Context and knowledge for functional buildings from the Industrial Revolution using heritage railway signal boxes as an exemplar

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Abstract

Developed to accommodate equipment for controlling train movements at railway stations or junctions, railway signal boxes are one of the least changed survivors[1] of buildings defined as functional, a building category emerging during the Industrial Revolution specifically for occupation in support of an industrial process rather than occupied by people. Industrial Revolution buildings are now part of industrial heritage and there is an issue concerning heritage authenticity[2] in presenting these buildings, where potentially diverse groups of people may have different perceptions of the buildings. Reeves[3] identified that surviving signal boxes needed systematic study as a

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way of determining the most effective means of reconciling the divergent pressures on effective conservation of those buildings defined as possessing heritage value. The aim of this research is to identify varying perceptions of the heritage functional building as a means of developing an effective conservation strategy by a research methodology of creating an original taxonomical model and applying this to a sample range of British signal boxes to determine representative signal box taxonomies and seeing these taxonomical findings to the railway landscape context. Using this contextual data, it becomes possible to apply varying individual knowledge to signal boxes. Findings are that skills and knowledge relative to signal boxes are specific and divergent. Conclusions are that context provided by the taxonomical model developed in this research determines the effectiveness of signal box conservation, that this model is applicable to functional buildings from the Industrial Revolution in the UK as well as in other, industrialised countries, and that there is a need for relevancy to support interpretation. Conservation policies need to recognise these issues, along with further research to understand the motivations where custodians, whether owners or conservators on behalf of end users, make decisions concerning heritage functional buildings worldwide.

Keywords: building conservation, functional industrial buildings, taxonomical model, heritage interpretation, Industrial Revolution, railway signal boxes.

Introduction

Railways transported the Industrial Revolution, with stations acting as, “the focal point for the community as well as a transportation hub”.[4] Dethier described this hub as, “a veritable microcosm of industrial society, a public place where all social classes rub shoulders”.[5] For railways to take such a principal place in society, something only the

very far-sighted would predict in the early 19th Century, needed innovatory structures with functional purposes unimaginable a generation previously.[6] The station buildings, goods shed, engine sheds, signal boxes, locomotive works and other functional buildings became part of the social fabric, "only fleetingly glimpsed by the traveller … places where a staff never seen goes about its business … [as] … "traces of industrial archaeology".[7]

Previous research[8] suggested that the conservation of railway signal boxes, as an exemplar of innovatory Industrial Revolution buildings, represents, "an incompatibility between aspirations … and seemingly attainable reality", due to the specific nature of a building type that has heritage value in a particular environment. This creates pressures on the conservation process where all interested parties have different priorities, confirming the findings by Mclean that, "listed signal box often receive treatment that would be very unusual for other categories of listed structures".[9] In finding a way to identify an appropriate methodology for conserving signal boxes, Reeves[10] concluded that further work includes a systematic study of surviving signal boxes to identify whether either conservation or interpretation is appropriate where the heritage value of a building is evidential of human activity rather than the building's aesthetic qualities.[11]

Defining Functional Buildings of the 19th Century

Hudson discusses the Industrial Revolution in terms of capital, labour (the main source of this labour are workers released from agriculture) and innovation, noting that,

> *"As manufacturing regions became more successful, benefiting from the build up of specialist infrastructures and associated external economies, it became*

more difficult for the remaining rural manufacturers … to survive … cottage industry contracted in the wake of competition from machine."[12]

Without commenting directly upon the buildings associated with the move from cottage industry to the Industrial Revolution's specialist infrastructure, Hudson goes on to observe, "Industrialisation accentuated the difference between regions by making them more functionally distinct and specialised".[13]

In developing these ideas, Stokes notes that one of the defining characteristics of early railways was facilitating the move in economic activity from agricultural, small-scale landowning and manufacturing into regionally defined industries, helped by changes in banking law to allow bank financing of these developments by investment in joint stock companies. Furthermore, ready transport of coal allowed development of, "coal hungry steam technology".[14]

Considering buildings, this use of steam technology needed dedicated manufactories and thereby creating a class of building it is possible to define as 'functional'. Whereas, the pre-Industrial Revolution model of building was invariably for human or agricultural occupation, these new 'functional industrial buildings' housed machinery, processes or specific functions with human occupation ancillary to and serving the building's purpose. This includes the 'innovatory'[15] railway structures, such as signal boxes. Jones & Munday[16], in discussing the conservation of 19th Century industrial heritage, separated the building landscape from this era into manufacturing activity (including mineral mining) with associated transport, against a network of buildings for the workers, such as chapels, schools, institutes and housing. It is therefore possible to see these new functional industrial buildings as a separate class of building, the class being an indicator of changed building use brought about by the Industrial Revolution.

These functional industrial buildings do not necessarily possess architectural or aesthetic values beyond 19th Century norms, so following the principles established by Mydland & Grahn[17] conservation will tend to be local initiatives not so much to preserve the building and towards more maintaining a common identity, where heritage becomes a cultural process. They also comment upon policies that refuse to allow the relocation of a building threatened by demolition in its original location. Reeves[18] notes how community pressure has an impact on conservation of signal boxes, exemplars of functional industrial buildings, and introduces the 'Wylam Question' as an unanswerable policy conundrum where relocation compromises original authenticity.

Authenticity

Within the popular interest for industrial heritage, Stratton[19] identifies an enthusiasm for visiting and studying buildings associated with the Industrial Revolution. Noting the development of projects to present industrial heritage in a post-industrialisation context, Stratton observes,

> *"At best, industrial heritage projects can present challenging and important concepts relating to technology, industrialization and urban life. At worst … offering history and culture in its most trite and flavourless form."*[20]

Academics justify the preservation of heritage projects in terms of historical significance[21], the protection of which Araoz asserts as, "the authenticity of heritage has always been the fundamental end of all conservation work."[22] Ehrentraut presents a choice between,

> *"… exemplary scholarship with meticulous craftsmanship produces heritage monuments that doubtlessly are highly authentic by prevailing international professional standards."*[23]

