arq (2022), **26.4**, 357–376.
doi: 10.1017/S1359135522000604

A reflection on the 'ways of seeing' and 'methods of action' developed to manage the conservation of an iconic modernist school with measures to improve environmental performance.

Visualising St Brendan's: mapping a conservation management plan for Birr Community School

Gary A. Boyd, Aoibheann Ní Mhearáin, John McLaughlin and Tara Kennedy

St Brendan's Community School in Birr, County Offaly, Ireland is paradigmatic of a seminal cultural shift in Irish education in the 1960s. It was designed by Peter and Mary Doyle and built in the 1970s as a flexible and extendable system, a mat-building realised in concrete portal frames that articulate a series of generous social spaces including exterior courtyards and an interior 'street' *[1–3]*.

Owned by the Department of Education and Skills, administered by a Board of Management and occupied by approximately one thousand staff and pupils daily, St Brendan's has been in continuous use since its opening in 1980. Generations of its students have benefited from the intimate relationship between the cultural and social life of the school and the architectural form, fabric, and technology that facilitates it. While the management and form of the physical resources of the school have evolved over the decades, by present day standards – due to the lack of consideration given to such aspects at the time it was conceived and constructed – the building is suffering acutely from ongoing material degradation, issues of thermal and environmental performance, and what are now unacceptable levels of energy usage.

This article reflects on an interdisciplinary research project undertaken on the school between 2018 and 2021. It was led by an academic-practitioner team, funded by a 'Keeping it Modern' grant from the Getty Foundation in Los Angeles, and developed within the structure of a Conservation Management Plan (CMP).[1] The project aimed at providing a framework of means and options through which actions to improve and optimise the building's environment and energy usage could be considered, evaluated, and ultimately deployed in a manner consistent with the integrity of the architects' conceptual thinking and the principles expressed within the building.

Within the research lay the opportunity to reconcile the modern architectural heritage of St Brendan's and its embodiment of a new of type of education with the contemporary demands of a growing school in the context of climate change – the realisation of a sustainable educational paradigm for twenty-first-century Ireland. This necessitated a broad, holistic approach, one that involved negotiating the difficult path between the application of conservation methodologies and the realisation of environmental and energy measures and interventions that would, the team hoped, help to ensure the building's continuing viability in its use as a school.

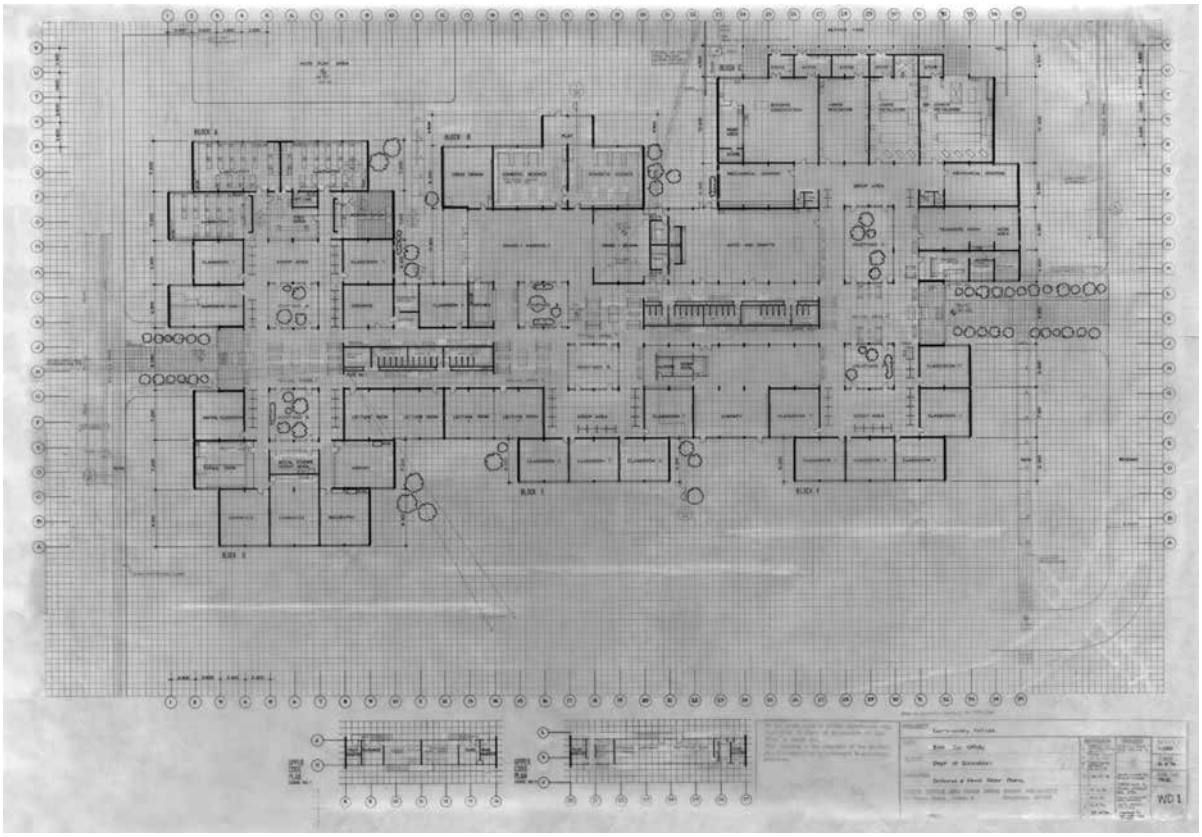
As well as drawing upon international conservation practice and theory, including Marieke Kuipers and Wessel de Jonge's influential *Designing from Heritage: Strategies for Conservation and Conversion*, the research was underpinned by an acknowledgement of 'the three dimensions of modernity': social, technical, and aesthetic as defined by Catherine Cooke and Ivor Richards.[2] These guided the stages of the project as a critical means of understanding the site and its position within modernism. An important concern of the investigations was the series of mutually influential relationships between 'social' and 'technical' aspects of the school.

While the core team had expertise within architectural humanities and design, it was clear from the outset that the scope of the project required a wide range of specialised inputs. Ultimately, we would draw upon, curate, and combine expertise, knowledge and methods from humanities, social science, building science, and environmental disciplines and practices.[3] For the condition survey of the fabric, for example, a conservation engineer was engaged along with a bespoke metal window fabricator. The social research was carried out partly by expertise within the core team but was aided by the engagement of an architectural photographer as it was clear from the building's history that how it had been represented though photography had been integral to its perception and significance as a place. Environmental surveys, meanwhile, required inputs from experts in thermography, air pressure testing, acoustics, building energy usage and systems, and lighting.

The relationships between these phenomena were complex and necessitated an innovative approach in

1

3



2

1 View of St Brendan's Community School, Birr from entrance gate.

2 Plan of the school.

3 View of 'street' social space.

bringing together and, crucially, *visualising* this broad spectrum of historical, fabric, social, and environmental analysis. This was designed to develop an understanding of the school's daily performance, programmatically, socially and environmentally within the context of both its architectural significance and its material vulnerabilities.[4] St Brendan's may have embodied a radical new social agenda for education and indeed society in twentieth-century Ireland in its architecture, yet this building remains unlisted and, until recently, its significance (nationally and internationally) much overlooked. Part of the project's agenda involved raising awareness in the value of the building among existing and potential stakeholders. The creation of accessible forms of communication that would both synthesise and make clear the complex data generated and the relationships between them, was central to the team's approach in forming the Conservation Management Plan.

Ways of seeing

The work was organised in stages. Firstly, the project sought to establish a series of methods of analysis and 'ways of seeing' the school: *surveys* gathered a range of material and information on the building; and *interpretative analysis* examined, synthesised, and re-presented this material. Secondly, with regards to the building's future, the research aimed to define 'methods of action' – *generating policies* and *strategies for intervention* and took the findings from the first stages to establish tools to make decision making on the future of the school easier. From this, a matrix of guidance for the site's future management and future interventions would be established. This both

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

emerged from and responded to the school's own conceptual and physical attributes.[5] Throughout the process there were milestones, the most important of which was perhaps the production of the *statement of significance*. The latter evaluated the findings of the surveys and thereby framed the conditions for the project's final observations and suggestions.

If the first two stages of the project can be designated 'ways of seeing' and the last 'methods of action', all were interrelated and relied on the continuous curation and creation of a wide range of visual material: from archival photographs and drawings to newly commissioned drawings, photographic and filmic studies, diagrams and graphs. These accompanied and complemented textual descriptions. Given the final purpose of the research to establish a means for managing the conservation of the school, communicating in a clear, precise, and evocative way to those stakeholders whose engagement with the project would ultimately be pivotal to its success was of central importance. The contents of the *statement of significance*, for example, were presented in a series of graphic iterations, which included a public exhibition.[6]

The findings and recommendations of the project – the means to manage the future of the building – were evidently of most value to the school. This article, however, focuses more on the methods and processes involved, including visualisation. The American architect and theorist, Stan Allen has categorised the architectural drawing as 'an assemblage of spatial and material notations', a means of communication and projection. It can be used either to transform reality by building, or else effect a new understanding of reality by describing and revealing relationships between physical objects and invisible systems, networks, and contexts. The representations of St Brendan's that were produced all highlighted critical aspects of the building. However, the series shifted in function towards the end of the project from description and analysis to more explicit instruction – what Allen has termed 'allographic' – drawing as communicating directions for others to carry out.[7] But while these emerged from a close engagement with a specific artefact, this article argues that the 'ways of seeing' and 'methods of action' developed and visualised here – in response to the tenets of modernism as identified by Cooke and Richards and deployed by Kuipers and de Jonge[8] – contain the possibilities of a broader application in the conservation of other mid-twentieth-century buildings.

The surveys

The first stage of the project – executing the (i) historical; (ii) present condition; (iii) social; and (iv) environmental surveys – was designed to create as broad a picture as possible of the school within the context of both its architectural value and its material vulnerabilities. The surveys evoked different approaches: humanities-led methodologies, which sought to establish its position within national and international architectural as well as local and national culture; social science methodologies which, among other things, involved interviews concerning the current use and personal experiences of the building; and finally, building science approaches incorporating detailed examinations of the physical fabric of the artefact as well as the measuring and recording of its current environmental conditions.

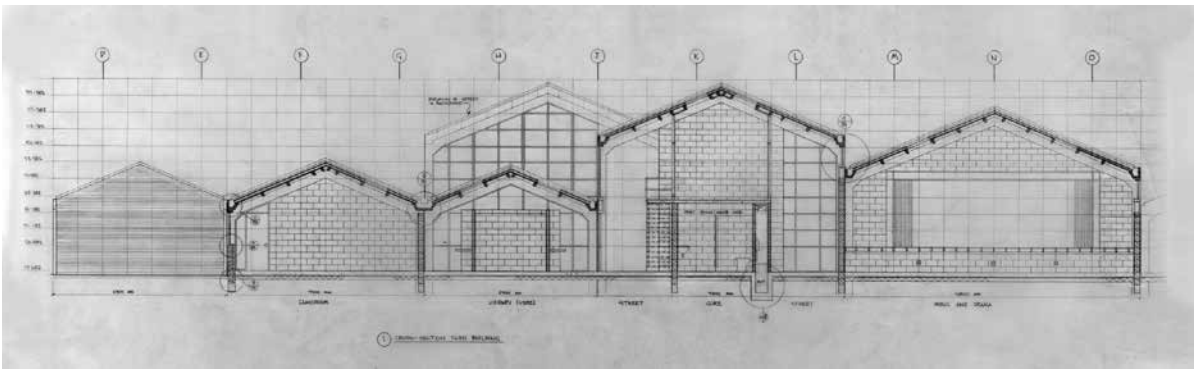
(i) Historical survey

The historical survey involved a mix of methodologies, including archival and desktop research, oral interviews, and site visits. Oral interviews provided subjective forms of information and perspectives on the material uncovered by the archival and desktop research.[9] While Peter and Mary Doyle are sadly deceased, the research team had the opportunity of interviewing Peter Twambley and John Meagher, both of whom had worked in the Doyles' practice and on the Birr project.[10] They provided additional insights on the processes involved in conceiving and refining the design. In addition, the Doyles' daughter Ann, also an architect, was interviewed. Talking to her allowed a widening of the focus to rest on broader issues such as how her parents thought about architecture in general when she was growing up, and in the period when the building was being designed. Similarly, personal insights, this time from the client side, were provided by discussions with the original school principal – who liaised with the Doyles on the development of the built design – as well as his successors who oversaw its subsequent operation and management as a school, as well as its physical extensions.

