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Recycled Railway Corridors: An Urban Design Perspective

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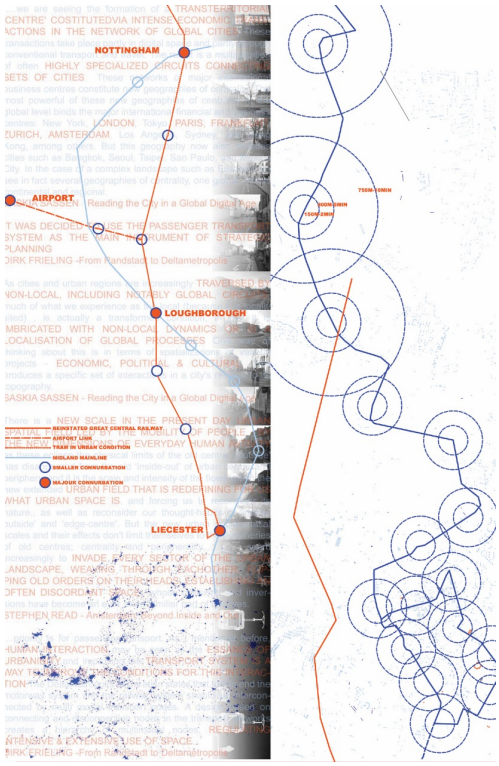
Abstract

In order to present an urban design perspective on recycled railway corridors this research considers the importance of place qualities to selected regional and neighbourhood transit contexts, also the spatial implications of a variety of certain differing transit modes are reviewed. This examination considers normative urban design criteria in relation to concepts of sustainable, transit-supportive built environments. This notion required a conceptual framework which accommodates the sophisticated and subjective aspects of regional design. Further, a visual methodology capable of accumulating significant quantities of data relevant to urban design was requisite. A qualitative case study strategy of inquiry was therefore adopted. Three UK recycled railway corridors were selected as case studies and considered independently and interdependently. This comparative analysis was predicated upon a variety of sources; archival, documentary and observational.

This research uncovered urban design truths in the empirical context of recycled railway corridors. A high proportion of the instances examined in this research illustrate perfunctory urban design responses to public transit spaces, both in the regional and neighbourhood contexts. These instances were evocative of influences that prompt homogenisation in the anatomy of the built environment, with the automobile-dominated landscape showing prevalence. In these instances, normative urban design qualities were largely absent from the public realm. In lieu of these qualities 'anywhere' design responses, that failed to address issues of authenticity and place specificity, occupied those important spaces that relate to the public transit systems.

However, this condition was not ubiquitous. This research examined instances where careful interdisciplinary 'joined-up thinking' has led to a set of place specific, transit supportive urban designs. Here, the opportunities inherent at the convergence of public transit systems and the human scale public realm have been taken advantage of. This has been achieved through the consideration of issues such as palimpsest, rootedness and place specificity, which have resulted in exemplars of bespoke, transit supportive urban designs.

There are many whom require acknowledgement for their help in the completion of this thesis, from both personal and professional positions. The foci of this research, the urban design of recycled railway corridors, was first examined through a design exercise as opposed to the empirical research it is now. This design exercise was conducted under the tutelage of Dr Timothy Brindley. The task set was to accommodate a relatively large amount of new dwellings on ex-industrial brownfield sites within the city of Leicester. As part of the city-wide site analysis for this project, it soon became apparent that a significant amount of that land use typology were linked, by what it transpired to be, the disused Great Central Railway alignment. This prompted a change in perspective from a city-wide to a regional outlook in order to incorporate sites beyond the city boundary that were linked by what was perceived at the time to be a dormant asset (see below). This design task, and the further questions which it prompted, was in essence, an embryonic exercise for this research.



Both this design exercise and the resulting theoretical review (for which Dr Timothy Brindley was also dissertation supervisor), introduced the researcher to the notion of transit supportive urban design theory. This brief exercise in applying 'Transit Town' principles as part of a design exercise highlighted the paradigm's inherent complexities to the researcher. Once the opportunity arose, a Ph.D. proposal was submitted with the intention of examining these complexities in detail. This researcher owes Dr Timothy Brindley a debt of gratitude for recognising the scope of, interest in, and significance in this topic, especially considering other academics were dismissive of the ideas.

Personally the researcher has a complex relationship with the issue of disused / recycled railway corridors which can be difficult to articulate without becoming sentimental. The image below is of a dissed railway line close to the Derbyshire / Nottinghamshire boarder. This line, having just passed under a bridge that previously carried the dismantled 'Ripley Rattler' tramway, is a spur towards the Loscoe Colliery off the Midland Railway between Nottingham and Sheffield.

This Image also shows to the right the garden of my childhood home and to the left housing that was built during the researcher's lifetime, which turns its back to the disused line. Phenomena such as this have been formative. I have distinct memories of walking this and other 'railway solemn' (Association of Train Operating Companies, 2009), wondering what happened to the trains[1] and what the future holds for such spaces? A curiosity that is extending through and beyond this research. This curiosity is at the bequest of my late father Alan[2], whose intelligence, critical ability and insatiable pursuit of knowledge I could only hope to emulate.

I owe a debt of gratitude to my close family; my Mother, Aunt and Partner. Without their patience and considerable financial support this research would not have been possible. This gratitude also extends to my supervisor, Tim Heath. Without his patience, advice, time, support and encyclopaedic knowledge of urban design this research would not have been

[1] Other instance of the researcher finding themselves at places that used to be railway lines: Childhood memories of Victoria Bus Station in Nottingham on the site of Victoria Railway Station, attending the re-opening of Langley Mill Railway Station with junior school, playing football adjacent to Newstead Railway Station during the reinstatement work of the Robin Hood Line, visiting a family members house adjacent to the reinstatement work of the Robin Hood Line, working as a labourer in a cabinet making factory on the site of the closed Great Central Railway in Hucknall, walking to university (undergraduate) along a disused line that ran along the bottom of the garden.

[2] Who would have most likely been in the same A-level group as one of the key authors in this text, had he been allowed to attend sixth form college at the age of 16, as opposed to going straight into work for Raleigh, at the site that is now the University of Nottingham's Jubilee Campus.

possible either. Further, I have enjoyed our deliberations over, what I hope, has been a mutually interesting topic. My gratitude also extends to Dr Kim Lawson, whose advice, coaching and compassion have enabled the completion of this thesis.

To Alan

for Sam & Georgie

As our home town of Nottingham's motto states: *Vivit Post Funera Virtus*

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1 Introduction

This research examines 'recycled railway corridors' (RRC) through an urban design lens. By definition, an urban 'design' can be considered either a noun or an adjective (Wall & Waterman, 2009). As a noun, urban 'design' can be defined as a proposition for the configuration of a place[3]. The majority of the work within this research uses the definition of urban design as an adjective, a characteristic of an urban environment. Therefore, the focus of this research is, in this specific research context, built environments that are relating or belonging to RRCs and also built environments that constitute or are characteristic of cities and towns in relation or belonging to RRCs. Wall and Waterman (2009) go further and elaborate on the question 'what is urban design?'

> *"There is still plenty of debate as to the scope and the goals of urban design. There is consensus, though, that the work of urban design exists at the intersection of architecture, landscape architecture and city planning" (Wall & Waterman, 2009, p. 17)*

For the purposes of this research, the above definition requires extension beyond Architecture, Landscape Architecture and City Planning to include Regional Planning/Design[4], Land Use Planning and Transport Planning.

The key idea here is the notion of urban design being situated at an 'intersection'. The following diagram illustrates the relationship between the research territory (RRCs) and a set of individual yet overlapping component parts. Good urban design (Carmona, Heath, Oc, & Tiesdell, 2003) is the sum of these parts being greater than their constituent individual elements. Therefore, the theme of exploring the constituent parts coming together at RRCs bears closer examination.

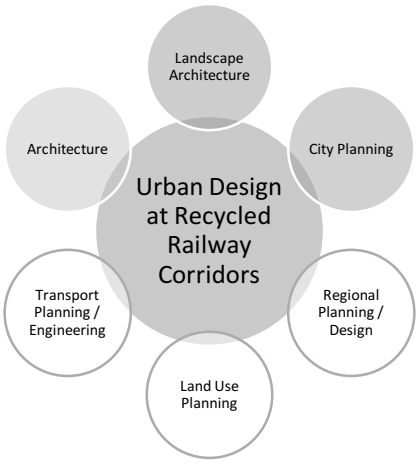


Figure 1.1 RRC and Intersecting Disciplines

[3] In this research this type of plan is used as a document to a small degree to examine the design intention of a proposed built environment in lieu of realised environs.
[4] Chapter Two discusses the argument made by Calthorpe and Fulton that regions should be designed.

This model appears insufficient to describe the relationships of the intersections at the urban designs of RRCs. It implies a flat hierarchy between the six disciplines and urban design. The literature review demonstrates that there is a stronger synergy between urban design and regional planning/design relative to the other disciplines in the context of RRCs. Therefore, a diagram such as the one below might be more appropriate.

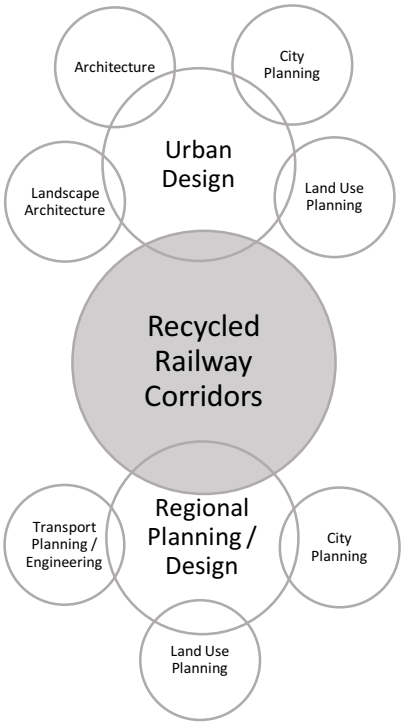


Figure 1.2 RRC and Intersecting Urban and Regional Design Disciplines

This introduction sets out the research problem by discussing the background to the study, the definition of the problem and the scope of this research. It then goes on to summarise studies that have previously addressed the problem and highlights potential gaps in those studies, which are discussed in further detail in the literature review. Subsequent to this, the introduction discusses which audiences this research is relevant to and which methods and methodologies are used. The content and structure of this thesis is then explained and this introduction chapter is concluded with the purpose statement.

1.1 The Research Problem

This first subchapter of the introduction sets out the context to the research. It explains the background to the study, sets the research problem and broadly explains the research scope.

Background to the Research

In 1963, the Beeching Report published recommendations which were implemented over the subsequent decade: 6000 miles of closed routes/2000+ closed stations. This means there is a total of circa 10,000 miles of closed routes in the UK. This implementation was carried out at the height of positivist modernism, reflected in the published findings of the report. This was in conjunction with the emergence of the automobile for both freight and personal transport. However, in 2015 the neologism – 'recycled' railway corridors – borrowed and adapted from Calthorpe and Fulton, is emerging with a number of examples seen in the last 20-30 years. This process is part of many aspects that contribute to the evolution of the RRC's built environments – from the regional scale to the street 'human' scale – with the cycle of closure and repurposing being both an agent and patient in the urban design change.

Considering the extent of disused routes and national housing targets running into the hundreds of thousands of dwellings per year, and an emerging political will to structure expansion around recycled corridors, it is possible to anticipate a future importance for urban design in these instances. Urban design exists at the intersection of many pressures and is formative of the environments within which people exist. This research takes pre-existing and emerging examples of this phenomena and surveys and examines these territories with reference to normative ideas of good urban design.

Definition of the Problem

After significant cuts to the national railway network between the late 1960s/ early 1970s[5] the UK was left with what A.T.O.C. (2009) term a 'railway solemn'; the aforementioned 10,000 miles of disused route[6]. The rights and wrongs of these closures continue to be debated. However, since the early 1990s a selected few of these routes have been reinstated, being utilised for permanent way public transit routes. These reinstatements, or, what is termed in this research, the recycling of these corridors, changes the built environments through which they pass.

After closure, many of these routes were disposed of in a piecemeal manner by their respective local authorities. This had a number of consequences for the respective built environments of the corridors. Large areas of land, in cities, towns and villages became obsolete, as did the corridors connecting them. Some were repurposed immediately, some

[5] Due to a combination of factors: the strain of two World Wars on the network, the amalgamation of competing companies into a nationalised system, the emergence of road-based freight transport and a political will to prioritise the automobile (Henshaw, 1991).

[6] Approximately two thirds of this figure were due to the 'Beeching cuts' with a third of that figure being pre-existing closed routes.

took a matter of years to be redeveloped and there are still considerable amounts of ex-railway land that are lying dormant at the time of writing, some 50 plus years after the publication of the Beeching Report. No overall register or repository of information concerning the geographical location, ownership or condition, has been found as part of the literature review of this research.

There have been two significant unplanned outcomes of the closures; heritage railways and cycle networks. According to the website of 'UK and Ireland Heritage Railways' there are, at the time of writing, 82 operational lines covering 357 miles[7] (575km). Their map, illustrated below, shows the geographical distribution (the heritage railways situated in Ireland were not counted in the above figures).

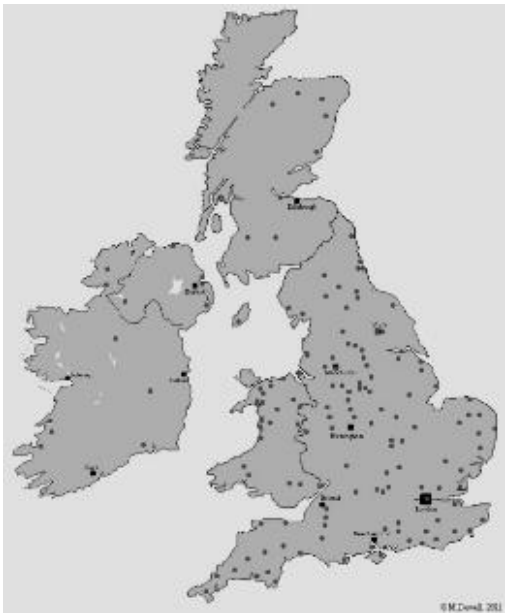


Figure 1.3 The geographical locations of Heritage Rail sites in the UK and Ireland. Source: www.heritage-railways.com

To contextualise this aggregate figure of 575km, it is comparable in route miles to the lengths of the United Kingdom's three most prominent railway routes. The East Coast Main Line from London King's Cross to Edinburgh and the West Coast mainline from London Euston to Glasgow have respective total lengths of 632km and 642km. The high-speed rail line between London St Pancras and Paris Nord is 491km. Whilst this highlights the significance of heritage lines in the United Kingdom, when compared to the amount of disused line the figure seems less significant: 575km as a total percentage of the 16,093km of disused line is 3.5%.

[7] Aggregate of figures given from www.heritage-railways.com for each line. These are taken from individual websites of standard gauge heritage rail operations. Narrow gauge heritage rail and transport museums were not included in this sum.

Heritage Lines are significant in economic terms also. In 2011, over 10 million visitors attended heritage lines across the UK, earning £92 million pounds for the various routes. This popularity is illustrated below;

Figure 1.4 Heritage Rail as a Significant Economic Matter

Dartmouth Railway showing the arrival of a heavily patronised eight-coach train as part of the tourist attraction. Source: Authors own (2011)

RRCs are a very different matter however. There are far fewer recycled railways than heritage lines, they have differing purposes and alternate underlying principles. Whereas a heritage line is a touristic endeavour rooted in nostalgia, a RRC has a variety of differing purposes and exhibits the underlying principles of palimpsest. Although they stem from the same genesis – the act of closure of a railway line – these two differing phenomena have distinct effects upon their urban designs and built environments. It is these urban designs with which this research is concerned; how recycling a corridor relates to the urban design of a previously dormant alignment, and what happens to the urban design at the nodes.

A key definition of this research is that of a 'RRC'. The term is adapted from the terminology used in a compact, yet crucial and illuminatory passage for the conceptualisation of this research, from Calthorpe and Fulton's publication, The Regional City:

> *"With the consolidation of our old train and freight network, much of our historic track is underutilized or abandoned. These lines are particularly important regional assets because they link the centres of historic small towns and they radiate from the city centre. These lines were often the formative network of our regions and now*

> *connect the areas that provide the greatest opportunities for redevelopment and infill: our old town centres and underutilized industrial areas. By combining this new technology with these old rights-of-way, we create an opportunity to recycle and reuse industrial Brownfields and older town centres. This combination of technology and track is affordable; it works at the densities appropriate to the maturing suburb; it can be more convenient than driving because of its right-of-way; and it focuses investment into areas that need it most." (Calthorpe & Fulton, 2001, p. 217)*

Whilst this passage does not specify the concept of a RRC *per se*, the notion is extrapolated from the principle of 'recycling and reusing industrial brownfields'.

The passage above neatly conceptualises the difference between a RRC and a reinstated railway route. The term recycle implies an attitude of forward-looking adaptive reuse whereas the term reinstatement implies a return to a previous condition. For example, a reinstatement would be heavy rail, with all the lines put back to their previous condition/configuration and each station is reintroduced with neither addition, subtraction nor adaptation – a distinctly nostalgic approach more akin to a heritage railway. The term 'repurposed railway corridor' does not precisely conceptualise the ideas under examination either, as this implies a deviation from heavy rail, and perhaps a public transit system altogether. RRCs can still utilise heavy rail, but retain adaptive characteristics in relation to contemporaneous influences[8].

The RRC is distinctly separate from a 'reinstatement' or 'repurposing'. In a RRC, the type of transport mode is not limited to heavy rail, the configuration of the route is based upon but not limited by previous alignments and the nodes along the routes have potential to be attuned to the contemporary requirements through addition or subtraction. The approach inherent in a RRC is more parallel to the idea of a palimpsest than that of nostalgia.

Research Scope and Rationale

As previously discussed, urban design at RRCs exists at the intersection of a number of disciplines. The literature review found little pre-existing studies that examined the precise context of this research from an urban design perspective. Therefore, it has been necessary to limit the scope of the research to investigate the phenomena through a regional design and urban design perspective. This process of setting limitations has been challenging as the boundaries between the disciplines that intersect at RRCs is seldom clear. As defined earlier in this chapter, urban 'design' can be taken as a noun or an adjective (Wall & Waterman, 2009). This research prioritises Urban Design being used as an adjective –

[8] For example, where double track alignments existed single track alignments may be currently present, due to lower levels of line traffic. Also, previous stations may not be situated in currently ideal positions meaning they need not necessarily be reopened, plus stations in new positions may be considered.

'constituting or characteristic of a city or town'. What constitutes the built environment at RRCs? What characterises the built environment at RRCs?

The scope of this research is restricted to the immediate environs of the RRC, the nodes along-the-line and the respective pedsheds[9] of those nodes. Although it is acknowledged in the terms of some disciplines, the influence of a transit node is further (or in some cases less) than the 1km radius around a stop, and this delimitation is common throughout the regional/urban design literature. In terms of the case study boundaries, any extension to or addition thereof[10] would be beyond the resource and capabilities of this researcher.

There are three key reasons for carrying out this research: its relevance and timeliness, professional reasons and personal reasons. The intentions of this research are to formulate one way of exploring RRCs, and consider a plausible and valuable discussion/set of conclusions relevant to this context that are both useful and interesting to those whose thinking occupies the aforementioned disciplinary intersections at RRCs, not least those of an urban design persuasion.

1.2 Theoretical Context

The existing literature used in this research sets out the 'context knowledge' (Flick, 2009) surrounding the urban design of RRCs. This theoretical context is introduced by discussing paradigms relevant to the combination of the built environment and transit, previously examined examples which occur in this research as case studies, and appropriate methodologies of inquiry. This literature is used to contextualise the findings of this research.

This literature review forms Chapter Two of this research. It is shown that there is already a great deal of knowledge regarding the interrelationship between transport and the built environment, from a number of interdisciplinary perspectives. The majority of this, however, is not from an urban design perspective, nor are RRCs paid much specific attention. Those works that are from an urban design perspective however, do point towards certain methodological approaches that relate to normative ideas of urban design. This research therefore addresses open questions over the empirical context of RRCs from the perspective of urban design which itself is sitting within the broader theoretical context of the relationship between built environments and transport.

[9] The pedshed being the extent of the territory practicably walkable related to a transit node. This concept is discussed in chapter two.

[10] For example: exploring disused lines that have not been reinstated, other uses of disused railway lines, other reinstatements on top of the three selected case studies, etc.

This research uses pre-existing literature in four ways. Theoretical literature surrounding the topic of the built environment and public transit is used to contextualise the debates surrounding RRCs and their urban design. Within this body of work are examples of studies that apply to similar empirical fields to this research. These studies also have methodological approaches which are debated in this research. The fourth way of using existing literature in this research is where a combination of theory and empirical literature exist specific to the exact real world contexts examined in the case studies. The table below shows these four categories of literature and cross-references them against the key theoretical works used in this research.

	THEORETICAL LITERATURE	EMPIRICAL LITERATURE	METHODOLOGICAL LITERATURE	CONTEXT-SPECIFIC THEORETICAL AND EMPIRICAL LITERATURE
Critical Regionalism	•			
Social City Region	•			
Transit Oriented Development	•	•		
Normative Urban Design	•		•	
Seven American T.O.D.s		•	•	
Sustainable Social City of Tomorrow	•			•
Hucknall			•	•

Table 1.1 Cross Reference between Theoretical Context of this Research and Theoretical Works Used

This literature review points to the role of urban design being key in the successful resolution of transport and the built environment. In the conclusion to their paper in the Journal of Transport and Land Use, Jacobsen and Forsyth write:

> *"How future projects solve the multiple and complex design challenges inherent in T.O.D. will depend on the particular circumstances surrounding each project, and on the ability of designers, policymakers, engineers, and local citizens to balance competing objectives. Overall, physical design – both in terms of visual quality and liveability – is an important aspect of making T.O.D. projects work and is worthy of further attention" (Jacobson & Forsyth, 2008, p. 82)*

This research will contribute to the debate surrounding the 'complex design solutions inherent in T.O.D. (transit oriented development)'. Although this research is concerned with urban design as opposed to development, there is a high degree of crossover and the intricacies of the territory of RRCs in the UK are an interesting context within which to collect evidence that contributes to this topic.

Potential Significance of this Research

This research is of potential significance to three key audiences: urban design practitioners, urban design theorists and those concerned with policy relating to place and RRCs.

This research uses a case study method, which has meant a corpus of real-world examples has been created. The analysis of these cases against a set of normative urban design criteria has meant that a number of both positive and negative instances of urban design at RRCs have been uncovered. These examples are of potential relevance to their own specific contexts and also any future plans to re-examine other disused railway corridors where a view to structuring growth is taken.

This research is also relevant to urban design theory. It takes pre-existing urban design analysis and interpretation techniques and applies them to a somewhat emerging field of enquiry. These techniques are then critically appraised using the real-world instances examined in this research.

The national planning policy framework calls for robust evidence in protecting historic transport routes for the purposes of increasing transport choice (Department for Communities and Local Government, 2012). This research has significance to this policy through surveying and reporting on the urban design of dormant railway corridors that have been recycled using mass transport means. This highlights a variety of settlement typologies and a number of design responses to the built environments along-the-lines of RRCs, at the nodes along these lines and to-and-from these nodes. The evidence gleaned through this research could contribute to a suite of analyses applied to this specific territory.

There is significant scope for recycling railway corridors due to the quantity of dormant railway alignments. Whilst it is a nonsense to envisage a future where these corridors are all restored, it is arguable that equally, it is hard to envisage a future where none of the solemn (Association of Train Operating Companies, 2009) of disused lines have potential for repurposing. For example, at the time of writing the most substantial repurposing of a RRC is the line between Cambridge and Oxford. Referred to previously in its earlier incarnation as the 'Cantab Crawler' by CS Lewis, this contemporary configuration, entitled 'East-West Rail' is currently undergoing phase 1 of construction

linking Oxford and Bicester. Phase 2 will see Bicester, Bedford, Milton Keynes and Aylesbury connected. The continuation of this between Bedford and Cambridge is under engineering review at the time of writing.

As mentioned previously in this chapter, the work of Jacobson and Forsyth (2008) is at the forefront of analysing T.O.D. through an urban design lens. This work is published in the Journal of Transport and Land Use. Having attended the World Symposium of Transport and Land Use in Delft (May 2014) the prevalence of land-use theory was noticed; however, there was little continuum of the urban design specific work highlighted by Jacobson and Forsyth. This might suggest two contrasting things pertaining to this research. Firstly, that the study of urban design at RRCs is indeed theoretically moribund, and not of interest to the wider academic community. On the contrary however, it may suggest that this research is well-timed, being based in an emerging field with some potential, founded upon established ideas of normative urban design that could operate closely with transport land-use planning theory.

At their 2014 party conference Liberal Democrat leader Nick Clegg, as part of the manifesto for the then forthcoming election, included the expansion of between three and five towns along the reopened route of East West rail, on Garden City terms. With the idea of developing along RRCs hitting the mainstream political agenda – although the party themselves were unsuccessful at this election – it is argued the timeliness of this research into the urban design of RRCs is fairly appropriate in political terms as well as theoretical and practice-based terms.

