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THE DIVERGENCE OF THE PROFESSIONS: JAMES GANDON, JOHN RENNIE AND THE BUILDING OF THE REVENUE DOCKS

Elizabeth Shotton

Keywords

John Rennie; James Gandon; Custom House docks; Ireland; architecture; engineering; training; changing role of the professions; docks; building techniques

Abstract

The Scottish engineer John Rennie (1761-1821) is often attributed as author of the trio of docks built in Dublin for the Commissioners of Revenue in Ireland. However the original dock was actually the work of James Gandon (1742-1823), a British architect who rose to fame during the course of his career in Ireland. This original dock, constructed 1792-1796, formed part of Gandon's first commission in Ireland to design the new Custom House and was built concurrently to the Grand Canal Dock by William Jessop (1745-1814) on the opposite side of the River Liffey. The confusion in authorship likely resulted from the significant rebuilding of the dock as part of Rennie's commission to add additional docks and warehouses to the quarter twenty years later.

Gandon's original Revenue Dock was a near replica, in both form and technique, of the Old Dock in Liverpool, first constructed by Thomas Steers (1672-1750) in 1715 and largely reconstructed after 1743, again by Steers. But, while dock engineering in Britain and Ireland was in its infancy when Steers built the first dock in Liverpool innovations had been introduced by both Jessop and Rennie by the end of the eighteenth century that rendered Gandon's work obsolete even as it was in construction. Gandon's ignorance of the rapidly evolving technologies used in docks, even when they were being undertaken in such near proximity to his own work, speaks to the differences emerging between the disciplines of architecture and engineering in the late eighteenth century.

The delineations, now so clearly apparent, between builder and designer, architect and engineer were still relatively ambiguous and fluid in the eighteenth century. Even between Gandon and Rennie, explicitly acknowledged as architect and engineer respectively, there was some overlap in the types of commissions undertaken, including docks, bridges and buildings in both men's careers. While the exponential growth in new technologies, materials and infrastructural projects in the late eighteenth century certainly contributed to the rise of the civil engineer as distinct from the architect, equally significant was the philosophical shift in the understanding of what constituted appropriate training, which led to a disparity in interests and aptitudes between architects and engineers.
INTRODUCTION

Though the exponential growth in new technologies, materials and infrastructural projects in the late eighteenth century contributed to the rise of civil engineering as a distinct discipline (Chrimes and Hots 1998; Briggs 1927), other factors contributed to the distinction between these disciplines and their aptitudes and interests during this century. Before this juncture, the title 'architect' was a generic term, encompassing a multitude of duties on a variety of project types (Crook 1969) while the title 'engineer' was almost exclusively reserved for military engineers (Chrimes and Hots 1998). Though other avenues into the practice of architecture existed, notably the gentleman-architect and the artist-architect (Crinson and Lubbock 1994), associated with grand tours and artistic training, the field remained dominated by craftsmen, or the builder-architects, who were supported by technical guides and pattern-books (Buchanan 1983; Wilton-Ely 1977; Briggs 1927; Crinson and Lubbock 1994). Engineering, beyond those educated in the military, was likewise dominated by practical craftsmen who had earlier apprenticed as millwrights, mechanics, instrument makers, or stonemasons (Buchanan 1983).

Though these divergent routes of entry to both disciplines persisted to some degree until the late eighteenth century (Wilton-Ely 1977), by the mid-eighteenth century a new system of articled pupilage began to surface in tandem with the establishment of drawing academies, culminating with the Royal Academy of Art in 1768, which was to become the primary influence on the architectural profession (Crook 1969). Although a similar system was to emerge in engineering, self-taught individuals still predominated, combining practical backgrounds with knowledge gleaned from increasing numbers of published treatises (Chrimes and Hots 1998). In the domain of architecture the combination of articled pupilage, which drove the conventions of stylistic dynasties, coupled with the uneven tuition received at the drawing academies that tended to focus on the pictorial to the exclusion of practical knowledge pertaining to construction (Crook 1969), served to delineate the artist-architect from the more practical-minded engineer. It is a milieu that was to profoundly influence both the British architect James Gandon (1742-1823) and the Scottish engineer John Rennie (1761-1821) in their approach to design.

