.

The Millennium Dome – London

The Dome was a truly spectacular project being some 400m diameter with 12 radial columns 50m high supporting a cable net. What was most difficult was maintaining a workforce impetus when confronted with negative headlines on an almost daily basis which threatened project cancellation.

Kansai Airport – Japan

The profile of the highly distinctive airport building crafted by Renzo Piano required a very complex tubular steel structure of toroidal geometry set out from a springing point 15km below the earth's surface. The building was 1.6km long and constructed on a manmade island 5km offshore in the Osaka Bay, Japan.

Obtaining the order meant convincing the Japanese customer that British industry was not strike ridden, nor were its workshops populated by those who had no company loyalty or job commitment. The ability to display a combination of apprentice, father and grandfather from the same family and who had 2, 24 and 51 years continuous service respectively, helped correct this misconception. Many visits to Japan were required and with reciprocal visits to the Watson offices and workshops by a battery of Japanese personnel. Negotiations were stressful and Joe began to feel that Watson's were taking on the role of Great Britain Ltd. This eventually provoked a visit from the then Prime Minister, John Major, who took great delight in painting a 'Made in Britain' stencil onto one arch. To the best of Joe's knowledge, there had never previously been any imports of structural steelwork into Japan probably because the market there is carefully controlled. The bureaucracy and time involved in achieving registration for work is considerable. Eventually, Watsons joined with Nippon Steel Co (NSC) and Kawasaki Heavy Industries (KHI), and obtained much needed work for their factories.

Establishing a favourable business climate with the Japanese is greatly dependent on strong personal relationships. In Kansei this was helped by actively partaking in hospitality, dispensed in abundance most nights. Joe developed a liking for Japanese food and hot saki and was frequently required to accompany his hosts in karaoke sessions: his contributions were described as 'legendary'.

The Kansei contract was considered a success, and led onto a partnership for the new airport at Chep Lap Kok in Hong Kong. This was the largest overseas contract ever carried out by Watson and involved the supply and erection of some 22 000t of structural steel arches. Each arch was assembled and welded into one piece, adjacent to the site, and then transported to its final location for erection by one of the largest crawler cranes in the world,

My ambitions for the Institution and the steelwork industry

Joe concluded by wishing the Institution well since it had been such a significant contributor to his engineering career. He also wished the steelwork industry well for the future and paid tribute to the many individuals who had helped, encouraged, taught and employed him over his career and of course he paid tribute to his family for their support.