Contextual Review

This contextual review briefly surveys reused, repurposed and RRCs. The breadth of this survey is international and establishes the context of the increasingly common phenomena of reconsidered disused railway alignments. These examples illustrate a variety of uses of urban design as a part of these reconsidering processes and this brief contextual review informs the research questions of this research both through examples of creative place-centric solutions and pragmatic conceptualisations.

Internationally, four interesting perspectives upon the use of redundant railway corridors/transit systems stand out. The High Line in New York and the ‘Rolling Masterplan’ for the Swedish city of Åndalsnes show significant creativity. Calthorpe’s American T.O.D.s and the Karlsruhe Tram-Train model (Hall, 2014; Hall & Ward, 2014) show innovation through a pragmatic approach.

The High Line’s instigation as an elevated linear park, designed to Landscape Urbanism principles, occurred in 1999 when the ‘Friends of the High Line’ organisation

was founded with the purpose of protecting what was then the threatened, disused railway route through Manhattan's Chelsea district. This elevated railway was situated to the west side of Manhattan Island, close to the banks of the Hudson River[11]. In 1939, the route was raised 10m above grade in order to avoid the circa 100 crossings that existed at street level. This connected many of the meat packing factories of the route directly, with some buildings being adapted to incorporate the railway through their structures. The High Line operated successfully for approximately twenty years until the 1950s when an increase in road-based goods traffic meant a decrease in rail-based freight, culminating in the last train running in 1980.

Figure 1.5 Inverted Obsolescence at the High Line

Source: (http://www.thehighline.org, 2012)

A design competition was launched in 2003 with the eventual winner being the team consisting of James Corner Field Operations and Diller Scofidio + Renfro. In early 2005, the competition entry designs for the High Line were exhibited in the Museum of Modern Art, and a year later work on the scheme commenced. This design, as illustrated above, shows an interesting use of palimpsest with the old railway infrastructure being integrated into the design, with the disused railway tracks visible as tangible artefacts within the contemporary programme.

A further repurposing of disused railway infrastructure that uses creativity in place-making is 'The 'Rolling Masterplan' entry for the city of Åndalsnes by Jägnefält Milton. As illustrated below, the designers proposed the retention of the railway tracks previously serving the disused docks to be repurposed in order to facilitate moving 'live/work pods' which can move around the area in response to climate and other situations.

[11] The northern end of this route is four blocks away from Madison Square Garden, and the southerly end approximately seven blocks from 555 Hudson Street, once the home of Jane Jacobs.

Figure 1.6 The Åndalsnes Rolling Masterplan'

Jägnefält Milton's proposal to repurpose the railway infrastructure as the basis for a novel, flexible urban morphology.

Source: (left http://www.dezeen.com/2010/12/22/a-rolling-masterplan-by-jagnefalt-milton/ right http://www.jagnefaltmilton.se/rolling-masterplan/)

This reflects some aspects of the conceptual framework of this research, where climatic conditions influence critical regionalism and historic land uses can be present in contemporary programmes.

A more pragmatic paradigm than these two examples, which is inclusive of, but not limited to, the reconceptualisation of redundant railway corridors is Peter Calthorpe's Transit Oriented Development. This architecture/urban design based theory which purports best practice at transit nodes is explored in detail in Chapter Two. However, there are examples where these theories have been translated into realised schemes, most notably in the North American context. For example, Portland, Oregon has shown a strategy of planning and growth management based on an existing city grid of approximately 200ft blocks (Abbott, 2002) and a focus on the relationship between mass transport and these development units. Calthorpe (1993) refers frequently to Portland, although other areas[12] have adopted Transit Oriented Development principles, which have become the focus of further academic work (Jacobson & Forsyth, 2008) which is also used by this research, again discussed in Chapter Two.

A further example of a more pragmatic, yet still creative, conceptualisation of both disused and continually used railway alignments is the Karlsruhe Tram-Train model where both light and heavy rail share the same tracks (Hall & Ward, 2014). Karlsruhe in Baden-Württemberg, Germany is renowned for developing this model and in doing so overcoming a variety of engineering challenges such as appropriate signalling, crash resistance, platform height, etc. This has led to a regional network, serving adjacent towns such as Baden-Baden. The urban design implication of this is that the transit corridor is potentially half the cross-sectional width it might otherwise have been, because of the two modes of public transit

[12] Other North American examples of T.O.D. include the San Franciscan 'Bay Area Rapid Transit' system, Vancouver (British Colombia) and Arlington, Virginia (1993).

sharing the same alignment. The Karlsruhe model (Hall & Ward, 2014) has been adopted by various cities across Germany, in the UK the Tyne and Wear Metro has light rail and heavy rail operating on the same tracks and Sheffield is piloting a scheme where trams and heavy rail passenger/freight traffic share lines as part of a network extension towards Rotherham.

The table below summarises the cities/networks that operate contemporary light rail systems, if those networks operated along previous railway alignments, and whether or not those networks are predominantly along RRCs.

NETWORKS PREDOMINANTLY NOT ALONG DISUSED RAILWAY CORRIDORS		
Sheffield Tram*	Blackpool	Edinburgh
NETWORKS ON CONVERTED BUT NOT RECYCLED RAILWAY CORRIDORS		
Tyne And Wear Metro	Manchester Tram	
NETWORKS USING RECYCLED RAILWAY CORRIDORS		
Nottingham	Midland Metro (Wolverhampton)	Croydon
Robin Hood Line	South Wales Rail	Borders Rail/Waverley Line
Cambridge Guided Busway		

Table 1.2 Summary of Contemporary UK Transit Networks that Relate to RRCs

The Sheffield, Blackpool and Edinburgh tram networks are predominantly along newly conceived alignments[13]. Although both the Tyne and Wear Metro and Manchester Tram have significant proportions of their network along previous railway alignments, they have not been categorised for the purposes of this research, as being RRCs. This is because the closure of the previous rail networks only occurred in order to facilitate the engineering work of the new configuration. Nottingham, Wolverhampton and Croydon have tram networks that utilise significant amounts of disused railway alignment. There are also three recent heavy rail networks that are configured along RRCs, as is the guided busway serving Cambridge.

This contextual review highlights both creative and pragmatic reuse and repurposing of disused railway corridors and the extent to which these previous alignments

[13] *The Sheffield tram network does have a small proportion utilising a previous railway alignment – circa 2.8km of a 29km network

have been part of contemporaneous transit solutions. This research examines three of these cases in order to gauge the contribution of urban design to place qualities in the context of these RRCs.

The Research Gap

In conducting the Literature Review and the Contextual Review it was found that a wide gap in the knowledge pertaining to urban design and RRCs existed in the UK. As referred to in the Literature Review, there are publications which refer directly to closed railway lines which have been reconsidered as public transit routes (Hall & Ward, 1998). However, only one of these (Richer & Hasiak, 2014) is from an urban design perspective and this compares one of this research's forty-four case study nodes with an equivalent case in France. Through this process of Literature Review and the Contextual Review, no published database of visual evidence pertaining to urban design at RRCs in the UK has been found.

There is much theory and practice concerning public transit and urban design, as referred to and discussed in the Literature Review (Chapter Two). This paradigm of transit-oriented development revolves around issues of 'walkability' and 'mixed-use human scale architecture' in close relationship to transit nodes. There was no corpus of data found concerning the built environment covering the walkability levels at the pedsheds of RRCs. Although Jacobsen and Forsyth (2008) set out a methodology for assessing transit-oriented developments from an urban design perspective, this work is neither specific to RRCs nor operable beyond the neighbourhood scale context. Moreover, this existing theory does not differentiate between the design implications inherent to various modes of public transit.

This research will contribute towards this gap in the knowledge by centralising urban design as a crucial part of 'joined-up thinking' in the context of RRCs. As well as focusing attention towards the transit node at the neighbourhood scale, this research will investigate the regional scale urban design implications along the line of RRCs. Further, this research considers the urban design implications of differing modes of public transit utilised in the different case studies.

1.3 Research Questions, Aims & Scope

This section of the introduction explains both the methodology and associated conceptual framework of this research. Firstly, the research questions are set out. Secondly, the aims of the research are stated, incorporating the scope of this research. Thirdly, the philosophical assumptions are introduced, laying out the epistemological assumptions, research method used and the operational framework for the research.

Main Research Question

This sub-section states the central research question and discusses its context. This question leads to a further four sub-questions, which examine in more detail the phenomena of the urban design at RRCs and the techniques used to study them. In the broadest sense, the central phenomena examined in this research (Creswell, 2009) is the built environment and urban design associated with RRCs. The research has one central question as posed below:

> *Why is urban design important in the case of the UK's recycled railway corridors' built environments?*

This is a broad question with a number of facets that will be examined through three case study RRCs. Within these case studies, the urban design and the built environments will be identified and urban design themes that emerge examined.

Detailed Research Questions

To narrow the focus of the research the following sub-questions have been posed. These questions contribute to the aim of answering the central question whilst allowing exploration and evolution of ideas throughout the research.

> *How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?*
>
> *How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?*
>
> *How does the urban design differ across a variety of transport modes used in recycled railway corridors?*
>
> *What techniques/approaches, applied to the varying territories of built environments along recycled railway corridors, can be used to survey, describe and interpret the urban designs?*

The first three sub-questions aim to examine the three territories of enquiry that apply across the three case studies. The first sub-question will be to survey and report the urban design characteristics of the RRCs themselves, which constitute the three case studies. The second sub-question does the same for the territories at the nodes of RRCs.

The third sub-question will examine how differing modes of transport[14] interact with their respective urban design along the selected cases of RRCs. The fourth sub-question will critically appraise the methods and techniques used to make the claims to knowledge that address the above questions.

Aims and definitions of the Case Studies

The aim of this research is to scope, via the use of an urban design lens, the built environments where a disused railway corridor has been recycled. Using a carefully selected suite of normative urban design ideas and conceptual frameworks relevant to the research of RRCs, this research will examine how particular types of spaces[15] occur in relation to the reinstatement of railway lines. Literature suggests that when transport, land use and urban design are considered together a certain typology of settlement can occur. This research will investigate whether this has been the case in specific regard to RRCs in the UK.

Depth and Breadth of Research

The literature review has not found any previous studies that look specifically at either the reinstatement or the recycling of disused railway corridors in the UK, from the perspective of design and the built environment. Due to this, the scope of the research is untypically broad. The case studies are described in detail in Chapter Four. The following table however, gives a brief illustration of this breadth.

		CS01 Robin Hood Line / Nottingham Express Transit		CS02 Cambridge Guided Busway	CS03 Borders Rail-Waverley Line	Total
		RHL	NET P1			
Line						
	overall length (km)	51.66	13.6	33.33	46.07	144.66
	total length: reinstated lines (km)	46.48	9.38	26.72	40.33	122.86
Node						
	overall tally	22 / 12		15	7	44*

Table 1.3 Summary of Case Study Corridor Lengths and Node Tallies

*44 total nodes including three 'joint nodes'

[14] Stand-alone Heavy Rail, a combination of Heavy Rail and Light Rail and Guided Bus

[15] Reinstated railway corridors, nodes along such corridors and the routes to and from those nodes

In total, this research covers 144.66km of network track length, 122.86km of which is along RRCs. This involves examining 44 nodes.

Delimitations of the Case Studies

At the commencement of this research, none of the reinstated disused railway lines present in the UK were discounted. However, due to the scope possible for a PhD, three instances of RRCs were selected. The 'Robin Hood Line' (Nottinghamshire), Cambridge Guided Busway and the 'Waverley Line' (Scottish Borders) were selected as the three broad cases to be studied owing to temporal, technological and political issues inherent within them.

Definition of Territories of Study

This research focuses on RRCs, which is inclusive of three key types of territory; 'along-the-line', 'at the station/stop' and 'to-and-from the station stop'. The figure below shows two of these three territories. 'Along-the-line', in this context means the direct environs of the corridor, taking a maximum context of a 50m cross-section. The next two territories are contained within the 1000m pedshed of a station/stop, as illustrated by the dark grey circle on the drawing below. The drawing itself is 3.7km across[16], the purpose of which is to illustrate context beyond the 1000m pedshed. The focus of this research is upon the urban design within the delimitations of the 1000m pedshed. These drawings illustrate the distinction between the 10 minute pedshed set at 1000m from the station/stop and the 5 minute pedshed set at 400m from the station/stop.

Figure 1.7 Example of the Delimitations of the Territory of Study

Source: Authors own (1.21 A, Appendix 166) (© Crown Copyright and Database Right 2016. Ordnance Survey (Digimap Licence).

[16] This is a standardised area across all the 44 case study nodes.

1.4 Research Methodology and Data Collection

The following subchapter summarises the philosophical assumptions underpinning this research. Chapter Three contains a detailed consideration of the claims to, and construction of knowledge made in this research. This research will contribute to knowledge in the broad field of urban design and, more particularly, in the sphere of urban design at transit nodes, with specific reference to the context of RRCs in the UK. This is an applied field of enquiry (Andrew Knight & Turnbull, 2008). Therefore, Chapter Three discusses the nature of knowledge in these above contexts, the limitations of these claims to knowledge and the manner in which they were acquired.

With the generation of new knowledge being the core purpose of this research, a Case Study inquiry was conceptualised, designed and implemented in order to report and examine the urban design of RRCs in the UK. This necessitated the consideration and execution of a number of urban design specific place interpretation tools. The evaluation of these tools as part of an iterative exploratory process is carried out, also in Chapter Three.

This research is oriented to the real-world practice of urban design at RRCs, therefore fitting into an ontology of pragmatism. Creswell (2009) notes a certain amount of choice in methods, techniques and research procedures inherent to this ontology. In this research, this freedom is used to apply urban design analysis techniques to the problem under study.

The primary research method employed as the 'overarching strategy' for this research is 'Case Study' method. This 'umbrella method' (Creswell, 2009) was selected as it allowed for real-life situations to form the focus of inquiry and reflection. Selecting real-life scenarios meant that the theories in the literature review could be reviewed concurrently with and used as a foil against real-life situations A discussion on whether or not this can produce valid claims to knowledge in the specific research context of urban design at RRCs is carried out in Chapter Three.

The operational framework of this research will overlay certain ideas from the broad canon of normative urban design theory, and theories specific to regional planning and urban design in relation to transport, across the context of RRCs. A three case study piece of research from contrasting regions of the UK[17] is carried out. The discussion of these cases revolves around these opportunities inherent in the pressured spaces at intersections of scale-dependant design decisions and place.

[17] Nottinghamshire/Derbyshire, Cambridge/Cambridgeshire and the Scottish Borders/Lothians

1.5 Structure of this Research

This introduction chapter sets out the background, scope and rationale for this research which then leads into the second chapter; the literature review. The review examines the pertinent literature underlining the research problem; polycentric regional planning, the transit town paradigm, relevant policy and normative theories of urban design.

Then, the Research Conceptualisations chapter explains the philosophical assumptions underlying the research, discussing the appropriateness and execution of Case Study method. It also goes on to explain the design of this research and reflects on the usefulness of the data sources and the bias and efficacy of the collection techniques in relation to the urban design interpretation tools used.

The next chapter introduces the three case studies. This takes each case study individually in chronological order of 'completion'[18]. Lastly, in this case study chapter the findings are presented in categories established as the area types set out in the Social City Region.

The fifth and sixth chapters discuss these findings. These discussions are organised into two sections which look at the spatial aspects examined in this research regarding recycling a railway corridor; 'along-the-line' and 'at-the-node'. Within each of these two sections the respective policy objectives are discussed first, then the urban design characteristics. The research is then concluded in the final chapter by referring the findings to the research questions laid out in this introduction.

1.6 Purpose Statement

The purpose of this research is to understand and examine the urban design of RRCs in the UK. The overall intent of this research is to acquire knowledge so as to contribute to the emerging academic discipline[19] of the physical design of built environments in relation to public transit. Further, this research will investigate what opportunities for place quality exists through urban design, in parallel with the transport planning realisation inherent to the process of recycling railway corridors. It is the intention that this research will also hold relevance to built environment professional practice[20] through the description and exploration of the complex, interdisciplinary, overlapping set of factors that occur in the built environs of RRCs.

[18] If the notion of completion is possible in this context.

[19] Jacobsen and Forsyth state that scholarly attention is focused upon policy, planning and economics in relation to T.O.D. and further work on the urban design practices is needed if the intentions of the aforementioned are to be achieved.

[20] Urban design incorporating the overlapping of architecture, master planning, landscape design, transport design, etc.

The reason for conducting this research is to put forward an informed debate and set of findings that pertain to the urban design issues of the core phenomena under study. This has a view to future lines that will be recycled and the evolution of those already realised, including the instances of those selected as case studies and those beyond the scope of this research. Whilst it is acknowledged that the data upon which these conclusions are drawn are not complete[21], the attention paid to the critical evaluation of the techniques used, it is argued, is also potentially useful to the academic and professional approaches to urban design at RRCs.

[21]The idea of a complete set of data in the context of urban design is debatable.

2. Recycled Railway Corridors & Urban Design Theory

This chapter examines the theoretical background of this research into urban design and recycled railway corridors. This is done in order to respond to the overarching research question ***'Why is urban design important in the case of the UK's recycled railway corridors' built environments?'***. The key theories discussed in this literature review are mapped in the table below. Initially, the conceptual framework underpinning the empirical observations and analyses made in this research is explained, which is based upon the critical regionalism paradigm. Here, the work of Frampton (1992), Nesbitt (1996) and Tzonis and Lefaivre (1996) is discussed in terms of how the theory can justify examinations of the urban design of recycled railway corridors. Subsequently, two regionally concentrated public transit focused theories are analysed with a view to extracting categories that will be useful to the examination of the case study recycled railway corridors, at the two key scales focused upon in this research; the regional and the neighbourhood.

The first of these two theories discussed is Transit Oriented Development (T.O.D). Here the work of Calthorpe (Calthorpe, 1993; Calthorpe & Fulton, 2001), Cervero (Cervero, 2007; Dunphy et al., 2004), Dittmar & Ohland (2004), are used to set out the principles and philosophies behind T.O.D., which are contrasted against such critics of the theories as O'Toole (O'Toole, 2000, 2009). There are two key finer-grain pieces of empirical inquiry concerning T.O.D. that are used in this literature review. The work by Jacobson & Forsyth (2008) lays out of a set of methodological procedures for the examination of urban design at T.O.D.s, which have been crucial to the conceptualisation to this research design. This study also highlights components of T.O.D., which have been particularly useful in the analyses stage of the research, such as the concept of a 180° station. Richer and Hasiak's work shares an empirical territory with this research (CS01 (NET P1) and in particular Hucknall (CS 1.12) and conducts a cross-case analysis with another recycled railway corridor in France (Valenciennes). Therefore, this study has informed this research in a number of ways: methodologically in terms of its comparative analysis, empirically through its shared territory and conceptually through its introduction of such ideas as the 'introverted/extroverted station'.

The second main theory used in this research is 'Social City Region' (S.C.R.) (Breheny & Rookwood, 1993). This concept sets out Breheny and Rookwood's (1993) vision for a sustainable growth pattern across a city region context. Whilst this is not an urban design theory, there is much crossover with the overall concepts in T.O.D. and these prompt issues for urban design in a transit-based regional context. Further, this theory breaks down its principles into sub-regional elements that have been used to categorise the case

studies depending upon the characteristics of the differing nodes. Each of these categories have urban design criteria attached which, later in this chapter, are argued to be appropriate to that specific sub-regional node context typology. There is a closely related theory to S.C.R. that shares an empirical context with this research. Hall & Ward's (1998) '*Sustainable Social Cities of Tomorrow'* (SSCT) is compared with S.C.R. in order to glean a number of shared and discrete components that are carried forward to the second stage of this literature review. Further, Hall and Ward's 'City of Anglia' (a conceptualisation of an SSCT) shares an empirical context with this research – CS02 the Cambridge Guided Busway.

<table>
<tr><td colspan="5">CONCEPTUAL FRAMEWORK: CRITICAL REGIONALISM & RECYCLED RAILWAY CORRIDORS</td></tr>
<tr><td colspan="3">TRANSIT-BASED REGIONAL DESIGN PARADIGM:
'TRANSIT ORIENTED DEVELOPMENT'</td><td colspan="2">TRANSIT-BASED REGIONAL PLANNING PARADIGM:
'SOCIAL CITY REGION'</td></tr>
<tr><td>Calthorpe's Definition of T.O.D</td><td>Jacobson & Forsyth's
'Seven American T.O.D.s: Good Practices for Urban Design in Transit Oriented Development Projects'</td><td>Richer and Hasiak's 'Territorial opportunities of tram-based systems: a comparative analysis between Nottingham (UK) and Valenciennes (FRA)'</td><td>Breheny & Rookwood's 'Social City Region'</td><td>Hall & Ward's
'Sustainable Social Cities of Tomorrow'</td></tr>
<tr><td colspan="5">DISAGGREGATION OF THEORETICAL COMPONENTS INTO SCALE DEPENDANT CATEGORIES</td></tr>
<tr><td colspan="3">REGIONAL SCALE CATEGORIES:
'ALONG-THE-LINE'</td><td colspan="2">NEIGHBOURHOOD SCALE CATEGORIES:
'AT-THE-NODE'</td></tr>
<tr><td colspan="5">Synthesis of Normative Urban Design Criteria Across the above Scalar Contexts</td></tr>
<tr><td>Lynch</td><td>Marshall</td><td>Gehl</td><td>Cullen</td><td>Fleming</td></tr>
</table>

Table 2.1: Overview of Theories relevant to this research

The principles useful to this research from critical regionalism, T.O.D. and S.C.R. are then broken down into categories which are considered most appropriate for the two key scales examined in this research; the regional and the neighbourhood. This disaggregation is in direct response to the two research questions: *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?'* and *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?'*. The first of these questions is conceptualised as the categories pertaining to spaces 'along-the-line' of recycled railway corridors. Whilst this research is bounded in its territories to the environs of recycled railway corridors and therefore does

not survey entire regions, these recycled railway corridors do exist at the regional (and sometimes pan-regional) scale. A comparative analysis is carried out using the following categories that are themes derived from a synthesis of the theories mentioned above:

- Ecological Features Along-the-Line of Recycled Railway Corridors
- Strategic Growth and Recycled Railway Corridors
- Urban Morphology and Recycled Railway Corridors
- Recycled Railway Corridors and Broader Transport Networks
- Interruptions to Disused/Recycled Railway Corridors
- Land Use and Recycled Railway Corridors
- Cycle Paths and Recycled Railway Corridors
- Topography Along-the-Line of Recycled Railway Corridors
- Pre-existing Engineering Infrastructure and Recycled Railway Corridors

In order to execute this comparative analysis, each of the above categories are considered in both the terms set out in the above theories and in finer-grain urban design terms, which is based upon the work of such authors as Lynch (1960), Marshall (2005; 2013), Gehl (2010; 2013), Cullen (1971), Walker (2012) and Fleming (2012). How the urban design principles of these theories apply to the context of recycled railway corridors is discussed later in this chapter.

Whilst it is acknowledged that the two scales of urban design are not the only scales to which examination of recycled railway corridors could be applied, it is argued that the regional and the neighbourhood are two key scales with which to observe urban design. They cover how the act of recycling a railway corridor has implications for broad territories; how railway corridors can both link and separate seemingly disparate and related areas. The more detailed neighbourhood scale that is focused at-the-nodes of recycled railway corridors is structured around the area types set out in the S.C.R., and human-scale urban design concepts such as those extolled by Gehl (2010), Cullen (1971) and Relph (1976) are mapped across the differing node typology contexts. This synthesis of literature structures the response of this research to the question: *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?'*. At each of these two key scales the implications of the transit mode adopted in the recycled railway corridor is considered, thus addressing the further research question: 'How does the urban design differ across a variety of transport modes used in recycled railway corridors?'. For example, the difference inherent in alternative transit modes can be as pronounced at potential land-use development patterns across a region as at the neighbourhood context in the immediate human-scale urban designs.

This research is concerned with producing an urban design perspective on the place qualities of the built environs of recycled railway corridors. This is a highly complex task, hence the intricate, cross-scalar approach evident in this literature review. Resilience is a crucial contemporary theme and the theoretical perspectives adopted in this research are necessarily broad in order to assess the extent to which urban design opportunities at

recycled railway corridors have been realised. Place specificity is a key concept throughout this literature review and the selected theories discussed in this literature review offer a number of perspectives on this concept in the context of recycled railway corridors. Urban design at recycled railway corridors requires 'joined-up thinking' and this literature review sets out which theories can be 'joined up' in order to assess these empirical characteristics. It is argued that through this synthesis of place-focused built environment paradigms, a justification for the collection, synthesis and evaluation of urban design evidence can be made in respect of recycled railway corridors.

