

Concrete in the Far North: The Duke of Sutherland's use of Concrete in the 1870s

David Scott Cowan

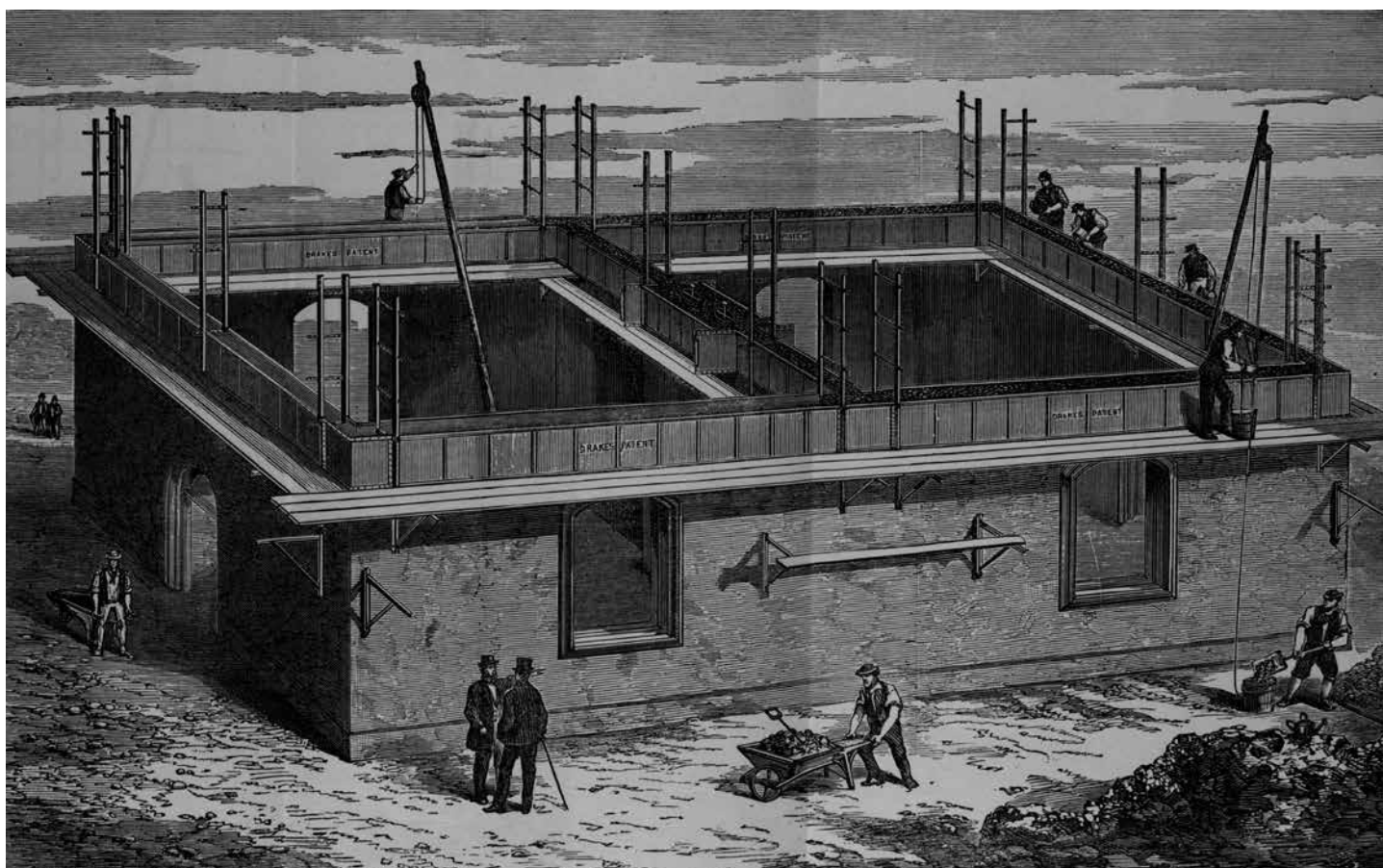


Fig. 1: Drake's patent apparatus for casting mass concrete buildings, 1869. Reproduced by permission of Cambridge University Library.