As opposed to, "… monument presentation, especially in respect to its animation", that involves the sterilisation of an exhibit …", obliterating all that took place in a building by, " subsequent commodification", and thereby creating a, "folkloristic entertainment industry". Nevertheless, visitor surveys to heritage sites provide, "softer", conservation justifications than academic perception. For example, Stratton found that most visitors to Ironbridge, "… are not studying specific technologies and structures but are … seeking 'an authentic representation of nineteenth-century life and industry'."[24] Mydland & Grahn[25] comment that, "social and cultural experiences contribute to the potential diversity", when attached to a value assessment in heritage interpretation. These findings present a contradiction between exemplary scholarship and visitor demand, a contradiction Ehrentraut alludes to,

> *"Since the conflicting positions are premised on criteria proclaimed by academic and professional "experts", they cannot be submitted to some higher authority for final arbitration. Any authenticity claimed for a heritage structure consequently remains the social construction of its assessors rather than the intrinsic property of the object."*[26]

Authenticity, "… a problematic and insufficiently explored concept…"[27], for a heritage building therefore seems to become a construct that derives in part from the intrinsic worth of the building and how various interest groups perceive the building.

One authenticity factor strongly emphasised by research is the significance of place. Araoz describes how heritage conservation maintained, "a particular focus on the material elements of the site as repositories on the significance of the place", and thereby becomes, "… axiomatic that the intangible aesthetic and historic values that were attributed to a place … lay on the extant material elements." Araoz goes on to

describe how if, "… the process of change per se can be an integral component of the significance of the place", such that,

> *"… spatial qualities … include such intangible carriers as … associative communal memories, communal rituals, and the historic patterns of urban evolution, all of which require conservation and protection".*[28]

The relocation of heritage buildings to museums as a way of saving and interpreting buildings is described by Stratton as, despite successes in Scandinavia, USA and Great Britain, a "discredited concept", replaced by a, "… focus on in situ preservation, rather than dismantling and re-erection."[29] This is an authenticity issue, where, "… the debate between preservation *in situ* and relocation to a new site involves still another dimension of authenticity", such that the original location, "… will present to some specialists a more accurate heritage image despite its derelict appearance …".[30]

Conservation without relocation will therefore make it necessary for visitors to recognise authenticity with the cultural heritage, with three distinct types of visitors identified by how they perceive authenticity,

> *"'Existential' visitors, emphasizes the importance of enjoyment and escape and mainly perceives authenticity through exhibited artefacts, 'aesthetical' visitors, perceives history through art, while 'social' visitors emphasizes the importance of learning and social experiences ..."*[31]

Whereas each visitor group represents a different perception of authenticity, their perceptions are distinct from Ehrentraut's experts. Mydland and Grahn demonstrate that 'official' discourses concerning heritage interpretation stress expert knowledge rather than a potential diversity from cultural experiences.[32] Tenbrink *et al*, in considering how differing parties connected with buildings will have different

perceptions, such that while there may be communication about a shared topic of a building, the communication will, "diverge greatly with respect to expertise, experience, discourse, task goals, responsibilities and expectations"[33], according to the differing cognition of building inhabitants, visitors and building experts.

With respect to railway signal boxes, authenticity is a function of transport history, embedded in the "contradictions and dilemmas of contemporary societies", where recognising the technology, "demands that we understand how and why … naming of artefacts, practices …is a necessary starting point of any analysis".[34] Crucially, Divall & Revill identify that, "the cultures of transport technologies are fundamental to understanding", rather than railway heritage and traditions becoming, "commodities that can be packaged and sold".[35] Thus, in seeking to apply authenticity to signal boxes, this becomes a quest for the phenomenon of authenticity where there is, "a connection between the form of the phenomenon and the process that produce it"[36], the process in this case being the organisational framework within which signal boxes evolved.

Organisation of signal boxes

Railways originally, following the precedent of mineral wagonways, developed to carry freight, whereas the organisation of passenger traffic initially followed stagecoach practice.[37] Eventually these evolved into the archetypical station[38], with passenger plus parcels handling facilities and a goods yard, ruled by a stationmaster[39] supported by a hierarchy of porters, clerks (booking and goods) and shunters.[40] For country stations, this community of buildings and staff represented, "a lifeline, a vital and potent source of contact with the outside world", for the villages served by the railway. And part of this station hierarchy was the signalman[41], answerable to the stationmaster yet relatively autonomous in the signal box.[42] Harris describes such a typical station, Flax Bourton in

the English county of Somerset, serving a village of under a thousand people and with a passenger service that, "mostly ran into hours", between passengers trains, "the station possessed a three-ton crane to handle goods, and could also deal with horse boxes and 'prize cattle' vans".[43] Flax Bourton closed in 1963.

The most significant difference we identify in Britain's railways from when most signal boxes opened is the transformation from a railway orientated towards freight to one structured around transporting passengers. This occurred gradually throughout the 20th Century, with the most important change arising from section 43 of the Transport Act 1962.[44] This removed the common carrier obligation to transport all freight offered, even if unprofitable, although freight traffic had been in decline since 1956[45] and British Railways was already withdrawing from the wagonload freight handled in the traditional station goods yards. In parallel was a widespread contraction of the railway network arising from the Beeching Report, shrinking from 18,214 route miles in 1961 to 12,098 at the end of 1969[46], as a continuation of closuring uneconomic lines started by the 'Big Four'[47] and into the early years of British Railways. Many of these early closures involved the withdrawal of passenger traffic lost to improved bus services, with the freight services continuing for many years afterwards, an example being the railway between Alnwick and Cornhill where withdrawal of passenger services in 1930 left a freight only railway, the last parts of which finally closed in 1965.[48] However, for the railway network as a whole, routes and stations remaining open after 1962 predominately served only passengers, with the staffing of stations uneconomic without the goods yard and progressively becoming unstaffed other than, where not replaced by centralised panel signal boxes, a signal operator in the only building remaining in use on site.[49]

Signal boxes are simple buildings, typically being a two-storey masonry or timber structure to a standard design either developed by each railway company or signalling equipment manufacturers and invariably modular to adapt the standard design for specific locations. Particularly for signal boxes built to a railway company design, there is a strong regional character to designs.[50] Paradoxically, modular designs do facilitate a certain degree of relocation, Kay[51] detailing several signal boxes relocated while still in railway company use, sometimes out of the original geographical area. An example of this practice is Magdalen Road Signal Box (figure 1), a Great Central Railway type 5[52] dating from the late 1890s and relocated in 1927 to former Great Eastern Railway territory by the London and North Eastern Railway (who took over the Great Central Railway and Great Eastern Railway in 1923). Compared with neighbouring signal boxes, the design of this relocated signal box is therefore noticeably different. While accepting Stratton's 'discredited concept'[53] citation concerning relocating heritage buildings to museums, the reality is that the historical relocation of signal boxes as an occasionally utilised practice creates a complicated precedent in conserving heritage signal boxes.