Gandon and Rennie were both involved in the building of a trio of docks on the River Liffey in Dublin between the late eighteenth and early nineteenth centuries (Fig. 1), which exemplifies this shift in aptitudes. The Revenue Dock (Old Dock) completed 1796 (now in-filled) as well as George’s Dock and the Inner Basin completed 1824, are commonly attributed to Rennie (Gilligan 1988; Rynne 2006; Cox 2009). Yet the first dock was actually designed in tandem with the Custom House by Gandon who was to rise to fame during the course of his career in Ireland. What is clear, from Rennie’s well kept business records, is that once awarded the contract to build the two additional docks and associated warehouses in 1814, Rennie was in a position to assess the condition of the original Revenue Dock in late 1820 in an attempt to estimate the cause for its failure (Rennie, 1820a). Based on this assessment three sides of this original dock in addition to its entrance channel were largely rebuilt by Rennie's resident engineer John Aird (1760-1832) under the supervision of Thomas Telford (1757-1834) following Rennie's death in 1821 (Telford 1822a). This subsequent rebuilding is likely responsible for the muddled record of authorship. Regardless, there remains substantial documentation that attests to both Gandon’s role on this first dock, as well as the significant differences between the approaches taken by Rennie and Gandon in the design of these structures.
THE DIVERGING PROFESSIONS

Gandon and the Emergence of Articled Pupilage

James Gandon had been self-employed since 1765, following his seven-year apprenticeship with Sir William Chambers (1723-96), before arriving in Dublin in 1781 to undertake the design of the new Custom House and adjacent docks. His work between these dates had been limited, the Nottingham County Hall (1772) being the one significant built commission, supplemented by a number of minor surveys and additions. Gandon had spent most of his time on competition entries as well as exhibitions, principally at the Royal Academy who awarded him the first Gold Medal in 1769. He also published, in partnership with the Irish architect John Woolfe (d.1793), two volumes of the *Vitruvius Britannicus* during this period (McParland 1985).

Gandon's training, from his early drawing tuition at Shipley’s Academy, his apprenticeship to Chambers at fifteen and his continuing drawing studies at the Society of Artists followed by the Royal Academy (McParland 1985), is symptomatic of architectural training in Britain during this period. Chambers was among the first architects to institute the practice of articled pupilage, have been educated into the profession by virtue of extensive travel and a brief period of study at the Ecole des Arts in Paris (Wilton-Ely 1977), with Gandon his first assistant (McParland 1985). Pupilage of this sort could be very uneven and little is known regarding Gandon's training under Chambers save for the plates he engraved for Chambers' *Treatise on Civil Architecture* of 1759 (McParland 1985). However, Chambers' preoccupations are considered formative to Gandon's attitude toward the practice of architecture, which McParland describes as eclectic, Roman in its bias and, most critically, dedicated to 'the primacy of subjective criteria: what mattered, where proportions were concerned, was the apparent not the real' (McParland 1985).
Thus, Gandon's training was that of the artist-architect, with its emphasis on drawing, geometry, proportion and the inherited stylistic tendencies of his principal employer. He was also conscious of the importance of nurturing potential patrons and it was this last lesson that proved decisive in Gandon's career, as it was not by means of an open competition, common at that time, that he won the commission for the new Custom House, but by virtue of his social connections through Paul Sandby (also responsible for the Nottingham introduction) to John Beresford, then First Chief Commissioner of the Revenue in Ireland.

Rennie: Of Craft and Theory

While Gandon's training was symptomatic of a trend in British architectural education, John Rennie's early education was far from conventional for the period. Raised on a substantial farm in Scotland, at age twelve Rennie apprenticed with the millwright Andrew Meikle (1719-1811) whose workshop was located on the Rennie farm (Boucher 1963). Having thrived under Meikle's tutelage for two years Rennie enrolled in Dunbar High School where Smiles suggests he exhausted what the school could offer him within another two years and returned to Meikle (Smiles 1861). By the age of nineteen, at the time Gandon was taking up his commission in Ireland, Rennie had forged a career for himself as an independent millwright, designing both machinery and the buildings to house them (Smiles 1861). It was at this point Rennie departs from a conventional career trajectory to take the unconventional step of enrolling at Edinburgh University to study Natural Philosophy, Chemistry as well as learning French and German during the course of his study of foreign texts (Boucher 1963; Smiles 1861).