This article is adapted from a talk given at Helmsdale in June 2022 as part of the celebrations to mark the 150th anniversary of the completion of the Duke of Sutherland's Railway to Helmsdale.

The 16th of May 1871 was 'quite a red-letter day' in Helmsdale, reported the *Northern Ensign*. Although the weather was 'exceedingly disagreeable, a cold northerly wind blowing down the Strath accompanied by occasional snow-showers' a large crowd had turned out to mark the completion of the railway line from Golspie to the new station at Helmsdale. 'Flags floated from various prominent positions ... and shortly before one o'clock the engine *Dunrobin* steamed into the station with a long train of carriages from Golspie and intermediate stations, amid prolonged cheers from the large crowd that had assembled at and near the station'.¹

In all the excitement at the completion of this key link in what we

now call the Far North Line between Inverness and Thurso, one aspect was largely overlooked. The new station at Helmsdale was built of a new material, using a building system patented only a few years previously: it was the first railway station to be built of mass concrete. Among the several newspapers devoting many column inches to the occasion, only the *Ensign* made reference to the station-house, calling it 'a neat and substantial concrete building', and as such it still stands to this day, recently re-purposed as holiday accommodation. There was, of course, nothing new in concrete itself: its history can be traced back to the Romans and beyond. What was new in the mid-nineteenth century was the invention of Portland cement and the patenting of what we now call slip-form casting: a trough made of iron which rises with the building under construction. These two developments made it possible to raise the walls of a house inside of five days. Suddenly,



Fig.2: Former Inn at Overscaig. Author's photograph.

building in concrete became an economic alternative to building in brick and stone, and for the two decades between 1860 and 1880 there was something of a craze for this new style of construction. One of its most enthusiastic proponents was the third Duke of Sutherland, whose name as a satisfied client appeared prominently in the prospectus² of the patentee of the apparatus, and builder in concrete, Charles Drake.

Charles Drake (1839-1892) was the son of a Devon builder who set up in business in London in 1868 and later claimed to have erected 'more concrete buildings than any other person'.³ They ranged from simple agricultural cottages to grand stately homes and also included many public and industrial buildings, such as schools, theatres, hospitals, steam laundries and agricultural buildings. He built entire villages for farms, collieries, textile mills and ironworks. He had a gift for promotion and publicity which included taking prime spots at industrial fairs and agricultural shows. This is possibly how his work came to the attention of the Duke of Sutherland, whose use of the material was noted by the *Aberdeen Journal* in 1872:

Referring to the advertisements of Drake's Patent in our columns, we see that the introduction of this comparatively new mode of building in the North is attracting considerable attention. We believe the Duke of Sutherland has secured a royalty licence from the Concrete Building Company, for the use of their improved concrete builder on his territory, where various houses have been erected with it during the bypast three years.⁴

The Sutherland Estate account books confirm that their first purchase of Drake's apparatus was indeed as early as September 1869.⁵ The first estate building to be constructed was an addition to the Inn at Overscaig on Loch Shin. We have a good account of its construction from the correspondence of the Estate Architect, William Fowler, and of the Dunrobin Factor, Joseph Peacock. We learn, for example, that all the materials and the casting apparatus were conveyed to Overscaig by the estate steamer, whose Gaelic name translates delightfully as *The Midge*. This made good sense when one considers that quite apart from the cement and ballast required, a full set of Drake's apparatus weighed over two tons: it is recorded as being 'fully at work' by late November.⁶ A second building, a cottage at Dunrobin Mains, was begun in the late autumn of 1869, but according to William Fowler it soon ran into difficulties. In a letter to George Loch, the Sutherland Estate Commissioner, dated 23 November 1869, he writes, 'The

weather has been so stormy as to prevent all further work at the cottage. I am afraid we must let this stand over till spring'.⁷ That winter was particularly harsh: 'I have no recollection of such a long winter and such intense frost as we have had this season',⁸ wrote Fowler to Loch in March the following year, and the cottage was not completed until the early summer. While the Duke evinced great interest in the project, Fowler did not share his enthusiasm. 'It has been a most tedious piece of work', he wrote to Loch in April 1870, 'and we have learned that we cannot build concrete walls new in winter. It cannot be done in frosty weather, nor in very wet weather'.⁹