The design for St Brendan's emerged from an architectural competition in 1974. Initiated by the Department of Education and administered by the Royal Institute of Architects in Ireland (RIAI), this aimed to generate new concepts for school buildings as well as select possible consultants for new school commissions.[11] The competition had been a result of an influential governmental report *Investment in Education* (1962) and subsequent legislative acts and policies such as the *Free Post-Primary Scheme* (first implemented in 1967). These collectively promised a democratic and secular education for the first time in Ireland and the concept of a 'community school', which offered both academic *and* practical educational opportunities to its students. Significantly, the competition brief did not specify a particular site.

The Doyles' entry did not win the competition but its placing secured them commissions to design three schools for the Department of Education: St Brendan's in Birr; the Community College at Firhouse in Dublin (1985); and Cashel Community School in County Tipperary (1987). Whereas versions of the premiated entries in the competition – first and second places were awarded to the architects Delany MacVeigh Pike, and Andrzej Wejchert, respectively – were also built, St Brendan's is widely considered to be the finest school of its generation. It was awarded the RIAI Triennale Gold Medal for the

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press



4

5

4 Section showing the various heights of the portal frames.

5 The school under construction showing its factory shed qualities realised by the cheap concrete portal frame.

best building built in the period 1980–2 and appeared on the cover of the *Architects' Journal* in December 1980.[12]

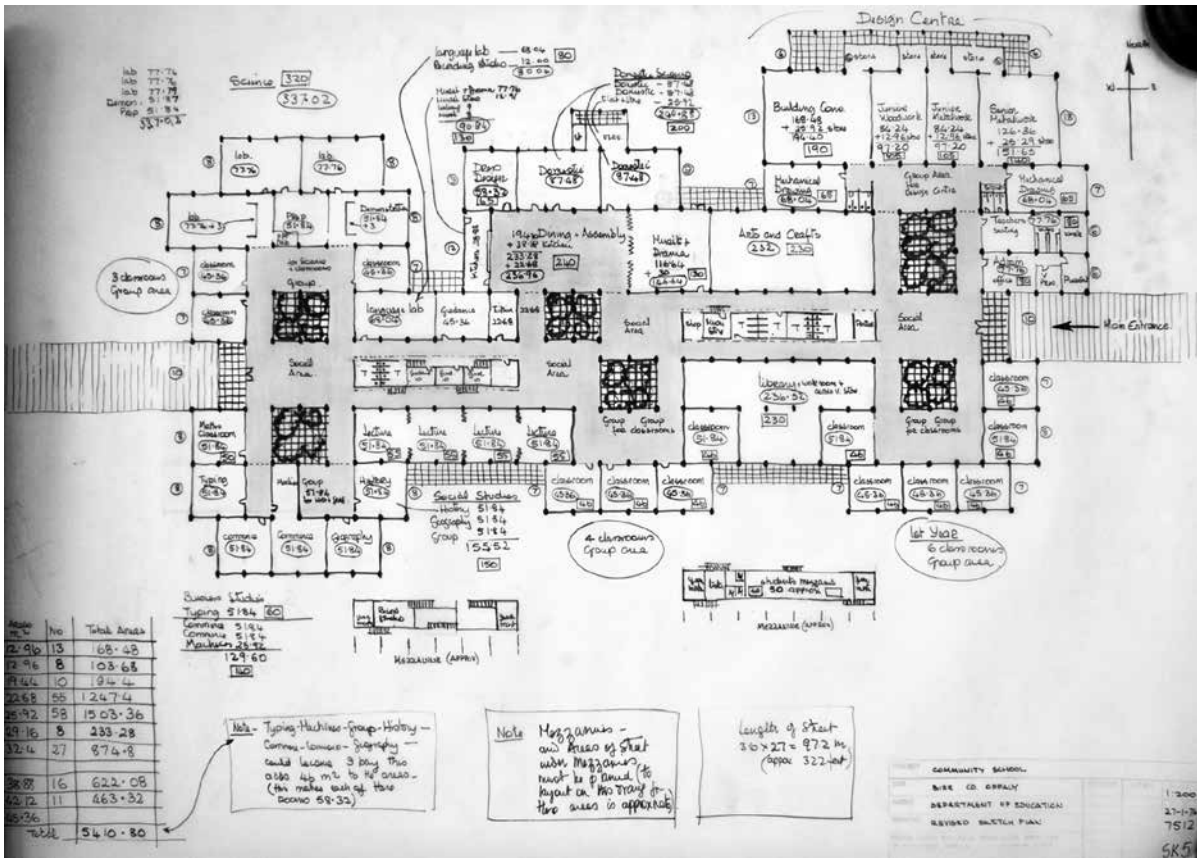
The Doyles' mat-plan of cheap, standardised portal frames of differing widths and heights may have offered a generic solution to the new educational environment *[4]* but it was also geared specifically to the context of Ireland's (straitened) *economic* conditions. As the architects suggested:

> *[T]here is little place for grandiose architectural monuments in a small, not very wealthy social democracy such as Ireland. Our approach is to build simply and hopefully with integrity [...] this usually means using available technologies and inexpensive material, all at minimum cost.*[13]

Yet the origins and influences of the building were international. Writing in 1980, the architectural critic and photographer John Donat described the building as an 'unlikely axis between Mies van der Rohe (whose planning grid at ITT in Chicago uses the same dimensions as the structural grid at Birr), Aldo van Eyck, Herman Hertzberger and Norman Foster'.[14] As confirmed in an interview conducted by the team with Twamley, Peter Doyle had studied in the Illinois Institute of Technology and subsequently worked for Mies van Rohe. Prior to this, both he and Mary Doyle had graduated from University College, Dublin before working for Michael Scott and Partners, Ireland's foremost modernist practice in the 1960s and 1970s.[15] The research team also identified affinities between St Brendan's and other iconic twentieth-century buildings, including Hunstanton Secondary Modern School by Peter and Alison Smithson (1949–54) and the Free University of Berlin by Georges Candilis, Alex Josic, and Shadrach Woods (1963). As part of this contextualisation, members of the team visited both buildings while other buildings of special interest to the project were also identified, studied, and visited. All of these were iconic examples of twentieth-century modernist architecture that shared: some characteristics with St Brendan's through a combination of common conceptual roots, similar construction methods and materials (in particular concrete-framed construction with large amounts of glazing); cognate functions; and/or had also undergone exemplary recent conservation work addressing issues similar to the ones faced at Birr – the Van Nelle Factory in Amsterdam (Brinkman and van der Vlugt (1931)), refurbished by Wessel de Jonge Architecten (2004); the Open Air School (Jan Duiker (1930)), refurbished by Wessel de Jonge Architecten (2010); University of Leicester Engineering Building (James Stirling and James Gowan (1963)), refurbished by ARUPs (2017); and the refurbishment of the Free University Berlin by Norman Foster and Partners (2005).

This research helped to locate the ideas expressed by the architects – in their discussions of their work in secondary sources or as revealed in the oral interviews – within an international architecture culture. In 1990, for example, Peter and Mary Doyle stated that 'buildings should be expandable, they should be flexible [...] ideally there is no fixed form'.[16] This echoed the conceptual underpinnings of the Free University, Berlin while St Brendan's also paralleled the aspirations of building through open systems seen elsewhere in postwar modernism.[17] At same time, according to the Doyles, the school was also conceived as 'a factory shed',[18] one that simultaneously drew on the construction techniques and technologies associated with the industrial vernacular of buildings associated with the Irish

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

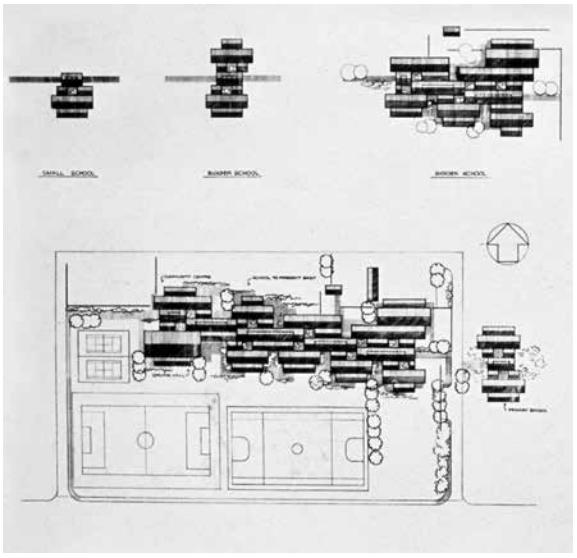


6

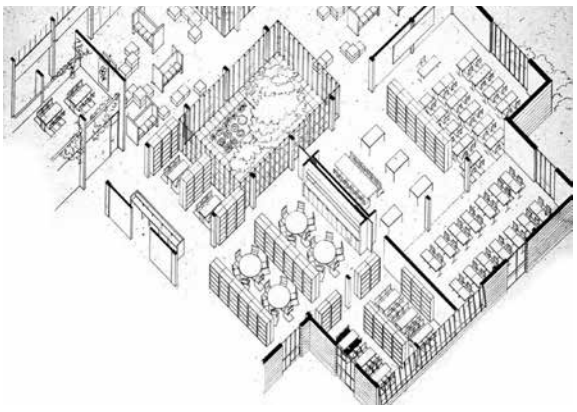
6 Sketch plan of school with 'street' highlighted.

7 Plan showing possible expansion and contraction of the portal frame system.

8 Competition entry axonometric showing occupation of space.



7



8

state's Industrial Development Agency (IDA) and its remit of attracting direct foreign investment into the country *[5]*. To this was added a stated eschewal of aesthetics as anything more than an unselfconscious outcome of the design process. Mary Doyle emphasised that she did not 'do' elevations – 'The elevation is the section … [t]he constructed details coming out in the façade.'[19] Meanwhile Peter Doyle, in responding critically to the emergence of a postmodernist architecture within Ireland, proposed in 1990 that:

> *The only way you can design a building is not to give it superficial signs to the public. I think the problems are much deeper than that. It is very dangerous for the architects to think of getting responses from the public through superficial means of expression. It is a very dangerous idea.*[20]

The *historical survey* also benefited from a close engagement with the drawings contained in the Peter and Mary Doyle Collection at the Irish Architectural Archive in Dublin. Including design and working plans, sections, axonometrics, planometrics, details, and sketches executed at a series of scales, these drawings aided an understanding of the design process – from the development and iteration of initial conceptual ideas and their evolution, to the specifications of materials and how the building would be fitted together. Unsurprisingly, there are numerous

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

iterations of the plan – often with the internal street highlighted – as it resolved itself into its final versions, *[6]*, firstly for the competition entry and secondly, often on gridded modular paper, as it progressed towards the site-specific plan for Birr. Iterative investigations of the sections are also present. These define the side-by-side and stepped, overlapping relationships of the different-sized portal frames to each other and thereby the economic means by which the building realised its rich variety of interior spaces. Other sets of drawings demonstrated the possibilities offered by the portal frame system for expansion and contraction *[7]*.

Despite an evident emphasis on structure and its articulation and components, how the spaces produced would be occupied is also clearly considered and proposed. A planometric for the competition entry, for example, shows an arrangement of spaces clustered around one of the courtyards formed by the portal frames and enclosed by brick and block walls. These spaces are shown fully occupied by furniture, some of which Peter and Mary would ultimately design specifically for the school (and equally economically in veneered chipboard and steel sections). The courtyard itself, meanwhile, is depicted as full of planted greenery including, touchingly, a small vegetable patch containing rows of cabbages that presumably were to be planted by the students *[8]*. Drawings like these seemed to confirm the architects' intention of the school as a type of infrastructure, one of a series of 'non-monumental'[21] buildings designed by the Doyles that facilitated the expressions of their inhabitants rather than that of the building itself. The drawings, however, were not only instructive to the understanding of the building generated by the *historical survey* but would also become influential in the graphic explorations and representations of the building and its attributes produced by the research team.