[Figure 1 near here]

Research methodology: Developing a taxonomic model

While there is comprehensive information available concerning signal box design[54] and the location of surviving signal boxes[55], our work draws upon a small number of researchers and is specific in application. The problem with developing an effective conservation strategy for heritage signal boxes, and consequently other functional heritage buildings, is interpretation[56], which takes forward the issues identified by Divall & Revill concerned with authenticity being a function of transport history[57] and

the work by Tenbrink *et al* in how different parties will view a building according their expertise and cognition.[58] This needs an extension of existing knowledge concerning signal boxes into a systematic understanding of heritage taxonomies as an innovative process potentially applicable to all functional buildings through sampling a range of heritage signal boxes, listed and unlisted, to provide context.[59]

To ensure rigour in our sampling process, this sampling fieldwork took place in three loosely defined tranches. These tranches were an initial pilot study to test a checklist for data collection against a small sample, an initial tranche to collect a broad range of data and, following a systematic review of data, a follow up tranche to ensure a representative sample of 36 signal boxes in terms of geographical distribution, design and indicative heritage value. The analysis consisted of:

1. Building description in terms of main elements, using Kay's methodology[60] of railway company or manufacturer, specific design type, structure, roof type and fixtures
2. Overall condition of each main element, using descriptive methodology derived from Hollis[61]
3. An assessment of heritage values[62]
4. A subjective assessment of potential for further use

In addition to the sampled signal boxes, the identification of other significant signal boxes noted in passing informed the overall taxonomy assessment and supports planning for future sampling. The objective of this fieldwork is to identify an overall heritage taxonomy. Furthermore, as this identification of heritage taxonomy is to understand the cognition of all who may observe the signal boxes, this limits the data collection to areas freely accessible to all parties and thereby publicly accessible areas.

Using this data, we advanced speculative thinking regarding knowledge and cognitive perception for all parties involved with signal boxes possessing definable heritage values.

Taxonomy applied to context

In considering context as a lead into knowledge and cognitive perception, the sample we present in Table 1 provides a representative cross section of signal boxes.

[Table 1 near here]

In conserving a building with a specific function, then authenticity is a measure in perceiving the effectiveness of this conservation. Two aspects present, being how much the building is faithful to its original construction or function and whether the surrounding context supports the conserved building. Both definitions, of course, display an infinite range of variations, although allowing a binary comparison it is possible to contrast the two aspects as a table (Table 2).

[Table 2 near here]

To allow this binary approach, we found it necessary to make assumptions concerning originality for the signal box and environment immediately surrounding the signal box. In each case, there will be a certain degree of subjectivity, yet within this constraint it is possible to define guidelines.

Signal box modifications that mean the building is no longer visually in an ‘as built’ condition can include, although not exclusively:

1. Significant external alterations unsympathetic to original design, including:
    - Replacing original timberwork with uPVC

- Removal of original fixtures, such as balconies
- Security enclosures

2. Relocated after ceasing use as a signal box, with or without modifications
3. Reuse in such a way that original use as a signal box unrecognisable to unfamiliar users of building

In practice, each of these guidelines is intellectually untenable, as buildings in use are continuously adapted to meet changing circumstances, with these adaptations being part of the building narrative. For signal boxes, even relocation is a potential part of the narrative with timber signal boxes particularly facilitating disassembly and relocation. Another common adaptation is replacing original timberwork with uPVC, insensitive to the original design yet a pragmatically functional way of life extending structures, especially where in a challenging coastal environment, and is therefore part of the building's narrative.

A definably recognisable railway environment that the original occupants of a signal box would recognise is where:

1. Railway is still open
2. Track layout and railway landscape still largely as when the signal box opened
3. A fundamentally unchanged streetscape surrounding the railway

Of these, a railway landscape still largely unchanged from when the signal box opened is the most intractable. As noted, even before the Beeching Report the railway landscape was changing with the gradual withdrawal of uneconomic passenger services and concentration of freight handling leading to the closure of smaller goods yards plus

retention of some branch lines merely for handling specific flows of freight. Even if the Beeching Report was a misjudgement unable to yield more than negligible savings[63] attempting to produce quick solutions to deep-seated problems[64] for vested political interests[65], the consensus is that a smaller network was inevitable. Passenger orientated and rationally pruned with an emphasis on productivity[66], the inevitable nature of this change includes surviving signal boxes facing a changed railway landscape.

This perception of the changed railway landscape becomes more complicated where the railway landscape is part of an identifiable community vernacular. Removal of listed wooden level crossing gates adjacent to the listed Plumpton Signal Box is an example. Mechanically operated from the signal box, Network Rail's plan to seek delisting of the gates and replacement by modern barriers met with local opposition specifically describing the gates as part of the village vernacular.[67] Failure of the mechanical mechanism, which Network Rail was unwilling to repair as, "not viable"[68], led to an extended closure of the level crossing with pressure upon the council to eventually permit delisting and replacement of the gates.[69]

Signal boxes surviving alongside closed railways are rare, as even if not demolished upon closure the structures, especially where entirely timber, are vulnerable to prolonged lack of maintenance making survival improbable. However, there are exceptions, usually predominantly masonry structures, such as the Broomielaw Signal Box, a North Eastern Railway structure closed in 1965, abandoned and now derelict (figure 2). As for the streetscape surrounding the railway, this is also sharply variable, and survival of an original streetscape strongly depends either upon an extended period of locally low economic activity preventing changes in the streetscape or whether the streetscape forms part of a conservation area.

[Figure 2 near here]

Using these, slightly arbitrary, definitions we assigned into each quadrant a sample of signal boxes surveyed to date, positioning in the quadrant according to how strongly the signal box meets the binary criteria.