Engineers of this period had risen in the field from a variety of routes; Telford began as a stone mason, Robert Mylne (1733-1811) trained as a mason and later an architect in Italy, William Jessop (1745-1815) had been articled to John Smeaton (1724-92), while Smeaton had studied law only to abandon the career to become a maker of scientific instruments before working as an engineer. It was the combination of a university training in the theory of mechanical philosophy under Dr. John Robison (1739-1805), in tandem with his apprenticeship with the millwright Meikle, that distinguishes Rennie from any of his near contemporaries, even Smeaton. For though Smeaton was university educated, Rennie was the first to bridge the apparent gap in Britain between the theoretician, men such as Robison, and the practical bias of the craftsman-engineer (Boucher 1963).

Thus, Rennie was well versed in the practical nature of mechanics and natural forces from his apprenticeship with Meikle and the more theoretical aspects of mathematics and physics from his university training. Following university he was to supplement this knowledge with a tour of the leading works of engineering in Britain at the time ultimately leading to employment with Boulton & Watt in 1784. By the time Gandon is contemplating the design of the first Revenue dock in Ireland, Rennie had established his engineering practice and was working, as he would do for the remainder of his career, on machinery for mills as well as docks, harbours canals and bridges.

THE REVENUE DOCKS

Gandon's Struggle

According to the correspondence between Beresford and Gandon while the latter was still in London, the first ambition for the Custom House project had been to build the much-wanted docks in an effort to convince the unruly public as to the merit of the scheme and allow “the plans for the building [to] be adjusted during this period” (Mulvany 1846). Whether or not Gandon arrived with dock plans is unclear, but construction was not to start until a decade later fol-
lowing the completion of the Custom House. Though no reason for this change of plan is recorded, it is known that a proposal for a dock was solicited from Jessop, and subsequently declined as being too extravagant, before Gandon’s proposal was constructed (Irish 1792). This may suggest hesitation, on the part of the client or by Gandon himself, as to his qualifications to undertake such an enterprise. Nevertheless, the docks were to be underway by 1792 under Gandon’s direction.

Gandon’s Revenue dock, adjacent to the Custom House, was a simple affair; a nearly rectangular basin built of 2 acres built of slender undressed stone walls (Telford 1822b) with a single pair of timber mitre gates of 30 foot width, with two sluice gates built into each leaf, closing on a timber cill and floor construction (Fig. 2). According to a Royal Commission of 1902 the depth of water over the cill at low spring tide was 3 feet which, in tandem with Rennie’s comments on the height of this dock wall being 6 feet lower than intended for Georges Dock (Rennie 1820b), suggests a height of 18-20 feet for the dock walls with an effective depth of water of 13 feet at high neap tide. Evidence from the Ove Arup files (1988a) record the east wall of Gandon’s dock, after its rebuilding, was approximately 6 feet in depth and lacking any evidence of counterforts. Geotechnical investigations revealed a base of dense sandy gravels (Ove 1988b) which, when coupled with the trouble encountered by Michael Dillon, the contractor for the construction of the dock (Dillon 1797), suggest that the walls rest directly on a substrate of dense material rather than on piled foundations. Though drawings from Ove Arup indicate the walls were straight in profile, it is more likely that they were battered, as indicated in Gandon’s drawing.

Although an accurate picture of the original dock, Gandon’s initial intentions had been to construct a tidal dock - made apparent by a memorial put forward to the Lord Lieutenant in March 1794 by the Ballast Board in Dublin two years into the excavation works. The Ballast Board demanded that “the new Dock at the Custom House may be constructed with Gates to keep in a sufficient Quantity of Water, so that Vessels may be constantly afloat therein instead of letting the Water flow in and out every Tide as the Corporation understand is at present intend-
ed” (Directors 1791-94). The difference between a tidal dock and one with gates would have been immense on a tidal watercourse of such insignificant depth as the River Liffey, where merchant ships of substantial draught could not remain afloat at all states of the tide. In a later response to a return letter and report (no longer extant), the Board replied that they were “inclined to hope and believe that the Depth of the Water proposed by Mr Gandon to be kept in the Dock at all times, Viz Ten foot, will be sufficient to keep most Vessels … Water borne” (Directors 1791-94). It is evident that Gandon adjusted his initial plans, both adding a gate as well as increasing the depth of water, in response to the Board’s remarks.