Finally, the historic survey helped to reveal and map how the building evolved over time from its ideal state in a site-less competition brief to the numerous extensions that were made as the school grew from its initial execution on the outskirts of Birr. Within this, the building fulfilled the architects' conceptual expectations of expendability and adaptability. The building has been extended four times: in 2010, 2015, 2016, and 2017. These interventions, by a local architect rather than the Doyles, took place on the periphery of the building and were confined to new classrooms, a new hall, and additions to its administrative capacity – on the south, north, and eastern ranges, respectively. These developments were encapsulated in the research in a so-called *Chrono Map*, which uses hybrid forms of plans and overlaid contemporary and historic (*Then and Now*) photographs to highlight and compare the additions to the building over time. On all occasions, the architect attempted to follow the material aesthetic and modular structure. But there was one key amendment. Whereas in the original construction, the portal frame structure ran from outside to inside the building, in the new interventions the portal frames were provided with a thermal break to prevent cold bridging.

In the early 2000s, prior to these extensions, the roof was replaced and associated works undertaken. These closed off the internal rainwater pipes originally contained within the concrete columns and introduced new downpipes to the exterior of the building. While this eliminated the problem of cold and leaks from the internal downpipes, it introduced a new problem. The water in the gutters now had to travel up to 40 metres to reach a downpipe, with the additional volume of water carried by the gutters increasing the risk of ponding and water penetration to the interior. Furthermore, the resolution of the new roof negatively altered aspects of the Doyles' considered interior environment. As would be revealed in the *Then and Now* photographs of the *social survey* and confirmed in the *environmental survey*, the positioning of rooflights in the new roof caused an uneven and problematic distribution of light across many of the classrooms. In addition, as well as other changes to details – including the introduction of a more corrugated and light-trapping soffit – the new roof also ignored the original colour scheme, which again had been designed by the Doyles to help the distribution of light throughout both the classrooms and social areas.

(ii) Condition survey

The *condition survey* into the physical state of the existing building was composed of four parts: drawing survey, condition survey, opening-up works, and window survey. The drawings of the school held by the Irish Architectural Archive were incomplete, a fact that only became known to the research team when another complete set of working drawings including details emerged in the possession of a local architect who had been involved previously in working on the building. These drawings – which represented a wide variety of scales (up to and including 1:5) – were added to a growing set of historical data. Combined with an entirely new commissioned measured survey of the existing buildings including its extensions, this began to allow comparisons to be mapped between what was supposed to have been built, what had been built and what had been altered in the intervening decades. Thus, the survey of the present condition of the school, which focused on its physicality, both expanded and complemented the contextualisation offered by the *historical survey*.

Often guided by visible deterioration and at typical points of failure in the fabric of the building, the *condition survey* also sought to expose the unseen or hidden conditions by way of opening up works. These were also used to confirm suspected energy losses due to materials – for example, in the cavity where the insulation had degraded. The survey provided a series of key findings. The concrete frame, including purlins and edge beams was structurally intact. Many of the windows could be repaired. The visibly evident rainwater penetration at the eaves beam was concentrated where the valley gutter lengths were longest, principally along the main circulation areas where the water ingress was

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

9 *Then and Now* comparative photographic study.

causing plaster to spall and adjacent timbers to rot. There were unbroken thermal paths from outside to inside caused by the arrangement of the concrete frame, eaves beam, and tiled cill. The condition of the wall ties within the cavity was unclear but there was partial corrosion of the steel lintols examined, which needed to be replaced. Some of these issues would resurface in the *environmental survey*.

(iii) Social survey

Three overlapping methods were used in the *social survey* to map the social life and ongoing inhabitation of the school: observational survey, consultation survey, and user-driven survey.

The observational survey involved the use of photography and film. Replicating the viewpoints and technologies used by John Donat in his original photographs of the school from the 1980s, a professional photographer was commissioned to realise a series of *Then and Now* comparisons *[9]*. In addition, the main social spaces were captured in time-lapse to reveal patterns of occupancy over the course of a day. This was complemented by a series of short walk-through films, which allowed fragments of the social life found within the variety of spatial conditions of the street to be represented. The consultation survey involved filmed 'walking interviews' with a cross section of the school's population, including two teachers and five students.[22] These were designed to further understand their use of the building, their daily routine and their relationship to the spaces they occupied. The interviewees themselves determined the routes of the walking interviews, and their descriptions of their daily lives as well as the places within the school that were meaningful to them .

The user-driven survey represented the students' personal experience and captured their attitude and feedback on aspects of the school's spaces including 'aesthetics' and 'comfort'. Again, this was achieved through photography but this time it was the students themselves who were the photographers, tasked with shooting the school under five different categories: places they 'liked the look of'; 'feel represent the spirit of the school'; 'feel comfortable in'; 'feel uncomfortable in'; and 'like to spend time in'.

The imagery and depictions of the school thus produced highlighted the value given by its occupants to its social spaces, particularly the street, that emerged as the focus for the categories of 'spend time in', 'feel comfortable in', and 'feel represented the spirit of the place'. Within this space it was observed that the original benches provided by the architects still represented the centre of social life, hosting everything from homework to impromptu birthday parties. The courtyards also featured on the students' radar, with photographs taken looking through them also being defined as representing the 'spirit of the school'. Many students also sought to capture the relationship between the inside and outside of the building, unconsciously affirming one of the key principles of architectural modernism.

Significantly, and corroborating the original

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

conceptual thinking of the architects, the building was not captured in elevation or from a distance as an object. Rather, the frequency of depictions of its messy active spaces and inside-outside relationships confirmed the intimate connections between the specific use of the building as a school and the materials, form, and organisation that facilitated these informal but critically important spaces of learning. The findings of the social survey and its overlapping methods, therefore, supported the view that one of the key significances of the site was the indivisible relationship between use and space and, therefore, a confirmation that both function *and* fabric should be the focus of any programme of conservation.

(iv) Environmental survey

The *environmental survey* incorporated a series of perspectives to generate a snapshot of the typical environmental conditions experienced within the school by its users: sound and daylight; air quality, temperature, and relative humidity (RH); air pressure; thermography; thermal bridge analysis; and analysis offered by the Passive House Planning Pack (PHPP) design tool. As stated above, the onsite testing and monitoring was conducted by a series of expert consultants using state of the art techniques. These were carried out in those spaces whose activities were most likely to be sensitive to fabric failure or inadequate environmental conditions. As classrooms are the location of focused study and stationary concentration, many but not all the observations were carried out in these spaces. To allow comparisons, both original classrooms and classrooms within the newer extensions to the building were tested and monitored.

The acoustic environment tests measuring key criteria – Horizontal Airborne Sound, Indoor Ambient Noise Levels and Reverberation Time – were carried out within typical classrooms in both the original design and the extension as well as a larger classroom type, the canteen, and the assembly room. The findings were mapped against *Acoustic Performance in Schools* guidelines of the Irish Department of Education and Skills.[23] The measurements showed that the spaces often did not meet current acceptable levels: sound insulation levels between classrooms and the corridor were low, indoor ambient noise levels marginally exceeded minimum requirements in one of the classrooms, and reverberation times in all the rooms examined were longer than desirable.

The daylight analysis was designed to measure and assess levels of natural light within (i) a typical classroom, and (ii) a larger learning space, using daylight modelling software. Analysing the social spaces was not considered a priority as a varied light level across these spaces was considered beneficial. The analysis confirmed that the replacement roof (built in the mid-2000s) had significantly altered the provision, dispersal, and quality of lighting, introducing new rooflights that were fewer in number and larger than the original built scheme. This caused excessively strong lighting beneath these rooflights resulting in too much contrast with the darker areas of the classroom. While in classroom's original design the side light from the windows was balanced by the rooflights deeper into the plan, in the current situation the rooflights do not provide sufficient daylight deep into the classroom.

The indoor air quality (IAQ) testing was conducted using AuHoo IAQ monitors located in three classrooms for four weeks at a time. This was designed to identify pollutants – Nitrogen Dioxide NO_2; PM2.5; tVOC; Ozone O_3, Carbon Dioxide CO_2; Carbon Monoxide CO – and when they emerge over a twenty-four-hour period. The results were measured against the Irish government Department of Education and Skills guidelines and identified a clear issue with elevated CO_2 levels at times when the rooms were fully occupied. Such levels generally cause users to have a reduced ability to concentrate, some lethargy and, in the upper levels, headaches and indicate the necessity for increased ventilation. While tVOC and PM2.5 levels showed average, acceptable rates, there were some spikes in PM2.5 across the weeks. These were assumed to relate to times when cleaning or spillage of cleaning materials occurred.

Temperature and relative humidity (RH) levels were captured by sensors installed in various locations around the school to represent the variety of different conditions present. These were in position for a period of eight weeks. The temperature readings indicated that while the rooms measured reached the required comfort temperature of 20 degrees, it seemed this was a result of the heating being turned on occasionally in the middle of the night. Consistently across the day the temperatures dropped from highs of up to 24 degrees down to 15 or 16 degrees by the end of the school day and as low as two degrees during the night. While the building could reach the required temperatures, it was clear it could not steadily maintain them. This was evident in the rapid fall-off of temperatures once the heat was turned off. There did not appear to be an issue with abnormally high or low relative humidity levels in the school. This was a positive finding, which explained the absence of visible mould growth, and was assumed to be a consequence of the excessive ventilation caused by air leakage through the fabric. Accordingly, any change to the internal environment to improve airtightness and mechanically ventilate the space may have a future effect on this, impacting the RH and potentially causing an increased risk of condensation and associated issues of mould growth and fabric deterioration.

The air pressure testing to determine air leakages, air permeability, and air changes per hour was conducted using an anemometer and air blower tests. The tests were undertaken in accordance with the provisions of the standard IS EN ISO 9972:2015.[24] Three specimen classrooms were chosen to correlate the results with the temperature, RH, and IAQ tests. The results showed several leakage points including: through the floor, column junctions, window junctions, external doors, wall plate, roof panels, and rooflights, as well as interior leakages between the sample classrooms and other spaces.

Thermography captured visualisations of heat loss

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

within the building. While measured in subject spaces, the instances of elevated heat loss recorded at, for example, the concrete columns – which run from outside to inside without any insulation – are evidently repeating cold bridges whose thermal properties can be assumed to be consistent throughout the building. A similar situation existed for the wall plate. The thermography study led to further thermal analysis of cold bridging at key typical junctions in the building including the eaves details and floor foundation perimeter details. These were inspected onsite and the existing condition modelled via numerical modelling software in accordance with BR497 and IS EN ISO 10211:2017.[25] Following this, two alternative scenarios modelling the effects of interior and exterior insulation were developed. While the insulation modelling showed marked improvements in heat loss through thermal bridge calculations, they were conducted without considering construction feasibility or suitability from a conservation perspective. Accordingly, there were significant limitations to these scenarios.

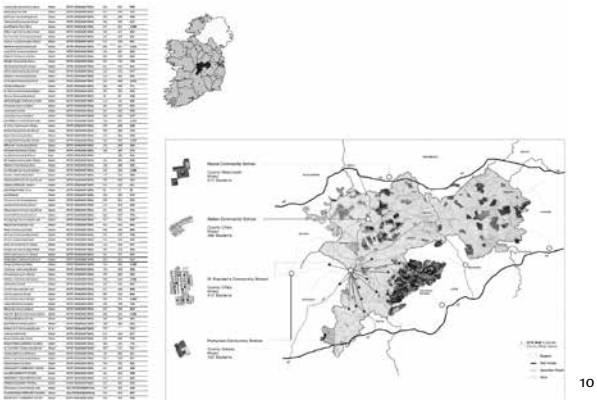
The final environmental survey involved the creation of a model using PHPP software to establish the current building performance levels with regard to fuel consumption, system sizing requirements, ventilation heat losses, overheating risk, primary energy consumption, and carbon emissions (where sufficient input values were available). A full model of the building was constructed in SketchUp and exported to the PHPP software (v9.6) using DesignPH plugin. The windows were entered manually in PHPP due to significant computational issues caused by the extent of glazing. From this, the annual heat demand was estimated at 255kWh/m^2.annum final/delivered energy. To put this in some context, a new-build Passive House school would have an annual heat demand of 15kWh/m^2.annum.