Fig.3: Cottage at Dunrobin Mains, shortly before demolition in 2020. Reproduced by permission of John Mackay, Golspie Heritage Society.

The cottage stood until only a few years ago, by which time it had become derelict, but thanks to John MacKay of the Golspie Heritage Society we have a photograph of it, and it also appears in the background to some family photographs taken in the 1970s by its next-door neighbours. When the author and his wife visited the site in 2022 they found only a corbel bearing the date 1870 which has been thoughtfully saved.

The next concrete challenge for William Fowler was to be Helmsdale station. Until 1870 the line from the south had terminated just shy of Helmsdale at a temporary wooden platform. The new station was to be on a site that was still a little to the west of the town, accessed across Thomas Telford's handsome bridge over the River Helmsdale. Its design was based on the existing stone-built station at Golspie, but executed in concrete. This allowed Fowler to keep the same proportions internally, but because of the thinner concrete walls 'the external proportions are entirely different', as he wrote to George Loch in May 1870.¹⁰ Curiously, the detailed specifications drawn up for the station in June make no mention of concrete: the entire building is specified to be of 'the best rubble (dressed) stone',¹¹ but when construction began in August Fowler wrote to Joseph Peacock saying the estate builder John Sutherland (who had supervised the Overscaig construction) had once again been appointed for 'the concrete work'.¹²



Fig.4: Helmsdale Station. Author's photograph.

Given his reservations about the use of concrete at the Mains, this late change is unlikely to have been at Fowler's behest, more probably it was an edict from the Duke himself – and it seems to have caused quite a stir. Where, for example, was all the apparatus used to cast the walls? In a letter to a Mr Alexander at Lairg, Joseph Peacock wrote on 18 August 1870 'The first day the steamer goes up the loch, mind that she calls at Overscaig to bring down the remainder of the concrete apparatus. Mind that not a bit is left behind'.¹³ It would seem that they did not find enough of it, for in the accounts for November and December 1870 we find two orders totalling just over £50 for additional apparatus from Drake's company. This time, however, the building's progress was not hindered by bad weather: by 16 December Fowler could report to George Loch that 'the upper floor is just erected and the goods shed started and the office is being fitted out', and in April 1871, 'the floors are laid and the partitions in the office and luggage room are fitted up'. The *Inverness Courier* remarked on the novel use of concrete, saying 'the operation has been watched with great interest'.¹⁴ On 23 June Fowler was able to report, perhaps with some relief, that 'Helmsdale Station is completed'.¹⁵

That the use of concrete was being driven largely by the Duke himself is evident from the estate correspondence of the same month. In a letter dated 19 June William Fowler takes issue with the Duke over its proposed use at Lochinver House in Assynt, one of the ducal family seats. In September 1869 the house had been badly damaged by fire, and although no lives were lost, much fine furniture was destroyed and the building suffered considerably. It would appear that the Duke was in favour of rebuilding in concrete, to the consternation of his estate architect, who had not even been asked for his opinion – but nevertheless offered one: 'I am not quite sure whether Your Grace wishes me to give an opinion about concrete for Lochinver House', writes Fowler, 'Concrete in this county can be said only to be experimental, and has only been in usage a short time'. He suggests that 'there might be found risk in using it for so important a work as Lochinver House'. He reports on two minor problems with water ingress at Overscaig and Helmsdale, and concludes, 'I am still of the opinion that concrete may be useful in some parts of the county. I think however that it is still on trial'.¹⁶ His own verdict on the material, it would seem, was a firm 'not proven'.