2.1 Critical Regionalism as the Conceptual Framework

This research is concerned with the generation of knowledge in the field of urban design relating to the context of recycled railway corridors in the United Kingdom. As such, a conceptual framework that reflects the sophisticated nature of the empirical context is required in order to provide a basis to the findings. A conceptual framework that is applicable to all the scales between the regional and the detailed design scale is required. In these considerations, a number of physical components of the built environment will need to be analysed both independently and interdependently. Not only will the conceptual framework of this research need to offer the ability to coherently relate abstract concepts pertaining to the built environment, it will also need to provide a basis upon which to conduct qualitative assessments of the built environments through which the recycled railway corridors occur.

This conceptual framework is also required to state a position from which to engage with the temporal aspects of the process of 'recycling' railway corridors and how this iterative cycle of 'development-obsolescence-reinvention-reuse' relates to urban design. A knock-on effect of these temporal cycles is that changes in contemporaneous transport technology occur, which in turn relate to the urban design of recycled railway corridors.

It is argued that critical regionalism, although not the only appropriate framework for this specific area of research, can provide a theoretical basis for the exploration of the fundamental issues concerning urban design and recycled railway corridors. It offers cues as to how the above issues can be addressed through a design-based lens. Tzonis and Lefaivre (1996) define a design that exhibits the 'critical' aspects of critical regionalism as one that is both 'self-reflective and self-referential' (Nesbitt, 1996). It is therefore argued that this research will set out to collect evidence in these terms: is the urban design at recycled railway corridors 'self-reflective' or 'self-referential' in the terms of the region within which it sits? Nesbitt (1996) goes on to say that a design that resembles critical regionalism will also demonstrate explicit statements and implicit metastatements. This

research will search for any such statements in the physical environment of recycled railway corridors.

Critical regionalism is an architectural paradigm, not an urban design paradigm. Therefore, it could be argued that it is somewhat problematic as a conceptual framework for this research. Although not entirely synonymous with the study of urban design, the proximity to and often blurred boundaries between architecture and urban design mean that it could be considered plausible for critical regionalism to be used as a theoretical framework for the assessment of built environments along recycled railway corridors through an urban design lens. Lynch (1960) crystallises the proximity between architecture and urban design, alluding to a set of shared fundamentals with the key distinction being scale:

> *"Like a piece of architecture, the city is a construction in space, but one of vast scale, a thing perceived only in the course of long spans of time. City design is therefore a temporal art, but it can rarely use the controlled and limited sequences of the temporal arts like music. On different occasions to different people, sequences are reversed, interrupted, abandoned, cut across." (Lynch, 1960, p.1)*

This resonates with the evolutionary processes of recycled railway corridors and also highlights the importance of temporal issues to what Lynch terms 'city design'. Such issues as 'reversal', 'interruption' and 'abandonment' are of intrinsic value to the understanding of recycled railway corridors and their relationship to urban design, the reversal being the act of bringing the route back into functional use, the interruption being the time between closure and reuse, and abandonment being the initial decision to cease mass transit use.

A study of urban design can legitimately incorporate assessments of aesthetics of place. Whilst subjective, if tempered with humility and deep consideration, such assessments can yield knowledge and be useful through the dialogue that leads to their generation. Mumford draws parallels between the aesthetics of place and the regional, ecological and social contexts within which urban designs exist (Luccarelli, 1995). These notions are reflected in critical regionalism:

> *"Tzonis and Lefaivre acknowledge a debt for their idea of regionalism to Lewis Mumford, the architectural and urban historian. In Mumford's writing of the 1940's, he was similarly concerned about the domination of technology and the limitations of the International Style. Regionalism is seen by all three writers as a secondary thread of modernism."(Nesbitt, 1996, p. 483)*

This research is being carried out in a post-industrialised context, after modernism, arguably after post-modernism and in a time when sustainability and resilience has usurped the aforementioned paradigms. Whilst positivist modernism as embodied in the international style is less of an issue in this research, homogenising cultural forces as a result of this mechanistic paradigm is certainly still a contemporary issue. This issue is played out in the debates surrounding mass transit, and in this case recycled railway corridors. One of the debates between the perceived rights and wrongs of mass transit focused development is

predicated by the idea that the automobile and the types of urban design their dominance dictates (sprawl), is a manifestation of market-based free will (O'Toole, 2009). Critical regionalism takes architecture, urban design, and the manifestation of physical design in the built environment as evidence of the prevalence of power between these two oppositions. This research will seek evidence of these positions in the territory of recycled railway corridors in the United Kingdom.

As argued above, an argument against the use of critical regionalism as a theoretical framework for this research is that there is not an 'exact fit', because an architectural paradigm is being used to formulate regional scale design-based assessments. This contradicts the inherent nature of critical regionalism. Whereas many architectural paradigms are formulaic, often resulting in the reproduction of solutions that Jacobs terms 'design cults', critical regionalism is strategic and any call for formulaic designs is replaced with strategies and common approaches that have an inherent malleability dependent upon context. As Frampton puts it, critical regionalism is a *"...critical category oriented to common features" (Frampton, 1992, p. 327)*. Therefore, it is acknowledged that this research is not wholly analogous to critical regionalism; however, critical regionalism does not require a strict adherence to a set of rules for the paradigm to hold true. Frampton lists seven key categories of critical regionalism, with six of these providing interesting stimuli for this research:

- a prioritisation of the 'fragmentary and marginal' as opposed to 'the big plan';
- the rejection of the built environment as a series of 'ill-assorted scenographic episodes';
- the persuasiveness of 'site-specific form';
- the use of the human senses in the interpretation of the physical environment;
- the eschewing of universalising civilisation over place-centred cultural indices; and
- a contemporary place-oriented culture without being unduly hermetic. (Frampton, 1992)

These points are elaborated upon below, giving consideration to the other theories used in this research.

Critical regionalism is contrasted against what Frampton (1992, 1996) describes as naïve utopianism of the early modern movement. In the rejection of 'the big plan' as epitomised by Haussmann and Le Corbusier, critical regionalism calls for a more nuanced marginalised regional form, although one that is accepting of the more progressive and emancipatory elements of modernism (Frampton, 1992). In specific relation to this research, this points to the necessity for the consideration of the region as a collection of

interdependent parts. This interdependency calls for simultaneous acknowledgement of ideas of specificity and the inter-relationship between places and nodes along a recycled railway corridor. It will be necessary, therefore, to identify core broad typologies within a region. This is the reason for the use of Breheny and Rookwood's 'Social City Region' (1993) in this research. This enables vastly differing settlement typologies to be considered independently; they can then be considered interdependently within their regional infrastructure and then again within their own regional specificities against other examples of the same settlement typology situated on other recycled railway corridors.

Frampton (1992) highlights a notion within critical regionalism that is crucial to this piece of research, that is, the rejection of a set of *"...ill-assorted scenographic episodes"* (Frampton, 1992). This is especially pertinent to one of the two scales that this research focuses upon, public realm as part of the neighbourhood scale. In this research, the built environment between the node of a recycled railway corridor and the extent of its pedshed is scrutinised in urban design terms. This involves actually walking, observing and depicting the built environments to and from the nodes along the recycled railway corridors. The analysis of these observations uses normative urban design criteria and established morphological characteristics analysis to examine whether or not these environments show evidence of a stimulating tectonic experience or an unconsidered laissez-faire set of happenstances.

When considering buildings in critical regionalism, 'site specific forms' are paramount and it is argued in this research that this has parallels with urban and regional design and that it is imperative to consider recycled railway corridors in such a way that engages with dialogues of place specificity. A contributory element to uniqueness of place is, according to Frampton (1992), topography. Being an architectural paradigm, when discussing topography, Frampton (1992) refers to the phenomena's relationship to the 'structure', with the term structure meaning a building and its direct territory. In this research, this term can be extrapolated in scale beyond the building to the urban design scales of the 'neighbourhood' and the 'region', without dilution of the theoretical substance. Therefore, when topography is described as *"...a three-dimensional matrix into which the structure is fitted" (Frampton, 1992, p. 327)*, this could be extrapolated for the purposes of this research to a three-dimensional matrix within which a recycled railway corridor and its associated urban design exists.

This consideration of site-specific factors is argued as the antithesis of a built environment subservient to the influence of 'universal civilisation' (Frampton, 1992). In critical regionalism air-conditioning is seen as the symptom of this universal civilisation at the architectural scale and, extrapolating again, it is argued that an automobile dependent/dominated environment is the urban design equivalent. This research will

therefore seek to gather urban design evidence of recycled railway corridors in order to ascertain whether or not such places have 'responded to the specific conditions imposed by the site, climate and light' (Frampton, 1992) or if symptoms of a 'universal civilisation' have occurred. The *a priori* position of this research assumes that sites will be a combination of both these conditions. The exercise that forms the foundations of this research is therefore an intention to form an *a posteriori* position derived from empirical evidence concerning whether or not this is indeed the case, and if so to what degree.

Two key tenets of critical regionalism are considered in parallel to make a proposition that is of crucial relevance to this research: the idea that a region dominated by one cultural centre with a number of subservient satellites is a deficient way of perceiving a region, and the idea that this is endemic of a universalising civilisation culminating in 'anywhere' places. The following principle states that critical regionalism flourishes at such cultural indices where this homogenisation has not manifest – the spaces between such models of homogenising paradigms.

> *"(7) Critical Regionalism tends to flourish in those cultural interstices which in one way or another are able to escape the optimizing thrust of universal civilization. Its appearance suggests that the received notion of the dominant cultural centre surrounded by dependant, dominated satellites is ultimately an inadequate model by which to assess the present state of modern architecture." (Frampton, 1992, p.327)*

Clearly, given the above, a polycentric regional model is more aligned to the principles of critical regionalism. In this research, one key task was to find a polycentric model that allowed for such 'cultural interstices' to be considered simultaneously in their own light and as part of a regional whole. This has led to this research using Breheny and Rookwood's Social City Region (1993) as a key text. This planning model states criteria for what constitutes a Social City Region. Crucially within this, six distinct conurbation typologies are made explicit, each with their own criteria and recommendations. This key differentiation between area types means that this research uses T.O.D. and S.C.R. in parallel. The empirical physical environments of the recycled railway corridors under study can be defined in these area types, using the criteria policy recommendations laid out by Breheny and Rookwood (1993). Also, this framework can be used to discern whether or not a cultural interstice has occurred at the recycled railway corridor in the form of a place-specific built environment.

The design paradigm critical regionalism has the optimum goal of creating built environments resembling a contemporary place-oriented culture. This does not call for one type of aesthetic, rather, it requires attention to regionally specific stimuli in the execution of design solutions; a common approach that can lead to disparate results. There are parallels between this process and the process of a recycled railway corridor. Critical regionalism calls for the reinterpretation of vernacular elements of the built environment. The distinction

between this and sentimental simulation of a vernacular is made explicit. Likewise, with a recycled railway corridor the process revisits a built environment phenomenon that has been made redundant in the process of the evolution of physical environments. Questioning this redundancy is likened to the reinterpretation of the vernacular. This process of questioning, reinterpretation and reiteration concentrating on recycled railway corridors, whilst using a disused railway as a formative element of the physical environment, can be moulded to contemporary situations through reinstatement or partial deviation of the route. The use of the original transport mode or an alternative transport mode is another example of where this stance can manifest. Each of these responses is an element in the iterative urban design cyclical process that occurs with recycled railway corridors. The counterpoint to this, the sentimental simulation of the vernacular, can be likened to a heritage railway line. Whilst this research is not critical of such endeavours, the distinction in principle must be clearly made both in terms of the physical environment and the underpinning principles. A heritage railway relies on nostalgia. A study into the urban design of recycled railway corridors relies upon palimpsest.

Critical regionalism's detractors argue that the design strategy can lead to chauvinistic nationalism (Frampton, 1992, 1996), the idea that certain geographical areas can have superiority over others based upon race or culture. This position is disagreed with within this research, in which it is argued that local cultures and the architectural and urban design responses are important to specific places. This can be achieved without using such architectural design responses that claim primacy over other regions or nations. Another criticism levied at critical regionalism is that it can produce kitsch. This, along with the previous criticism that it produces chauvinistic nationalism is rebuffed through the practice of self-examination in the designs that demonstrate critical regionalism (Frampton, 1992). This tradition of the critique, based on the philosophies of Kant and the Frankfurt school (Nesbitt, 1996), is inherent to critical regionalism. It is there to ensure that over-simplistic design responses that resemble kitsch and nostalgia without consideration for the contemporaneous debates and ideals are avoided.

Whilst the above point is a criticism of critical regionalism in general, there are potentially criticisms from within the sphere of critical regionalism in terms of its use in this research. Critical regionalism is opposed to the dominance of the visual in design (Frampton, 1992, 1996; Nesbitt, 1996; Tzonis & Lefaivre, 1996). In contrast, this research relies heavily on visual methodologies and could therefore potentially be seen to be at odds with those principles of critical regionalism that prioritise the experiential and visceral impacts of place. The visual methodologies adopted in this research however are not intended to be 'meaning neutral' recordings of a place at a specific time. The importance of these visual methodologies are explained in chapter 3.2.

However, critical regionalism does offer a justification for the integration of experience into the consideration of urban design at recycled railway corridors. Point number 5 in Frampton's (1992) definition of critical regionalism highlights the importance of human experience to judgements concerning the physical environment. This is crucial to this research as it goes towards a justification of the researcher's position that the use of photography was a worthwhile activity, both in the terms of how the researcher conceives reality and in the production of a permanent visual record that can be used to stimulate further inquiry. The majority of the evidence in this research was collected by the researcher in empirical settings. Whilst this leaves this piece of research open to the criticism of being overly self-referential, this is acknowledged but countered by two key points. Firstly, the existing body of knowledge regarding recycled railway corridors and urban design required a broad scoping exercise to be carried out before other research methods could be applied. Now this territory has been established, there is a large knowledge pool within which to apply a broader set of research techniques. The second justification is that using the theoretical lens of critical regionalism, although not exclusively, the experiences of the researcher do hold value because critical regionalism requires a conscious process of reflection regarding specificity of place.

> *"(5) Critical Regionalism emphasizes the tactile as much as the visual. It is aware that the environment can be experienced in terms other than sight alone. It is sensitive to such complementary perceptions as varying levels of illumination, ambient sensations of heat, cold, humidity and air movement, varying aromas and sounds given off by different materials in different volumes, and even the varying sensations induced by floor finishes, which cause the body to experience involuntary changes in posture, gait, etc. It is opposed to the tendency in an age dominated by media to the replacement of experience by information."(Frampton, 1992, p. 327)*

Although the images produced in this research do not attempt to replicate the experiences observed in the case studies, they can still represent instances where examples of these experiences took place. This process of visual depiction of the site highlights certain issues that can be considered beyond the visual. Although two-dimensional in their own right, the images in this research depict three-dimensional spaces that are analysed in urban design terms, therefore going beyond the 'image-oriented' (Zardini, 2005). For example, it is possible to point to a piece of paving represented in an image, which altered the researcher's gait. Whilst these visual depictions cannot be claimed as definitive truths, in the subjective terms of this research they are still useful to the field of urban design at recycled railway corridors. These images could in turn be feasibly used to say that the change of material in a piece of paving could be used to indicate, in combination with other urban design strategies, a transition between a station area with a mix of uses and a residential area. Imagining this scenario, this could contribute to the legibility (Lynch, 1960) of place at a recycled railway corridor while still adhering to the normative design principles of mixed use in combination with residential-led developments at transit nodes (Calthorpe, 1993; Hall

& Ward, 1998). In a territory such as urban design and transport engineering where there is a complex crossover of quantitative and qualitative values, careful consideration should be given to how and where these values can be gauged, and importantly, what can be learned from these observations. Critical regionalism, it is argued, provides a useful foundation upon which to base this research and an opportunity to link with the previously discussed theories from the standpoint of a pragmatic worldview.

This section explains how the regionally focused architectural design paradigm of critical regionalism permeates the theoretical underpinnings of this urban design focused research. This research operates at a variety of scales; the sensibilities inherent in this conceptual framework are present in, and influential to, these assessments of built environments. This section takes each of the research questions in turn, relates which parts of critical regionalism are pertinent to which research question and points to further pieces of theory that are used in the pursuance of knowledge in this research context. Parallels are drawn between critical regionalism, the 'Social City Region' (Breheny & Rookwood, 1993) and the 'Transit Oriented Development' (Calthorpe, 1993) paradigms that all have an underlying driving force of sustainability. Critical regionalism argues that an appreciation of local specificities concurrent with national and international trends is a component of a move towards the negation of detrimental environmental effects. A position that links the above theories and the political situation is discussed later in this chapter. These overarching issues derived from critical regionalism are present in this research: palimpsest, identity present in physical design, and ecological responsiveness. To reiterate the main research question:

> *Why is urban design important in the case of the UK's recycled railway corridors' built environments?*

These three tenets central to critical regionalism are the foundations, the meta-narrative to this examination of urban design at recycled railway corridors. They support the theoretical context, the underpinning of the approaches to the research, the assessment of the findings and the conclusions derived.

Palimpsest, the levels and layers of meaning written one on top of the other, wiped partially clean for the writing of new layers, is an idea pervading many approaches to urban design. The literal meaning of this process is of writing being (re)applied to a previously used parchment or painting being (re)applied to a previously used canvas; as an analogy, it can be applied to a region. It is clearly manifested in critical regionalism through the aspect of reinterpretation of place-specific design, without a slavish adherence to the vernacular. In terms of this research it is possible to apply this analogy. A recycled railway corridor can be interpreted as a reinstated piece of 'writing' within the region, which can be considered

as the 'parchment'. The new writing/route may match exactly, be close to, or deviate from the previous piece of writing/route. The parchment has parallels to the region in which the reinstatements occurred, in that it is a defined area within a broader context. The process of the first railway line can be likened to the first piece of writing. This is then 'rubbed out' but not erased and this can be likened to the closure of the railway line. But just as the writing on the parchment is not completely removed, nor is the presence of the disused railway line completely erased. The reinstated line, or new piece of writing, is then left with the choice of following a pre-existing path. This research is interested in how the previous iterations influenced the contemporary incarnation as evident in the urban design. Further, what opportunities are inherent to this process, as opposed to the blank parchment – the *tabula rasa* approach?

In this piece of research, where subjective observations of the built environment are presented, the theoretical foundations of this approach require substantiating. Meaning in the built environment is central to critical regionalism. This meaning is derived from observations primarily made at the place of study, the field of urban design as related to recycled railway corridors. Frampton (1992, 1996) states the reliance of critical regionalism upon architectural phenomenology. This is defined as the appreciation of spaces and places through the immediacy of the human senses.

> *"Frampton synthesizes aspects of the Frankfurt School's 'Critical Theory' as well as a phenomenological interest in the specificity of place. Phenomenological, political, and cultural issues concerning boundaries also surface as important."(Nesbitt, 1996 p.468)*

This differs from the research perspective where phenomenology can be considered as a strategy of inquiry (Creswell, 2009). In the architectural sense, legitimacy is given to an individual's sensory conception of place (Pallasmaa, 2005; Sharr, 2007; Zumthor, 2006) and that there is a relationship between this conception and a conceived and realised design. In research terms, a phenomenological approach requires the researcher to set aside their individual considerations with a view to being led by the research subjects (Creswell, 2009). The position adopted in this research is that both approaches have clear merit, although opposing positions. In this specific research context, the architectural definition of phenomenology can be utilised to search for and collect evidence from recycled railway corridors in order to present and instigate debate concerning the examples gathered and their relationship to normative urban design theories, morphological characteristics and planning aspirations. The current gap in the knowledge in regard to recycled railway corridors is such that there is a requirement to primarily survey the territory. It is argued in this research that this is plausible through an urban design lens. Further study could then adopt the phenomenological research perspective, which could build upon this survey of physical evidence, seeking to draw out any meaning through a phenomenological approach.

The broader issue of ecology and the environment is important to critical regionalism. This is argued through the primacy given to local environments within which specific designs exist. The logic follows that if attention to place-specific characteristics is upheld then the combination of climate, culture and craft (Frampton, 1992) will in principle produce a design responsive to 'a growing ecological crisis' (Nesbitt, 1996). It is acknowledged here that urban design is a component of a potential remedy to such an 'ecological crisis'. Williams (2005) highlights the thinking contemporaneous to this research, which broadly advocates relatively dense, mixed-use, contained settlements situated at nodes of mass transit systems. This is in opposition to zoned, automobile-predicated sprawl. Williams (2005) writes that improvements in urban design can facilitate a reduction in the impact of travel behaviours in ecological terms:

> *"The reasoning is that such forms reduce travel demand because people can work near their homes and make use of local services and facilities. Such forms can also provide population densities high enough to support public transport services and, through improved urban design, encourage cycling and walking." (Williams, 2005, p. 1)*

The adoption of critical regionalism as the conceptual framework for this research acknowledges the prioritisation of sustainability in the broader debate of transport and land use. This piece of research, however, considers urban design as being concurrently an 'means to an end' and an 'end' in itself. It is argued, through a critical regionalist lens, that should a physical environment at the node of a recycled railway corridor resemble the traits of critical regionalism then it will be simultaneously an encouragement to cycling and walking and also in line with other normative urban design theories. Such places could conceivably be simultaneously of interest and pleasure to the respective occupants whilst being earnest and responsible towards said occupants' planet. If this is translated into the sphere of urban design in relation to mass transit, then it is argued that regionally bespoke climates, cultures and the crafting of the physical environment warrant attention. In the specific case of this piece of research the transit system is one which occupies the territory of a recycled railway corridor and the physical environments under study are those territories through which they pass.

The focus of this research is urban design along the corridor of recycled railway corridors. This conceivably has an implicit paradox. Whilst the recycled railway corridor is inherently regional, the urban design can be considered simultaneously at this wide scale and be examined at a finer-grain detail level. This research question therefore necessitates a way of conceiving a transport corridor[22] as an artefact in the physical environment that is observable at a variety of scales and conceivable both in terms of individual components and as a whole. Critical regionalism points to two theoretical mechanisms, 'topography' and

[22] New, continuous, disused, repurposed, reinstated, recycled or blocked.

'identity', for theorising the collection of urban design evidence in relation to the following research question:

> *How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?*

Critical regionalism sees the engagement with and the potential for the accentuation of topography (Nesbitt, 1996) as a key component of a site-specific place-based response. In terms of recycled railway corridors this is an interesting and also potentially paradoxical point. Critical regionalism is opposed to a modernist *tabula rasa* approach of razing a site in favour of working with a given environment. The engineering necessities of railway corridors[23] mean that landscapes are often amended to suit. This is only a paradox however, if the temporal, cyclical and iterative process of recycling a railway corridor is overlooked. The interruptions into the landscape of the initial railway lines were often made over 100 years ago, whether closed or in continuous use. This means that they have been in existence for such a period of time (usually generations) that they can be conceivably considered as a part of the landscape in their own right. Although the initial construction potentially worked against the landscape, over time and use, these pieces of infrastructure have themselves become a part of the landscape's story. Therefore, it is prudent for this research to consider such elements as bridges, viaducts, cuttings, etc. and their reuse (or otherwise) in terms of 'engagement with' or 'accentuation of' the recycled railway corridors' relative topographies.

As well as along-the-line, this research concentrates on urban design at the nodes of recycled railway corridors. There are two closely related tenets of critical regionalism that are relevant to the research question reiterated below, a requirement for authentic design and a move away from nostalgic design responses:

> *How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?*

Authenticity is a response to what Nesbitt (Nesbitt, 1996) characterises as the commodification of shelter. Within this research context, 'shelter' could be considered as the buildings relating and pertaining to the nodes of recycled railway corridors. This could be the immediate buildings of the stations/stops, the approaches and environs of the stations/stops[24], the buildings and public spaces surrounding the stations/stops in such terms as use/tenure, density, and aesthetics. This research collects evidence in order to ascertain

[23] Gradients, minimum curve radii, grade separation strategies, etc.
[24] The extents of which is defined in this research as the 10 minute, 1000m pedshed

whether the shelter associated with recycled railway corridors exhibits its expression of local identity (Nesbitt, 1996) being suppressed in favour of a homogenised design response, or if an authentic place has occurred. Nesbitt explains a built environment that is authentic in critical regionalist terms as one which demonstrates an appreciation for the specific place qualities and tectonics. She writes that a critical regionalist piece of architecture is one that *"...evokes the oneiric essence of the site, together with the inescapable materiality of building"* (Nesbitt, 1996, p. 468). It is argued that this framework can be applied to the built environs of a recycled railway corridor. Do the nodes of the recycled railway corridors under study relate to the oneiric essence of the site? Is there a place-specific response to the materiality of building[25]? If so, an authentic urban design response could be argued in those instances. If not, then other forces have driven the urban design.

A design that resembles a critical regionalist approach will therefore be experiential rather than image-oriented[26] (Nesbitt, 1996). This notion prompts the question: are the routes to and from the nodes of recycled railway corridors 'image-oriented' or 'experiential'? Use of local materials, a response to the local microclimatic conditions, and the articulation of local light conditions as manifest through design, are solutions that are all cited (Nesbitt, 1996) as strategies towards a critical regionalist approach. The opposing position would be, by example, a design that uses a building material without conscious consideration to the materials of the area; a design that misses or avoids climatic design opportunities with a preference for an homogenised form and/or programme; a design that relies upon artificial light when natural light could have produced a more interesting experience, such as an experience that relates the human to the passing of time.