[Table 3a near here]

[Table 3b near here]

The most striking feature of this exercise is how the changing context is potentially the most important aspect in perceived authenticity for surviving signal boxes. Out of all surviving heritage signal boxes, only the listed Birmingham New Street Signal Box (figure 3) is unequivocally unchanged in an unchanged context, largely because it is a 1960's power signal box for a modern railway station. It is possibly to similarly view the panel signal box at Liverpool Lime Street, in that while the trains are much changed, the railway streetscape around the signal box, recently closed and with an uncertain future, is largely unchanged since construction. Heritage becomes a flexible term, as modern power signal boxes are a distinctive part of a modernised railway and therefore fulfil the test of being in a railway environment that the first occupants of the signal box would recognise. Another example of unchanged signal boxes in an unchanged environment are signal boxes for a special purpose. Such an example is Clachnaharry Signal Box (figure 4), which serves no purpose other than controlling a railway swing bridge over the Caledonian Canal, a function unchanged since opening.

[Figure 3 near here] [Figure 4 near here]

Many originally mechanical signal boxes no longer contain the original equipment, with modern electronic equipment controlling an extended area of operations or merely

function as a location to remotely monitor modern level crossings. Where signal boxes retain mechanical signalling equipment rationalisation, through the removal of sidings and junctions, is resulting in the underutilisation of this equipment. The exception that almost proves this rule is Shrewsbury Severn Bridge Signal Box (figure 5), where the complex three-sided layout still hints towards former complexity, whereas the LNWR goods yard adjacent to the closely neighbouring Shrewsbury Crewe Junction Signal Box closed in 1971.[70]

[Figure 5 near here] [Figure 6 near here]

York Platform Signal Box, Carlisle No 4 Signal Box and Horsham Signal Box (figure 6) are each in railway environments unchanged in essence since construction. All three are no longer in use as signal boxes with two, York Platform Signal Box and Carlisle No 4 Signal Box, unrecognisable as signal boxes even though inside passenger stations recognisable as original despite replacement of steam age signalling with modern, remotely controlled, signalling appropriate for electric trains. Horsham Signal Box has lost the steam locomotive depot behind yet continues to face an electric railway that prompted construction of the signal box and a goods yard, albeit now used for track maintenance trains as opposed to freight.

Listed signal boxes solidly populate the unchanged signal boxes in a changed context category. Of these, there is some change to the signal box from an ‘as built’ condition, either represented by pragmatic changes that are essentially part of the building’s narrative, such as an additional porch on Pulborough Signal Box (figure 7) constructed well in advance of the listing process, or advancing post closure deterioration, such as Rhyl No 2 Signal Box (figure 8). This category also includes the previously discussed Plumpton Signal Box, where the signal box, closed and mothballed as no longer needed

to operate the new barriers, is an unchanged structure incongruously set alongside the modern barriers, wig-wags and radar obstruction scanning equipment.

[Figure 7 near here] [Figure 8 near here]

There are a small number of listed signal boxes in the totally changed category, mostly where pragmatic changes are so insensitive to the original design that that it changes the character of the signal box. The uPVC windows in the architect designed[71] St Bees Signal Box are an example, although comparing this with Pulborough Signal Box shows a weakness with these arbitrary distinctions. The timber porch at Pulborough Signal Box matches the original materials, even if a low-quality addition, while the uPVC window design at St Bees Signal Box attempts to match the original timber windows while enhancing building usability.

Our considering Frome Mineral Signal Box and Radstock North Signal Box (figure 9) as totally changed represents buildings relocated after closure, in both cases the relocation confined to the upper operating floor onto a new, with modern rather than original brickwork, ground floor locking room. While the railway environment, within the curtilage of an engine shed turned into a railway heritage centre, is genuine, the relocated setting is ersatz, an idealised environment simulating an original setting. That both buildings, retaining their original locational identities and well maintained, are in an environment that strongly supports educational interpretation therefore strongly presents an intellectual challenge in whether conservation should include interpretation. Significantly, the relocation of both buildings is within former Great Western Railway territory and, therefore, whatever failing the relocated buildings my exhibit, they retain a regional resonance. In contrast is Lydney Junction Signal Box (figure 10), a British Railways (Midland Region) design originally at Heysham Harbour, relocated to

Western Region territory and thereby losing regional resonance. However, this relocation serves an operational requirement and, appropriately, the signal box takes on a new identity in the precedent of Magdalen Road Signal Box.

[Figure 9 near here] [Figure 10 near here]

Knowledge

Having determined context for signal boxes, our next question is how people interact with these heritage buildings. We postulate two distinctly defined groups of expert stakeholders, being experts in railway signalling or heritage buildings. Examining each group in turn identifies a similar spectrum of engagement or expertise. As for context, it is equally possible to plot these groupings, although with the skills being on a spectrum rather than a scatter within the slightly artificial binary context diagram possible.

[Table 4 near here]

For railway signalling, the expert group are railway signalling professionals and railway enthusiasts with specific knowledge of the subject. By definition, the most expert of these should be railway signalling engineers or signal operators, while the railway enthusiasts will encompass a wide spectrum from those working with signalling in the heritage railway movement, where there is a safety accreditation for these skills, down to those with a basic knowledge of the subject. For non-experts, it is possible that older people remembering the erstwhile railway with widespread mechanical signalling will have a passing familiarity with the signalling though memory of seeing the ‘everyday’ railway.

We identified a similar spectrum regarding expertise in heritage buildings. For the experts, each discipline presents a spectrum of ability depending upon the training and experience of the individual. There are also inevitable differences of outlook, so the building conservationist and building historian will be equally knowledgeable yet are likely to take a different view when faced with a specific building. A comparable situation arises with architects and building surveyors. Whereas one possesses greater in-depth knowledge of historical styles and design, the other has an equally in-depth knowledge of how buildings perform over an extended period, with these different abilities informing how they perceive a building. The distinction between expert and non-expert is less distinct for heritage buildings. For example, there are property professionals, such as real estate surveyors, who have an elementary grounding in the issues of heritage buildings, while there are amateurs who through an interest will have a tremendous knowledge of heritage buildings and an intuitive yet unarticulated sense of conservation values.