Gandon’s original strategy of a tidal dock was unusual, as by the close of the eighteenth century dock systems had evolved beyond tidal basins to include not just a gate, but a pair of gates to effect a lock, as were present at the contemporaneous works for the Grand Canal Company on River Liffey under the direction of Jessop. As Gandon had been advised by Beresford at the start of the project to “come by Liverpool by all means, as you will then see their docks, and procure every information about them” (Duffy 1999), his approach was likely influenced by this example (Fig. 3). Liverpool had a glowing reputation for its docks at that time, yet their system was idiosyncratic, having evolved under the supervision of company dock engineers, thus were unrepresentative of contemporary advances (Ritchie-Noakes 1984). The single most eccentric aspect of their docks was that only a single gate was used on the entrances in tandem with a dry basin between the dock and river (Clarke 2002). Whether Gandon was given a tour of the docks by Henry Berry (1719-1812), the dock engineer at that date, is uncertain, but the tidal nature of the dry dock adjacent to the River Mersey may account for Gandon’s first instinct to provide a dock with no gates, to which the Ballast Board was to take such exception. Once chastised regarding this lack, Gandon still drew on recent experience and proposed a dock with a single gate, emulating the Old Dock in Liverpool designed by Thomas Steers (?-1750) earlier that century, rather than a pair of gates to provide a lock as used in the Grand Canal Dock. The difference between these strategies is significant, as in order to preserve the water level in the dock gates could only be opened for an hour or two at either side of high tide to allow ships in or out while a lock system allowed for entry or exit at any state of the tide (Vernon-Harcourt 1885).
The construction of the entrance and gate were equally anomalous with contemporary practice of the period, though very similar to what is known of Steers’ work. No details regarding the entrance and gate construction of the Old Dock are known however, the timber mitre gates closing on a timber cill and floor construction used in Gandon’s work are a representative description of Steers’ sea gates on the Newry Canal of the same period (McCutcheon 1963), which were known to leak, a flaw also apparent in the Revenue Dock when assessed by Rennie in 1820. By the late eighteenth century dock entrances had advanced from timber-bottomed structures, as used by Steers and Gandon, to a form of inverted arch constructed entirely of masonry, or brick faced with masonry as used by Jessop in the building the locks at the Grand Canal Dock, so as to evenly distribute the upward pressure of water under the floor and walls of the lock (Vernon-Harcourt 439). Dock gates of the period had also evolved into a curvilinear form, again used by Jessop at the Grand Canal Dock, which allowed for the more equitable distribution of forces across their surface and a more efficient use of material (Colson 1894). Similarly, rather than the straight batter used on the Revenue Dock and Steers’ dock before it, walls were by this time more commonly built with a continuous curvature from top to bottom, the object being “to increase the stability of the wall by bringing the centre of gravity nearer the back and somewhat lower” (Colson 1894; Kirkpatrick 1998). Though who first developed this is unrecorded, it is certain that Jessop used this structure, in combination with the regular placement of counterforts, in the Grand Canal Docks in Dublin (Hadfield and Skempton 1979; Directors 1796).

**George's Dock and the Inner Basin**

By 1811 Rennie’s advice was being sought regarding additional docks for the Custom House, for which several proposals had been offered, each of which he duly reviews and repeatedly queries regarding the necessary cill height and the need for a lock structure rather than a simple gate (Foster 1811). Though compelled to provide a draft plan earlier, it is not until 1813 that Rennie submits a full proposal for consideration (Fig. 4). Rennie by this time has acquired considerable experience, having been involved on docks at Grimsby, East Leith, Hull, a series in London including the East India Docks and London docks as well as reports on many others. Rennie’s techniques are therefore far more advanced than could be anticipated from Gandon, however his work in Dublin shows continued innovations on these techniques.