Closely linked with the idea of experiential urban design is place theory. A seminal work in this regard is 'Place and Placelessness' by Edward Relph (1976). Relph draws a distinction between three types of spaces: 'pragmatic', 'perceptual' and 'existential'. This research is concerned with the type of space that could be considered existential, the space of everyday life. The idea that a route to and from a transport node is an existential space is based upon how they are ordinarily used[27]. It is the intention of this research to take this 'everyday', 'typically unnoticed' situation and consciously focus upon the urban design of these 'ordinary' spaces. The intention was to use photography to home in on these situations, in line with the work of Relph (1976). Here the concept of 'rootedness' is crucial; the notion that an urban design, a 'place', could not work anywhere else other than precisely where it is situated. This could be down to plot pattern, light, material or any other number of design

[25] Building being used as a term to encompass the buildings, public realm and landscaping strategies

[26] In this instance an image-oriented design is a design which has been conceived in order to produce a small number of seductive scenes, usually for the purposes of decorating statutory submissions/marketing literature: a design that forgoes the real human experience in lieu of a design that works from a handful of viewpoints.

[27] Commuting, regular leisure or shopping trips for example.

factors. However, the core of this idea is that if the design were to be 'picked up and moved' to a different situation it would fail. This rootedness is equated to the success or otherwise of places in terms of recycled railway corridors. Critical regionalism offers a framework through which to consider issues of place specificity and place theory in this particular research context.

It could be argued that by definition a recycled railway corridor is not a nostalgic act. The route re-made, the transport mode, and any deviation from the original route exhibit an adaption to contemporary demands over any urge to recapture past events. This research question seeks to collect evidence with a view to assessing if this attitude has perpetuated itself into the urban design at the nodes of the recycled railway corridors. Nostalgia is not a component of critical regionalism (Nesbitt, 1996). If it is evident in the urban design of the case studies, a design impetus other than that of the conceptual framework adopted in this research can be argued to have occurred.

Frampton (1996) notes the problematic nature of achieving a place-committed critical regionalist design response: *"Such a conjunction between the cultural and the political is difficult to achieve in late capitalist society."(Frampton, 1996, p. 481)*. This research is being completed almost 30 years subsequent to this piece of writing; however, the late capitalist epoch remains and it is this condition within which the case studies of recycled railway corridors used in this research were conceived and realised. Critical regionalism offers the considerations that informed the collection and analysis of evidence through which to examine recycled railway corridors: 'experiential' considerations, 'place-oriented' considerations and 'the consideration of natural light' (Frampton, 1992).

In this research, critical regionalist principles have been extrapolated beyond the scale of architecture to that of urban design. This research also considers the modes of mass transit systems as elements of the built environment and, although not static elements like buildings or landscapes, the differing transport modes each carry a differing three-dimensional presence. These can be considered both in their own right and also in terms of design parameters relating to their immediate surroundings. The following research question examines this notion:

> *How does the urban design differ across a variety of transport modes used in recycled railway corridors?*

Sudjic (1992) highlights the potential strength of the relationship between mass transit and identity. This is broken down into three constituent aspects, the identity of the transport mode, the identity of the transport node, and the identity of the engineering infrastructure:

> *"Yet the physical characteristics of a transport system – the red buses that are vanishing from London, the art nouveau Parisian metro station entrances, the elevated railway in Chicago, are among the most potent means of establishing the identity of the city." (Sudjic, 1992, Page 255).*

These three aspects of identity through transit are focused upon in the research questions concerning the urban design of recycled railway corridors 'along-the-line' and 'at the node'. Each aspect contributes to identity through their design. Critical regionalism defines identity as the physical manifestation of some kind of cultural, economic and political will (Frampton, 1992). Critical regionalism resists processes that lead to a loss of contextual identity. It is argued that by taking these two positions of critical regionalism and that of Sudjic hand-in-hand, the recycling of a railway corridor has the potential to go beyond transport-engineering benefits[28] and to contribute to the manifestation of a place-based identity through the urban design of the built environment.

There are other pieces of theory that share an empirical context with this research where comments are made regarding the aesthetics of the transport rolling stock in combination with a study of the quality of public spaces adjacent to the nodes (Richer & Hasiak, 2014)[29]. What this research examines is the differences in the urban design across the three differing transport modes used in the relative cases: train, tram and guided bus. There are a variety of considerations between these differing transport modes. Taking the station/stop platform as an example of this point, where people integrate from an 'urban environment' to a 'transport environment', a number of differences can be examined. In the most basic descriptive terms, a train requires a platform, a tram requires a smaller platform that is larger than the pavement, and a guided bus requires a pavement like a normal bus. These have significant urban design implications in such terms as land use, landscaping and detailed design. What this research does is examine how this might influence the design of those adjacent spaces. For example, how might the above requirements alter the urban design of a public square associated with the transport node? What design opportunities do the related physical requirements and mandatory access criteria of mass transit hold between the differing modes? Issues previously discussed that are derived from critical regionalism such as authenticity, identity and local specific microclimate responses are appropriate to such explorations.

This research considers recycled railway corridors as elements within polycentric regions. This requires the identification and exploration of different settlement typologies within such regions. The premise of this exploration is built upon one of the core aspects of

[28] Benefits such as lower automobile congestion through higher public transport usage, shorter journey times, lowering emissions, etc.

[29] Richer and Hasiak (2014) argue the rolling stock of NET P1 is more aesthetic than that of the other case in their research, Valenciennes.

critical regionalism, the aspect that rejects the 'universal Megalopolis'. This rejection is founded upon a belief in the of act place creation. In this specific research context, critical regionalism is therefore used as a framework with which to identify trends and place-based commonalities across differing settlement typologies without any attempts to search for or recommend any universal solutions. This research examines a variety of settlements and their urban design relationship with recycled railway corridors in order to collect evidence of either the 'differentiation of culture' as espoused in critical regionalism (Frampton, 1992) or the antithesis of this position, the commodification of the built environment, the 'anywhere design'. Critical regionalism as the conceptual framework sets up a number of notions to be examined through the cases studies in this research:

- Relationship/Accentuation of Topography
- Authenticity
- Identity
- Palimpsest and Anti-Nostalgia
- Spatial and Experiential
- Place Theory and
- Commodification or place creation?

These concepts call for certain ways of examining the built environment that can accommodate the above ideas. Chapter Three explains this conceptual framework in relation to the visual methodologies adopted and in conjunction with the epistemological stance in more detail.

A significant component of the worldview behind this research is that design matters: architectural design, urban design, landscape design, transport design and the integration of these and other facets that contribute to the built environment. Although this involves aesthetic presuppositions, the manifestation of the built environment is cyclically endemic of and able to adjust to larger trends such as political, cultural and social trends. This is why critical regionalism was adopted as the conceptual framework. It allows for detailed design decisions to be contemplated in their regional context, it accommodates searches for trends in approach without a loss of appreciation for place specificity and it rejects the commodification of the built environment over place creation. Nesbit (1996) clearly summarises the critical regionalist position in the tussle for built environments:

> *"The universal Megalopolis is patently antipathetic to a dense differentiation of culture. It intends, in fact, the reduction of the environment to nothing but commodity. As an abacus of development, it consists of little more than a hallucinatory landscape in which nature fuses into instrument and vice versa. Critical Regionalism would seem to offer the sole possibility of resisting the rapacity of this tendency. Its salient cultural precept is place creation; the general model to be employed in future development is the enclave that is to say, the bounded fragment*

> *against which the ceaseless inundation of a place-less, alienating consumerism will find itself momentarily checked." (Frampton, in Nesbit 1996 p.482)*

Adopting these terms, have the urban designs of recycled railway corridors resisted the 'rapacity of the tendency' towards the universal megalopolis? Or, do they represent one such 'enclave of resistance to place-less, alienating consumerism' (Frampton, 1992)? These concepts are discussed in greater detail with reference to transit-supportive urban design theories.

2.2 Transit Oriented Development

In the mid-1980s, American architect-planner Peter Calthorpe published a set of ideas pertaining to pedestrian-focused mixed-use development; the 'pedestrian pocket', situated adjacent to and in close inter-relationship with a transit system (Van der Ryn & Calthorpe, 1986). These ideas evolved into the theory 'Transit Oriented Development' (T.O.D.). This architectural/urban design paradigm has strong parallels with 'smart growth' and 'new urbanism'. However, T.O.D. is specifically focused upon public transit systems as generative elements of regional design, meaning there is a high level of relevance to this research into the urban design of recycled railway corridors.

There are seven principles of T.O.D. and each of these are of relevance to the research questions of this thesis, as summarised in the table below.

PRINCIPLES OF TRANSIT ORIENTED DEVELOPMENT		
PRINCIPLE 1	*Organise growth at the regional level to be compact and transport supportive*	This principle of T.O.D. relates to the overall research question and to the research question which focuses upon recycled railway corridors at the regional scale
PRINCIPLE 2	*Place commercial, housing, shops, parks, and civic uses within walking distance of transit stops*	These principles relate to the research question appropriate to the neighbourhood scale urban designs of recycled railway corridors
PRINCIPLE 3	*Connect pedestrian-friendly street networks which directly connect local destinations*	
PRINCIPLE 4	*Provide a mix of housing types, densities and costs*	
PRINCIPLE 5	*Preserve sensitive habitats, riparian zones, and high quality open space*	This principle relates to the regional scale urban design at recycled railway corridors and the conceptual framework
PRINCIPLE 6	*Make public spaces the focus of building orientation and neighbourhood activity*	This principle relates to the research question focused upon the urban design at the neighbourhood scale
PRINCIPLE 7	*Encourage infill and redevelopment along transit corridors within existing neighbourhoods*	This principle relates to both the regional and neighbourhood scale urban design of recycled railway corridors

Table 2.2: Summary of T.O.D. Principles in Relation to Research Questions

The two T.O.D. principles that apply to the research question *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?'* are listed above as Principles 1 and 5. The first Principle of compact and transport-supportive development is also relevant to the overall research question, raising the issue of what is transport-supportive development. This can be extrapolated into a query about what is 'transit-supportive urban design', which is addressed in the second part of this literature review where normative urban design criteria are synthesised with T.O.D. and S.C.R. principles. The preservation of ecological habitats and open spaces is a recurrent theme between T.O.D., S.C.R., and the conceptual framework that perceives the region as an ecologically closed loop. Principle 7, which proposes infill developments and regional scale, also relates to the research question *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?'* as it proposes such infill developments within a context of existing neighbourhoods.

Perhaps the most important principle of T.O.D. for this research is Principle 2 which advocates mixed-use development within a short walking distance of transit node, which is illustrated in the diagram below. The 'pedshed', the territory within short walking distance of a particular point, defines both land use and urban design legibility terms relating to a particular transit node, in this research a transit node along a recycled railway corridor. How this pedshed is articulated is intrinsically linked to idiosyncratic place factors such as topography, existing land-use patterns and design vernacular. Networks of 'walkable streets' (as opposed to 'roads') which connect sub-areas to transit nodes are key to supporting human scale pedestrian urban design. The types of street patterns which contribute to transit-supportive urban design are discussed later in this chapter. The mixing of housing types and tenures is a further principle that acts as a key distinction between transit-supportive urban design and automobile-prioritised urban design. This research will examine this aspect, in combination with the above aspects, using urban design criteria to examine whether or not transit-supportive urban designs have occurred at the case study recycled railway corridors at the regional and neighbourhood scales. A synthesis of these T.O.D. principles is illustrated in the diagram below, taken from *'The Next American Metropolis: Ecology, Community, and the American Dream' (Calthorpe, 1993)*.

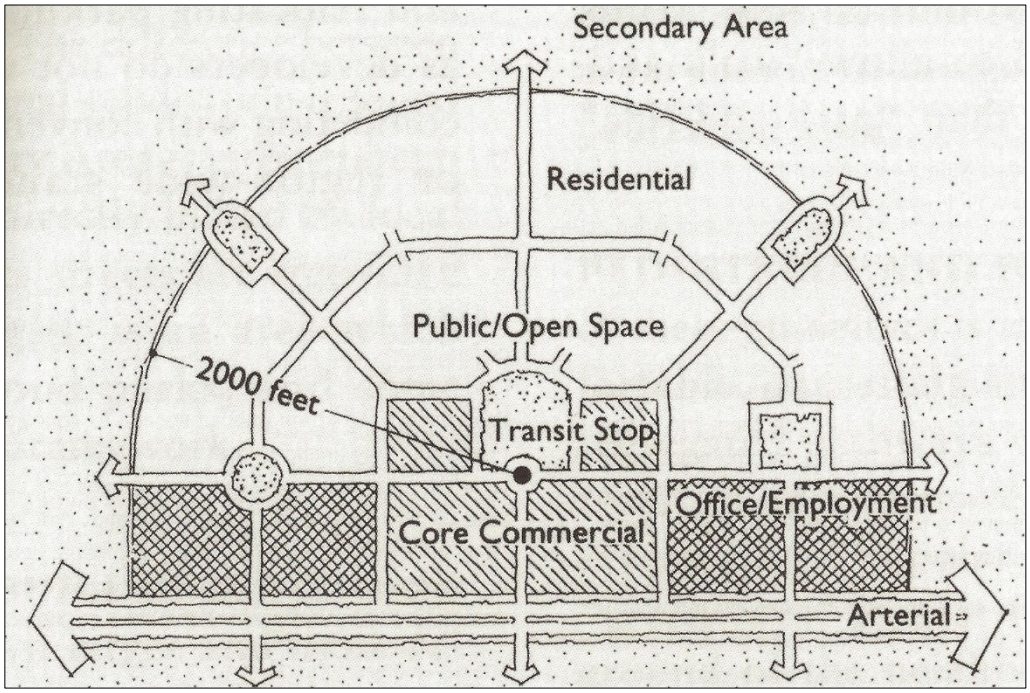


Figure 2.1: Calthorpe's T.O.D. Archetype (1993)

This diagram shows the principles of T.O.D. in a diagrammatic spatial relationship. Source: (Calthorpe, 1993)

The diagram above illustrates Calthorpe's (1993) model of the T.O.D. archetype. This diagram illuminates a number of urban design imperatives that are salient to this research, where the overriding research question is *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?'* The transit node is central to this model, with the immediate extent of the T.O.D. being the 2000ft pedshed. This is a distance of circa 600m, which is broadly recognised as being between a five and ten minute walk. This diagram is not to scale; however, there are 3-4 perimeter blocks within this 2000ft distance, which means each block would be circa 150m deep. This distance is comparable to Gehl's (2010) definition of a human scale city block. It is noted however that the three blocks which are closest to the transit node are smaller than the two blocks to the periphery of the 2000ft pedshed, meaning these specific blocks are even closer in scale to Gehl's recognition of this historically widespread distance. This diagram is split into three segments in terms of land use. The majority of land within this T.O.D. archetype is taken up by residential development that occupies the periphery of the pedshed; commercial land use surrounds the transit node, which together with office/employment areas forms a barrier to the arterial road. It is worthy of note that this arterial road curtails a 360° development around the transit node. It is worth reiterating here that this diagram represents a model and that Calthorpe (1993), in line with the concept of place specificity crucial to the conceptual framework of this research, stresses that this model is adaptive in relation to unique site constraints.

There are certain T.O.D. principles seen in the model above which carry implications for the research question *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?'*. The above diagram does not relate to any indicative existing settlement; whilst it is appreciated this is a diagram indicative of a model, in the real world examples used as case studies in this research adjacent settlements to the recycled railway corridor nodes will be examined as well as discussions regarding urban design responses to regionally specific vernaculars. Neither does this diagram indicate what happens when pedsheds overlap creating 'clusters' (Richer & Hasiak, 2014). This is a configuration that will be considered in this research and how it relates to the transit mode adopted in the recycled railway corridor, as well as the regional scale urban design ramifications. The diagram above also indicates a secondary area, although not specific as to what it is. Potentially this could be, for example, relatively lower-density residential or such ecological features/riparian strips as mentioned in the seven principles of T.O.D.. One striking element of this diagram is how in principle the two types of transport corridor act in terms of Lynchian edges. The arterial road to the bottom of the diagram acts as a Lynchian (1960) edge-barrier, curtailing further development in that direction and only being broken in three places by perpendicular roads. The transit corridor, however, acts as a Lynchian (1960) edge-seam. It runs between the residential area and the commercial, integrating with three 'public open saces' including the one situated at the transit node.

There are aspects of the above diagram which are salient to the research question '*How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale*? Quite reasonably, the diagram shows the transit node in the centre of the model. However, the foundation of a recycled railway corridor is a pre-existing condition being brought back into use, therefore the previous or current node may not be in the centre of the space. If this is not the case, this prompts examination of the urban design to ascertain what benefit and opportunity are gleaned from such an 'off-centre' position. The diagram also features public space adjacent to the transit node. This is a space of intense pressure between transport interchange and human scale place qualities. This research will examine different examples from differing context typologies in order to gauge the importance afforded to urban design in the case of recycled railway corridor nodes. In a transit-supportive urban design these public spaces adjacent to the transit nodes, according to T.O.D. principles, would be bounded by commercial land uses. Whether or not this is the case and how such places are configured in urban design terms will be examined in this research across the differing settlement contexts.

At a finer-grain scale than that illustrated in the diagram above, the street pattern is crucial to supporting these land-use patterns and creating such a 'walkable' transit-supportive pedshed configuration. The above diagram shows a grid-like street pattern

(Marshall, 2005) interspersed by public spaces which are shown as a square, a circus and a square/circus hybrid. These urban design characteristics will be discussed in more detail further in this chapter with a focus upon which aspects can be construed 'transit' supportive, meaning which are in line with the broader T.O.D. principles. Residential land use is evident in the above diagram as being situated to the periphery of the pedshed. This will prompt examination of the case study nodes to ascertain if and how this manifests in the built environment and what difference there might be across the differing settlement typology contexts. Together, and further synthesised with the urban design criteria discussed further in this literature review, a framework is set out with which to analyse the case study examples of recycled railway corridors in order to answer the overriding research question of this thesis *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?'*. Further, more detailed aspects of T.O.D. will now be discussed, including criticisms of the theory, T.O.D.-focused studies that share a partially common empirical territory with this research, and T.O.D.-focused studies that have methodological implications for this research.

One of the most prominent detractors of T.O.D. is Randall O'Toole who, based upon his advocacy of free market solutions to urban planning and design, criticises not solely T.O.D. but planning overall. In the paper 'Is Urban Design Creeping Socialism' (O'Toole, 2000) the idea of formulating a plan for a place is deemed both unsuccessful and abhorrent.

> *"Ironically, the failure of past planning is the premise for the latest planning fad ... The solution, of course, is to give the current generation of planners more power than ever before because this time they claim to have it right." (O'Toole, 2000, p. 501).*

O'Toole makes a vigorous defence against planning based upon what he sees as inherent infringements of such concepts as freedom of choice, property rights and mobility that occur when spaces are designed. However, this is done without acknowledgement of how these concepts of market will manifest themselves in the built environment: the dichotomy of sprawl versus place. Further, when O'Toole talks of freedoms, rights and choices these benefits are only extended to those sections of society willing and capable of owning and operating a car. This notion is countered by Dittmar and Ohland (2004) in 'the New Transit Town: Best Practices in Transit Oriented Development':

> *"Choice is the defining feature of the best neighbourhoods. A well-designed neighbourhood offers many activities within walking distance for those who do not drive (e.g., the young and the elderly), people who cannot afford cars, and people who choose not to rely on cars to get around. Providing a mix of uses within neighbourhoods helps make communities more convenient, because several errands can be completed in one trip, and more affordable because a car is not needed for every trip." (Dittmar and Ohland, 2004, p.25).*

This stance does not force people to forgo their cars, it offers an option for them not to be used, whether that be by necessity, choice or mere preference on any given day. This

scenario, as opposed to the option extolled by O'Toole, has simultaneous societal and environmental implications. Urban design configurations can support these choices. This position of O'Toole is the polar opposite stance to that set out in the conceptual framework of this research. However, it is not a merely aesthetic stance, although aesthetic ramifications do exist for different approaches to development. The planned and designed solution, to the conjoined problems of transit and built environments, is capable of including aspects of culture and environment through regionally specific responses. The argument between proponents of T.O.D. and those of O'Toole are primarily situated in a different international context to the focus of this research. However, lassez-faire free market approaches to the built environment are also prevalent in the United Kingdom and principles of T.O.D. are relevant to examining urban design of recycled railway corridors. In the conclusion to 'Gridlock: Why We're Stuck in Traffic and What to Do about It' (O'Toole, 2009), the differences between the cross-continental attitudes to living near public transport are highlighted:

> *"Americans have a choice. We can spend tens or hundreds of billions of taxpayer dollars on transportation projects that sound good but really serve only a small elite. Or we can restore a user-fee-driven system that will continue to improve personal mobility and reduce transportation costs for generations to come. The former may fit Europe's and Japan's aristocratic heritage. To best serve our way of life, America must use mobility over image." (O'Toole, 2009, p. 236).*

Once the use of the term 'Europe' in a pejorative sense is overcome and that those unable to drive can be considered 'elite', then the issues of equity and accessibility in transit and the built environment become prominent. O'Toole is advocating a mass-transit-free automobile-prioritised suburb as a progressive, economically sensible and inherently fair solution to growth. Calthorpe (1993), however, counters this argument by stating that the American Suburb has three significant negative impacts: the loss of community; the loss of the built environment being scaled to the human being; and the loss of natural environments. These principles are squarely aligned with the principles of critical regionalism, as discussed previously in this chapter as part of the conceptual framework.

> *"The result of this era is that both the city and suburb are now locked in a mutually negating evolution toward loss of community, human scale, and nature. In practical terms, these patterns of growth have created on one side congestion, pollution, and isolation, and on the other urban disinvestment and economic hardship."(Calthorpe, 1993, p. 9)*

These negative aspects of a free market dominated existence – congestion, pollution and isolation, as argued by Calthorpe (2001) – can be alleviated through T.O.D.. Through these alleviation strategies, issues of equity are addressed with disinvestment and economic hardship potentially reduced through the combination of an environment that is walkable, connected to a broader employment market via a mass transit system. This T.O.D. solution addresses accessibility. The principles of T.O.D. design are not reliant on private vehicle

ownership; automobiles are still a part of the strategy, just not the predominant element. This research, as part of the cross-case analysis, considers both sides of this polemic debate in order to respond to the question '*Why is urban design important in the case of the UK's recycled railway corridors' built environments?'*

As mentioned previously, T.O.D. and Smart Growth are parallel paradigms. Litman (2009) in 'Evaluating Criticism of Smart Growth' sets out the core philosophical and practical objections to the idea of growth married with public transit, which are summarised below:

SUMMARY OF CRITICISMS OF SMART GROWTH / TRANSIT ORIENTED DEVELOPMENT (LITMAN, 2009)	
PETER GORDON AND HARRY RICHARDSON	Transit Oriented Development reflects a socialist/collectivist ideology.
JOEL KOTKIN	Suburbia requires defending against a 'smart growth attack' and that this is a social responsibility on behalf of a 'consumerist middle-class'.
WENDELL COX	T.O.D. and Smart Growth are endemic of an attitude of anti-opportunity.
EDWIN S. MILLS	Any attempt at the reduction of sprawl is harmful to both individuals and societies concurrently.
EDWARD GLAESER AND MATTHEW KAHN	Economic efficiency (i.e. the least amount of spending on public transport) is a universal benefit.

Table 2.3: Opponents and Counter Arguments to T.O.D.

Source: (Litman, 2009)

There are authors however, who refute the above arguing that the costs of continuing to build using only the suburban sprawl model are foreseeably high:

> *"Abandoned suburbs and social unrest are just two of the apocalyptic scenarios proposed for our future as the oil runs out, and we are already waging wars over petroleum resources. What we are doing to our health is only slightly less disturbing: the jury is still out on just what is causing the marked increase in obesity observed around the developed world, but most health professionals agree that a sedentary, car-anchored lifestyle contributes greatly." (Soderstrom, 2008, p. 14).*

Proponents of T.O.D. however, do not claim its solutions to be a panacea for all of the above, but reductions in driving do have benefits other than carbon calculations, even if a 'low carbon economy' is an ultimate target (Stern, 2006). Whilst opponents of T.O.D. cite the support of a free market as a counter argument to T.O.D., proponents of T.O.D. argue that without a mass transit option a market distortion occurs (Litman, 2009). Planning Policy Guidance 13 (Department for Communities and Local Government, 2001) and the National Planning Policy Framework (Department for Communities and Local Government, 2012) refer to such a widening of transport choice in their demand for disused transit networks to

be assessed before being severed. Ideas and perceptions of 'freedom' and 'choice' are ingrained within the T.O.D. debate. Calthorpe (1993) refutes sprawl being the epitome of a market-led expression of 'freedom of choice':

> *"Along with this sticky question of physical and social form is the erroneous belief that our community's physical form is the result of free choice, the market's wisdom, and the statistical sum of our collective will." (Calthorpe, 1993, p. 10)*

Therefore, urban design, as alluded to in the conceptual framework, is endemic of more than a subjective aesthetic, a manifestation of cultural and political will. Calthorpe (1993) avoids criticisms that T.O.D. designs succumb to 'architectural determinism', a position backed up by Litman (2009) who argues that consumers, if that isn't a misnomer for people who inhabit the built environment, are flexible, adaptable and can flourish within T.O.D. conditions:

> *"Critics tend to assume that consumers are inflexible, helpless and lazy, and so would be unable to accept living in more smart growth communities and reducing their automobile travel. However, experience indicates that people are actually quite adaptable and creative, enjoy walking and cycling, and can flourish in a wide range of land use conditions and transportation patterns." (Litman, 2009, p. 3).*

This sentiment reflects the position set out in the conceptual framework that leans towards urban designs that are specific through reference to their region, immediate context and programme. This is reflected further in this chapter where transit-supportive urban design traits are discussed in regard to appropriateness to their immediate context typology.