Once again, we found a striking contrast. The spectrum of skills and knowledge are strongly linear within a single dimension, with two conspicuous exceptions. The first is the amorphous grouping of ‘general public’, who do not possess any identifiable knowledge in heritage buildings or signalling. It therefore follows that if this group engages with either signalling or heritage buildings, the presentation of information will need a strong element of interpretation to make the engagement accessible and thereby satisfying. It becomes inevitable that interpretation will involve compromise to ensure this engagement, even if the compromise is unsatisfying for the experts. The second exception is the unlikely individuals who possess skills that cross over the two linear skill spectrums, these individuals having a responsibility to satisfy the conflicting demands from the two skill spectrums in a way that guides effective conservation.

Conclusions

Conserving individual heritage signal boxes is possible. However, the optimum environment of conserving in an original context is invariably unavailable, so our conclusion is that conservation strongly implies acceptance of two default compromises:

1. Conservation within a changing context will satisfy the test of authenticity for a signalling expert, in that the signal box is in the original position with original equipment yet provide a building that is sterile in terms of effective heritage building conservation
2. Conservation in a changed context will require a level of interpretation that is unacceptable, or at least uncomfortable, for experts in signalling and heritage buildings

Either solution requires a conscious decision, along with precise documentation record of changes to maintain, "a cumulative account of what has happened to a significant place, and understanding how and why its significance may have been altered".[72] Neither solution fully satisfies the test of effective conservation, thereby reinforcing Mclean's assertion concerning the treatment of signal boxes.[73]

With custodianship for most surviving signal boxes, it is possible to feel a modicum of sympathy for Network Rail where conservation of historic assets must appear to be low priority in achieving a modern, cost-effective railway. Equally, cost-effective can so often appear homogenised, using standard solutions to all problems without regard to wider considerations. Reference to Table 3a demonstrates how changing context is the prevalent theme, in each case the changing context making interpretation of the

conserved building much more difficult, especially where an observer has limited knowledge of the reasons for conserving the building. Therefore, alongside conservation, there appears to be a need to provide relevancy for interpretation, the vertices described by Tenbrink *et al*[74] giving a sense of making the reason for conservation accessible for all observers of the building, particularly where the original function changes and recedes from collective knowledge. With 'functional buildings', two options appear to present themselves in providing relevancy:

1. Conservation must include every aspect that supports the reason for the functional building's existence
2. Relocation of the functional building to a location where the building has relevancy

Both options present problems. For the first option, as the Plumpton Signal Box example demonstrated, there is a tension between conserving every aspect and appropriate modernising of infrastructure. Applying this principle would demand the continued use of conserved infrastructure, with, for Plumpton Signal Box continued staffing for no other reason, holding the conserved railway landscape in a stasis, and potentially bringing conservation into disrepute. Conversely, conservation is about preserving significance, the culture of transport technology defined by Divall & Revill[75], so we identify that there is a case for conserving a complete railway landscape as an example, even if such conservation presents as an anachronism. The second option relies upon us partially rejecting Stratton's assertion[76] concerning the discredited nature of relocation, especially as there is a precedent in terms of signal boxes. However, there is a different motivation here, as relocation for railway operational reasons becomes part of a building's narrative rather than relocation to make railway heritage a sellable

package. Again, contradictions present, as relocating a signal box to a heritage tourist railway for operational reasons, such as the regionally discordant Lydney Junction Signal Box, falls into both criteria, serving an operational need for a sellable tourist experience.

Overall, heritage signal boxes, as a model for heritage functional buildings built for a specific purpose and difficult to adapt, represent contradictions when subject to the normally accepted principles of building conservation. As a result, these heritage buildings present difficulties in receiving appropriate conservation. Our conclusion is that conservation policies for functional heritage buildings in any post-industrialisation country need a stronger emphasis on relevancy as a lead into effective interpretation derived from an understanding as to how all interested parties perceive the building. It is also appropriate that further work is necessary to understand the motivations and processes enacted by custodians of heritage functional buildings.

Notes

1. Kay, *The Signal Box*, viii
2. Reeves, "Policy for conservation of heritage railway signal boxes in Great Britain", 54
3. Ibid, 56
4. Parissien, *Station to Station,* 9-10
5. Dethier, *Le Temps des Gares*, 6
6. Biddle, *Britain's Historic Railway Buildings: A Gazetteer of Structures and Sites*, 11-12
7. Dethier, *Le Temps des Gares*, 91
8. Reeves, "Policy for conservation", 54

9. Mclean, “Conservation of culturally significant mechanical signal boxes”, 319. Listed is the generic nomenclature applied to buildings of architectural or historical significance in the UK that have statutory protection.
10. Reeves, “Policy for conservation”, 14
11. Drury & McPherson, *Conservation Principles: Policies and Guidance*, 28
12. Hudson, *The Industrial Revolution*, 81
13. Ibid, 106
14. Stokes, “Early Railways and Regional Identity”, 313
15. Biddle, *Britain’s Historic Railway Buildings* 21
16. Jones & Munday, “Blaenavon and United Nations World Heritage Site Status: Is Conservation of Industrial Heritage a Road to Local Economic Development?”, 587
17. Mydland & Grahn, “Identifying heritage values in local communities”, 584
18. Reeves, “Policy for conservation”, 48-9 & 52
19. Stratton, “Tourism and the industrial heritage”
20. Ibid, 117
21. Ibid, 120
22. Araoz, “World-Heritage Historic Urban Landscapes: Defining and Protecting Authenticity”, 34
23. Ehrentraut, “Heritage authenticity and domestic tourism in Japan”, 270
24. Stratton op cit. Described as the ‘The Birthplace of the Industrial Revolution’, the various sites in Ironbridge Gorge became a museum in 1967.
25. Mydland & Grahn, “Identifying heritage values”, 570
26. Ehrentraut, “Heritage authenticity”, 270