The extent of the glazing and poor performance of the windows meant that these elements contributed to about 55% of the overall heat loss. By contrast the roof, being of relatively modern construction, contributed about 5%. Despite being uninsulated, the extent of the floor slab, due to its relatively efficient overall shape, and the thermal mass effects of the ground meant that it contributed only circa 15% of heat loss. The external wall heat losses were estimated at about 25% of overall fabric heat losses. While it is difficult to predict heat losses from convection/ventilation/air infiltration without carrying out pressurisation testing on the entire building, the PHPP calculated total heat losses from these sources to be approximately 33% of the total. However, IAQ monitoring suggested the building is not sufficiently ventilated for the number of occupants, but simultaneously having relatively high infiltration losses due to gaps/cracks/leaks in the fabric. Therefore, it is likely that the estimated losses due to ventilation/infiltration were over-estimated in the PHPP as it assumed adequate ventilation provision.

The testing and measurement generated a significant amount of data. This generally confirmed and quantified against current environmental guidelines, the qualitative findings from other sources including formal and informal discussions with staff, students, and members of the board of management – that the school and its classrooms: were too hot in summer, too cold in winter; often suffered from inadequate ventilation, yet still leaked significant amounts of air; had unequal or inadequate dispersal of light and problems with glare; experienced issues with acoustic transmission; and that the building was significantly inefficient in its energy use.

Interpretive analysis

If the first stage of the research was about the gathering and initial collation of information, the second stage used this information to reveal otherwise unseen relationships in the school by exploring, synthesising, and visually expressing the connections between the historical, condition, social, and environmental surveys. The two principal creative methodologies used – *drawing* and *film* – were joined by a third, *the diagram*, as the 'ways of seeing' began to crystallise into 'methods of action' around the pivot of the *statement of significance*.



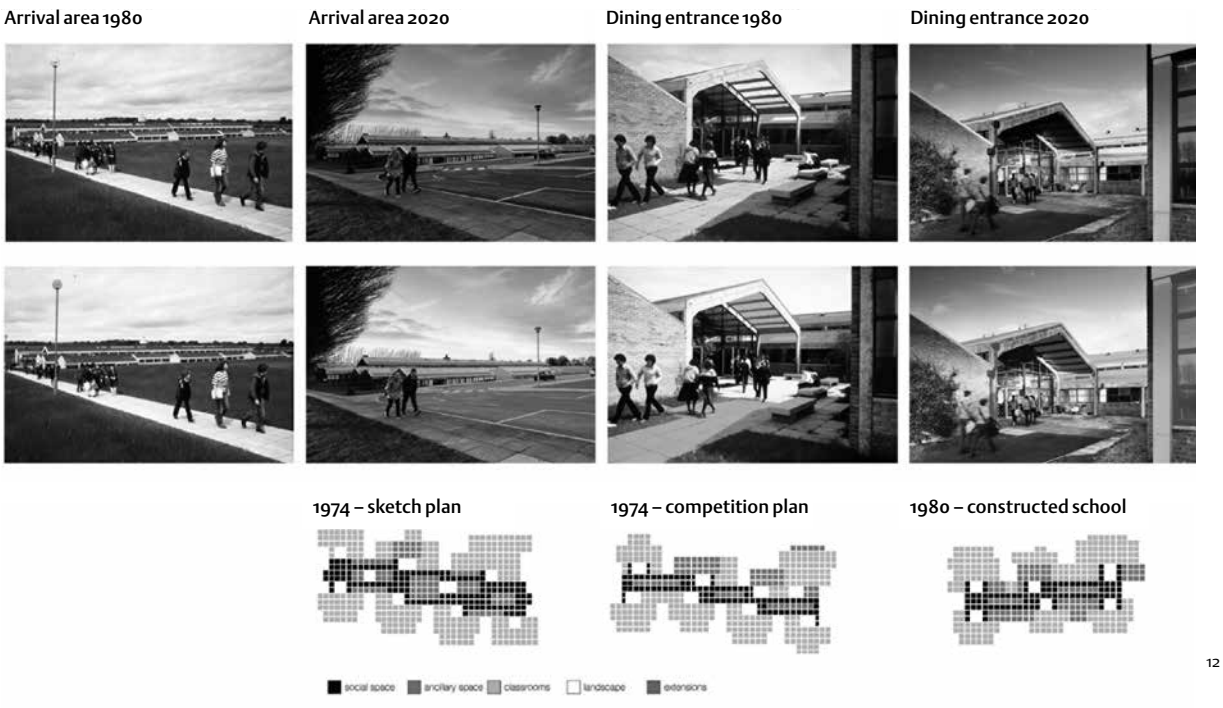
10

11

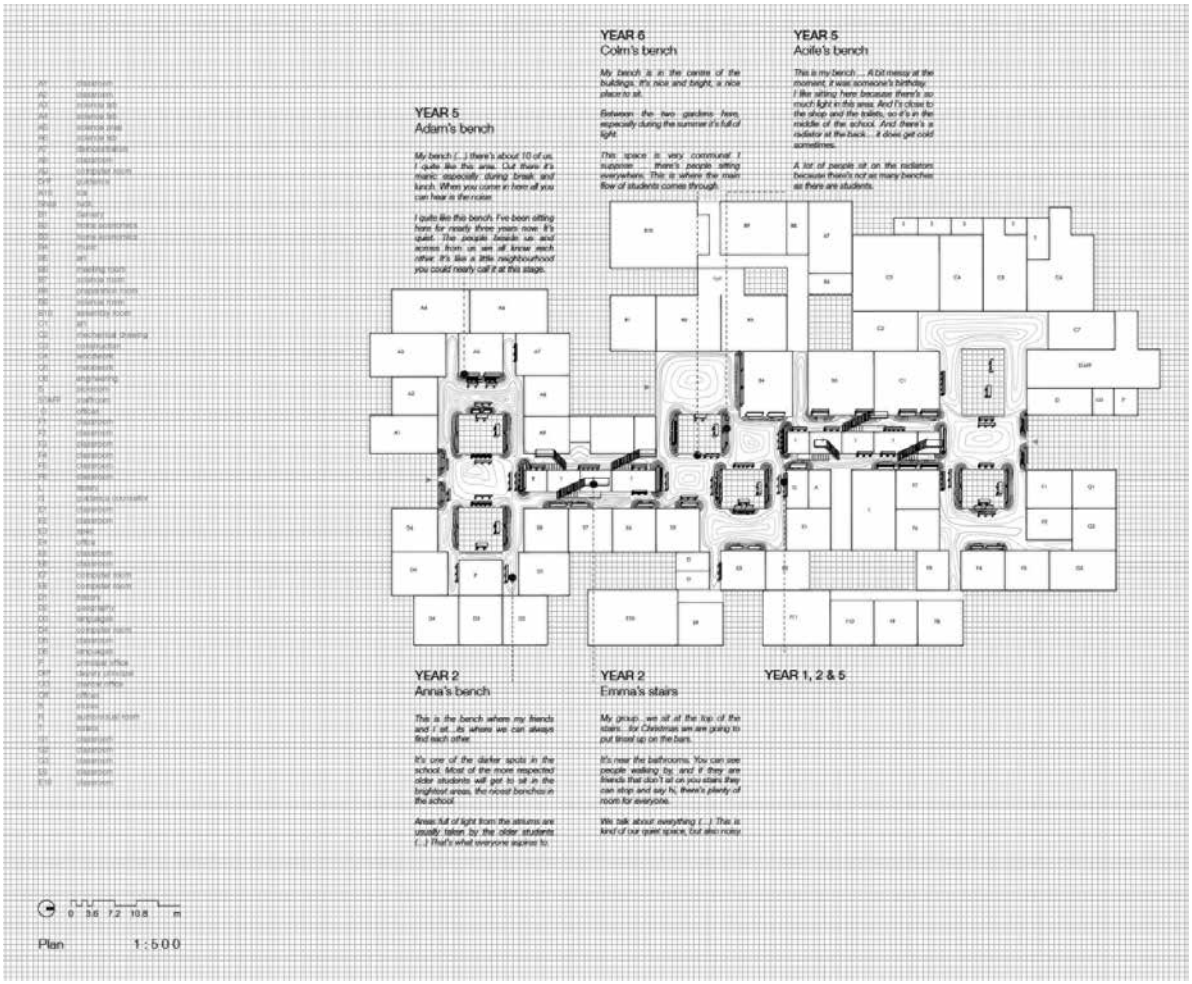
10 *Network* map. This establishes the building as part of a larger series of educational facilities and spheres of influence.

11 *Location* map. This iterates the building's position (circled) on the edges of Birr in a suburban landscape of gentle undulations punctuated with low-density housing developments. It also draws attention to the nearby 70 acres of bogland owned by the school. The identification of this latter landscape suggested a potential future energy resource for the school.

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press



12

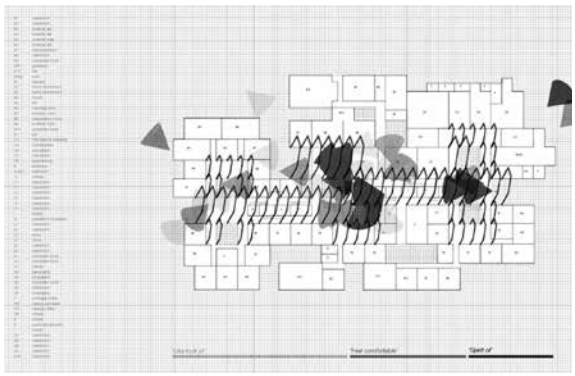


13

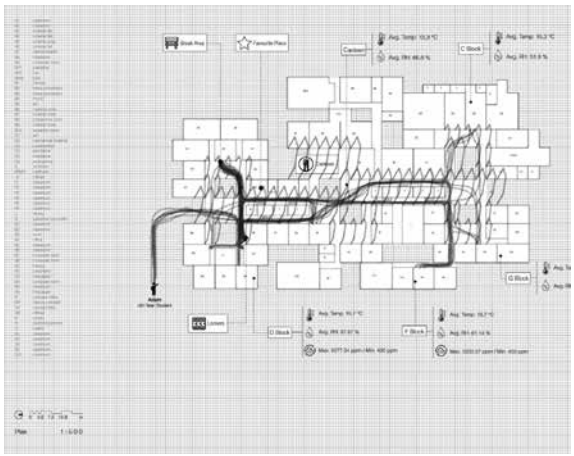
12 *Chrono* map. Originally in colour, this showed the evolution of the building over time through mapping its extensions and provided photographic overlays highlighting changes in components and elements and their relationships to the whole.

13 *Social Heat* map. This combines the conventions of a weather map with the observations of some of the building's users to provide an understanding of and communicate the densities of occupation and types of activity found within the 'street'.

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press



14



15

14 *Student Photography* map. The mapping of where the students had taken their photographs confirmed the centrality and value of the street to the social life of the school.

15 *A Week in the Life* map. Mapping a single student's experience against the backdrop of environmental data (temperature, relative humidity, and the percentage of carbon dioxide present), this drawing provides an indication of the student's frequency of occupation of spaces within the school and the environmental conditions experienced within them. This is placed within the context of more subjective observations concerning the value placed by the student on certain locations and spaces.

Drawing/mapping

Representing the intangible aspects of the school involved the making of a series of new mappings under the following headings: network, location, chrono, social heat, photography, and environment. Each sought to reconcile hard with soft data, showing physical properties overlayed with ephemeral aspects such as time, networks, experience, temperature, etc. These mappings were considered as both a method of further analysis and a means of representation – a mode of conveying complex information to stakeholders in an efficient and accessible way.

The *network* map contextualised the building as part of a wider space of school and education facilities. The map shifts the idea of place as being solely connected to a location to instead showing it as a series of relationships in a system and, in that sense, open to change *[10]*. *Location* established the school's relationship not only to the town of Birr and its suburbs but also to the landscape of boglands, which, during the twentieth century provided employment, contributed to the culture of the area and, significantly, provided the original heat source for the building. In fact, the school was given some 70 acres of bogland as an educational resource in the 1990s, a fact that is noted on the drawing *[11]*.