Fig.5: Concrete buildings in Sutherland mentioned in this article.

Lochinver House was not, in the end, rebuilt in concrete, and there appears to have been little demand for Drake's apparatus on the Sutherland estate for a few years. The next mention of it in the estate correspondence comes in a letter dated 22 August 1878 from William Fowler to Joseph Peacock, the Dunrobin Factor, informing him that 'The Duke wishes the concrete apparatus to be sent to Brora. I have had it looked out and have sent notice to the station master to send it for tomorrow'.¹⁷ This next project allows us to look beyond William Fowler's scepticism and to gain some insight into why the Duke was so enthusiastic about concrete, and where it fitted into his world view. It was an essential part of his grandiose and ultimately ruinous Land Reclamation Scheme of the 1860s and 70s. This was an attempt to re-populate the interior of Sutherland after the depredations of the Highland Clearances fifty years earlier, which had resulted in the estate being made up of a few very large sheep farms, the crofters having been forcibly re-settled on the margins. The Duke's latest idea was to create, by land drainage and improvement, a number of middle-sized sheep farms that could also grow fodder to sustain the sheep in winter. It involved large-scale ploughing by means of steam-hauled ploughs supplied by the agricultural engineering firm Fowler and Sons of Leeds. One of the areas chosen for improvement was around Kinbrace in the Strath of Kildonan, a little to the north of Helmsdale. In all, five medium sized farms were planned there, each with 100 acres of arable land and a further 1,000 acres of outrun for grazing the sheep.



Fig.6: Epidemic Hospital, Urquhart Road, Aberdeen, 1900. Image courtesy of Aberdeen City Libraries.

To oversee the management of the scheme the Duke appointed a Commissioner for Reclamations, a post which reported directly to him, bypassing the hierarchy of the Estate Commissioner and Factors. The job went to an outsider, George Greig, who was a native of Kincardineshire and at the time an employee of Fowler and Sons. Greig described himself (in the 1881 census) as an 'agricultural engineer'. Part of his remit, also bypassing the Estate Architect, was to build the farmsteads on the reclaimed land; and it would seem that he had a clear directive from the Duke that they should be constructed of concrete: a material and a building system of which he knew practically nothing. Perhaps unsurprisingly, Greig seems to have had little support from the estate management. Although he could have learned much by consulting the Factor, Joseph Peacock, the Commissioner, George Loch, or (especially) the Architect, William Fowler, he was obliged to seek information elsewhere. He resorted to asking for help in the pages of the architectural journal *The Builder*, and we can perhaps sense his anxiety behind this seemingly innocent question, which appeared in the issue for 31 August 1878:

Sir, I wish to get information in regard to the building of concrete houses. The Duke of Sutherland is desirous of extending his reclamations in the centre of Sutherland, where there is difficulty in getting skilled labour, and it has been suggested that the houses might be constructed entirely of concrete, including the floors, walls, partitions and roofs. I will feel obliged if any of your correspondents can give us any information whether or not this is practicable, or whether it would be more expensive than the ordinary method of erecting houses. There is plenty of gravel to be got from the burns in the neighbourhood.¹⁸

The letter is signed 'G.G.' The following week there were two replies – one from Charles Drake, who surprisingly makes no mention of the work he has already done for the Duke. He assures G.G. that there would be no problem as to the practicability of building in concrete in Sutherland, and goes on to list its advantages, which include 'dryness, warmth, being fireproof, durable, and especially as regarding the roofs, less liability to need repairs'. Of greater interest, however, is the information that Drake gives of work that he has already carried out elsewhere in Scotland, since he mentions buildings that otherwise we might not have been able to attribute to him, in addition to others that had already



Fig.7: Waverley Hydropathic Establishment, 1876. Reproduced by permission of the University of Aberdeen.

attracted much attention. They include a theatre, a hospital and a slaughterhouse in Aberdeen, and a brief examination of these suggests why the Duke of Sutherland added the new technology of concrete work to his repertoire of engineering projects such as the Land Reclamation Scheme and the railway: they all belong to the same progressive mind-set. In his letter Drake suggests that 'G.G. or his agents may have the opportunity to satisfy themselves by personal examination'¹⁹ of these buildings.