27. Kolar & Zabkar, “A consumer-based model of authenticity: An oxymoron or the foundation of cultural heritage marketing?”, 652
28. Araoz, “World-Heritage Historic Urban Landscapes”, 36
29. Stratton, “Tourism, industrial heritage”, 122
30. Ehrentraut, “Heritage authenticity”, 270
31. Kolar & Zabkar, “A consumer-based model of authenticity”, 654
32. Mydland & Grahn, “Identifying heritage values”, 566
33. Tenbrink *et al*, “Cognition and Communication in Architectural Design”, 266
34. Divall & Revill, “Cultures of transport: representation, practice and technology”, 14-5
35. Strangleman, “The nostalgia of organisations and the organisation of nostalgia: Past and present in the contemporary railway industry”, 741
36. Dovey, “The quest for authenticity and the replication of environmental meaning”, 46
37. Simmons & Biddle, *British Railway History*, 473
38. Richards & MacKenzie, *The Railway Station: a Social History*, 19-20
39. Although the gender specific nomenclature is out of date, we use it here because of contemporaneous usage.
40. Member of staff employed to couple and uncouple railway vehicles, along with managing the movement of vehicles within a station or goods yard.
41. Again, contemporaneous gender specific nomenclature and referred to henceforward by a more modern description, signal operator.
42. Simmons & Biddle, *British Railway History*, 452-3
43. Harris, *The Railway Dilemma, The Perpetual Problems of Ownership, Costs & Control*, 108

44. Transport Act 1962
45. Bonavia, *British Rail, The First 25 Years*, 163-5
46. Ibid, 120
47. Simmons & Biddle, *British Railway History*, 31. The 'Big Four' is a normally accepted, albeit informal, appellation for the four railway company groupings that ran the majority of British railways between 1923 and 1947, the four being the Great Western Railway, the London Midland and Scottish Railway, the London and North Eastern Railway and the Southern Railway.
48. Addyman & Mallon, *The Alnwick & Cornhill Railway*, 89
49. Richards & MacKenzie, *The Railway Station*, 237-8 & 241
50. Kay, *The Signal Box*, 32-3
51. Kay, *Signalling Atlas and Signal Box Directory*, 15-29
52. Kay, *The Signal Box*, 126-8
53. Stratton, op cit, 122
54. Kay, *The Signal Box*
55. Kay, *Signalling Atlas*
56. Reeves, "Policy for conservation", 11-12
57. Divall, "Heritage Railways as Museums: Occupations and Landscapes", 4
58. Tenbrink *et al*, "Cognition and Communication", 264
59. Reeves, "Policy for conservation", 56
60. Kay, *The Signal Box*, vi-vii
61. Hollis, *Surveying Buildings*
62. Drury & McPherson, *Conservation Principles*, 27-32
63. Harris, *The Railway Dilemma*, 130
64. Simmons & Biddle, *British Railway History*, 29

65. Bonavia, *British Rail*, 112. Harris, *The Railway Dilemma*, 139, notes the omission of certain key documents from the National Archives and therefore possibly, "tactfully destroyed".
66. Harris, *The Railway Dilemma*, 130
67. Topham, *Plumpton Green villagers man the barricades to save railway gates*
68. BBC News, *Plumpton Grade II-listed level crossing plan is rejected*
69. BBC News, *Listed level crossing barrier to be removed in Plumpton*
70. Cobb, *The Railways of Great Britain: A Historical Atlas*, 286
71. Historic England, *St Bees Signal Box*
72. Drury & McPherson, *Conservation Principles*, 24
73. Mclean, "Conservation, mechanical signal boxes", 319
74. Tenbrink *et al*, "Cognition and Communication", 268-71
75. Divall & Revill, "Cultures of transport", 15
76. Stratton, op cit, 122

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Table 1a

Key contextual information leads by identifying the original railway company or name of signal box manufacturer (with the original railway company in brackets) and specific design type.

Signal box	***Key contextual information***
Birmingham New Street	1. BR bespoke, 1966, listed grade II, open although scheduled for closure 2. Station open, unchanged passenger railway environment
Broomielaw	1. NER type C2a, 1897, closed with railway 1965, derelict 2. Station closed 1964/extant, goods yard closed/track removed, trackbed extant
Carlisle No 4	1. LNWR bespoke, 1880, group listed grade II*, closed, offices 2. Station open/modified, largely unchanged railway environment

Chathill	1.	NER type N1, 1873, listed grade II, closed
	2.	Station open, goods yard closed/not extant
Clachnaharry	1.	McK&H [HR] type 3, 1890, group listed grade B, open, controls swing bridge
	2.	Unchanged railway environment
Didcot [Frome Mineral]	3.	GWR type 2, 1875, originally Frome Mineral, relocated 1990s, open, heritage railway site
	4.	Former engine shed developed as heritage railway centre
Didcot [Radstock North]	1.	GWR type 27c, 1909, originally Radstock North, relocated 1985, open, heritage railway site
	2.	Former engine shed developed as heritage railway centre
Dorchester South	3.	BR(SR) type 16, 1959, open
	4.	Station open, goods yard closed/not extant, adjacent brewery redeveloped

Downham Market	5.	GER type 2, 1881, group listed II, open
	6.	Station open, goods yard closed/not extant, adjacent flour mill still extant
Eastbourne	7.	S&F [LBSCR] type 5, 1882, brick to floor, listed grade II, closed, mothballed
	8.	Station open, goods yard closed/not extant
Haltwhistle	1.	NER bespoke, 1901, listed grade II, closed, mothballed
	2.	Station open, junction closed, goods yard closed/not extant
Heckington	1.	GNR type 1, 1876, listed grade II, open
	2.	Station open, goods yard closed/shed extant, adjacent windmill grade I listed
Hereford	1.	LNWR/GWR joint type 2, 1884, open
	2.	Station open, railway environment close to signal box fairly unchanged

Horsham	1.	SR type 13, 1938, listed grade II, closed, offices
	2.	Station open, engine shed closed/not extant, goods yard open for civil engineering trains
Liverpool Lime Street	1.	LMS type 13, 1948, closed, mothballed with various proposals for future use
	2.	Station open, unchanged passenger railway environment
Lydney Junction	1.	BR(LMR) type 15, 1970, originally Heysham Harbour, relocated 1996, open, heritage railway
	2.	Station open, goods yard used for heritage locomotive storage
Magdelen Road	1.	GCR type 5, late C19, relocated 1927 (no record former location), open
	2.	Station open, junction closed, goods yard closed/not extant