Chrono-mapping examined the changes to the building over time using two methods, comparative photography and a series of diagrammatic plans that showed the evolution of the building from initial sketch to its present condition, including its extensions. The *Then and Now* photographic study produced in the first stage was further analysed and rendered to highlight the differences that had occurred. A red tone applied to the 1980s photographs indicates elements that have changed, a blue tone on the 2020 images indicates where elements have been added. Seen together they provide a precise snapshot of the key changes that had taken place within the building's fabric and landscape *[12]*.

A series of maps extrapolated from and spatialised the findings of the social surveys. The *social heat* map, for example, uses a series of contour lines – like the isobars of a weather map – to represent the frequency and density of occupation of the street *[13]*. Meanwhile, the *student photography* map represents the huge concentration of the students' interest in the social spaces *[14]*, while *a week in the life* tracked the journeys and daily experiences of a single individual, Adam, a fifth-year student. This information was further overlaid with environmental data to give a picture of the school's daily flux *[15]*.

The often-complex environmental data was also re-presented in a series of drawings and diagrams that conveyed the information in a more immediate and user-friendly format. The *weekly temperature and relative humidity* map, for example, was composed in a circular form that temporalised the readings in two hourly increments across a typical week *[16]*. This also allowed comparisons to be easily made between the school's actual conditions versus desirable comfort ranges. The *daily environmental* map combined the motif of the school plan with the use of colour to track temperatures in all the spaces across the hours of the working day *[17]*. The images make it clear that the classrooms only reached the desired temperature of 20 degrees in the first hour or two of the morning. After this the heat drops off. What also became evident, was that the central, social area was often at a higher temperature than the classrooms.

Film

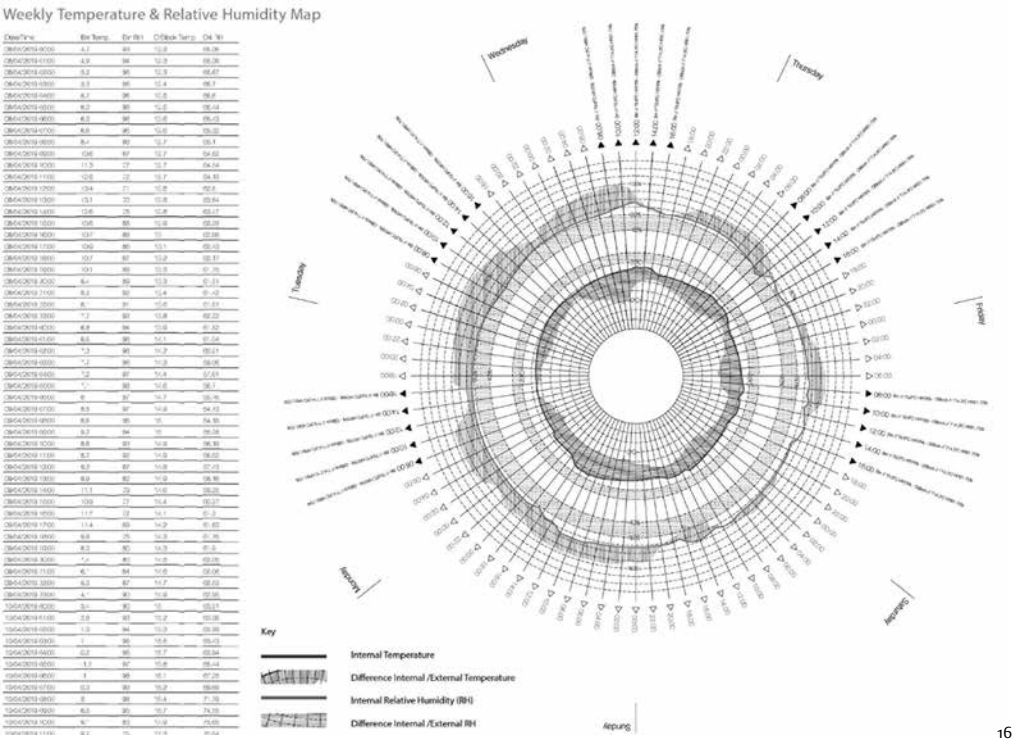
Film was considered an accessible medium to communicate the values embedded in the school building while also documenting the structure as it now stands. The films included a *walking film*, shot moving from north to south of the internal street

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

16 *Weekly temperature and relative humidity* map. As suggested by its title, this drawing visualised environmental criteria against a temporal scale of one week divided into two-hour increments. The mapping of these criteria over time made visible those moments within the week when desirable conditions were not met.

17 *Daily environmental* map. Originally in colour, this used a repeated plan of the school and colour gradients to track the temperature within the building over the course of a day. The images confirmed that often the social space is warmer than the classroom spaces a situation, which, along with other observations, ultimately provoked the idea of a designed zonal differentiation of temperatures within the building.

18 Stills from *tracking shot* film. This was designed to evoke the activities of the street and the lived quality of its spaces.

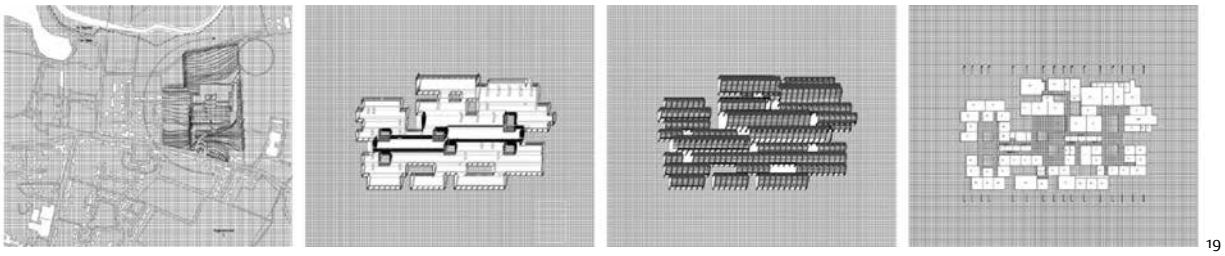


16

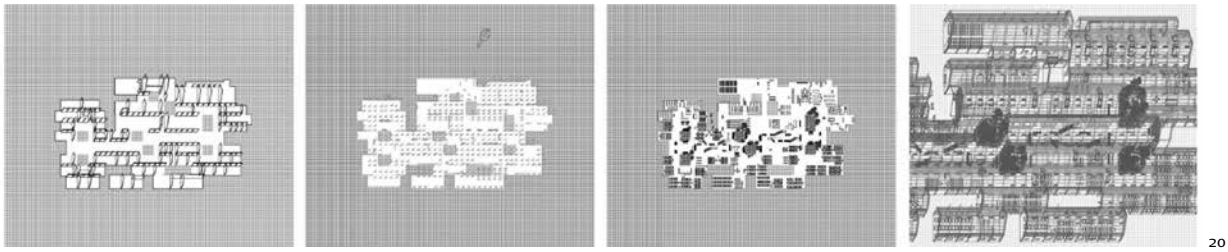
17

18

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press



19



20

19 Shearing layers. These axonometric drawings map Stuart Brand's Shearing Layers criteria on to the specific spaces of the school. From left to right: site, skin, structure, space place.

20 Shearing layers. Surfaces, services, stuff, society.

by the commissioned filmmaker with a camera mounted on a gimbal.[26] This recreated the experience of occupying the central space during break-time. A series of *tracking shot* films were also taken in carefully selected locations. In each instance, the camera moves east to west across the plan of the building to evoke the scale of change in the section as well as the changing light from courtyard to corridor, to street. This construct, as well as the choice of a black-and-white medium, highlighted the range of transparency and spatial depth in the plan, the impact of the trees in the courtyard, and the layering of views through spaces. The camera was mounted on tracks to provide a steady, continuous uniform quality, which counterposed the active life of the occupied social spaces and the soundscape of the school *[18]*.

Statement of significance and shearing layers

As previous suggested, the synthesised and revisualised data contained in the *statement of significance*, which appraised the building's values generally within a series of contexts – architectural, international, social, and landscape and place – was pivotal to the resolution of the project in defining a future framework for action. However, a more precise means of identifying and ascribing value to the building's individual components and features was also necessary. To isolate these elements, Stewart Brand's concept of 'shearing layers': site, structure, skin, space plan, services, and stuff[27] was adopted and adapted to include two other categories – *surfaces* (originally proposed by Kuipers and De Jonge)[28] and *society* (proposed by the research team). This made eight values in total. Again, a methodology of drawing was used as a means of communicating the qualities and position of these elements within the school building. Following one of the principal modernist drawing conventions used by the Doyles to evoke the structural and spatial qualities of the school, it was decided that the planometric drawing would be an appropriate vehicle for this *[19, 20]*. A repeating base drawing was constructed and inhabited in a series of iterations, each of which highlighted a shearing layer and its composition of elements. Once identified and represented, the significance of each element could begin to be evaluated, as follows.

Site

This layer included the school's immediate surrounding as well as its wider context. It also related to environmental conditions present onsite that are independent of the building. This is the slowest element to change; it preceded the building and will outlast it. Six elements were identified in this shearing layer: the bog, location, topography, exterior planting, views, and orientation. The bog was noted as of exceptional value relative to the school's social role and its location on the suburban outskirts of Birr has been key to the building's identity.

Structure

This related to the primary structural elements of the building and, therefore, has the longest life and is the least likely to change. Three elements were identified: portal frame, purlin, and edge beam. The development of a precast concrete portal frame structure that allowed for flexibility and adaptability in plan was central to the original project's conceptual design. Accordingly, the portal frame's expression and its impact on the spatial experience is of exceptional importance.

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

Skin
Skin related to exterior surfaces, including the walls, windows, and roofs. These typically have a medium life span, of 15–30 years, often being changed or replaced for technical reasons as their materials come to the end of their lifespan or newer technologies provide greater improvements. We identified six elements: courtyard glazing, classroom windows, perimeter and gable walls, clerestory windows, roof, and rooflights. Of highest value are the courtyard elevations, which are significant across all the three identified values of modernism: *socially,* through the light and transparency they offer; *technically*, in the expression of the means of construction; and *aesthetically*, in creating the visual experience of the street.

Space plan
This concerned the internal layout of the building and the spatial elements of the plan, including where the internal walls, ceilings, and doors are placed, and the enclosures, connections, and sense of openness created by this. Eight elements were identified: the grid, the street, programme arrangement, daylight, section, stairs/vertical elements, inside/outside (courtyards), and the relationship to exterior. The programmatic clustering around courtyards, connected by the spine of the street, and underpinned by the grid, is of exceptional value. This, along with the considerable daylight and spatial experience allowed by the changing section and clerestory lighting, creates a spatial plan centred on the street that is of central importance.

Services
This concerned the mechanical and electrical systems that bring heat, power, air, and water to the building. These components typically have a life span of anything from 5–30 years and are almost always upgraded in buildings. Where they are deeply embedded, the changeover of services can be costly and very intrusive. Three elements were identified: lighting, heating, and the water tower/chimney. The original services were exposed and expressed for reasons of economy although this also had an aesthetic value, as they were carefully aligned with the space plan. Upgrades to the services have meant the newest installations are not aligned with the original design intention. The original services chimney for the peat-fired boilers, which also acted as a water tower, is of exceptional significance.

Stuff
This relates to the most changeable elements of the building, from personal possessions to furniture used daily and often moved around: the parts of the building that are used most intimately by people. Three elements were identified: courtyard planting, benches, fitted furniture and clock. Although the most ephemeral aspects in our occupation of a building, elements such as these often have a high impact on our experience of place. The planting in the courtyards was considered a key moment. The benches equally are of exceptional significance in the social performance of the school and in achieving the Doyles' ambition for the street.