Confounding those who have perspectives that rely upon people as consumers only, the issue of transport mode choice has been investigated from the phenomenological perspective (Mann & Abraham, 2006). Time and cost are factors in transit mode choice, with specific 'journey-based effects' and 'identity' also being important, as are 'considerations of personal space'. These factors, however, according to Mann & Abraham (2006) are not cumulative and people use subjective and variable combinations of the above influences within their individual specific contexts when deciding transport mode. This strengthens the case for a transit-supportive urban design; if a walkable pedestrian environment with a variety of opportunities and pleasant space is on offer, it is reasonable to say that this could support public transit choice.

There are therefore strong, often polemical, arguments for and against T.O.D.. This research takes the overall principles of T.O.D., extrapolates these into finer-grain urban design criteria and examines case study recycled railway corridors using this framework as a theoretical base upon which to form assessments of these spaces. In doing so the research question *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?*' will be answered using a comparative analysis of a number of empirical cases. This methodological approach, based upon observation, has been informed by previous work concerning urban design and T.O.D..

Justin Jacobson and Ann Forsyth (2008) contribute to the debate surrounding T.O.D. by focusing upon urban design at the neighbourhood scale in relation to the nodes of their selected case study examples. The core methodological implications of this publication for this research are discussed in Chapter 3.6 where the following aspects are taken into account:

- The intentions of the investigation
- The iterative selection process of cases
- The disaggregation of T.O.D. theory across differing node context typologies and
- Applicable urban design assessment tools

This paper, *'Seven American T.O.D.s: Good Practices for Urban Design in Transit-Oriented Development Projects'*, published in the *Journal of Transit and Land Use*, stresses the importance of urban design and place considerations at transit nodes, describing these aspects as a means of mediating the tensions between places of transport interchange and intense land uses (Jacobson & Forsyth, 2008). This research is focused upon answering the following question: *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?'* Therefore, the criteria set out by Jacobson & Forsyth in this paper, as well as the manner in which their data was collected, is useful and closely related to this research into urban design and recycled railway corridors. This also contributes to the research question *'What techniques/approaches, applied to the varying territories of built environments along recycled railway corridors, can be used to survey, describe and interpret the urban designs?*'. Observation is important to the work of Jacobson & Forsyth (2008) and is crucial to this research.

The twelve principles set out (see box below) by Jacobson and Forsyth (2008) are placed within the context of the body of knowledge concerning the built environment and mass transit as being supplementary to the existing scholarly work that concentrates on other facets of urban design at transit stops: policy, financial, etc. The box below shows how these twelve principles are split into three key categories: 'processes, places and facilities' (Jacobson & Forsyth, 2008). The latter two categories relate closely to this research's questions where the contribution of urban design to place qualities at the regional and neighbourhood scale of recycled railway corridors is paramount.

PROCESSES	
PRINCIPLE 1	Appreciate that planning and developing great places takes time
PRINCIPLE 2	Engage the public and experts as collaborators and work with activist energy
PRINCIPLE 3	Programme spaces for use
PRINCIPLE 4	Invest in maintaining spaces
PLACES	
PRINCIPLE 5	Design at a human scale
PRINCIPLE 6	Provide public spaces that accommodate a variety of uses and users
PRINCIPLE 7	Use design and programming strategies to increase safety
PRINCIPLE 8	Allow for variety and complexity
PRINCIPLE 9	Create connections between spaces
FACILITIES	
PRINCIPLE 10	Design sidewalks and crosswalks for appropriate pedestrian use
PRINCIPLE 11	Integrate transit and transit facilities into the urban pattern
PRINCIPLE 12	Don't forget (but don't overemphasise) car movement and car parking

Table 2.4: Jacobson & Forsyth's 12 Principles of Good Urban Design at T.O.D.s

Source: 'Seven American T.O.D.s: Good Practices for Urban Design in Transit-Oriented Development Projects', published in the Journal of Transit and Land Use (Jacobson & Forsyth, 2008)

Under the category of 'places' Jacobson and Forsyth's fifth principle states to 'design at a human scale'. Jacobson and Forsyth define this concept as:

> *"Design so that the areas that people inhabit—such as sidewalks, plazas, and transit stations—are scaled to be usable and interesting to people moving at walking speed."(Jacobson & Forsyth, 2008, p. 77).*

A more detailed discussion of 'human scale urban design' references the work of Jan Gehl (2010) and is situated further in this chapter, while Chapter 6.3 examines the case study nodes in these terms. As well as being crucial to the experiential aspects of critical regionalism, human scale built environments are crucial in the work of Calthorpe's (1993) where he sets out the intentions for place inherent to T.O.D.:

> *"This ethos provides a specific aesthetic of place – scaled to the human body, timed to a stride, patterned to ceremony, and bonded to nature." (Calthorpe, 1993, p. 11).*

This idea of a space 'patterned to ceremony' as noted above, links to Jacobson and Forsyth's sixth principle which calls for the 'provision of public spaces that accommodate a variety of uses and users' (Jacobson & Forsyth, 2008, p. 77). This research surveys the case study nodes in order to examine differing examples where these criteria have occurred at recycled railway corridors, whether or not these occurrences are responsive to place-sensitive issues and if the configuration of such spaces relate to the node context typology.

Issues of safety are of clear importance to Jacobson and Forsyth with Principle 7 stating: *"Use design and programming strategies to increase safety"* (Jacobson & Forsyth, 2008, p.78). Jacobson and Forsyth (2008) acknowledge that safety is a far more complex issue (Oc & Tiesdell, 1997) within Urban Design than the four key issues that they set out: 'lighting', 'access control', 'visibility' and 'movement'. Issues pertaining to safety are considered in the cross-case analysis carried out in this research.

Principle 8 of Jacobson and Forsyth's (2008) '*Good Practices for Urban Design in Transit-Oriented Development'* is to *"Allow for variety and complexity"* (Jacobson & Forsyth, 2008, p. 79). They equate complexity with a 'positive sense of place', which again correlates with the conceptual framework of this research. Complexity in this context can mean materials or land uses and these aspects of variety will be examined in the case study nodes in order to gauge the contribution of urban design to place opportunities at the nodes of recycled railway corridors.

Principle 9, the final principle categorised under 'places' states: *"Create connections between spaces"* (Jacobson & Forsyth, 2008, p. 79). The respective street/plot patterns (Marshall, 2005), walking distances, and the character of the pedestrian routes available at the node of recycled railway corridors, is examined at a number of case study examples as part of this research. Although naturally Jacobson and Forsyth use much American terminology for certain urban design aspects of connective pedestrian areas, these can be counted as relevant to this study: 'highways', 'huge parking lots', 'connectivity between buildings and the outdoors', 'discontinuous sidewalks', and 'uncomfortable cycle routes'.

These five principles categorised under 'places' provide crucial detail in this research into the urban design of recycled railway corridors. There are clear parallels between the place specific aspects of the conceptual framework critical regionalism, the principles of T.O.D. and normative urban design criteria that are discussed at a more detailed level further in this literature review.

The next category of 'Good Practices for Urban Design in Transit-Oriented Development Projects' (Jacobson & Forsyth, 2008) is 'facilities'. Principle 10 is highly pertinent to this study: safety, pleasantness and convenience are key to the design of

'sidewalks'. The pedestrian environment at the node of recycled railway lines is analysed in Chapter 6.5 where this idea of walkability forms the focus for the cross-case synthesis. Although 'walkability' – the quality of human experience to an authentic built environment – is not explicitly mentioned in the conceptual framework, in the context of a node of a recycled railway corridor the pedestrian environment is one of the most crucial.

Principle 11: 'Integrate transit and transit facilities into the urban pattern' (Jacobson & Forsyth, 2008 p.80) reflects the complexity of spaces at nodes and along-the-line of recycled railway corridors. The research question that states '*How does the urban design differ across a variety of transport modes used in recycled railway corridors?*' looks carefully at how the three modes of transit featured in the case studies integrates with the urban design of recycled railway corridors. This facet of the built environment is of importance considering the correlation between transit mode and place recognition (Sudjic, 1992), and how crucial place matters are to the key question of this research.

Jacobson and Forsyth's (2008) twelfth and final principle of 'Good Practices for Urban Design in Transit-Oriented Development' is 'Don't forget (but don't overemphasise) car movement and car parking'. (Jacobson & Forsyth, 2008, p.81). This notion of balancing the urban environment taking in consideration of the automobile, and in doing so questioning its dominance, is recurrent throughout T.O.D. literature. In 'Developing Around Transit: Strategies and Solutions that Work' (Dunphy et al., 2004) cite ten development strategies and the fourth is 'get the parking right'. Although this contradicts free market opponents of T.O.D. (O'Toole), this notion corresponds closely to Jacobson and Forsyth's ideas. The configuration and nature of car parking provision is examined in relation to recycled railway corridors in this research.

> *"Although it is common practice to locate parking immediately adjacent to the station, broader community goals are best served when parking is moved away from the platform. The land nearest the station is the best land for development, so using it for parking means a lost opportunity." (Dunphy et al., 2004, p. 174)*

Opportunity is a key theme throughout this study and the cross-case analysis examines where and how urban design opportunities have been taken along recycled railway corridors. T.O.D. theory posits that the configuration of parking is a crucial aspect to whether or not such opportunities have been taken. In their conclusion, Jacobson and Forsyth (2008) emphasise three key aspects of the success of urban design in the instances of T.O.D.s:

> *"Success in this endeavour will be, at least in part, a function of the liveability, accessibility, and attractiveness created by careful physical planning and good urban design." (Jacobson & Forsyth, 2008, p. 82).*

These three aspects of 'liveability', 'accessibility' and 'attractiveness' are also relevant to this research. The conceptual framework offers a structure with which to examine the empirical evidence of the case studies through appropriate visual methodologies (Rose,

2007). Issues of attractiveness and liveability are addressed in this research through the observations made at the case studies, where place characteristics are compared between different built environment examples within and across the case studies.

A further piece of work concerning T.O.D. is *'Territorial opportunities of tram-based systems: a comparative analysis between Nottingham (UK) and Valenciennes (FRA)'* (Richer & Hasiak, 2014). Whilst this piece of work informs the conceptualisation of transit-supportive urban design criteria applicable to recycled railway corridors through the discussion of 'introverted and extroverted stations' (Richer & Hasiak, 2014), there is a shared empirical territory (NET P1 and CS 1.12 Hucknall) with this research. Methodologically, there are also similarities between the ways both of these pieces of research pursue knowledge in the field of urban design at recycled railway lines: qualitative assessments of aesthetics of place through observation and photography.

Richer and Hasiak (2014) make reference to territories of inquiry in their paper that are considered in this research as at the neighbourhood scale of the transit system. They argue that there is confusion between the train stop and the tram stop at (CS 1.12) Hucknall, with neither a public building nor a designed public space signifying the presence of nor difference between the transport nodes. This is a question of legibility; this research draws upon the work of Lynch in order to examine urban design at both the regional and neighbourhood scales. The levels of connectivity between Hucknall node and its respective town centre are also investigated by Richer and Hasiak (2014). This research also examines issues such as street pattern, walkability and permeability with regard to connectivity between transit nodes and their respective towns. Richer and Hasiak (2014) note the URBED master plan for Hucknall which calls for an increase in connectivity between the node and town centre. However, this master plan has not been implemented at the time of both this work and this research, leading Richer and Hasiak (2014) to describe the urban design of this place as being tentative. Hucknall (CS 1.12) receives a high level of attention in this research also, as the built environment at this node shows distinct characteristics.

The accumulation of these factors has led to Hucknall being presented as an 'introverted' node (Richer & Hasiak, 2014), one that has 'little impression upon its direct and associated environs', satisfactory in terms of mandatory engineering standards yet not taken full advantage of place-based opportunities that mass transit can afford an area. The counter-point to the 'introverted' Hucknall given by Richer and Hasiak (2014), is that of an 'extroverted' urban design at Denain on the Valenciennes network in northern France. Whilst this research's case studies are all in the UK, it is interesting that Richer and Hasiak (2014) have compared the NET P1 recycled railway corridor to a similar instance in France. They also make regional scale observations; Richer and Hasiak (2014) note that in the French example the landscape and the transport infrastructure show consideration and

integration. It is particularly interesting for this study as Richer and Hasiak (2014) state that the Valenciennes network utilises an old railway corridor – a recycled railway line. A further comparison is that the new configuration in France does not stick rigidly to the previous route and extends further into the main shopping area of Denain, necessitating the integration between the transport infrastructure and the pedestrian environment.

Richer and Hasiak (2014) characterise Valenciennes as, in contrast to Hucknall, an 'extroverted' node. They state that the opportunity of renovating the streets was taken, using the mass transit route as "an urban planning tool" (Richer & Hasiak, 2014, p. 230) through the renovation of the public spaces adjacent to the route. This reconfiguration, it is argued, was a stimulus for a transport interchange that signifies its use through design, as opposed to Hucknall where the transport node lacks urban design signification. Denain is explicit about its purpose through architectural and urban design such as large glazed structures for shelter over platforms situated in renovated public spaces (Richer & Hasiak, 2014).

These contrasted cases are used as examples of 'introverted/extroverted' urban designs at nodes within 'Territorial opportunities of tram-based systems: a comparative analysis between Nottingham (UK) and Valenciennes (FRA)'. This research examines, in a not dissimilar manner, the three stated case study recycled railway lines at the regional and neighbourhood scales in order to generate knowledge pertaining to the importance of urban design to the UK's recycled railway corridors' built environments.

This section has taken the transit-supportive urban design paradigm of T.O.D., discussed the themes within in terms of the conceptual framework, and overlaid finer-grain urban design criteria. The following chapter carries out a similar exercise regarding S.C.R. by examining complementary theories that share an empirical context with this research.

2.3 The 'Social City Region' & Recycled Railway Corridors

Breheny and Rookwood (1993) established the concept of a 'Social City Region' (S.C.R.) in the Town and Country Planning Association's (TPCA) '*Planning for a Sustainable Environment'* (Blowers, 1993) and in this collection of works 'sustainable development' is set out as being possible through an integration between disciplines and the adoption of a long-termist approach. Whilst at the time of writing the concept of sustainability is well established (Banister, 2002; Hall & Ward, 1998), the notions present in Breheny and Rookwood's (1993) chapter is still relevant to an examination of urban design at recycled railway corridors. Social impacts and environmental contexts relating to 'transport and urban form' were considered as part of the S.C.R. recommendations, which are salient to this research into the urban design of recycled railway corridors.

This research focuses on Breheny and Rookwood's (1993) chapter 'Planning the Sustainable City Region', where their 'S.C.R.' concept is explained. This chapter sets out a series of recommendations for how to achieve such an 'S.C.R.' and a series of checklists to monitor the progress of future developments in terms of sustainability are laid out. This literature review synthesises aspects of S.C.R. with certain traits of critical regionalism, T.O.D. and normative urban design criteria. This is done in order to establish a framework with which to examine urban design at recycled railway corridors The fact that S.C.R. is explained in a publication by the TCPA and that the terminology of 'Social City' is used, points to a conceptual heritage leading back to the Garden City Movement. Indeed, the twelfth chapter of 'Garden Cities of To-morrow' (Howard, 2nd edition 1902 (reprint 2010) is entitled 'Social Cities', and the values championed in that original text have transcended its historical context into the present day. The phrase 'Social City' encapsulated Howard's (2nd edition 1902 (reprint 2010) impetus for an increase in the living standards of his contemporaries:

> *"The problem with which now we have to deal, shortly stated, is this: How to make our Garden City experiment the stepping stone to a higher and better form of industrial life generally throughout the country." (Howard, 2nd edition 1902 (reprint 2010), p. 91).*

At the time of writing of 'Planning the Sustainable City Region', a contemporary key question was how to achieve a resilient way of living, which remains relevant today; a settlement configuration that retains the positive aspects of contemporary existence whilst eradicating the wasteful attributes. These two conjoined objectives correspond to the principles of critical regionalism, T.O.D. and the S.C.R.. This research into urban design at recycled railway corridors is informed by a combination of qualities from within these theories in its pursuit of an answer to the question: *Why is urban design important in the case of the UK's recycled railway corridors' built environments?*

This review of the 'S.C.R.' shows that certain aspects are consistent throughout this approach for 'sustainable growth in the sub-regions' (Breheny & Rookwood, 1993):

- 'reductions in pollution and waste'
- 'efficiency in use of materials'
- 'less harmful transport systems and greater proximity between living'; and
- 'working and service areas'.

These aspects have been extrapolated, some indirectly and some directly, to the consideration of urban design at recycled railway corridors. Pollution can be reduced and efficiency of materials achieved through denser residential development in relation to transit nodes (Calthorpe & Fulton, 2001) and this land-use model would also mean more efficient transport systems (Banister, 2002). Using these aspects highlighted above, Breheny and Rookwood (1993) discuss conditions which would achieve a 'S.C.R.' under the categories *'natural resources', 'land use and transport', 'energy'* and *'pollution and waste' (1993)*.

The most applicable of these categories to this research is *'land use and transport'* although, as with the aspects listed above, these categories overlap when considered in terms of urban design and recycled railway corridors. Within the category *'land use and transport'*, the five conditions noted below are compared against the potential urban design implications.

SOCIAL CITY REGION CATEGORIES UNDER 'LAND USE AND TRANSPORT'	
SOCIAL CITY REGION CATEGORIES	IMPLICATION FOR URBAN DESIGN AT RECYCLED RAILWAY CORRIDORS
a reduction in distance for the daily workplace commute	A mix of residential and commercial land use in proximity to recycled railway corridor transit nodes
a greater use of public transport	A prioritisation and integration of transit infrastructure into the built environment
a balancing of public transport loadings (with a view to reducing fuel consumption)	Consideration for walkability at transit nodes in order to support public transit choice
an increase in self-sufficiency regarding food/goods/services	Opportunities to sell local produce in relation to recycled railway corridor
a concentration of development that is served by public transport	T.O.D. model urban design at recycled railway corridor nodes

Table 2.5: S.C.R. Land Use & Transport Categories and RRCs

Source: (Breheny & Rookwood, 1993)

These S.C.R. categories relate to the research questions for this thesis. 'A greater use of public transport' relates to the question '*How does the urban design differ across a variety of transport modes used in recycled railway corridors?*', as the increase in use of public transport means an increase in need for transit-supportive urban design. The research question *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?*' relates to the third and fifth S.C.R. category, as walkability and T.O.D. design principles apply to the nodes of recycled railway corridors.

The remaining categories *'a reduction in distance for the daily workplace commute'* and *'an increase in self-sufficiency regarding food/goods/services'* apply to spaces along-the-line of recycled railway corridors and hence apply to the research question '*How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?'*. This prompts examination of the urban design of recycled railway corridors across their respective case study regions. The other aspects, 'natural resources' and 'energy and pollution and waste' do have urban design implications, but bearing in mind the scope of this work, they are not used in this research, concentrating instead on the aspects which correspond to the greatest degree with the cases of urban design at recycled railway corridors.

The S.C.R. itself is illustrated by the diagram shown below, which makes a number of recommendations overlaid across a partial segment of an archetypal core-periphery settlement pattern. This diagram shows both road and public transport networks converging at the city centre core.

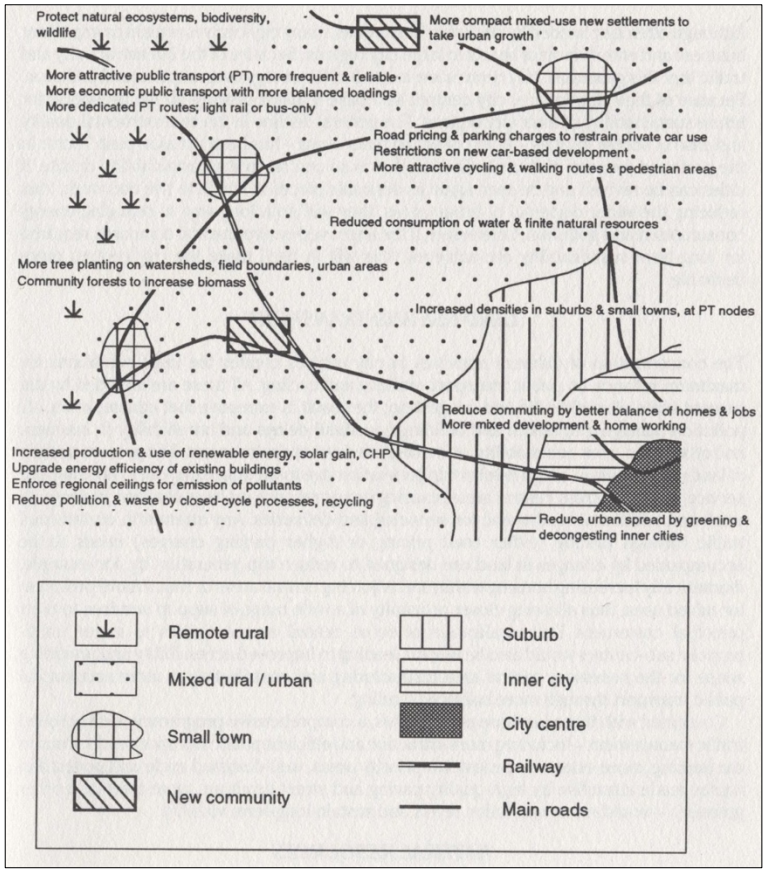


Figure 2.2: Breheny & Rookwood's Social City Region (1993)

This diagram, from 'Planning the Sustainable City Region', shows a spatial configuration of a number of 'area types' in relation to each other and a theoretical public transit system. Source: (Breheny & Rookwood, 1993)

These aspects and their recommendations inform this research in the following ways: the research question *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?'* is influenced by six of the recommendations in the diagram above. The notion of increasing public transport patronage and balancing those loadings can be related to recycled railway corridors and, by definition, of their contribution to a public transport system through the reintroduction of the previously dormant network. The grade separation of the recycled railway corridor can mean that potentially this public transport system will be more attractive due to its unencumbered alignment, which can also potentially increase reliability and frequency. Inherent potential exists in a recycled railway corridor to develop clusters of new developments along these previously disused alignments. As well as strategic built environment growth, this act of clustering can mean protection for natural ecosystems ('community forests', 'increased biomass', more 'biodiversity and wildlife habitats'). This clustering of developments can

also alleviate pressure on the inner city, which could afford a further opportunity for 'greening' and 'decongesting' these areas.

The research question *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?'* shares issues taken from the four following aspects of the S.C.R.. An increase in intensity of development at public transit nodes is squarely aligned with the principles of T.O.D. and is an aspect where the nature of urban design implications at recycled railway corridors can be observed at the case study nodes. Further, the concept of mixed-use developments absorbing growth are again in line with T.O.D. and will have observable ramifications at recycled railway corridors. It will also be possible to observe whether or not the built environments at the nodes of recycled railway corridors are car-based or public transit supportive.

There are also two aspects of the S.C.R. which pertain to the research question '*How does the urban design differ across a variety of transport modes used in recycled railway corridors?'*. The S.C.R. calls for more dedicated public transit routes and the act of recycling a railway corridor will provide this, and by utilising such disused alignment the contemporaneous configuration will be, at least in the main, a dedicated public transit corridor grade-separated from the main road network. The S.C.R. calls for this to be light rail or bus-only; however, this research also examines instances where the recycled railway corridors utilise a heavy rail alignment. An increase in cycling is also cited in the S.C.R., which although not quantified as part of this research, urban designs which facilitate this and their relationship to the recycled railway corridor case studies will be observed. The work of Fleming (2012) and his adaptation of T.O.D., 'Bicycle Oriented Development', will be used to inform this examination of the built environments of recycled railway corridors. Walking routes and pedestrian areas are cited as being important in the S.C.R. diagram below, which coincides with the impetus of walkability as discussed earlier with regard to T.O.D.. The urban design aspects at recycled railway lines will be examined in this research with regard to walkability at the nodes of recycled railway corridors.