Maiden Newton	1.	GWR type 7d, 1921, Group listed grade II, closed, mothballed
	2.	Station open, junction closed, goods yard closed/not extant
Montrose North	3.	NBR type 1, 1881, listed grade C, open
	4.	Station open, adjacent sidings closed/not extant
Newhaven Town	5.	S&F [LBSCR] type 5, 1879, timber, open
	6.	Station open, goods yard closed/not extant
Plumpton	7.	LBSCR type 2b, 1891 listed grade II, closed, mothballed
	8.	Station open, goods yard closed/not extant, adjacent level crossing totally modernised
Portsmouth Harbour	9.	SR type 13, 1946, closed, mothballed
	10.	Station open, mostly unchanged passenger railway environment

Pulborough	11.	S&F [LBSCR] type 5, 1878, brick to floor, group listed grade II, extended, closed, mothballed
	12.	Station open, junction closed, goods yard closed/not extant
Rhyl No 2	13.	LNWR type 4, 1900, listed grade II, closed, partially derelict
	14.	Station open, reduced in extant
Shrewsbury Crewe Junction	15.	LNWR type 4, 1903, listed grade II, open
	16.	Station open, nearby goods yard closed/not extant
Shrewsbury Severn Bridge	17.	LNWR type 4, 1903, listed grade II, open, largest surviving mechanical signal box in Great Britain
	18.	Station open, railway environment close to signal box mostly unchanged other than sidings/turntable removed

St Albans South	19.	MR type 2a, 1892, listed grade II, closed
	20.	Station open, goods yard closed/not extant
St Bees	21.	FR type 3, 1891, listed grade II, open, original windows replaced with uPVC
	22.	Station open, goods yard closed/not extant
Stirling Middle	23.	CR type N2, 1901, Group listed grade A, open
	24.	Station open, south engine shed closed/not extant, south goods yard closed/largely not extant, although adjacent warehousing from same era converted into other uses
Stirling North	25.	CR type N2, 1900, Group listed grade A, open
	26.	Station open, north engine shed closed/not extant, north goods yard closed/not extant

Truro East	27.	GWR type 7a, 1899, open, structural defects
	28.	Station open, engine shed closed/not extant, goods yard closed/not extant
Ty Croes	1.	LNWR type C&H, 1872, listed grade II, open
	2.	Station open, goods yard closed/not extant
Wainfleet	3.	GNR type 1, 1899, listed grade II, open
	4.	Station open, goods yard closed/not extant
Wareham	5.	LSWR type 4, 1928, open, windows replaced by uPVC
	6.	Station open, goods yard closed/not extant, goods shed now offices
Wylam	7.	NER type N5 overhead, ~1897, listed grade II, open
	8.	Station open, goods yard closed/not extant

York Platform

9. NER bespoke, 1907, group listed grade II*, closed 1951, café/retail

10. Station open, unchanged principally passenger railway environment

Table 1a

Glossary (railway companies)

BR	British Rail
BR(LMR)	British Rail (London Midland Region)
BR(SR)	British Rail (Southern Region)
C&H	Chester and Holyhead
CR	Caledonian Railway
FR	Furness Railway
GCR	Great Central Railway
GER	Great Eastern Railway
GNR	Great Northern Railway
GWR	Great Western Railway
HR	Highland Railway
LBSCR	London Brighton and South Coast Railway
LMS	London Midland and Scottish Railway
LNWR	London and North Western Railway
LSWR	London and South Western Railway

MR	Midland Railway
NBR	North British Railway
NER	North Eastern Railway
SR	Southern Railway

Glossary (signal box manufacturers)

McK&H	McKenzie and Holland
S&F	Saxby and Farmer

Table 2

		Context	
		Changed	Unchanged
Signal box (building)	Changed	Signal box extensively modified, relocated or unrecognisable. Railway environment that first occupants of the signal box would not recognise.	Signal box extensively modified, relocated or unrecognisable. Railway environment that first occupants of the signal box would recognise.
	Unchanged	Signal box in approximately 'as built' condition. Railway environment that first occupants of the signal box would not recognise.	Signal box in approximately 'as built' condition. Railway environment that first occupants of the signal box would recognise.

Table 3a

Signal box (building)	Context: Changed	Context: Unchanged
Changed	 St Bees Signal Box (1891). Unusually for a signal box, architect designed, this Arts and Crafts influenced design being by John Harrison from the Lancaster based architectural practice Paley and Austin. Note the replacement uPVC windows.	 York Platform Signal Box (1907). Seemingly, an extremely successful café and retail reuse of this building in the main passenger concourse.
Unchanged	 Plumpton Signal Box (1891). Notice on the right is one of the wig-wags for the controversial replacement level crossing that changed the railway environment and made the signal box redundant.	 Liverpool Lime Street Signal Box (1948). This signal box is within a railway environment solely used by passenger trains, so other than additional of equipment for electric trains, the railway landscape is relatively unchanged since construction.