Georges Dock and the Inner Basin, as they were to be later called, were 1.25 acres and 4.5 acres respectively, with a lock to the river as well as a lock between the two docks. This additional lock effectively made Georges Dock an entrance basin to the second dock, a strategy to maintain the water level of the dock that was in practice even at the time Gandon and Jessop were at work in Dublin (Hyde-Page 1801) and that was absent from Jessop’s work only due to its deletion by the Directors for reasons of cost (Directors 1794). The walls and lock structures are built of dressed granite, with a system of counterforts interlocked to the walls with stone coursing (Rennie 1815-21) rather than the iron ties favoured by Jessop (Directors 1794). The inverted arch structure of the locks, earlier used by Jessop, are used here (Rennie 1815-21), but though at Rennie’s earlier East India Docks there appears to be a curvature radiating up the side walls, by the time George’s Dock in Dublin was constructed the side walls of lock entrance were made vertical (Ove 1988c) to ensure a stable width of water regardless of level (Colson 1894). Further advances involved the laying of masonry flat at the gate floor, above the curvature of the substructure, to facilitate the gate mechanisms at the cill, an objective fulfilled at the early London Docks in timber. The curved dock walls have also evolved under Rennie, with the addition of a heel to the back footing of the wall (Rennie 1815-21) to increase its resistance to movement at the toe of the construction (Bray and Tatham 1992). In addition to the upward hydraulic pressure
under the entrance to the dock, the walls of the structure faced similar horizontal thrust from the soils, and the presence of any water in them, often leading to sudden collapses during construction or when a dock was laid dry for repairs (Vernon-Harcourt 1885). Rennie accounted for this problem by constructing sewers around the perimeter of both George’s Dock and the larger Inner Basin to which it led, draining the surrounding soils of excess water into the River Liffey through flap-gates (Rennie 1820c).

Most indicative of Rennie’s approach are the alterations he makes during the course of design. Critical to Rennie’s proposal was the angle of the entrance channel to the Intended Basin (Georges Dock). In reviewing earlier proposals, Rennie had insisted that entrances be at an acute angle to the river to aid a vessel into the dock under the influence of two forces, the current of the tide and a Hauser, suggesting that this angle “can be determined by comparing the Strength of the Current of Tide” (Foster 1811). Intriguingly, Rennie later reverses the inclination of his entrance canal, following a survey to assess the strength and direction of the tidal force relative to the velocity of the current on the river (Rennie 1815), evidence of his careful investigations.

Rennie's earliest work in Dublin in 1801 is also telling, when he was called upon to give an opinion as to the state of the harbour. Rennie spent three weeks in Dublin at this time, with the navigator Captain Joseph Huddart (1741-1816), studying tidal movements, taking soundings and investigating the pattern of shipping and types of ships frequenting the port (Rennie 1801a).
Based on Rennie's survey, the average class of vessel in the port of Dublin drew between 14 and 15 feet of water, with the lower class of West Indiamen and smaller Colliers drawing between 11 to 13 feet (Rennie 1802). Information which Gandon failed to acquire, that could have informed the cill height and water depth of the earlier Revenue dock, which could only accommodate the smaller range of ships even at the highest neap tide. In contrast, Rennie’s locks had 6 foot of water over the cill, an entrance channel 35 feet in width and walls 29 feet 6 inches high, to enable access for any class of ship. Once this information is amalgamated with the specifications outlined by Rennie for the dock construction dated 1815 (Rennie 1815-21), in tandem with later evidence regarding the sewer derived from the Ove Arup survey undertaken during demolition works in 1988, the relative difference between the two docks becomes clear (Fig. 5).

![Figure 5: Section through Revenue Dock (James Gandon) and Georges Dock (John Rennie) (Author 2012)](image)

CONCLUSIONS

The relative difference between the work of Gandon and Rennie on the Custom House Docks could be attributed quite simply to the disparity between the works of a novice versus the well-seasoned practitioner. Docks were not, after all, Gandon’s field of interest, while Rennie had made a considerable career of such work. As a newcomer to the arena of dock engineering Gandon had had learned a good deal from his brief exposure to the Liverpool docks all the while being responsive to adjudication by the members of the Ballast Office as they strove to educate him in this quickly evolving field. There was little reason for Gandon to doubt the worthiness of the model he had been encouraged to study. Even Rennie, on his grand tour of Britain, had visited the very same set of docks in Liverpool in the spring of 1784, four years after Gandon, and commented, “the docks at this place are certainly the finest in Europe” (Rennie 1784). But Rennie of course had laid out a very different career path from that of Gandon and it is not long after this that the docks at Liverpool no longer garnered the initial praise he had laid on them, but a rather more critical report.