As discussed above, the S.C.R. theory is formative in the conceptualisation of this research, which has the overall research question *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?'*. The cross-referencing between sustainable principles set out in the S.C.R. and T.O.D. enable a framework for assessing the urban design of the case study recycled railway corridors. Hall and Ward (1998) note the similarities between the 'S.C.R.' and Calthorpe's (1993) 'Transit Oriented Development' (T.O.D.), discussed above both in terms of date of publication and overall approach:

> *"His concept, which he calls 'Transit Oriented Development' (T.O.D.), bears an astonishing physical resemblance to the ideas of Breheny and Rookwood, developed independently and published in the same year."(Hall & Ward, 1998, p. 146).*

Both ideas are regional scale paradigms, which espouse development along transit corridors, in reference to the tradition of Howard (Howard, 2nd edition 1902 (reprint 2010). There are however, key differences between T.O.D. and S.C.R. and it is within these fissures that the conceptualisation of this urban design prioritised research operates. The contexts of the two ideas are different; T.O.D. is rooted in American culture with the S.C.R. being of a British perspective. T.O.D. is initiated by architects Peter Calthorpe and Sim Van der Ryn (1986) whereas S.C.R. is from a planning perspective. As stated previously, both perspectives are highly relevant to research into urban design at recycled railway corridors. However, and crucially for the conceptualisation of this research, the S.C.R. is broken into six 'components' or 'area types' which are based on OPCS classifications of urban areas contemporary to the publication of that book chapter. This, from the perspective of this research, is a key differentiation between T.O.D. and S.C.R.. This means a disaggregation of principles within S.C.R. theory forming a set of distinct yet regionally-dependant settlement contexts. This is in contrast to T.O.D. which has a series of components which apply in principle across all node contexts, although Calthorpe acknowledges that each development be unique (Calthorpe & Fulton, 2001).

This research takes these 'area types' as formative node context typologies and extrapolates planning aspirations into queries of how potential urban design characteristics are manifest, in order to examine nodes and corridors of recycled railway corridors. This conceptualisation of the S.C.R. operates in parallel with the conceptual framework by paying close attention to areas other than the dominant core of cities, in a similar way to how critical regionalism sees a dominant centre with subordinated satellites as an undesirable configuration. These area types are: 'City-Centre', 'City-Inner', 'City-Suburb', 'Small Town & New Community', 'Mixed Urban-Rural' and 'Remote Rural'. These are taken to form the basis of node context typologies and the specific urban design criteria used to examine each context is explained in more detail in sub-chapter 2.6. This disaggregation is in line with critical regionalism's principles of place-specificity and this research synthesises these traits. It takes aspects of T.O.D. and contextualises their urban design implications specifically at recycled railway corridor nodes which relate directly to context typologies derived from the S.C.R. 'area types'. This application of urban considerations towards areas not central to cities is conceived by Soja in Postmetropolis where the term synekism[30], or the linking of urban-ness to positions beyond the primary city space, is

[30] Soja gives this definition of the term 'Synekism': "Synekism is directly derived from *synoikismos*, literally the condition arising from dwelling together in one house, or *oikos*, and used by Aristotle in his *Politics* to describe the formation of the Athenian *polis* or city-state." Soja (2000). Page 12.

sponsored just as Breheny and Rookwood (1993) establish planning principles (with urban connotations) for segments beyond the city core.

> *"This regionality enlarges the scale of city space right from the start, and points to the need to see even the earliest cities as regional agglomerations. Keeping in mind the regionality of city space is not easy, for we tend to see the city as a formally bounded area distinct from its surrounding "non-city" or "sub-urban" or "rural" hinterland and countryside. It is only in this inner area that we conventionally attribute the distinctive qualities of urban-ness or the experiences of urbanism as a way of life." (Soja, 2000, p. 16)*

Each of these area types are, as can be seen when they are discussed in more detail further in this chapter, focused upon public transit nodes. Whilst the S.C.R. makes no mention of the utilisation of disused railway alignments, the concepts inherent to this theory can be used in this examination of recycled railway corridors. These aspects of such regional agglomerations, as part of the complex configuration of the S.C.R., have urban design implications at the two key scales featured in this research: the regional and the neighbourhood. There are theories that build upon the work of Breheny and Rookwood (1993), which apply and develop its principles, in a continuation of Howard, into propositions based upon real world conditions.

Elaborating on the 'S.C.R.' is Hall and Ward's concept of 'Sustainable Social Cities of Tomorrow' (SSCT). Three key examples of this idea are given, which are all regional organisations of clusters of development, with clear reference and genealogy to Howard's original Garden City ideas. These SSCTs exhibit a series of relatively denser conurbations separated by green belts along public transit corridors. Two of these three SSCTs utilise what Hall and Ward term 'reopened railway lines'; in the terms of this research, recycled railway corridors. In one such example, the 'City of Anglia', the reopened railway line is a case study within this research (CS02). Although the CGB and the City of Anglia do not map precisely over one another, the larger of CS02's two sections does correspond very closely with one of the two reopened railway lines of the City of Anglia, with the key difference being that the real world case is of a lesser extent. There are however, 'clusters' on the City of Anglia diagram which do correspond to nodes within CS02, albeit under different titles.

An SSCT (Hall & Ward, 1998) is a proposal participated in by the TCPA (Hall & Ward, 1998) where urban compaction is pursued but not to the detriment of the quality of urban life, predicated upon a combination of regional and sub-regional strategies with the reuse of urban sites as a priority. Whilst this research does consider closely brownfield development, it also considers the corridors of disused railways, which often link these brownfield sites (Calthorpe & Fulton, 2001) as a priority. The SSCT advocates a portfolio approach where top-down and bottom-up perspectives meet in order to achieve strategies which transcend urban/greenbelt boundaries. This portfolio approach relates closely to the

area types of the S.C.R., where differing solutions are applied at different area type contexts, but in line with consistent underlying principles, which are in turn supported by public transit linkages.

Hall and Ward (1998) set out the principles of a SSCT using what they term twelve 'building blocks'. These are listed in the table below which includes how these building blocks relate to the theories which comprise this literature review and which of the research questions these building blocks are most relevant to.

HALL & WARD'S BUILDING BLOCKS OF THEIR 'SUSTAINABLE SOCIAL CITIES OF TOMORROW'		
BUILDING BLOCK 1	*Develop Urban Nodes*	T.O.D. emphasises development at the node of mass transit networks; this building block relates to the research question pertaining to the neighbourhood scale.
BUILDING BLOCK 2	*Selective Urban Densification*	The advancing of brownfield opportunities is an important aspect of T.O.D., This building block relates to the research question which examines recycled railway corridors at the regional scale.
BUILDING BLOCK 3	*No Town Cramming*	This building block relates to the overall research question and the notion of quality of place inherent to the conceptual framework.
BUILDING BLOCK 4	*Strategic Provision for Greenfield Development*	This relates to the research question situated at the regional scale and relates to the S.C.R. principle of creating more compact mixed-use developments to accommodate growth.
BUILDING BLOCK 5	*Distance*	This building block relates to the research question which considers RRCs at the regional scale and as distance between settlements implies legible (Lynch, 1960) districts.
BUILDING BLOCK 6	*Top-Quality Linkages*	This building block relates to the S.C.R. in its promotion of dedicated public transit routes and cycle paths, which also reinforces the purpose of the research question which investigates differing public transit nodes along recycled railway corridors.
BUILDING BLOCK 7	*Clustered Development*	This building block relates to the research question that is concerned with the design of recycled railway corridors at the regional scale.
BUILDING BLOCK 8	*Town Expansions and New Towns*	This building block relates to the small towns and new communities Area type of the S.C.R., which in turn relates to the research question pertaining to urban design at the regional scale along recycled railway corridors.
BUILDING BLOCK 9	*Density Pyramids*	The question of density and quality of place is crucial to the overall research question.
BUILDING BLOCK 10	*Variation according to Geography*	This building block can be equated to the primacy afforded topography within the conceptual framework of this research which can be applied at the regional scale examination, focused upon the urban design of a recycled railway corridor
BUILDING BLOCK 11	*Areas of Tranquillity*	Ecological features and repairing the strips are features included in S.C.R. and T.O.D. theory. These will be examined at the regional scale in this research.
BUILDING BLOCK 12	*Stimulate Remote Rural Areas*	The S.C.R. has area types pertaining to the stimulation of 'remote rural areas' 'mixed urban rural' and 'remote rural'.

Table 2.6: Hall & Ward's 12 Building Blocks of their 'Sustainable Social Cities of Tomorrow' and RRCs

Source: (Hall & Ward, 1998, pp. 182-187)

The research question '*How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?'* draws influence from Building Blocks 2, 5, 6, 7, 8, 10, and 11. Issues such as densification, segregation and coalescence, the linking and clustering of development nodes and ecological and geographical responses will be examined in the case studies and these building blocks of the SSCT are influential in this process. The research question *'How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?*' also draws significance from Building Blocks 1, 4 and 12. Here, developing nodes both in urban and peri-urban contexts are relevant to the examination of recycled railway corridors as well as being recurrent themes throughout the literature review. Building Block 6 which refers to top-quality linkages corresponds to the research question '*How does the urban design differ across a variety of transport modes used in recycled railway corridors?*'. Here, as with the S.C.R., a prioritisation is given to high-quality public transport that can be achieved through segregated alignments such as, although not limited to, recycled railway corridors. Building Block 3 relates to the qualities of place extolled in the conceptual framework of this research; the avoidance of town cramming being very much an urban design issue because increased densities, according to urban design theory, can increase concomitantly with place qualities.

Within *'Sociable Cities: The 21st Century Reinvention of the Garden City'*, Hall and Ward (1998) propose one such SSCT, the City of Anglia. This shares a partial empirical context with CS02 of this research. Positioned across circa 90 kilometres from Peterborough to the north, Cambridge to the east and what Hall terms Howard's 'Social City' of Welwyn Garden City, Stevenage and Letchworth to the south. This SSCT is in a predominantly Y-shaped configuration with crossing between the main arms proposed along 'new (reopened) transit routes'. Within this concept, there are twelve instances of 'urban regeneration/selective expansion' and eighteen instances of diagrammatic 'new communities'. These new communities are clustered together reflecting Building Blocks 4, 6, 7, 8 and 12, as seen below.

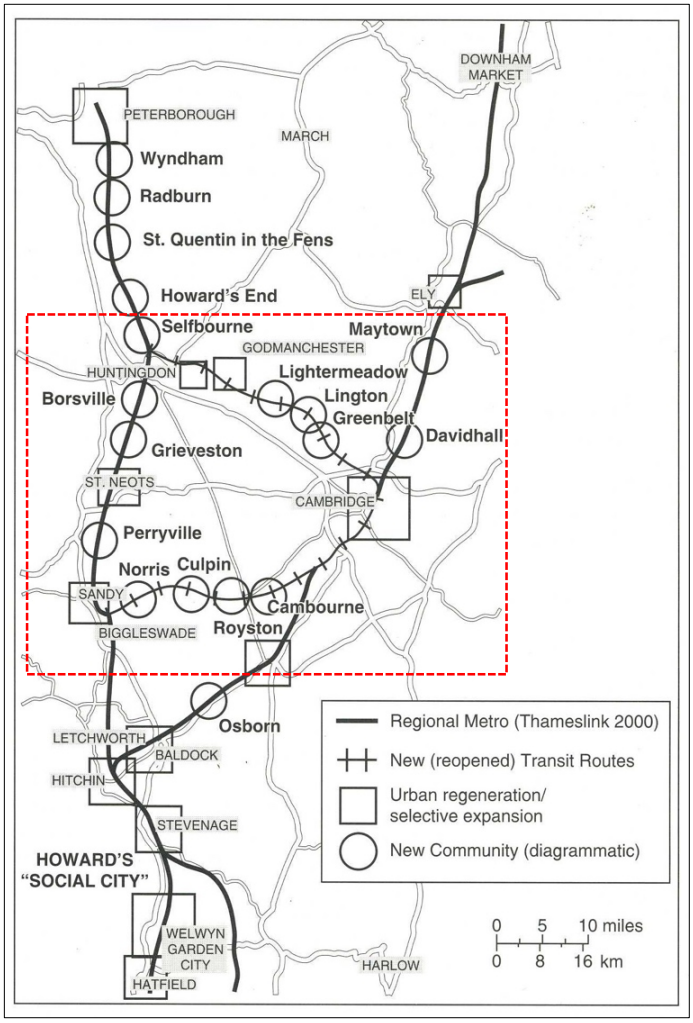


Figure 2.3: Hall & Ward's 'City of Anglia'

Source: (Hall & Ward, 1998, p. 200)

Although this diagram omits key pieces of railway infrastructure[31], it shows how a recycled railway corridor can be conceived in conjunction with existing transport networks. Further, the recycled railway corridor holds opportunities for new 'transit town' (Dittmar & Ohland, 2004) communities, the regeneration of existing settlements and sustainable urban extensions.

The excerpt below shows an enlarged version of the diagram focusing upon the shared territory of enquiry. The northern 'reopened transit route' between Cambridge and Huntingdon is today the northern section of the Cambridge Guided Busway (CS02). As described in Chapter Five this guided busway terminates at St Ives (CS 2.15), situated on the diagram below between Godmanchester and 'Lightermeadow'.

[31] For example, the two heavy rail routes between Ely, March and Peterborough/Cambridge, Stansted Airport and London Liverpool Street.

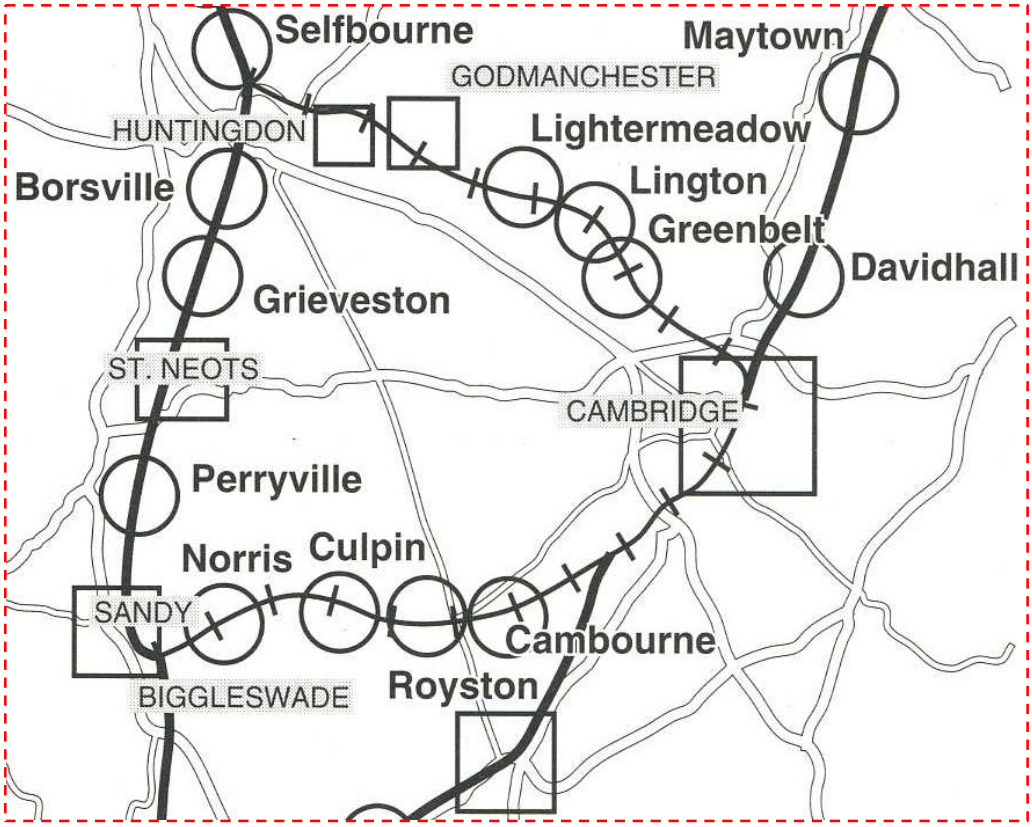


Figure 2.4: Excerpt from Hall & Ward's 'City of Anglia'

Source: (Hall & Ward, 1998, p. 200)

Further, there is a proposed new town, Northstowe (CS 2.11), situated in a similar position to 'Lington'. The southern arm of the CGB is much shorter than the southern 'reopened transit route' as seen on the diagram below. Trumpington P&R (CS 2.01) is the south westerly terminus of the CGB, which on the diagram below would be situated just beyond the bottom left corner of the Cambridge 'urban regeneration' zone, illustrated as a square box.

The key of the City of Anglia diagram shows four aspects of SSCT that are crucial to this research: *'Regional Metro', 'New (reopened) Transit Routes', 'Urban Regeneration/Selective Expansion'* and *'New Communities'* (Hall & Ward, 1998). The interconnectedness of these four elements are set out by Hall and Ward as significant components of SSCT. This research seeks real world examples of regeneration, expansion and new communities at RRCs in order to examine the finer-grain urban designs. This has been done with a view to establishing the extent to which these spaces and places have taken advantage, through transit-supportive urban design principles, of the opportunities inherent to recycled railway corridors.

2.4 The 'Human Scale, 'Walkable' Places and Recycled Railway Corridors

Two core urban design concepts in the field of this research that permeate the discussed theories of public transit based urban design strategies, are 'the human scale' and 'walkable places':

> *"It is about communities more diverse and integrated in use and population; more walkable and human-scaled; communities which openly acknowledge and formalize the decentralization at work in our times". (Calthorpe, 1993, p. 9)*

These two urban design conceptualisations of space are applicable to both the key scales of this research, and in each of the contexts examined. These crucial urban design concepts will be discussed in turn in this literature review, in relation to the conceptual framework, the broader transit-focused theories and wider urban design theories.

T.O.D. (1993) design theory calls for the environs adjacent to, and associated with nodes along the public transit networks to be conceived and realised at the human scale (Calthorpe, 1993; Jacobson & Forsyth, 2008). The practical notion of 'usability' and the more subjective notion of 'interest' augment Calthorpe's (1993) intentions for place and he goes on to talk about human scale in conjunction with these points: *"This ethos provides a specific aesthetic of place – scaled to the human body, timed to a stride, patterned to ceremony, and bonded to nature."* (Calthorpe, 1993, p.11). There is a clear synergy here between the work of noted urbanist Jan Gehl (2010) and this design imperative for T.O.D.s. The combination of Gehl's reflections on '100m urban unit' and the consideration for 'eye level prioritised design' (Gehl & Svarre, 2013) are significant finer-scale points relevant to that which Calthorpe idealises as an urban form for a T.O.D. 'timed to the stride and scaled to a human body' (Calthorpe, 1993).

Jacobson and Forsyth's (2008) 12 principles of good urban design at T.O.D.s (chapter 2.2) are specific in prioritising this significant stratum of urban design: 'the human scale'. The fifth of Jacobson and Forsyth's (2008) 'Principles of Good Urban Design at Transit Oriented Development' is to 'design at a human scale' (Jacobson & Forsyth, 2008). Jacobson and Forsyth's (2008) elaborate upon this and define what they consider to be human scale design at transit nodes: *"Design so that the areas that people inhabit—such as sidewalks, plazas, and transit stations—are scaled to be usable and interesting to people moving at walking speed."* (Jacobson & Forsyth, 2008, p. 77). Similarly to Calthorpe, this statement has a clear corollary with the work of Gehl. For example, the idea consideration for eye-level interest at walking speed is central to Gehl's studies into the components of human scale design (Gehl & Svarre, 2013).

Jacobson and Forsyth (2008) add a further layer of detail to their considerations of human scale urban design by highlighting specific characteristics to be provided in good T.O.D. environments. This prompts the manner in which this examination of built environments at transit nodes is carried out: *"Provide human-scale details such as architectural features on buildings, street furniture, and plantings."* (Jacobson & Forsyth, 2008, p. 77). The observations in this study are not limited to these features; however, it is agreed that these are crucial aspects of the built environment. This human scale of use, interest, aesthetic, scale, timing and pattern is examined at recycled railway corridors through comparative cross-case analysis.

Jan Gehl's studies of the way in which public spaces are used by their inhabitants are seminal works within the field of urban design. First published in the 1970s, 'Life Between Buildings: Using Public Space' (Gehl, 2011) is a response in contradiction to functionalist modernist architecture and planning paradigms. In a similar vein to critical regionalism (Tzonis & Lefaivre, 1996) and T.O.D. (Calthorpe, 1993) it looks to previous city forms with a view to understanding and reinvesting the best qualities back into contemporary built environments. Whilst influential in the practice and theory of urban design since its initial publication, the principles inherent in this publication are arguably still pertinent. More recently published, 'Cities for People' (Gehl, 2010) is a continuum of the work of Gehl. This volume culminates in a set of recommendations which prioritise the notion that human senses (Zardini, 2005) are a crucial aspect of design execution in regards to place specificity. Further, that the combination of these aspects is intrinsically linked to the scale of environments, which can support and facilitate a lively, safe, sustainable and healthy life. Synthesising these normative urban design criteria with the morphological imperatives of T.O.D., it is argued that this literature review provides a theoretical foundation with which to analyse urban design at recycled railway corridors. The common ground is the imperative to provide a space in which the prioritisation is in favour of people and 'human locomotion' (Marshall & Lorimer, 2013).

> *"If we are to encourage pedestrian and cycle traffic and realise the dream of lively, safe, sustainable and healthy cities, we must begin with a thorough knowledge of the human scale. Understanding the scale of the human body is important if we are to work purposefully and appropriately with it as well as address the interplay between the small slow scale and the other scales also in operation."(Gehl, 2010, p. 56)*

These notions of healthy and sustainable cities are used to examine the recycled railway corridor case studies where two key categories of human scale are used, derived from the work of Jan Gehl: 'the building size' and the notion of 'respect for the human scale' (Gehl, 2010).

Gehl (2010) makes a subtle observation crucial to this research regarding the relationship between the size of buildings and the process of their procurement. Bearing in

mind the cyclical, morphological process of recycling railway lines it is crucial to recognise that at the same time as the majority of the railway closures in the United Kingdom, a change in the development of urban form (Soderstrom, 2008) was taking place. In a similar vein to critical regionalism (Frampton, 1992), Jan Gehl's theories are a reaction to modernist principles of planning, which were becoming widely manifest in the United Kingdom circa the 1960s. This paradigm was also contemporaneous to the Beeching Report's (British Railways Board, 1963a) preparation , with its recommendations for widespread closures being executed up until the early 1970s.

> *"Whereas in the past cities were built by adding new buildings along public spaces, today new urban areas are often collections of random, spectacular stand-alone buildings between parking lots and large roads."(Gehl, 2010, p. 56)*

Therefore, in this period, not only the way in which cities evolved was changing, but also the way in which movement around and between environments was evolving too. The conceptual framework of this research, which uses critical regionalism, can be seen as a reaction to this shift in paradigm towards the proliferation of such larger scale, 'stand-alone' buildings. This predilection is built on a rejection of image-based architecture and a scepticism with regard to placeless, homogenised, market-led developments.

> *"In the same period, architectural ideas have shifted their focus from elaborately detailed buildings erected in an urban context to spectacular individual works, often with a laboured design idiom, built to be seen in a flash at great distance. The visions and thinking are large, just like the scale."(Gehl, 2010, p. 56)*

A recycled railway corridor has in essence a reconsideration and reconfiguration of previous conditions. It is argued in this research that this principle of reconsideration and reconfiguration, the palimpsest, also be applied to the urban design territories along recycled railway corridors.

Jan Gehl's (2010; 2013) studies show that the size and scale of a building is imperative to place qualities and that the finer-grain configuration of larger buildings in relation to other urban design criteria is crucial. The image below shows Jan Gehl's (Gehl, 2010, p. 40) study into the building height and the ability to recognise faces on the street level. This is a key factor in determining whether a place has been designed to the human scale (Gehl, 2010) or not. Designing to the human scale does not preclude the use of structures above five storeys. However, if this condition is to be the case then Gehl's study denotes that the negative effects of not being able to recognise faces at the street level from this threshold and above be mitigated by such urban design elements as active frontages at street level:

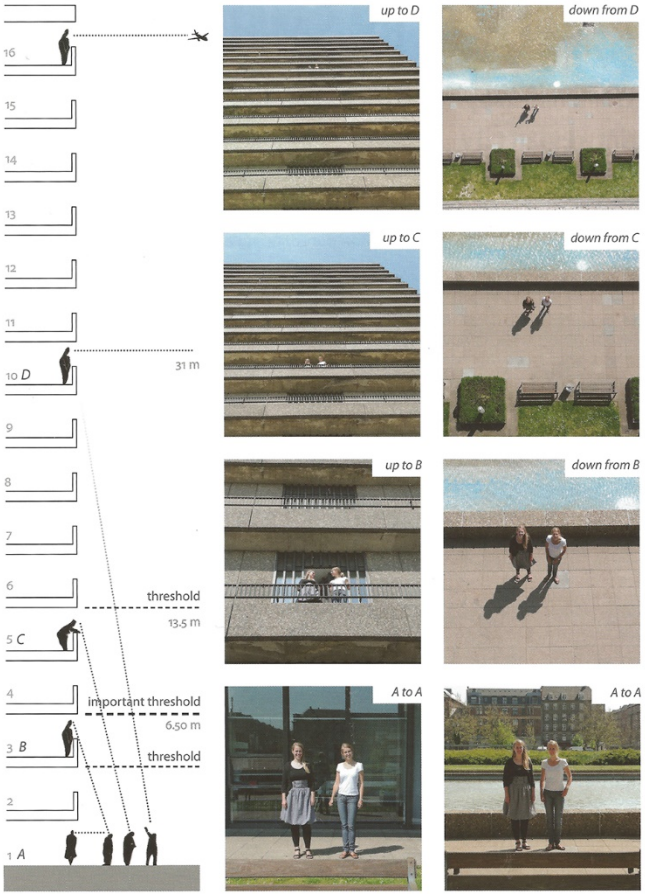


Figure 2.5: Gehl's Human Scale and Building Height

This image by Jan Gehl shows the link between the height of buildings and personal interaction based upon the ability of the human eye to distinguish facial features. This sets three key thresholds: the first is a ground-level where interaction is easiest, the second is around a third storey of the building where facial recognition becomes harder although still possible, and the third threshold is above the fifth storey of the building where recognition becomes difficult.