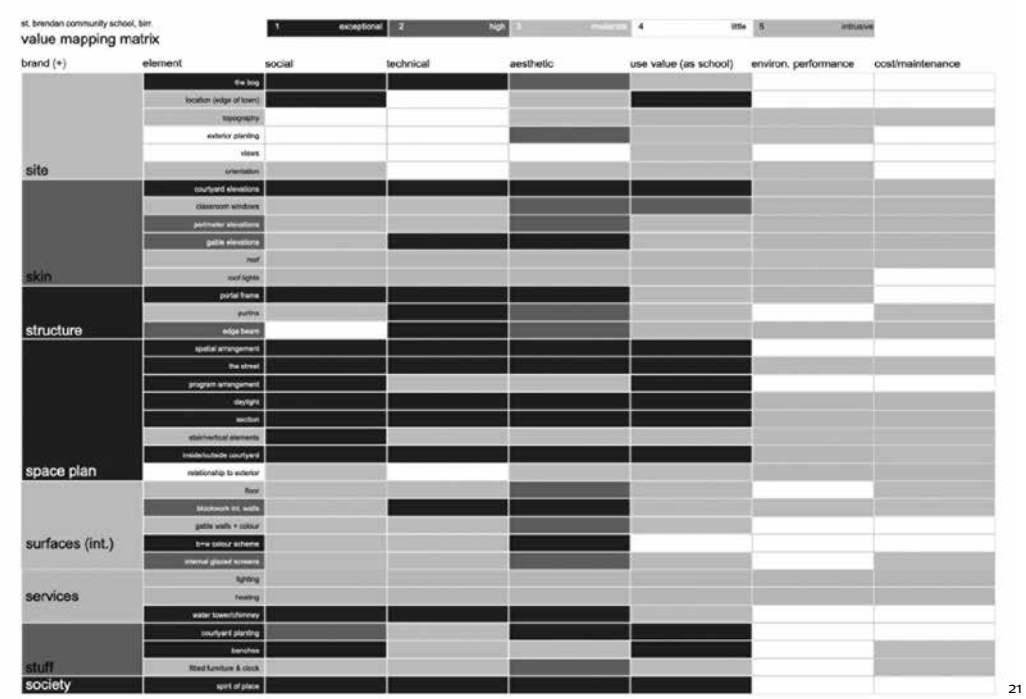
Surfaces
This related to the surfaces closest to the users experientially: the surface of the wall and floor, their materials and impact. It is closely allied to the *space plan* and *stuff* layers. Four elements were identified: floor, blockwork internal wall, colour scheme, and internal glazed screens. There is considerable overlap between surface and structure. The expression of this construction is key to the experience of the space. The reflective dark floor is significant, as is the expression of construction evident in the blockwork internal walls. The original colour scheme was largely monochrome, except for the internal gable walls, which were painted in bright colours, although some of these have changed over time.

Society
This layer was added by the team to reflect the ethos of the school as it both embraced social change in Irish life in the twentieth century while including the everyday social life of its staff and students. This is represented as a single layer, without elements. What emerges is a composite portrait of the multiple elements in the building and their relationship to each other. Of highest significance is the social performance of the street, which is supported by the qualities conferred by the courtyard, daylight, structure, and relationship to adjacent spaces. The term 'society' relates to the original design intention as well as the school's significance within Irish social history. It also points the direction for the future of the building.

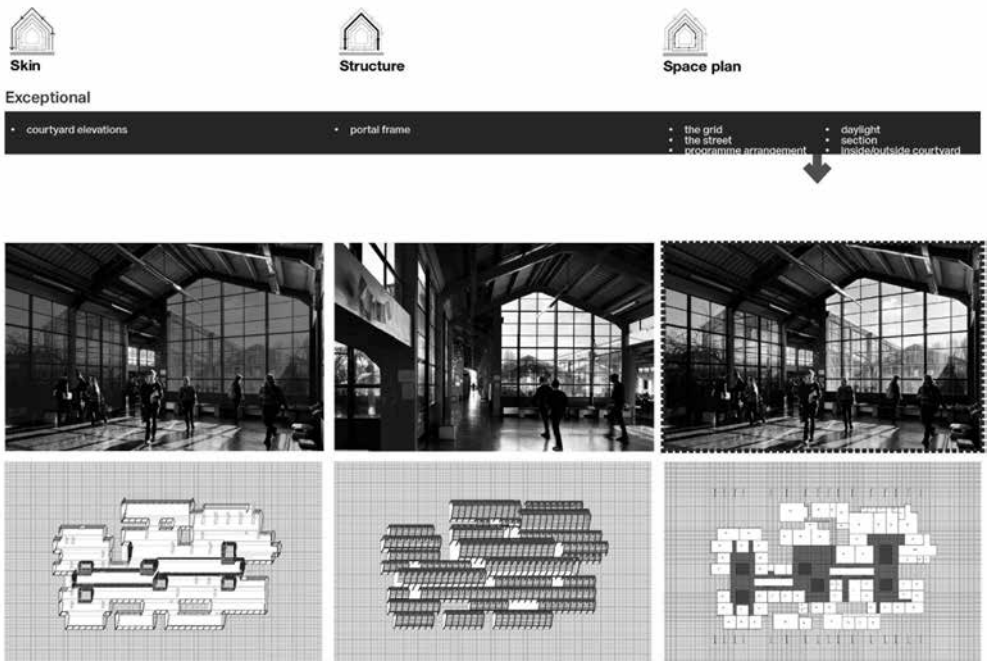
Methods of action: generating policies and strategies for intervention

The approach towards the final stage of the project involved the production of further diagrammatic representations and interpretations. The *statement of significance*, which drew on the contextual research conducted in the surveys, established 'why' the building is important – internationally, architecturally, socially, and in terms of landscape and place – while the *shearing layers* allowed an intimate examination of 'what' exactly was of value and 'where' it was located within the building. From this an integrated *value matrix* was created for the building and further communicated in an additional series of representations. The matrix used the shearing layers and their elements to form the Y-axis, ordered from least likely to change (site) on the top, to most likely (society) on the bottom. The X-axis incorporated the social, technical, and aesthetic values of modernism as previous defined, along with other utilitarian headings: use value (as school), environmental performance, and cost/maintenance. Five levels of value were ascribed to each element – 'exceptional', 'high', 'moderate', 'little', and 'intrusive' – by measuring each component by their contribution to the school as an overall system within the context of the international, architectural, social, and landscape and place values, established in the

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press



21 *Value Mapping Matrix*. This colour-coded table, which maps an interpretation of Brand's shearing layers criteria against assumed values of modernism, allows an accessible means of appraising value within the building's components and their relationship to the whole.



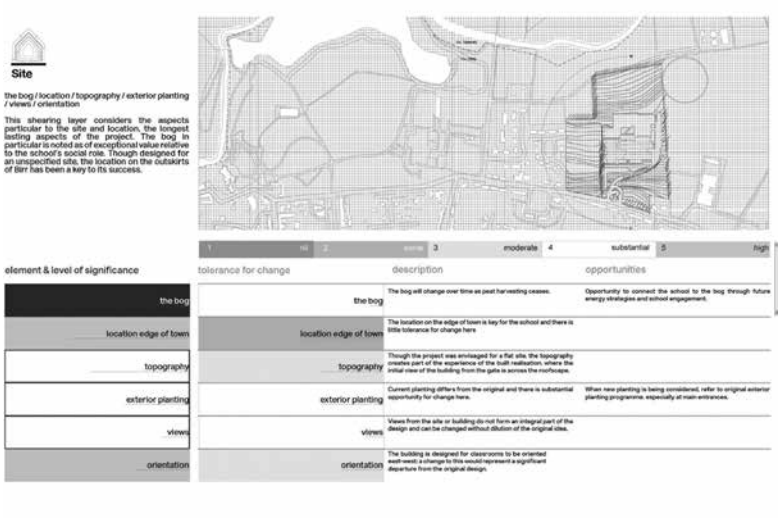
22 *Value Mapping* applied: skin, structure, space plan. Originally in colour, these drawings effectively spatialised the Value Mapping Matrix showing where the components occur within the building through a combination of axonometric projections and the overlaying of photographs with tones. These visual devices also allow the relationships between the elements and from elements to the whole to be identified and appraised.

statement of significance. These were colour-coded from dark to light blue, respectively, with the other categories of 'little', delineated in white and 'intrusive', in grey *[21, 22]*.

Among other things, this visualisation of the valuing process confirmed the location of highest significance around the central space of the street, the courtyards, the levels of transparency between them and the presence of the structure. Also immediately evident are the areas of least value that correspond to areas that are no longer original, such as the roof and the services. The matrix also begins to suggest parts where possible interventions would be most acceptable, those that have the highest *tolerance for change* without adversely impacting their own or the overall significance of the site.[29] This was formulised in another matrix diagram using a similar colour-coding system: three pinks from dark to light indicate nil, some and moderate tolerance, respectively; while white represents substantial, and grey, a high tolerance for change *[23]*.

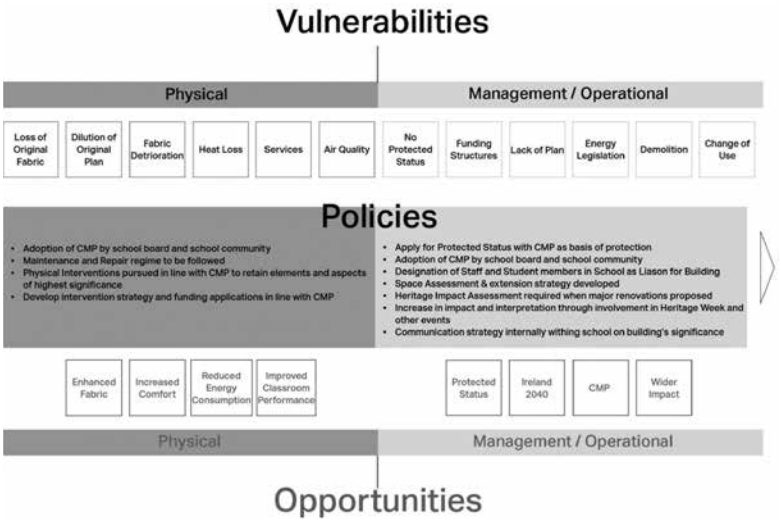
The *value matrix* and its companion the *tolerance for change matrix* were the last two ingredients necessary to generate *policies* and suggest *strategies for intervention*. As outlined in the *Illustrated Burra Charter* (1992), the generation of policies for intervening in and managing sites of significance is one of the key stages in the conservation planning process.[30] Again, our policy framework assumed a visual form that presented the vulnerabilities and opportunities as

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press



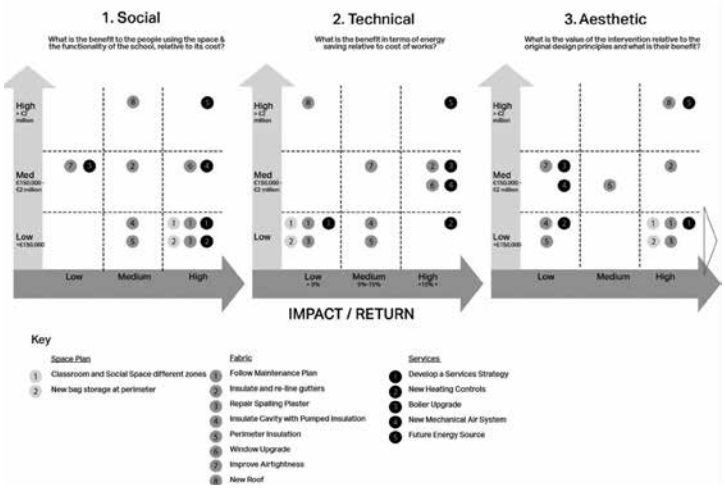
23

23 *Tolerance for change* applied: site. Following the Value Mapping exercises, and seen in conjunction with them, this diagram represents one of a series of hybrid images created to assess the possibility or desirability of changes within different elements and components. Again, while components are considered individually, taken together the diagrams describe relationships between different elements, and between elements and the whole.