The theatre that Drake mentions was originally named Her Majesty's, and is now the Tivoli. Its façade is of granite, but most of the rest of it is of cast mass concrete. It attracted great attention in the press, partly due to the extraordinary speed with which it was completed – work began in May 1872 and it opened its doors on 19 December of the same year. As Drake says in his letter, concrete is substantially fireproof – a great advantage at a time when theatres burned down with depressing regularity. The hospital had similar benefits for public safety: built as the Epidemic Hospital on Urquhart Road it had its first test in a smallpox epidemic in 1878 and was still serving this vital function as late as the typhoid outbreak of 1964. The concrete walls and floors, though rather cheerless, had the advantage of being easy to keep hygienic and germ-free. Drake's slaughterhouse was just off Wales Street on a site now occupied by the Beach Boulevard, a dual carriageway built in the late 1950s. Little is known of the building that Drake lays claim to, but it is believed to have been built for one of the Fleshers' members, Thomas Knowles. It was described as 'possessing all the most recent appliances and improvements'²⁰ and, being built of concrete, it would have been easy to hose down and keep clean. So in its use of concrete in the 1870s, we find Aberdeen at the forefront of a revolution in building technology and in public health and safety. This advance would not have been lost on the Duke of Sutherland: he too led the way by being among the first in the North of Scotland to adopt the use of concrete and its associated building system.

Mention should also be made of two other significant uses of concrete in Scotland in the 1870s. One is illustrated in Drake's prospectus, on a page where the Duke of Sutherland is named as a satisfied client. The Waverley Hydropathic Establishment at Melrose in the Borders was completed in 1871 and shortly afterwards was doubled in size. It was at the time (and maybe still is) the largest building constructed of mass concrete in Scotland, and was a topic of intense interest in Scotland and indeed around the world. Nothing like this had ever been attempted before; it appears in several photographs by George Washington Wilson which give some idea of its massive scale. It still stands, now known as the Waverley Castle Hotel.

Further down the Edinburgh-Carlisle railway, at Hawick, Drake responded to another pressing need by building what he called 'good and cheap dwellings for the poor'. Hawick was undergoing massive expansion at the time, with the rise of the woollen mills, and the town's population had more than doubled in a decade. The mill workers' living conditions were appalling, with disease and infant mortality at an all-time high. The enthusiasm for the use of concrete this time came from the workers themselves: the *Southern Reporter* recorded how well Drake's work was received:

The concrete system of housing introduced at Weensland last summer, and looked on as Utopian, has established itself in public favour ... A long range of workmen's houses, and a large wool store, have been constructed of that material.²¹

This must surely be the first use of the word 'utopian' in connection with concrete: what it meant was that possibly for the first time in their lives, workers' families could live in a clean, dry house that was free from vermin and easy to keep warm.



Fig.8: Concrete farm buildings, Lochside, Kinbrace. Author's photograph.

It was against this background that the second tranche of the Duke of Sutherland's concrete building was commenced. The Land Reclamation Scheme brought together all of the Duke's technological innovations: the steam ploughs (of which there were eight in all at work), the railway, and now the use of concrete in the farmsteads. To these we could add two more steam driven machines, both patented by Drake: a stone crusher and one of the first powered concrete-mixers. The first would have provided cheap, locally sourced raw materials by crushing the stones hoicked out of the ground by the ploughs, and the second would have turned the resulting aggregate into concrete. In 1879 the *Northern Ensign* reported that 'Mr Greig, the energetic manager, is at present erecting four very fine houses'.²² These were in the Strath of Kildonan, though in fact only three were built. The best example is at Lochside and is now part of the Achentoul Estate. It is virtually untouched since completion. The next best, which has been significantly altered, is at Harvieston on the road to Badanloch. The third, at Bannockburn on the road to Forsinard, was started but never completed. They were all built to a standard plan: the house forms one side of a square, and the farmstead forms a large concrete box, with internal divisions. James MacDonald, an agricultural journalist from Aberdeen, visited the site in 1880, and his report is the best contemporary description we have of the Duke's innovations:

These buildings are of novel construction, being almost entirely formed of concrete. The office houses are covered with one large span of corrugated iron, supported by girders of worn-out rails, which are obtained cheaply at the railway station, and which suit the purpose admirably. With the exception of this roof, however, and the doors and windows, the whole construction is formed of concrete – walls, floors, stairs, roofs, and even the floors of the attics and granaries, which have no support other than the concrete.²³

Cost was a powerful driver for the use of concrete over more traditional materials. James Macdonald tells us that the cost of each of the farms was £450, which contrasts with the £2,000 for similar buildings at Shinness built of stone.



Fig.9: Unfinished farm buildings, Bannockburn, Kinbrace. Author's photograph.

Interesting as the two completed buildings are, we can learn much from the third building, at Bannockburn. Because it was never completed it has never been altered, nor has much of it received the finishing coat of render that was applied to all of Drake's buildings. It is possible to see the lines of the shuttering, at exactly two-foot intervals (these are also visible at Helmsdale Station), and the aggregate is uneven in size and clearly made of the local stone. The reason it is incomplete is also linked to the Land Reclamation Scheme: the whole project was abandoned in 1880. In the words of the Deer Forest Commission, set up in 1892 to examine land use in the Highlands and Islands, it had been 'a failure in every sense of the word'.²⁴ It had cost over £200,000, and the Duke is said to have 'never got a farthing of rent for the whole thing'.²⁵

There are several reasons why we do not find more concrete buildings on the Sutherland Estate. One could be that, as William Fowler feared, the climate was just too harsh: there were reports at the time that the completed buildings suffered badly from condensation, and the week after Drake's letter *The Builder* printed another reply to Greig's enquiry, from a certain J.S.S. who says that he 'knows Sutherlandshire well', and suggests that the concrete walls would not keep out the driving rain²⁶ – a claim that Charles Drake vigorously denied. Another reason is that the construction method went out of fashion. It was an idea that was simply too far ahead of its time. In 1874 Charles Drake made an impassioned and prophetic speech calling for a 'new style of architecture' and he urged architects to find 'the right architectural treatment of concrete buildings'.²⁷ However, the architectural establishment turned against him and this early foray into modernism was rejected in favour of the Arts and Crafts movement which comprehensively rejected system building. Drake died in 1892, the same year as the third Duke, and his dream of a concrete utopia was put on hold until the next century.



Fig.10: Turkish Room, Arlington Baths, Glasgow. Mark Liddell Photography.

This then is the extent of the Duke of Sutherland's experimentation with concrete in the 1870s. But we have one more reason to be grateful to him, and especially to George Greig who in August 1878 picked up his pen and wrote to *The Builder*. Drake's reply to that letter is an important document for historians of early concrete. In it, not only does he expand on his work in Aberdeen but he also makes reference to one of the most daring and innovative of his buildings, and this letter is, so far as the author knows, the only source that links him to it. Built in 1875, it gives us a glimpse of what might have been if architects had responded to Drake's call for a new style of architecture. In what appears almost as an aside, he refers to 'the domed concrete roof of the Arlington Street Swimming Baths, Glasgow'. It is, he says, 'the best of the concrete roofs I have executed in Scotland'.²⁸ The Turkish Room cannot be seen from the street and it is not much to look at from the outside, but inside it is spectacular. The domed ceiling soars to a height of perhaps thirty feet or more, the dark blue plaster pierced with coloured glass stars. The room is heated by a *plenum*, ducting cast into the floors and walls, to a temperature of around 100 degrees Fahrenheit, so even in the coldest Glasgow weather it is as hot as a sauna. Like the theatre, the hospital, the slaughterhouse, the hotel, the cottages and the railway station that we have looked at in this article, it demonstrates the astonishing diversity of concrete buildings that were being commissioned in the 1870s by wealthy patrons such as the Duke of Sutherland and built by early pioneers such as Charles Drake. Together they stand as a monument to a vision that had to wait for a further fifty years before being fully realised.