Table 3b

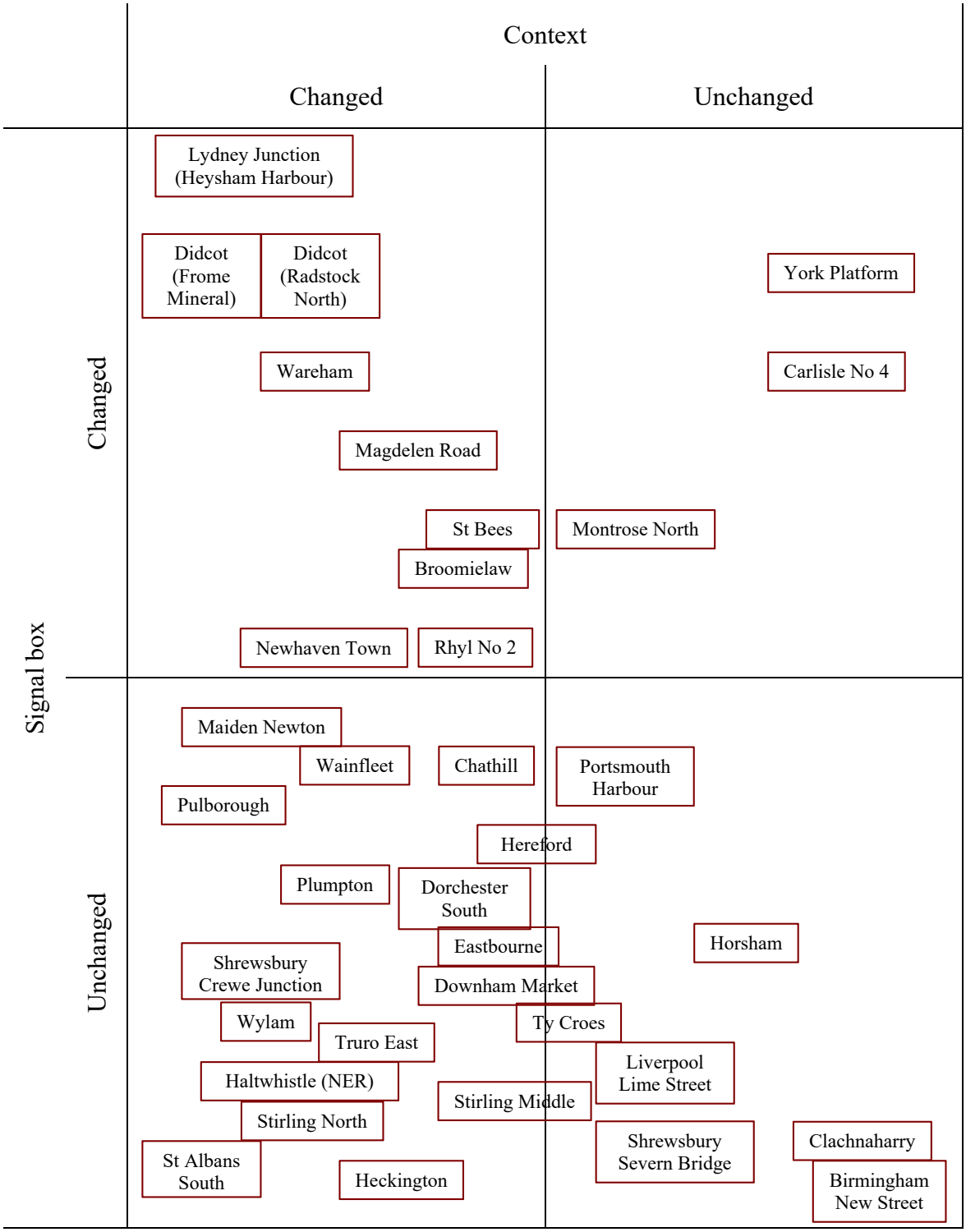
Context
Changed
Unchanged
Signal box
Changed
Unchanged
Lydney Junction (Heysham Harbour)
Didcot (Frome Mineral)
Didcot (Radstock North)
York Platform
Wareham
Carlisle No 4
Magdelen Road
St Bees
Montrose North
Broomielaw
Newhaven Town
Rhyl No 2
Maiden Newton
Wainfleet
Chathill
Portsmouth Harbour
Pulborough
Hereford
Plumpton
Dorchester South
Eastbourne
Horsham
Shrewsbury Crewe Junction
Downham Market
Wylam
Ty Croes
Truro East
Liverpool Lime Street
Haltwhistle (NER)
Stirling Middle
Stirling North
Shrewsbury Severn Bridge
Clachnaharry
St Albans South
Heckington
Birmingham New Street

Table 4

Knowledge of railway signalling	Knowledge of heritage buildings: Non-expert	Knowledge of heritage buildings: Expert
Expert	Railway signal operator or signalling engineer Railway enthusiast with specialist interest and knowledge	An unlikely combination!
Non-expert	People with memory of the 'older railway' with mechanical signalling The general public Interested public, such as members of the National Trust	Real estate surveyor Architect or Building surveyor Building conservationist or Building historian

Figure 1: Magdelen Road Signal Box (1927). A Great Central Railway design signal box relocated in 1927 to this site in former Great Eastern Railway territory.

Figure 2: Broomielaw Signal Box (1897). Abandoned since 1965 and overall still structurally sound. Even the surviving timberwork, including block instrument shelf behind the front windows, is still potentially repairable and balcony ironmongery still extant.

Figure 3: Birmingham New Street Signal Box (1966). While the cityscape buildings may be different from 1965, the cityscape environment is true to this building. The railway landscape, electric passenger railway, is the reason for construction of this signal box, so has unmodified authenticity.

Figure 4: Clachnaharry Signal Box (1890). Only modern track and enclosure of the lead way (opening through the brick plinth) show any changes since construction. The open swing bridge is visible to the left.

Figure 5: Shrewsbury Severn Bridge Signal Box (1903). ‘Rail-locked’ within a triangular site that will make access difficult for reuse following closure, this is the largest surviving mechanical signal box in Great Britain. The rail-locked situation gives a powerful sense of railway landscape authenticity.

Figure 6: Horsham Signal Box (1938), being a Southern Railway type 13, an Art Deco influenced design known as the ‘Odeon’ style. Opposite the signal box is the original goods yard, now slightly reduced in size and in use for civil engineering trains. Behind the signal box was situated the former engine shed, redeveloped as industrial units. Recognisably a signal box and, other than the missing engine shed, the railway landscape is presumably recognisable in comparison with 1938.

Figure 7: Pulborough Signal Box (1878). The London Brighton and South Coast Railway (LB&SCR) made extensive use of the standard modular signal box designs by the signalling manufacturer Saxby and Farmer (John Saxby being a former employee of the LB&SCR). Pulborough Signal Box is a Saxby and Farmer Type 5 design, although the unsympathetic porch is a later addition that pre-dates the listing. The staircase is a replacement.

Figure 8: Rhyl No 2 Signal Box (1900). Although still structurally stable and reasonably carefully mothballed, the building presents a derelict impression.

Figure 9: Radstock North Signal Box (1909). In an equivalent manner to Frome Mineral Junction Signal Box, this is a relocated operating level on a replica locking room plinth. An attempt is made to match the bricks to original, although again is apparently in contemporary bricks. Note the effort to provide a contextual interpretation in the relocated setting.

Figure 10: Lydney Junction Signal Box, formerly Heysham Harbour Signal Box (1970). Relocated in 1996, the entirely timber construction facilitating relocation, this well-presented signal box serves an operational requirement on a heritage railway.