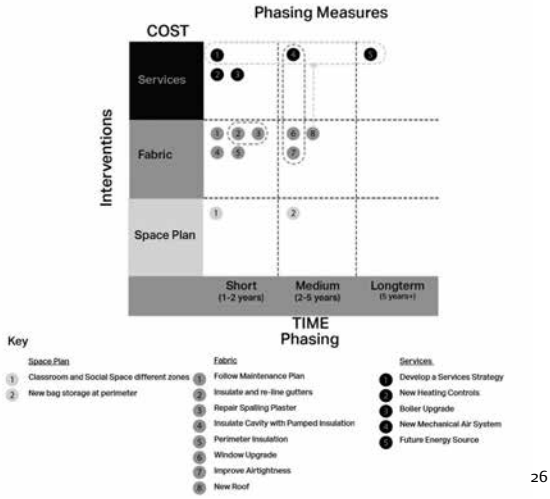


24

24 *Vulnerabilities and opportunities*. Together with the Value Mapping and Tolerance for Change exercises, recognition of the building's vulnerabilities and opportunities were pivotal in generating a series of policies and, in turn, defining potential interventions.



25

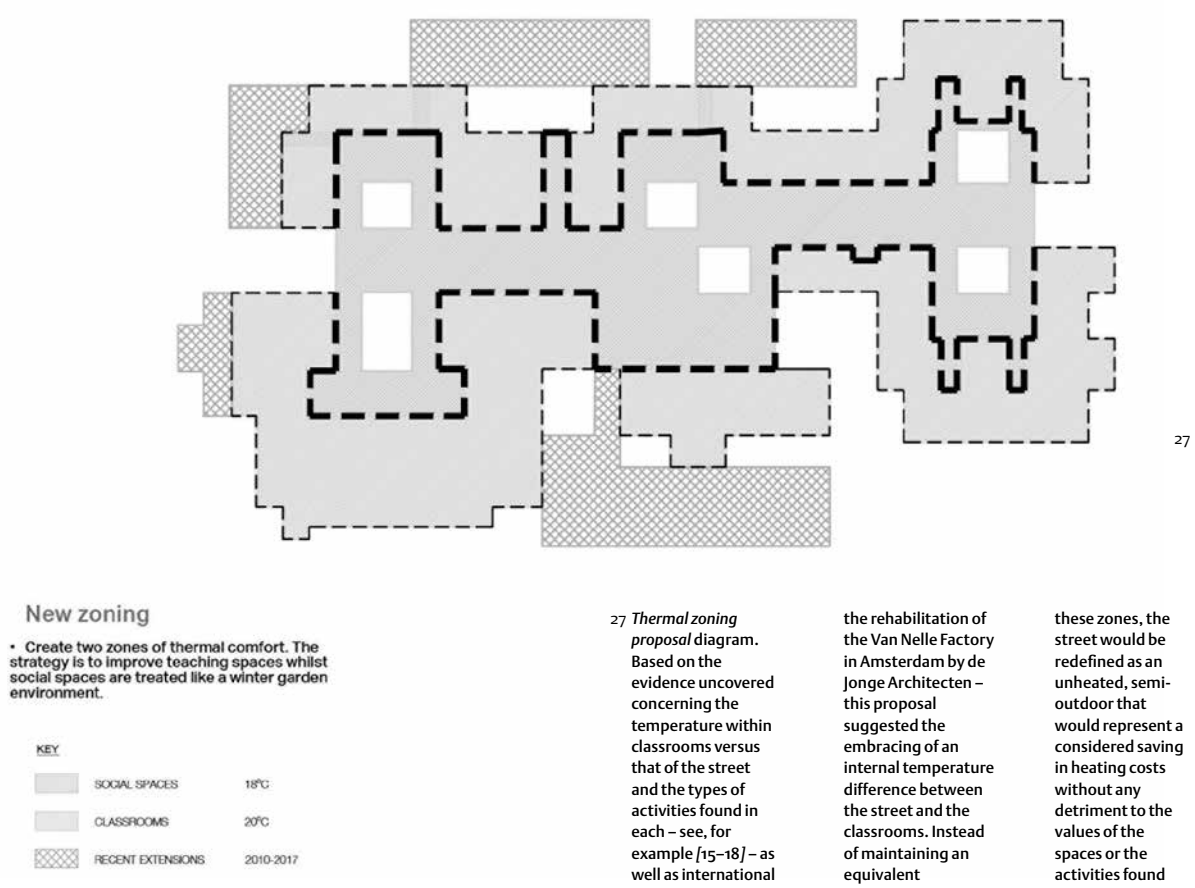


26

25 *Cost versus value mapping*. The series of proposals for possible interventions generated through the research process were evaluated in this diagram on grounds of impact across social, technical, and aesthetic criteria versus cost.

26 *Phasing measures*. This diagram proposed the timing and potential bundling of certain works for reasons of efficiency and costs.

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press



27

27 *Thermal zoning proposal* diagram. Based on the evidence uncovered concerning the temperature within classrooms versus that of the street and the types of activities found in each – see, for example *[15–18]* – as well as international precedents such as the rehabilitation of the Van Nelle Factory in Amsterdam by de Jonge Architecten – this proposal suggested the embracing of an internal temperature difference between the street and the classrooms. Instead of maintaining an equivalent temperature across these zones, the street would be redefined as an unheated, semi-outdoor that would represent a considered saving in heating costs without any detriment to the values of the spaces or the activities found there.

identified with reference to the assessments of significance *[24]*. Once more, these sought to reconcile the issues arising from the building's environmental performance with the pressures of conservation. The complexities of these had been revealed by the project but now, through the continuation of the research process, could be reduced into twelve clear, simple, and easy to follow policies. These fell into two categories: (i) Physical and (ii) Management and ranged from the straightforward and generic such as 'Design and Follow a Maintenance and Repair Regime' (Physical) to the more specific, such as 'Apply for Protected Status with Conservation Management Plan (CMP) as the basis of Protection' (Management and Operational). The suggestions for physical and material interventions were divided in three specific types – space plan, fabric, and services. These were governed by the ethos of 'doing as much as is necessary and as little as possible' as observed in international conservation best practice.[31]

Once again, the proposals for interventions were described in both text and illustration. Given the financial and economic restraints of publicly funded education in Ireland, the interventions were also mapped in three graphs, which sought to distil the potential benefits of the interventions under the three values of modernity: (i) Social: What is the benefit to the people using the space and the functionality relative to the cost? (ii) Technical: What is the benefit in terms of energy saving relative to the cost of works? (iii) Aesthetic: What is the value and benefit of the intervention relative to the original design principles? Here, the Y-axis determined the estimated cost and X-axis potential value *[25]*. Recognising that many of the proposed interventions were or could be co- or interdependent, another graph was created to describe the potential for *phasing* the works, using short-, medium-, and long-term time frames. Many of the interventions, such as the simple provision of new heating controls were both low cost and could and should be immediately actioned, while others, like the insulating and relining of the gutters were both medium cost and medium term in the phased timescale. Still others required significant investment as part of what now could be recognised as long-term strategies *[26]*.

The latter included a new system of thermal zoning where, rather than trying to keep an overall constant temperature across the whole school, the classrooms would be treated differently from the social spaces and the street. Informed by a similar strategy utilised in the refurbishment of Brinkman and van der Vlugt's Van Nelle Factory by Wessel de Jonge Architecten in 2004, this was designed to reinforce the street as an outdoor space and inhibit the introduction of an undesirable constancy of temperature across zones of differing functions. This proposal was considered a low-cost, high-impact intervention *[27]*.

Perhaps more controversially, given its relatively positive thermal performance in comparison with other aspects of the building's fabric, part of the intervention strategy suggested that the roof should be replaced. This was considered a high-cost, high-impact proposal, one that at the outset of the project would have been considered unnecessary. The proposal is indicative of a change in perspective,

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

which stems directly from the holistic understanding of the site generated by the breadth of the scope of the research and its integration of the social, technical, and aesthetic values of modernity. As cited earlier the present roof, which is nearly twenty years old and coming to the end of its expected life span, was a replacement to the original. Executed in the mid 2000s, this was prior to more recent and rapid developments in passive energy technologies. As suggested above, the design of this roof had involved many compromises and embodied qualities that were considered detrimental to the building. These included the poorly considered size and positioning of the rooflights, which has had a deleterious impact on the classroom learning environments, and the new profile of the ceiling, which detracted from the quality of other interior spaces – and, most conspicuously, the street. The proposal to replace the roof was based on the future potential of a new roof to address a number of issues simultaneously. Currently, it represents a large, non-original area of the building that, spatially and socially and especially in terms of environment and energy, could work far harder.

Thus, we proposed that a new, technologically smarter roof, deployed as an integrated aspect of the overall strategy, would bring significant benefits to the operational and environmental conditions of the building at the same time as conserving or reintroducing some of the architects' original design concepts, principles, and aesthetics. These included improved rooflighting and the opportunity to return to the intents of the original design while integrating new shading and automatic rooflight technologies to control light and ventilation; better thermal performance and airtightness; the opportunity to create an integrated services strategy within the roof including mechanical measures to improve air quality; the opportunity to introduce water attenuation measures through sedum or other materials to help resolve the issues of pooling and water penetration due to the long gutters and the increasing volume of rainfall caused by climate change; and, finally the opportunity to incorporate solar/PV panels or similar energy technologies to produce hot water, generate electricity, and significantly reduce the overall energy running costs of the building. The latter was part of a range of proposed strategies for future onsite and sustainable energy production and use. Collectively these would reduce or potentially remove the school's present reliance on oil and its replacement with locally produced biomass, some of which could potentially be cultivated on the school's own 70 acres of bogland. In fact, these measures sought to reconcile original concepts and assumptions for the building with current environmental and energy pressures. The original design of St Brendan's had presupposed the abundance of a cheap and local energy source: peat, harvested mechanically from Ireland's midlands bogs. In the replacement of this fossil fuel by oil, the poor insulation, swathes of glass and ultimately leaky fabric of the building made the school especially vulnerable, not only to the inevitable price hikes of an often volatile globalised oil market but also subsequently to increasing regulatory and moral imperatives to diminish the carbon footprints of buildings. Thus, the research project's identification of means of reducing these vulnerabilities and dependencies through a series of measures, up to and including the school's generation of its own energy needs on the roof and elsewhere, is of critical importance.

Conclusion

The contribution of this research – and the Conservation Management Plan it produced for St Brendan's as one of its key outputs – does not lie within its individual proposals. Rather the project has been designed to communicate the values inherent within the school to a variety of audiences and provide tools to aid the decision-making necessary to manage the school's future life. This concerned using a series of methodologies to observe and record a necessarily broad range of phenomena, from subjective, intimate, and personal experiences with the building, to the scientific measuring of its environmental conditions and fabric performance. Of pivotal importance was the development of new ways of seeing, which sought to integrate the three dimensions of modernity with the means of both valuing and visualising often complex invisible phenomena such as, for example, the social life of the school.

In many ways, the project reflects the Doyles' original conceptual thinking that articulated the design of the school as an open system, an extendable matrix that – while located on the periphery of a small town in the midlands of Ireland – embodied principles, techniques, strategies, and methods of communication that are essentially site-less. There is then a corollary between the building's design intent and the methods of analysis developed and deployed to understand and value it. In both instances they lend themselves to other, future iterations, to change and elaboration, to difference without undermining the integrity of either. While the range and techniques involved in describing St Brendan's responded specifically to the school's attributes, the overall approach and strategy of combining technological, social, and historic data is evidently transferable. For other buildings and typologies, different subsets of criteria or phenomena may emerge and be substituted for the ones described here, but still remain as essential components within a similar overall framework of analysis.

It is, however, only through making such things apparent and accessible that they can be integrated into decision-making processes. This is a role that the architect, with expertise in the synthesising and representing of information in and around the acts of design, demonstrably has the skillset to perform. To paraphrase Albert Einstein's comments on Le Corbusier's *Le Modulor*, the latter's system of harmonious and useful relationships of size and measurement, the potential of the research presented here is to allow a framework of options that make bad decisions difficult and good ones easier.