Acknowledgements

Thanks to: The Earl of Sutherland, for permission to quote from material in the Sutherland archive; The National Library of Scotland; Golspie Historical Society; Timespan, Helmsdale; The Sutherland, Achentoul and Badanloch Estates; The Friends of the Far North Line; Carol Briggs.

References

- 1 *Northern Ensign*, 18 May 1871, p.4.
- 2 Drake Bros & Reid, *Concrete Building by Her Majesty's Letters Patent* (1870), p.42.
- 3 *Journal of the Royal Institute of British Architects*, 10 April 1876, p.228.
- 4 *Aberdeen Journal*, 15 May 1872, p.1.
- 5 National Library of Scotland Sutherland Papers (NLS), Factors' Accounts p.74. Acc 12173/20
- 6 NLS, Architect Letter Books, William Fowler to George Loch, 14 September 1869. Acc 10225/250
- 7 *Ibid*, 23 November 1869.
- 8 *Ibid*, 12 March 1870.
- 9 *Ibid*, 18 April 1870.
- 10 *Ibid*, 28 May 1870.
- 11 NLS, Specifications for Helmsdale Station, 30 June 1870. Acc 10853/552.
- 12 NLS, Architect Letter Books, William Fowler to Joseph Peacock, 5 August 1870. Acc 10225/250.
- 13 NLS, Factors' Letter Books, Joseph Peacock to Mr Alexander, 18 August 1870. Acc 10225/300.
- 14 *Inverness Courier*, 20 October 1870, p.6
- 15 NLS, Architect Letter Books, William Fowler to George Loch, 16 December 1870, 17 April 1871, 23 June 1871. Acc 10225/250.
- 16 NLS, Architect Letter Books, William Fowler to the Duke of Sutherland, 19 April 1871. Acc 10225/251.
- 17 *Ibid*, William Fowler to Joseph Peacock, 22 August 1878. Acc 10225/254.
- 18 *The Builder*, 31 August 1878, p.921.
- 19 *The Builder*, 14 September 1878, p.970.
- 20 *Aberdeen Press and Journal*, 25 March 1874, p.4.
- 21 *Southern Reporter*, 3 December 1874, p.2.
- 22 *Northern Ensign*, 28 August 1879, p.4.
- 23 J Macdonald, 'On the Agriculture of the County of Sutherland', *Transactions of the Highland and Agricultural Society of Scotland*, 1880.
- 24 *Deer Forest Commission* evidence, Maclean, 1892.
- 25 E McIver, *Memoirs* (Constable, 1905). p.119.
- 26 *The Builder*, 21 September 1878, p.998.
- 27 C Drake, 'Building in Concrete', *Proceedings of Civil and Mechanical Engineers Society*, 13 March 1874, p.14.
- 28 *The Builder*, 14 September 1878, p.970

Further Reading

A Tindley, *The Sutherland Estate, 1850-1920* (Scottish Historical Review Monograph, 2010).

G Douglas and SW Martins, 'Concrete Farm Buildings: examples from Sutherland' *Journal of the Historical Farm Buildings Group*, 1995.

P Collins, *Concrete: The Vision of a New Architecture* (McGill-QUP, Montreal, 2004).

David Scott Cowan is the great-grandson of the concrete pioneer Charles Drake (1839-1892). He is a retired television producer and a graduate of the University of Aberdeen.