Source: (Gehl, 2010, p. 20)

This is of significance to this research into the urban design at recycled railway corridors because both normative urban design literature and market forces prefer a high density adjacent to a transit node, although for differing reasons[32]. The most likely solution to a need for high-density development is a taller building. This work by Gehl demonstrates that careful consideration of the height and integration at street level of tall buildings is key to producing a human scale design in the context of where the pressure to go above three storeys exists; in this context the assumption is that this pressure exists adjacent to the transit node of a recycled railway corridor. A large amount of research attention has been paid to land use and mass transit (Journal of Transport and Land Use). The principles of human scale urban design are where the implications of these strategic level land-use decisions turn into real spaces, and real places where events happen involving real people. This is why these ideas of the human scale have been absorbed into this research, in order to complement the pre-existing transport and land-use research.

[32] Transit-supportive urban design theory favours a critical mass which increases vitality; market forces rely upon 'footfall' to generate markets.

A crucial facet of human scale urban design is the relationship between the speed of movement of the individual and their appreciation of space. It is no coincidence that the popularisation of the automobile occurs at the same time as a decrease in both mass transit and human scale urban design. Gehl explains, what Calthorpe would call an 'aesthetic of place – scaled to the human body, timed to a stride' (Calthorpe, 1993), through the speed in which people walk through places and how this is intrinsically linked to the appreciation and comprehension of those places:

> *"At speeds greater than walking or running, our chances of seeing and understanding what we see are greatly diminished. In all cities where traffic was based on walking pace, space and buildings were designed as a matter of course on a 5 km/h (3 mph) scale. Pedestrians don't take up much space and can easily manoeuvre in a narrow setting."(Gehl, 2010, p. 43)*

This idea applies, in Lynchian terms, to 'paths', 'nodes' and districts, or in this research context to streets and public squares associated with public transit. Gehl argues this is derived from a shared human commonality, in the example of the public square, a shared maximum distance with which humans can observe each other in some detail:

> *"The social field of vision at approximately 100m (110 yards) is also reflected in the size of most squares and plazas in all cities. 100m (110 yard) distances enables onlookers to stand on one corner and get a general view of what is going on in the square."(Gehl, 2010, p. 38)*

The examinations carried out at-the-node of recycled railway corridors are informed by this notion of whether or not spaces relate to the 100m organic ideal of a public space.

Gehl calls for a respect for the human scale (2010). This call is reflected in the conceptual framework, where critical regionalism argues for a built environment that represents its inhabitants as cultural, political and economic agents. It is argued here that if this is the case then the built environments will show respect for human scale, and if not the case, then the built environments will resemble inhabitants being treated as part of a numerical, aggregated, homogenised whole. This research will seek to collect evidence for comparative analysis in order to ascertain whether or not 'respect for the human scale' has occurred in the urban design strategies at recycled railway corridors. Together, transit oriented development (Calthorpe, 1993; Dunphy et al., 2004) and bicycle oriented development (Fleming, 2012) called for walkable and cycle-able neighbourhoods. This is paralleled by Gehl in the broader context of urban design, not just that related to transport nodes:

> *"The challenge is that the principles of good human scale must be a natural part of the urban fabric in order to invite people to walk and cycle. For many reasons, in future we will have to build many large complexes and buildings with large dimensions and many stories. But neglecting the human scale is never an option."(Gehl, 2010, p. 59)*

If human scale urban design principles are apparent at the recycled railway corridors that form the case studies in this research, then this will be apparent through observation. Evidence of these urban design traits will be gathered and recorded with photography. This evidence will also demonstrate where these principles are absent. Irrespective of result, a contribution to the body of knowledge in regard to urban design at recycled railway corridors will be made either by highlighting opportunities, or documenting opportunities which have been taken advantage of.

The second of the two core urban design concepts in the field of transit-supportive urban design considered here is the constitution of a 'walkable' place. In 'The Regional City' Calthorpe and Fulton (2001) make the distinction between engineering matters and an urban design-led approach, lamenting the traits of spaces that perform to technical criteria yet don't engage their inhabitants:

> *"Too often we plan and engineer rather than design. Engineering tends to optimise isolated elements without regard for the larger system, whereas planning tends to be ambiguous, leaving the critical details of place making to chance." (Calthorpe & Fulton, 2001, p. 43)*

This research examines recycled railway corridors in order to ascertain if place-making and genius loci (Frampton, 1992) has been given such a chance, although as evidenced previously in this literature review, it is debatable whether or not planning is a discipline divorced from place-making. Walkability, along with other urban design characteristics examined in this research at recycled railway corridors, is emphasised as one such key aspect of place-making:

> *"The engineering mentality often reduces complex, multifaceted problems to one measurable dimensional. For example, traffic engineers optimise road size for auto capacity without considering the trade-off of neighbourhood scale, walkability, or beauty. Civil engineers efficiently channelize our streams without considering recreational, ecological, or aesthetic values. Commercial developers optimise the delivery of goods without balancing the social need of neighbourhoods for local identity and meeting places. Again and again we sacrifice the synergy of the whole for the efficiency of the parts." (Calthorpe & Fulton, 2001, p. 43)*

Walkability, therefore, is a key design mechanism with which to consider 'the whole'; the experienced environment relating to transit corridors and nodes. Further, the importance of the ecology and regional identity (Frampton, 1992) have been emphasised in the conceptual framework of this research. However, it is at the human scale, the moment at which people engage with spaces where walkability is paramount.

The argument for a pedestrian-aligned environment is rooted beyond places that can be pleasurable, although from the perspective of this research this attribute is at a high priority. Banister (2002) sets out the frightening health and environmental ramifications of transport choice:

> *"Transport is a major user of energy, with all forms of transport consuming some 34% of total energy consumption in Britain. Transport is a major contributor to environmental pollution and is one sector where most of the trends are in the wrong direction, with increases in emissions of greenhouse gases (some 26% of carbon dioxide), contribution to acid rain (54% of nitrogen oxides and small amounts of sulphur dioxide) and other gases which have effects on morbidity, fertility and mental development (57% of lead, some 74% of carbon monoxide, and 28% of particulate matter – PM10)." (Banister, David. 2002, page 1)*

Journey length is closely linked to mode of travel (Banister, 2002) with shorter journeys being more likely to be made using non fossil fuel dependant means; 'human locomotion' (Marshall & Lorimer, 2013). The logic supporting T.O.D. and walkable environments is that the more reasons to travel, situated in proximity to homes and connected by streets resembling walkable urban designs, the less likely cars are to be used for that journey. Further, if these stimuli are positioned at or around public transit nodes, then if automated travel is used, that trip is more likely to be taken via a more social, less polluting mode such as a train, a tram or a bus. A causal relationship between T.O.D., urban design configurations and transit patronage has not been proven. The reasons behind transit mode choice (Mann & Abraham, 2006) are highly sophisticated and go beyond the configuration of the built environment:

> *"The typical definition of T.O.D. is purely descriptive: a mix of uses, at various densities, within a half-mile radius around each transit stop. Though the dimensions of T.O.D. are well documented as the distances people are most likely to walk for a commute trip, there is little clear evidence that a prescribed set of uses or densities will deliver sufficient riders to support functioning transit systems." (Dittmar and Ohland, 2004).21*

However, the notion of transit-supportive urban designs is not dependent upon one metric of increasing transit system patronage nor does its success hinge upon a reduction in car journeys, despite both aspects being desirable. Walkability has social dimensions beyond those criteria subservient to transport markets: the weight of opportunity for personal interaction (Barton, Grant, & Guise, 2003; Read, 2005) and pleasant environments (Frampton, 1992) should not be underestimated. Despite this, opponents of T.O.D. (Calthorpe, 1993) suggest that transit-supportive urban designs reduce freedoms through the curtailment of automobile use. Dittmar, however, argues otherwise;

> *"Given our addiction to cheap, easy travel, our immediate reaction to the concept of travelling less is to see this as a restriction rather than a benefit. However, for example, reducing the distance and time between the workplace and the home offers the possibility of improving our work/life balance, as well as improving our health and fitness and the social cohesion of our currently fragmented communities once they are transformed from sterile dormitories into animated neighbourhoods that are accessible by walking and cycling. (Dittmar, 2008). Transport & neighbourhoods 7*

Central to the concept of the animation of neighbourhoods, as discussed above, is that of walkable streets. Dittmar equates walkable places with an increase in potential life balance. This can be enhanced by a place with which inhabitants engage with their surroundings; the

legible city (Lynch, 1960). Further, in terms of more detailed walkability considerations it is possible for public realms to contribute and support such 'social cohesion' through places designed to support interaction between people; convivial (Barton et al., 2003) public realms, the sort of chance meetings that do not occur in traffic (Read, 2005) but serve to fuse as opposed to fragment communities. A related notion of a 'conspicuous' (Barton et al., 2003) public realm is also a crucial component of walkability. Landmarks, as emphasised by Lynch (1960), be they grand gestures or pieces of site-specific design details adorning a building (Frampton, 1992) contribute to a sense of place. Given the potential of transit spaces to be legible landmarks in the built environment landscape, this research examines real world case studies through this theoretical lens in order to compare regionally bespoke urban design responses, both with each other and against generic design responses.

Further to Banister's assertion that journey length is crucial to the choice of journey mode, one must consider connectivity (Barton et al., 2003) as a crucial aspect to walkability. Amenities within a pedshed measurement give a coarse scale indication if an area is transit supportive; however, it is a finer-grain analysis of the public realm which indicates if a walkable townscape (Cullen, 1971) is in existence.

> *"The 400m criterion needs to be applied with care. It is the distance people on average actually walk; if routes are indirect, the straight-line distance may be much less. Access is also influenced by gradients (especially for older people) and psychological barriers such as subways or intimidation by road traffic. Conversely, most people are prepared to walk further for high-quality metro or tram services." (Barton, Grant, Guise, 2003)124*

This image below, from Ditmar's Transport and Neighbourhoods (2008) illustrates this point. Whilst this diagram illustrates a bus route only, it does indicate how directness of connection can differ (Marshall, 2005) between compartmentalised configurations and grid-based systems.

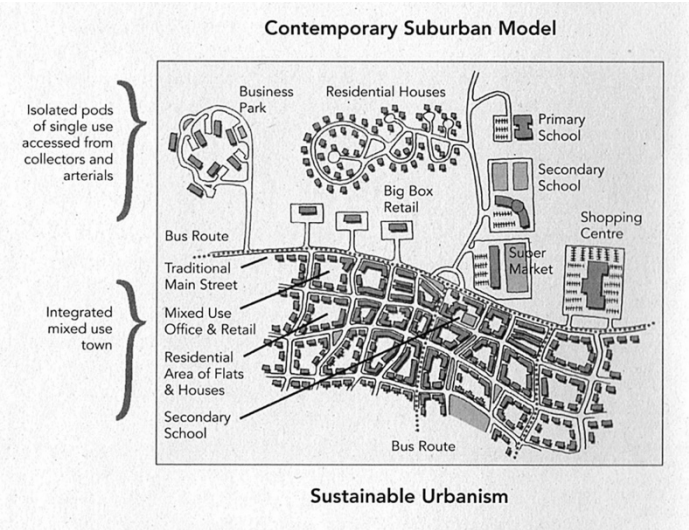


Fig 2.6: Contrasting Models of Street / Plot Pattern

Source: Transport and Neighbourhoods (Dittmar, 2008, p. 20)

The quotation above also mentions two aspects which influence walkability in the built environment; gradient and psychological barriers. Crucial to a place-specific response is how the spaces have been configured in relation to the area's specific topology (Frampton, 1992) and therefore consideration on how gradients have been negotiated at recycled railway corridors is a part of this research. Main roads and parking implications (Breheny & Rookwood, 1993; Hall & Ward, 1998) are also considered in this research. The above diagram reflects a street pattern (Marshall, 2005) which has an inherent choice of route and is direct, meaning half the criteria for a convenient urban design would be met (Barton et al., 2003). Detailed empirical urban design investigation is required in order to examine places in terms of amount of physical obstructions and the nature of crossing vehicles' paths (Barton et al., 2003), the further components of convenient walkable public realms.

In summary, walkability and human scale public realms are considered the 'foundation' to transit-supportive urban design and as such, these issues will be considered in the comparative analysis of the case studies comprising this research into recycled railway corridors.

> *"Although each system depends on the others, walkable environments are the foundation, and convenient trunk lines are the catalyst. It is important to build every link in the transit chain, yet light rail or its equivalent and walkable destinations are often the critical missing elements in this hierarchy of service."(Calthorpe & Fulton, 2001, p. 216)*

Human scale walkable urban designs are crucial to both of the research questions and frame the examination of urban design's contribution to place qualities in the context of recycled railway corridors across the regional and at the neighbourhood scale. A further key conceptualisation of the built environment which integrates human scale considerations and the idea of walking/moving through spaces is Gordon Cullen's ideas regarding 'Townscape' (1971). Townscape is concerned with the inter-relationship of physical elements in the built environment (Larice & Macdonald, 2007) and it is asserted by Cullen that people have a kinaesthetic relationship with their environs. In this research context, Townscape has clear relevance to the urban designs of recycled railway corridors. Concepts such as 'uniqueness' and 'specificity of place' are manifest through differences between situations that show contrast. Spatial ideas such as 'this and that', 'here and there', whilst being perceived as an urban whole can, according to Cullen (1971), contribute to such a specificity of place. This correlates to the conceptual framework, based upon critical regionalism. Cullen (1971) argued that spaces are experienced sequentially and that variety in these spaces increases interest. This manifests itself in both theory and practical ideas that have influenced urban design praxis since its publication (Larice & Macdonald, 2007). The idea that the way people perceive the built environment and the way in which its constituent parts are connected is crucial to townscape theory:

> *"The conceptual underpinning of the method involved the idea of two interlinked chains: an integrated chain of human activity, and a spatial chain of physical elements." (Larice & Macdonald, 2007, p. 167)*

The idea that people have wide-ranging needs from the built environments, that can therefore only be satisfied through such a complexity, is crucial to this examination of recycled railway corridors. There are, therefore, parallels here between a 'townscape' (Cullen, 1971) and a complex T.O.D. place, where a mix of building use, variety of building type and accommodation for many types of human and vehicular transport are preferred.

Gordon Cullen's townscape (1971), as a philosophy of urban design, argues the case for factors such as 'interest' and 'complexity' in public spaces in order for them to become more engaging and interesting for their inhabitants. Transit-supportive urban design theory is preoccupied with the immediacy of the built environment to its human occupants (Calthorpe, 1993). The territory of this research is no exception with the overall premise of this examination being focused upon the collection of urban design evidence collected at recycled railway corridors. The quotation below regarding strategies for achieving good places highlights three key criteria. These are accepted as components within this enquiry: human movement through spaces (Gehl, 2010), the accommodation of vehicles (Jacobson & Forsyth, 2008), and journey-based choice (Mann & Abraham, 2006):

> *"The key to a successful strategy is reclaiming streets for people: walking, cycling, idling, playing, sitting, drinking, talking, selling. Traffic has to be sufficiently tamed so as to pose little threat in terms of accidents, noise, fumes or space domination..... Neighbourhood movement planning should open up choices for all groups – old and young, rich and poor – so that people have attractive options for how to get to friends, facilities and places."(Barton et al., 2003, p. 117)*

The consideration given to 'neighbourhood movement planning', similar to the notion of 'human locomotion' (Marshall & Lorimer, 2013) is of theoretical use to this research into the urban design of recycled railway corridors. It is argued therefore that Townscape criteria is pertinent to the method of gathering and analysing data within this research. This sequential, narrative logic (3.7) inherent in townscape theory is predicated upon a necessarily subjective synthesis of human scale and walkable urban design theories that in these analyses of the urban design of RRCs are valuable.

As discussed above, if an urban design is to be transit-supportive then responses to these issues must be present. Therefore, in order to answer the overall research question *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?*', observations are required at the case studies in order to carry out the comparative analysis. The final two sections of this literature review explain in more detail how the concepts and theories discussed above have been used in the analysis of the case study data collected in this research.

The previous four sub-chapters have discussed theories relevant to the overall research question *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?'* The following two sub-chapters relate specifically to the two detailed research questions that relate to particular scales. The research question '*How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?'* will focus upon the empirical territory along-the-line of RRCs. The research question '*How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?'* will focus upon the empirical territory at-the-node of RRCs.

2.5 The Regional Scale: Along-the-Line

The following nine categories are derived from the above literature review and form the structure for the consideration of and examination of RRCs at the regional scale.

- Ecological Features Along-the-Line of Recycled Railway Corridors
- Strategic Growth and Recycled Railway Corridors
- Urban Morphology and Recycled Railway Corridors
- Recycled Railway Corridors and Broader Transport Networks
- Interruptions to Disused / Recycled Railway Corridors
- Land Use & Recycled Railway Corridors
- Cycle Paths and Recycled Railway Corridors
- Topography Along-the-Line of Recycled Railway Corridors
- Pre-existing Engineering Infrastructure and Recycled Railway Corridors

Each of these themes are addressed in this sub-chapter and are discussed in terms of finer-grain urban design theories in order to form the basis of the comparative analyses made in this research regarding transit-supportive urban design at RRCs.

Ecological Features Along-the-Line of Recycled Railway Corridors

Sustainability is a key driving force behind the theories pertinent to this research and commensurate with this, ecologically important features are a key theme running throughout this literature review. T.O.D. considers the region as an ecologically contained system (Calthorpe & Fulton, 2001), which is a notion that has parallels with Lucarelli's (1995) summary of Lewis Mumford's ecological region. The complexity of such a regional paradigm is reflected upon by Fishman (2001) in the foreword of 'Regional City: Planning for the End of Sprawl' (Calthorpe & Fulton, 2001). This statement encompasses ideas of a temporal perspective in line with the tenets of critical regionalism; a referencing and reuse excluding nostalgia. This is echoed by Luccarelli (1995) in '*Lewis Mumford and the Ecological Region: The Politics of Planning'* where, in direct reference to Calthorpe's (1993) T.O.D., where he states that:

> *"The revival of interest in regional land use planning indicates the continuation of Mumford's legacy: the importance of reorienting place as a means of social and environmental reform." (Luccarelli, 1995, p. 220).*

This revival is of particular relevance to this examination of place at recycled railway corridors; have reorientations of place manifest in the case studies and if so has urban design been supportive of this? The parallels between T.O.D. and S.C.R. have been drawn earlier in this chapter and ecological features are an area where comparisons exist. The table below summarises Breheny and Rookwood's (1993) attitude towards ecological features as part of the S.C.R. both at the regional scale and at the area type classified as rural node.

BROAD REGIONAL CONTEXT
Protect natural ecosystems, biodiversity, wildlife
More tree planting on watersheds, field boundaries, urban areas
Community forests to increase biomass
RURAL NODE TYPOLOGY
Develop more mixed forest and wildlife habitats
Avoid monocultures and enhance biological diversity
Develop wind farms in all suitable locations
Design leisure and tourism facilities to protect local eco-systems and promote environmental awareness
Compact organic waste and stop nitrate runoff from artificial fertilisers
Protect watersheds and purity of water supplies

Table 2.7: Summary of Literature Regarding 'Ecological Features'

Source: (Breheny & Rookwood, 1993)

One aspect of the above, salient to the research territory along-the-line of recycled railway corridors, is *'Avoid monocultures and enhance biological diversity'* (Breheny & Rookwood, 1993). The recycling of a railway corridor often occurs in abandoned areas that have been overtaken by nature in an *ad hoc* manner. These areas can have significant amounts of biodiversity, which, if these corridors are brought back into public transit service this biodiversity is potentially lost. Calthorpe speaks of recycling brownfield sites (Calthorpe & Fulton, 2001) and this research considers disused railway corridors and the recycling thereof as an act of re-purposing linear brownfield sites with negative consequence of loss of biodiversity and potential natural habitats. Considering the importance of sustainability, this research will examine whether or not the case studies have identifiable mitigating strategies to this loss of biodiversity. One such strategy could be the consideration of the design of the transit corridor. The two images below of Rotterdam and den Haag illustrate both an urban and suburban example where the transit corridor has been 'greened', meaning a place for biodiversity exists (for example within the trees or the ground covering of the corridor) in conjunction with the public transit system.

Fig 2.7: Examples of 'corridor greening'. Source: (Author's own, 2014)

A further aspect of the S.C.R. (Breheny & Rookwood, 1993), as seen in the table above is *'Design, leisure and tourism facilities to protect local eco-systems and promote environmental awareness' (Breheny & Rookwood, 1993)*. This research will examine if and where country parks exist along-the-line of recycled railway corridors and what urban design responses exist in relation to these riparian (Calthorpe, 1993) land-use types. Soja (2000) refers to wilderness spaces as part of a regional city:

> *"City space, however, involves a much larger and more complex configuration, a specific geography that, by its very definition, tends to be dynamic and expansive in its territorial domain. It will always contain inhabited or, for that matter, uninhabited wilderness areas that do not look urban in any conventional way, but nonetheless are urbanised, part of the regional city space and thereby deeply affected by urbanism as a way of life and by the synekism that inheres to dwelling together in a shared space." (Soja, 2000, p. 16)*

Calthorpe (1993) posits riparian strips as a crucial aspect of his conception of the regional city. A recycled railway corridor is interesting in terms of whether it is an 'inhabited' or an 'uninhabited wilderness' (Soja, 2000) once the corridor has been, to an extent, given back to nature as seen in the images above. The recycled railway corridors under examination in this research traverse a variety of 'territorial domains' (Soja, 2000) and area types. In this process, urban design evidence of ecological repair will be discussed and include consideration of such aspects as 'nature reserves', 'farms', 'wind farm' (Breheny & Rookwood, 1993), and how such elements relate to a regional topography (Frampton, 1992). The conceptual framework introduces the concept of dwelling into the discussion regarding recycled railway corridors and how urban design features facilitate the relationship between urbanised environments and ecological features.

Questions of authenticity, appropriateness and place quality (Relph, 1976) are relevant when considering the relationship between ecological features and recycled railway corridors. Further, the precise relationship between these two spatial elements is important; for example, do the nodes along-the-line of recycled railway corridors respond in a bespoke design manner to the ecological features present or is the urban design of a more generic nature? Has the physical relationship between an ecological feature and the recycled railway corridor node been considered in terms of connectivity (Barton et al., 2003) and legibility (Lynch, 1960) in order to promote a mutually reinforcing relationship? Also, given that

country parks as ecological features are touristic facilities, what are the accessibility arrangements in relation to the recycled railway corridor and to what extent has car parking been emphasised (Jacobson & Forsyth, 2008) within this relationship.

The S.C.R. (Breheny & Rookwood, 1993) also specifies the presence of agriculture between public transit nodes. This research will examine the urban design configurations and implications of this land-use type along-the-line of recycled railway corridors. It is assumed that agriculture would exist in a greenbelt configuration around a settlement; however, this research will examine whether this is the case in relation to recycled railway corridors. Given that a recycled railway corridor can act as a legible (Lynch, 1960) path and edge (often in the way of a barrier as opposed to a seam), this research will examine whether or not the recycled railway corridor runs along the edge of a settlement. This means that a node in this situation would have a substantial amount of its pedshed not configured in line with transit-supportive principles (Calthorpe & Fulton, 2001; Dittmar, 2008; Dittmar & Ohland, 2004; Dunphy et al., 2004) but instead exhibit traits of a 180° station (Jacobson & Forsyth, 2008). This research will also examine instances where agriculture exists between the nodes and how the urban design response relates to the regional topography. Community forests, again an aspect of Breheny and Rookwood's (1993) S.C.R., will also be examined in this research through an urban design lens in relation to the recycled railway corridor. This raises issues of connectivity and permeability between forests and communities and how the transit mode's urban design implications mean differing spatial configurations.