But there is more to this than the simple difference between the skills of the novice and the expert. There is also the question of awareness of the forces at play that must be attended in such an endeavour. Rennie is a man who willingly acknowledges his lack of expertise and, when faced with a novel challenge, actively questions the nature of the thing to be built and seeks out the guidance of those more knowledgeable. This is clear from his extensive study on the ships, shipping, tides and winds of Dublin harbour in the company of Captain Huddart. On that same trip he was known to have contacted Jessop as well, to query him regarding the nature of soils in the area, knowing he had recently completed the Grand Canal Dock (Rennie 1801b). Likewise, in stark contrast to Gandon’s first foray into dock engineering, is Rennie’s initial work in the...
field at Grimsby Harbour in 1797, a project which saw the invention of the hollow dock wall in response to seemingly unbuildable soil conditions (Boucher 1963). This was not a newly acquired tendency but one that underpinned Rennie’s engagement with the world around him: an interest in how things worked, and what worked upon them. Even within that first early journal there exists a careful study of the Bridgewater Canal system and its workings: its sluices, gates and basins for water supply as well as its construction. So detailed are Rennie’s notes that it becomes clear that he must have spoken with some one in order to understand the subterranean works on site, implying an understanding that there was more to the works than what was simply visible above ground.

Rennie was sensitized to the primacy of material and mechanical forces, having been predisposed by his background as a millwright supplemented by his university studies, in contrast to Gandon’s background and approach. Though Gandon’s aesthetic judgement and the manipulation of form were well honed, at no point were these sensibilities to be modulated by any activity which could sensitize him to the more primal forces which would come to bear on his work at the Custom House, nor perhaps would he have wished it so. While it is true that Gandon’s work on the original Revenue Dock was undermined by the rapid transformation of technologies underway concurrent to his work, which had relied heavily on Steers’ outmoded construction in Liverpool, the level of curiosity manifested by Rennie is seemingly absent in Gandon’s approach to this original dock. No mention is made of testing tides or surveying the bulk of ships, neither are experts consulted, though on occasion they appear unbidden. Yet, the form and its construction appear remarkably like the Steers’ dock, despite the dissimilarity in physical context. The uncanny resemblance of between these docks suggest that Gandon’s attention was focused on the form, rather than the rational behind it. While the shape of Steers’ Old Dock is remains something of a mystery, recent archaeological excavations by Oxford Archaeology North confirm that the bedrock, on which the walls rest, slopes precipitously downward toward the corner of the indentation in the otherwise rectangular form (Quartermaine and Raynor 2009), suggesting that the bedrock in Liverpool precluded a fully rectangular basin, a condition that was not present in Dublin. The only remaining explanation is that in early docks increased width at the entrance was often provided to enable ships to turn around (Vernon-Harcourt 1885). Whether Gandon was aware of this latter rationale is unclear, but the figure of the dock does relate closely to the geometries planned for Beresford Place and the streets radiating from it north of the Custom House, suggesting he adapted the eccentricity to suit the geometries of his larger urban plan.

Aird’s dealings with Gandon nearly thirty years after the Revenue Dock was complete reveal that Gandon's preoccupations remained firmly attuned to formal aesthetic concerns over the more pragmatic considerations of security, or the required water level to successfully float a ship. Aird’s recommendation to secure the bonded docks and warehouses with a high stone wall were firmly rejected by Gandon who insisted on a lower decorative iron railing (Telford 1822c). Likewise during the course of rebuilding the entrance and walls of Gandon’s dock, despite repeated arguments put forward by Telford and Aird, the Commissioners refused to allow them to raise the west wall of the dock adjacent to the Custom House (Telford 1822d). Though Gandon’s name is never elicited in this correspondence, given the explicit lack of rational by the Commissioners and Gandon’s continued presence, it is possible that the reluctance to raise the west wall of the dock may well have been based on an aesthetic concern raised by Gandon himself. While Gandon’s gifts were undoubtedly as fine tuned as Rennie’s, the two men focused on very different types of information, Gandon’s preoccupation with aesthetic concerns having never been challenged by a different manner of engagement during the course of his training or later career, which profoundly influenced the form of the trio of docks east of the Custom House.
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