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

Notes

1. The authors wish to acknowledge and thank the individuals and organisations who contributed to this research. The Getty Foundation's 'Keeping it Modern' (KIM) grant made the project possible and its series of workshops held in London in June 2018 were instrumental in guiding its thinking. Of individuals we would especially like to thank Cesar Bargues Ballester and Antoine Wilmering (of the Getty Foundation); Thomas Pearson (who presented at the 'Keeping Ireland Modern' symposium organised by the research team); Wessel de Jonge and Catherine Croft (who presented at 'Keeping Ireland Modern' and visited the school), and Sheridan Burke (who also visited the school). Their insights and comments on the project have been both extremely useful and much appreciated. The project would not have been possible without the help and co-operation of the students and staff at St Brendan's Community School, including: its principal John Kennedy; former principals Ming Loughnane, Brother Denis Minehane and Tom Foley; deputy principals Fidelma Foy, and Paul D'Arcy; teachers Brian Kennedy, Aengus Byrne, Sharon McConnell; school staff Margaret Hensey, Jackie Dunne and Christy O'Sullivan; students, Emma Mulrooney, Anna Morris, Adam Hart, Aoife Scallan and Colm Hogan. Also with thanks to the Doyle family, Peter Twamley and John Meagher for participating in interviews and supporting the project. Finally, we would like to acknowledge the inputs and assistance of the Department of Education and Skills.
2. Marieke Kuipers and Wessel de Jonge, *Designing from Heritage: Strategies for Conservation and Conversion* (Delft: TU Delft, 2017); Catherine Cooke and Ivors Richards, 'Modern Movement Documentation as a Central Resource for Architectural Education', *Proceedings: Second DOCOMOMO International Conference, Dessau September 16–19, 1992* (Dessau: DOCOMOMO, 1993). See also, Peter Marquis-Kyle and Meredith Walker, *The Illustrated Burra Charter: The Australian ICOMOS Charter for Places of Cultural Significance* (Burwood: Australia ICOMOS, 1992); ICOMOS International Committee on Twentieth-Century Heritage, *Approaches to the Conservation of Twentieth Century Cultural Heritage Madrid-New Delhi Document* (ICOMOS 2017) and, for example, Susan Marsden and Peter Spearritt, *The Twentieth Century Historic Thematic Framework: A Tool for Assessing Places* (Los Angeles, CA: Getty Conservation Institute, 2021); Shannon Mattern, 'Maintenance and Care: A Working Guide to the Repair of Rust, Dust, Cracks, and Corrupted Code in Our Cities, Our Homes and Our Social Relations', *Places Journal* (November 2018); Patrice Frey, Liz Dunn, Ric Cochran, *The Greenest Building: Quantifying the Environmental Value of Building Reuse* (Greenbuild, 2011); Wessel De Jonge 'Sustainable Renewal of the Everyday Modern', *Journal of Architectural Conservation*, 23:1–2 (2017), 62–105; L. Dimevska, M. Cvetkovska, A. T. Gavriloska, M. Lazarevska, M. Knezevic, 'Assessment of Current State of Modernist Building Heritage of Skopje in Terms of Sustainability, Energy Efficiency and Authentic Appearance Degradation', *People, Buildings and Environment* (2020); Bradley T. Carmichael, 'When Modern Becomes Historic: Preserving the Modernist Building Envelope', *Building Design + Construction* (May 2012), 40–6.
3. The team consisted of an academic-practitioner core (Queen's University Belfast and John McLaughlin Architects) augmented by external consultants: Queen's University Belfast (QUB), Professor Gary A. Boyd (project leader), and Professor Greg Keeffe; John McLaughlin Architects, Irene Brophy, Tara Kennedy, John McLaughlin, Aoibheann Ní Mhearáin (project coordinator) Tomás Prendeville, Tani Sanchez. External consultants: David Maher (David Maher and Associates structural & conservation engineers); Ros Kavanagh (photography and film); Bill Hasting (ARC Consultants, conservation consultancy and daylight analysis); Andrew Lundberg (Passivate, energy consultancy); Greenbuild (thermography and air pressure testing); ICAN Acoustics (acoustic testing); Lambstongue (specialist window consultancy); with additional inputs from Frank Lewis and Ciaran O'Brien (Department of Education and Skills); and graphic design contributions by New Graphic.
4. Some preliminary findings and a description of the approach to project were discussed in Aoibheann Ní Mhearain and Tara Kennedy, 'Reframing Social Value in 20th-Century Conservation', *Architectural Design, Special Issue: Social Value in Architecture* (July/August 2020), 94–103.
5. The terminologies are derived from two sources. Firstly, John Berger's seminal book (and broadcasts) entitled *Ways of Seeing*, which used a range of new perspectives to invite the audience to reconsider iconic artworks (London: Penguin, 2008). Meanwhile Charles Eames described the act of design as a 'method of action' in responding to a question posed by Madame L'Amic, cited in John Neuhart, Marilyn Neuhart, Ray Eames, *Eames Design* (New York, NY: Abrams, 1989).
6. The exhibition was opened in the Irish Architectural Archive in Dublin on 7 November 2019 alongside the pubic symposium *Keeping Ireland Modern*. The exhibition later moved to the school itself in Birr to coincide with the events and celebrations surrounding the fortieth anniversary of the St Brendan's opening.
7. Stan Allen, 'Notation and Diagrams: Mapping the Intangible', in Stan Allen, *Practice: Architecture, Technique and Representation* (Abington: Routledge 2000), p. 41.
8. Cooke and Richards, 'Modern Movement Documentation as a Central Resource for Architectural Education', and Kuipers and de Jonge, *Designing from Heritage: Strategies for Conservation and Conversion.*
9. One significant source was the work that had already been carried out by members of the research team on the building concerning its inclusion in the exhibits for the Irish pavilion (curated and designed by Gary A. Boyd and John McLaughlin) at the 2014 Biennale de Venezia. See, for example, Aoibheann Ní Mhearain, 'Education – "My Father Has Got a Tractor Shed Like This" – The Doyles, the Concrete Frame and the Democratisation of Education', in *Intra-Éireann: Infrastructure and the Architectures of Modernity in Ireland 1916–2016*, ed. by Gary A. Boyd and John McLaughlin (Abingdon: Ashgate, 2015; repr. Routledge, 2017).
10. Peter Doyle passed away in 1995 and Mary Doyle in 2015.
11. O. Richardson, 'Buildings for Education', in *150 Years of Architecture in Ireland: RIAI 1839–1989*, ed. by John Grady (Dublin: Royal Institute of Architects in Ireland, 1989), p. 94.
12. John McLaughlin and Aoibheann

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press

Ní Mhearáin, 'Revisit: Birr Community School', *The Architectural Review* (June 2019), 76–88.
13. Mary Doyle and Peter Doyle, *New Irish Architecture* (Dublin: Royal Institute of Architects in Ireland, 1990), p. 7.
14. John Donat, 'Community School Birr: High Quality – Low Tech', *Architects' Journal,* 172:52 (December 1980), p. 1244.
15. Peter Doyle, 'Obituary of Michael Scott', *RIAI Yearbook* (Dublin: Clavis Press, 1990), p. 66.
16. Cited in *The Architecture of Peter and Mary Doyle*, ed. by John O'Regan (Dublin: Gandon Editions, 1990), pp. 13–16.
17. Shadrach Woods, 'Free University, Berlin', *World Architecture 2*, ed. by John Donat (London: Studio Vista, 1965), p. 113.
18. Peter Doyle in *The Architecture of Peter and Mary Doyle*, ed. by O'Regan, p. 15
19. Mary Doyle in *The Architecture of Peter and Mary Doyle*, ed. by O'Regan, p. 15.
20. Cited in *The Architecture of Peter and Mary Doyle,* ed. by O'Regan, p. 15.
21. Anon., 'Community School at Birr', *Architecture in Ireland*, 2 (April 1980), 28.
22. Participants were chosen to represent a variety of viewpoints including: a teacher who was new to the school; students from a range of year groups; a student who was new to the school; a 'second generational' student (whose parents had also attended the school); and a teacher who was a former student.
23. Irish Department of Education and Skills, *Technical Guidance Document TGD-021-5 Acoustic Performance in New Primary and Post Primary School Buildings* (Dublin: Department of Education and Skills, 2013/revised 2015).
24. ISO 9972:2015, *Thermal Performance of Buildings – Determination of Air Permeability of Building – Fan Pressurization Methods* (Geneva: ISO Publications).
25. Tim Ward, Graeme Hannah, Chris Sanders, *Conventions for Calculating Linear Thermal Transmittance and Temperature Factors* (BRE 497, 2nd Edition) (London: HIS BRE Press, 2016); and ISO 10211: 2017, *Thermal Bridges in Building Construction – Heat Flows and Surface Temperature – Detailed Calculations* (Geneva: ISO Publications, 2017).
26. The commissioned filmmaker was also the commissioned photographer, Ros Kavanagh. A trained architect, his knowledge and observations of the building gathered through numerous site visits to both photograph and film the school was invaluable.
27. Stewart Brand, *How Buildings Learn: What Happens after They are Built* (London: Viking, 1994).
28. Kuipers and de Jonge, *Designing from Heritage: Strategies for Conservation and Conversion.*
29. Sheridan Burke, 'Tolerance for Change: Introducing a Concept and a Challenge to ICOMOS Members', in *Conservation Turn – Return to Conservation: Tolerance for Change, Limits of Change: Proceedings of the International Conference of the ICOMOS, International Committee for the Theory and Philosophy of Conservation and Restoration* (Florence: ICOMOS 2011).
30. Marquis-Kyle and Walker, *Burra Charter*.
31. See ICOMOS, *Approaches to the Conservation of Twentieth Century Cultural Heritage Madrid-New Delhi Document.*

Illustration credits
arq gratefully acknowledges:
The St Brendan's Keeping it Modern research team, 10, 11, 13–17, 19–27
Ros Kavanagh, 18
John Donat (RIBA Library Photographs Collection) and Ros Kavanagh, 9, 12
Peter and Mary Doyle Collection, Irish Architectural Archive, 2, 4–8
John Donat, RIBA Library Photographs Collection, 1, 3

Acknowledgements
The authors would like to acknowledge the support of Queen's University Belfast, University College Dublin, University College Cork, and the Cork Centre for Architectural Education (CCAE), in the production of this article.

Competing interests
The authors declare none.

Authors' biographies
Gary A. Boyd is Professor of Architecture at Queen's University Belfast. A Leverhulme Major Research Fellow from 2018 to 2022, the book resulting from this research, *The Face of Coal: Mining and Modern Britain*, is published by Lund Humphries (December 2022).

Aoibheann Ní Mhearáin is a Technical Advisor with the Higher Education Authority (Ireland) Capital Programmes Unit. She is an award-winning architect with extensive experience as an academic, teaching in the Cork Centre for Architectural Education (CCAE) and at University College Dublin where her research engages with the history of twentieth-century architecture in Ireland, with a special focus on educational buildings.

John McLaughlin is a practicing architect and senior lecturer in architectural design at University College Cork. He curated the Irish Pavilions at the Venice Architecture Biennales in 2012 and 2014, and was an invited exhibitor in the Venice Architecture Biennale in 2016. He co-edited the book *Infrastructure and the Architectures of Modernity in Ireland 1916–2016* (Routledge 2017) with Gary A. Boyd. He won the Arthur Gibney Prize from the Royal Hibernian Academy in 2019 and exhibited at *Words + Works Biennale of Artistic Research in Architecture* at KADK, Copenhagen in 2019–20.

Tara Kennedy is an award-winning architect and artist. She is a member of Free Market, which was originally conceived as the Irish Pavilion for La Biennale di Venezia in 2018. A co-founder of Culturstruction (with Jo Anne Butler), Kennedy was a co-founder of 'Commonage Summer School' (2011–13). As well as initiating socially driven design and research projects, she practices with John McLaughlin Architects and is a lecturer at Cork Centre for Architectural Education (CCAE).

Authors' affiliations
Gary A. Boyd, Queen's University Belfast, United Kingdom.
Aoibheann Ní Mhearáin, University College Dublin, Ireland.
John McLaughlin, University College Cork, Ireland.
Tara Kennedy, University College Cork, Ireland.

Authors' addresses
Gary A. Boyd
g.boyd@qub.ac.uk

Aoibheann Ní Mhearain
aoibheann.nimhearain@ucd.ie

John McLaughlin
john.mclaughlin@ucc.ie

Tara Kennedy
tara.kennedy@ucc.ie

https://doi.org/10.1017/S1359135522000604 Published online by Cambridge University Press