Strategic Growth & Recycled Railway Corridors

A core tenet of T.O.D. is that at a regional scale the 'Organisation of Growth should be compact and transit-supportive' (Calthorpe, 1993) and this concept is a stimuli for this research. Firstly, the idea of a transit-supportive built environment is key and this literature review discusses a range of urban design criteria that in combination can contribute to 'transit supportiveness'. Secondly, the point that will be discussed here is that of organisation. Issues of scale and type of growth patterns are crucial (Breheny & Rookwood, 1993; Hall & Ward, 1998) in combination with finer-scale urban design to taking transit-supportive advantage of the opportunities afforded by the recycling of RRCs. This research will examine regional level planning diagrams in order to ascertain what role, if any, the RRCs play in such an 'organisation of growth'.

The regional planning contexts of the three case studies highlight 'growth areas' (Department for Communities and Local Government, 2009) associated with recycled railway corridors in a similar way to Hall and Ward's (1998) development 'clusters' along 'reopened railway lines', as indicated earlier in the diagram for the 'City of Anglia'. Also, the impetus for 'agriculture between nodes' as set out in Breheny and Rookwood's S.C.R.

(1993) is reflected in the prevention of coalescence between settlements as seen in the respective regional plans (Department for Communities and Local Government, 2009). These regional planning diagrams also highlight housing growth targets and indicative positions. This research will examine how these relate to the territories of the recycled railway corridors and what urban design implications these strategic decisions might have for the urban design of the RRCs; for example, higher density residential development near transit nodes (Breheny & Rookwood, 1993; Calthorpe & Fulton, 2001).

An important aspect of regionally important strategic growth is the introduction of new communities which is reflected in the public transit supportive theories (Breheny & Rookwood, 1993; Calthorpe & Fulton, 2001; Dittmar & Ohland, 2004; Hall & Ward, 1998). The number of new communities within the three case studies will be tallied and categorised into 'new towns', 'urban regeneration' and 'urban extensions'. The spread across the three cases will also be noted in order to see if the cases undertook a similar strategic approach to the utilisation of the RRCs in terms of strategic growth. Further, the term 'community', in relation to urban design characteristics will be examined in this research, i.e. what place qualities support the idea of community beyond the land-use type of new residential settlement. Density and proximity to the transit node (Calthorpe, 1993) are considered in conjunction with parking emphasis (Jacobson & Forsyth, 2008) and walkability criteria (Barton et al., 2003). The idea of dwelling in (Pallasmaa, 2005; Zumthor, 2006), as opposed to merely inhabiting residential buildings in proximity to a RRC is also considered in this section of the analyses. Other key aspects of walkability are the proximity, connectedness (Barton et al., 2003) and street pattern (Marshall, 2005) of residential areas to the RRC and these aspects are used as an indicator of both strategic and place-quality intent.

Urban Morphology & Recycled Railway Corridors

The morphology of urban areas surrounding RRCs is considered in this research and one key aspect of this is 'imageability' (Lynch, 1960). Lynch (1960), below, describes a 'railroad cut' as an example of what he terms an 'edge'. By this definition, an edge is a linear element that forms a boundary between areas of development. This piece of research looks at recycled railway corridors specifically and collects urban design evidence in order to examine in what ways Lynchian edges influence the urban morphology along such corridors.

> *"…edges are the linear elements not used or considered as paths by the observer. They are the boundaries between two phases, linear breaks in continuity: shores, railroad cuts, edges of development, walls. … Such edges may be barriers, more or less penetrable, which close one region off from another; although they may be seams, lines along which two regions are related and join together." (Lynch, 1960, p. 47).*

The term 'linear breaks in continuity' could be used to describe either a dormant or active railway corridor and this concept will be examined in this research. Further, this examination of the RRC case studies will compare where edges are acting as barriers and where they are acting as seams. In doing so, the relative urban design implications in transit-supportive terms such as 180° stations (Jacobson & Forsyth, 2008) and permeability and connectivity (Barton et al., 2003) will be discussed. The differences between the modes adopted in the RRC will also be discussed in terms of how their alignments act as edges and what knock-on implications this has for transit-supportive urban design criteria such as walkability (Calthorpe, 1993).

Recycled Railway Corridors & Broader Transport Networks

The 'creation of dedicated public transport routes' (Breheny & Rookwood, 1993; Calthorpe & Fulton, 2001; Hall & Ward, 1998) is a common theme within the theories extolling public transit-supportive urban forms. The phenomena of recycled railway corridors would not exist without large-scale closures of sections of what was a previously far more expansive rail network. This network was conceived over a period or approximately fifty years[33] in a market-led piecemeal fashion. The background to the morphological implications of these railways' inception, evolution and closure are important to this research's examination of contemporary recycled railway corridors. There are circa 10,000 miles of disused railway in the United Kingdom (Association of Train Operating Companies, 2009) meaning that as well as the case studies in this research, there are potentially further contexts where the urban design considerations of recycled railway corridors may be of use. The image below is taken from the 'Beeching Report' (British Railways Board, 1963a, 1963b) and illustrates where circa 6,000 of the aforementioned 10,000 miles of closed railway alignment originate.

[33] 'Railway Mania' (Mathias, 1983) is a term given to a period of time with an overriding economic influence, such as the 'dot-com bubble' in the 1990s. It was preceded by 'canal mania' (a similar burst of expansion but with an alternate mode of transport) and is a broad description of an approximately ten year long period where a disproportionate expansion of the rail network occurred, in relation to its long-term need. Railways at this time were private enterprises, developed with permissions from Acts of Parliament (as opposed to Belgium for example, where the state took control of the planning of the network) and as such, competition between those who wished to open lines was fierce. Both perpetuating and requiring the industrial revolution, railways were primarily conceived as a means of transporting raw materials to manufacture or finished products to market. As such, railways were often closely associated with larger companies, who, if they owned their means of transportation of goods had a competitive advantage. Further to this, should a company require the use of another company's line, the privilege of doing so would be costly. This led to a duplication of provision, which when passenger transport became of comparable importance to freight traffic, would mean a duplication of service. This 'duplication of service' is cited in the 'Beeching Report' (British Railways Board, 1963a) as a justification for the closure of lines. The period of railway mania when it was at its most feral was between 1844 and 1846. During this period parliament granted licence for over 6,200 miles of track to be created. Interestingly, this is a comparable amount of line recommended for closure through said Beeching Report; although similar in quantity, these lines do not correspond exactly.

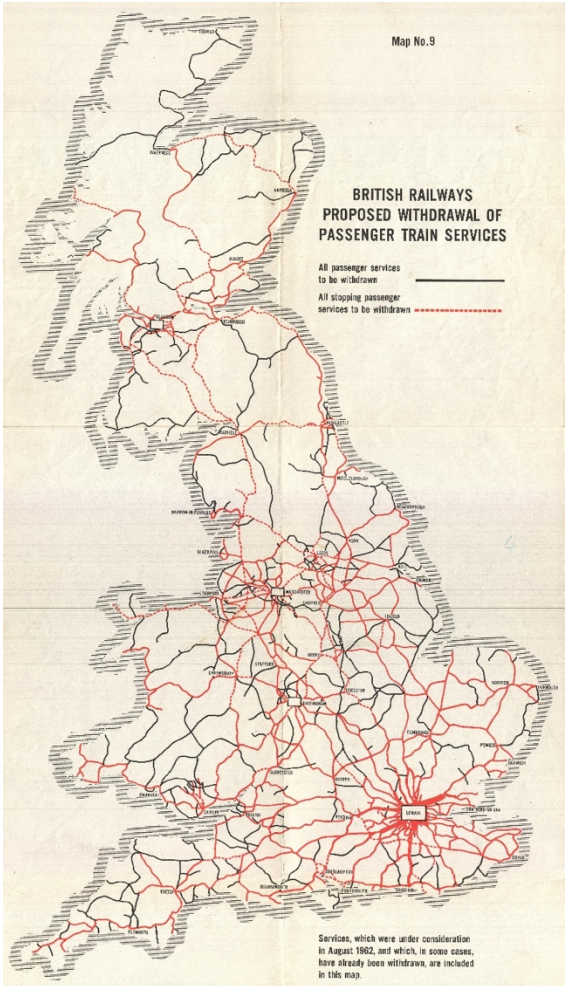


Fig 2.8: Extent of Network Closures

Source: (British Railways Board, 1963b)

When railways are considered in urban design terms such as Lynchian paths/edges/districts (Ford, 1999; Lynch, 1960) in combination with land-use categories such as disused marshalling yards/depots/stations, then the resultant fallow nature of significant quantities of this land-use type are important. These types of spaces can potentially influence certain areas and their associated urban fabrics for extended periods. Permanent way transport provision can be removed in various different ways:

- The service to a particular station can be reduced.
- The service to a particular station can be cancelled with the retention of the line upon which that station sat.
- The service to a particular line can be reduced or cancelled.

Even if the cancellation of service along-the-line occurs it does not necessarily mean that the line is closed completely as freight services can still operate along the alignments (British Railways Board, 1963a), albeit at probably a far reduced frequency. There is also the full closure of a line. These factors, however, do not necessarily mean an alteration in the urban morphology as in many instances the track bed can remain and the

area of land taken up by the disused railway corridor continues to act as a barrier (Lynch, 1960) between separate areas. This means that even though traffic ceases on a particular railway corridor, alignments can still act as if there was a full service, at least in the urban design terms described above. This scenario is not ubiquitous; the removal of permanent way transport provision can be a factor in evolving urban morphologies. In the example of RRCs, when a railway route is completely closed, for example, the tracks can be taken up and the previous alignment built upon, severed or repurposed (for example turned into a road). Each of these instances can have an influence upon the potential type of transport mode adopted in any reiteration of a previous permanent way network. This implies two ways in which a recycled railway corridor could influence the urban morphology of the particular area: through land use and transit mode choice. Further, the mode of the RRC can influence the urban morphology, for example if a cycle route (Fleming, 2012) is incorporated into alignment then an increase in grade-separated transit network can be incorporated. The three case studies used in this research demonstrate a variety of examples in these terms.

Hall and Ward (1998), whilst discussing components necessary in achieving a 'Sustainable Social City of Tomorrow', highlight the importance of these transport networks that they term a 'Regional Metro'. Whilst individually a recycled railway corridor cannot be conceived as a regional Metro, its importance within such a structure should not be understated and in turn, can be considered a key.

> *"it will prove another spectacular example of the Colin Clark rule: again, transport will make the city." (Hall & Ward, 1998, p. 162).*

An important aspect of a regional Metro for this research is the transit mode adopted, as this has a range of urban design implications across the master planning to the detailed design scales. This is important to the research question *'How does the urban design differ across a variety of transport modes used in recycled railway corridors?'*. This can be interlinked to the positioning and configuration of any new communities (Calthorpe, 1993; Hall & Ward, 1998) and the integration with cycling and walking (Marshall & Lorimer, 2013). The identity of places can also be likened to the public transit mode (Sudjic, 1992) and given the importance afforded place quality within this research (Frampton, 1992); these interlinked theories highlight the importance of interdisciplinary opportunities inherent to an RRC.

Main roads (Breheny & Rookwood, 1993) are seen on the conceptual diagram of the S.C.R. (Breheny & Rookwood, 1993) forming arterial routes focused towards city centres. These main roads are accompanied by the annotation *"Road pricing and parking charges to restrain private car use" (Breheny & Rookwood, 1993, p. 161)*. As part of the complex infrastructural system that is a contemporary transport network, it is impossible to separate main roads from the urban design issues of recycled railway corridors. However,

the consensus found within this research's literature review is that the dominance of the automobile with detriment to other modes of transport is unsustainable (Banister, 2002; Calthorpe, 1993; Hall & Ward, 1998). Sections of the reviewed theories go further, advocating the position that there should be a reversal of this hierarchy of automobiles, first through a prioritisation of human locomotion (Marshall & Lorimer, 2013) over the primacy of the car, but also public mass transit (Calthorpe & Fulton, 2001; Marshall & Lorimer, 2013).

As mentioned previously Jacobson and Forsyth's twelfth principle of good urban design at a T.O.D. environment is *"Don't forget (but don't overemphasize) car movement and car parking"* (Jacobson & Forsyth, 2008, p. 81) which prompts this research to examine the parking emphasis at nodes along-the-line of RRCs. This idea of balance is relative to node context, and complicated given the conflicts inherent between maximising parking provision and transit-supportive urban design theory (Calthorpe, 1993), which advocated dense, mixed-use plots connected by walkable streets in proximity to transit nodes. How automobile spaces, pedestrian spaces and public transit spaces are mediated in the case studies is crucial to the 'genius loci' (Frampton, 1992) of the RRC.

Interruptions to Disused / Recycled Railway Corridors

Although PPG 13 (Department for Communities and Local Government, 2001) has been superseded, its influence over the case studies of this research makes it nonetheless relevant. It prohibited 'unnecessary severance' by protecting potential transport routes for future public transport choice. Whilst this clause (Department for Communities and Local Government, 2001) does not reference disused railway lines exclusively, this land use certainly falls within the stated category. The term 'unnecessarily severed' also implies an opposite state – a situation where severance is necessary. This research speculates, using the case studies, what might constitute a 'necessary' or 'unnecessary' severance in urban design terms and the consequences of such judgements for RRCs. Under the heading '4. Promoting sustainable transport' (Department for Communities and Local Government, 2012) clause 41 of the National Planning Policy Framework (NPPF) continues this issue from PPG 13:

> *"Local planning authorities should identify and protect, where there is robust evidence, sites and routes which could be critical in developing infrastructure to widen transport choice." (Department for Communities and Local Government, 2011, p. 11)*

Such a protection, for the purposes stated here of future transport choice, is relevant to this research. Urban design evidence can contribute to an evidence base regarding potential infrastructure, especially when the potential inherent in T.O.D. (Calthorpe, 1993) are acknowledged in relation to RRCs.

Land Use & Recycled Railway Corridors

A key land-use aspect to a recycled railway corridor is 'urban regeneration', which at a broad scale can have urban design implications in terms of acting as a Lynchian edge (Lynch, 1960), as either a barrier or a seam. At the finer-grain urban design where human scale (Gehl, 2010; Gehl & Svarre, 2013) implications impinge upon people's experience of place and public transit, such issues as active frontages, building materials and opportunities for vitality are key concepts which will be used in the analysis of the observations made in this research along-the-line of RRCs. The type of land-use directly adjacent to nodes along-the-line of recycled railway corridors and its propensity to be transit-supportive or otherwise, is crucial not just to the immediate locale but to the coherence of the whole corridor (Calthorpe, 1993). It is anticipated that the case studies will highlight areas where urban regeneration has not occurred along-the-line of the recycled railway corridor and these fallow opportunities will be compared against contrasting examples where the use of pre-existing railway architecture has been utilised for urban regeneration. These examples in turn will be examined through an urban design lens in terms of their contribution to such qualities as natural surveillance and security (Barton et al., 2003), the situation of complementary amenity (Breheny & Rookwood, 1993; Cervero, 2007), a mixed provision of services (Breheny & Rookwood, 1993; Calthorpe, 1993) and how these aspects relate to the emphasis afforded to car parking (Jacobson & Forsyth, 2008).

Selective urban expansion is differentiated from urban regeneration in this research because of its strategic nature. There is the inference that the physical position of such a land-use type as a selective urban extension is positioned to the extremis of an existing conurbation. In this research the strategic approach will be considered both at the regional level and at the detailed urban design scale where cross-referencing between these two perspectives will highlight any inclusion or absence of transit-supportive urban design thinking. The urban design qualities used to consider the case studies are similar to those criteria above used to consider 'urban regeneration'. This process will examine places in terms of an emphasis on place qualities that prioritise all-day activity at the human scale (Gehl, 2010), along-the-line of a RRC.

Mixed-use development is a wide-ranging idea crucial to theories extolling transit-supportive environments (Calthorpe & Fulton, 2001; Dittmar, 2008; Jacobson & Forsyth, 2008). The study of mixed-used urban design is detailed and complex; in this research where the scope is so broad, a very coarse-grain definition of mixed use is adopted which utilises the previously mentioned principles of good urban design at T.O.D.s set out by Jacobson and Forsyth (2008). Their sixth principle, 'Provide public spaces that accommodate a variety of uses and users', states:

> *"Successful transportation environments attract people moving through them. However, public spaces—places where people can stop, sit, and gather—are often ignored in transportation projects, where the emphasis is on moving people around. … Good public spaces are ones where people like to stop and sit to read a newspaper, eat lunch, or meet friends."(Jacobson & Forsyth, 2008, p. 77).*

The notion of dwelling (Pallasmaa, 2005; Zumthor, 2006) in a transit-supportive environment is central to mixed-use urban design in this context; providing a space for the sitting, stopping and gathering mentioned above (Walker, 2012). Such areas are characterised by Cullen (1971) as 'precincts' which means an organisational feature separating such land uses as mass transit (including Cars, Lorries and Trains) from built-up pedestrian enclosures. It would, therefore, be expected to be able to identify such areas as part of the comparative analysis of this research's case studies. This separation could conceivably allow for what Jacobson and Forsyth (2008) term 'public living rooms' where street furniture is used to create 'nooks'. This type of space can be used alongside public art, which could be considered in Lynchian landmark (1960) terms *"a visual clue that a place is special and a good place for gathering, either for a planned activity or just to pass the time."* (Jacobson & Forsyth, 2008, p. 77). A further and crucial aspect of Jacobson and Forsyth's conceptualisation of mixed use at public transit nodes is that of flexibility. The provision of space through urban design for such activities as local markets and public festivals are seen as key and this provision is an aspect that will be identified in the case studies.

Industrial areas are important to this research concerning the urban design of recycled railway corridors. Given the temporal link between the development of the railways and industrialisation (Mathias, 1983), many working industrial areas were linked by rail. The demise of both heavy industry and the proliferation of the road freight carriers left the UK with a number of redundant ex-industrial sites, linked by redundant railway corridors. Industrial buildings, however, are difficult to reconcile with transit-supportive urban design. The scale of the buildings themselves mean that individual structures can be as big as Lynchian districts (1960) and further, the industrial parks within which they are often situated could plausibly be conceived as 'mega districts'; areas that potentially, in the terms of this research, cut off sections of pedsheds from their transit-supportive urban designs and connectivity to public transit nodes. In addition, the environments of industrial estates are almost typically the antithesis of pedestrian-friendly environments. The diagram below (Barton et al., 2003) illustrates how the configuration of street and plot can significantly reduce the actual distance from a transit node as compared to the radial pedshed. This problem is exacerbated when industrial units are positioned on typical industrial estate street patterns.

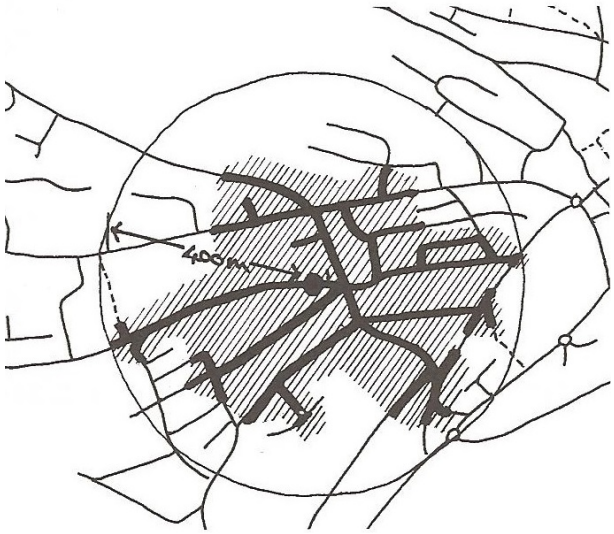


Figure 2.9: Indicative Street and Plot Patterns Implicating Access Within Pedshed

Source: (Barton et al., 2003, p. 124)

Not only are industrial areas problematic for pedestrian design, but when they are in close relationship with recycled railway corridors there are significant design issues to be overcome. Heavy rail for instance would pose significant risks at the crossing point between road-based heavy freight and trains, if the crossing were at grade in an industrial area. Further, with light rail that more than likely has overhead live wires, a conflict can occur between the heights of lorries serving the industrial units and the necessary power cables for the trams. In land-use terms however, industrial areas can be complementary to certain commercial building forms such as large offices although it is highly unlikely that a combination with these elements could form an overtly transit-supportive urban design.

The overall diagram of Breheny and Rookwood's (1993) S.C.R. has an annotation that states there should be 'Restrictions on new car based development' (Breheny & Rookwood, 1993). Banister (2002) however, comments that since the time of writing of 'Planning the Sustainable City Region' (Breheny & Rookwood, 1993) the refusal of planning permissions on the basis of inadequate access has become problematic; in doing so the social consideration of quality-of-life so important in the Social City Region is reiterated:

> *"Particularly over the last 20 years, it has become increasingly difficult for planning authorities to refuse planning permission on the basis that access is inadequate. Many authorities have attracted development through the promise of free parking on site that are often only accessible by car. There seems to be a basic inconsistency between a strategy for location decisions that encourage greater use of the car and longer journeys, and one that provides local accessibility and is compatible with the need to reduce the use of resource. Increasingly transport plays a central and crucial role in determining who gains access to what opportunities, and as such forms an important part of every person's quality of life"(Banister, 2002, p. 2)*

This is a crucial consideration in the examination of the urban design of recycled railway corridors. This study will reflect upon whether or not the case exists where the following

recommendation has been met: *"Refuse permission for new car-based out-of-town retailing and business parks" (Breheny & Rookwood, 1993, p. 160)*, and in doing so examine how the urban design in such instances relates to the RRC.

Cycle Paths & Recycled Railway Corridors

In principle, RRCs offer the opportunity to accommodate a cycleway along-the-line of the reconfigured alignment. If the relationship between a cycleway is closely designed with a rail/light rail/guided bus route, then a number of potential benefits can accrue in line with grade separation from the standard road network:

- Quicker, more direct routes for cyclists to centres
- Gradients more amenable to the bicycle
- Safer journeys due to grade separation from cars
- Healthier cycling due to increased distance between cyclist and car fumes

In normative urban design theory the concept of dedicated cycle routes are a key feature of future sustainable development, with certain authors promoting cycling as a formulating element of sustainable morphologies (Calthorpe, 1993; Fleming, 2012).

Fleming (2012) coins the term *'cycle space'* in *'Cycle Space: Architecture and Urban Design in the Age of the Bicycle'* (Fleming, 2012); an interesting publication in the terms of this research, by an architectural theorist from New Zealand. An opportunity inherent in recycling railway corridors is the way in which the gradients of trains operate at levels generally comfortable to many cyclists. The following quotation describes the idea of a *'Bicycle Oriented Development'* (Fleming, 2012), similar to Calthorpe's 'Transit Oriented Development' (1993) but with the bicycle as the main catalyst for structuring a certain type of built environment as opposed to public transport. A salient point here is that the first area or zone to be suggested (Fleming, 2012) as an area of 'Bicycle Oriented Development' is that of a 'railway easement'. The notion occurs here that, to some degree, permeates almost all the literature reviewed in this research; the issue of how to deal with sustainable forms of transport in a post-industrialised urban condition (Banister, 2002). 'Human Locomotion' (Marshall & Lorimer, 2013) is a key movement that reviews town planning from a health and evolutionary development perspective. Town planning principles are important to this concept where the benefits of urban morphologies that prioritise walking and cycling as healthy behaviours are promoted. These forms of locomotion can be supported by certain urban morphologies and this research examines the case studies from an urban design perspective in order to glean knowledge into built configurations along-the-line of RRCs. These observations will be conscious of land-use patterns through to building material choices and the proportions of any cycle paths (cross-sectional width) apparent in the cases.

Topography Along-the-Line of Recycled Railway Corridors

Building Block 10 of Hall and Ward's (1998) SSCT requires that *'Variation According to Geography'* be a priority when considering the built form. As discussed previously, site-specific forms (Tzonis & Lefaivre, 1996) are a crucial aspect in critical regionalism when urban design is considered alongside place specificity (Relph, 1976). This notion can have considerable implications when considering the pedshed and its articulation in terms of transit-supportive urban design. Given the propensity of railway corridors to form their own landscapes which is counter to the principles of critical regionalism, this can then paradoxically necessitate an urban design suited to site. This nuanced site-specific response, which may or may not be a limitation in the terms of other transit-supportive urban design theory (Jacobson & Forsyth, 2008), can conceivably relate to and contradict both critical regionalism and transit-supportive urban design theory. It is noteworthy that it is not just buildings that can be greater than the human scale.

Man-made as well as natural topographies will be considered in this research. Whereas Fleming (2012) suggests that 'hilly regions should be left to those who prefer to drive', this research examines territories with topographies that are difficult to develop as result of mineral extraction. Both T.O.D. (1993) and the S.C.R. (Breheny & Rookwood, 1993) call for 'riparian strips' and 'ecological features' and this research will survey the relationship between recycled railway corridors along historic railway alignments and associated disused mineral extraction sites which have been repurposed as restorative elements.

Pre-existing Engineering Infrastructure & Recycled Railway Corridors

The recycling of a railway corridor implies, at a minimum, the consideration of the reuse of pre-existing engineering infrastructure. This act of reuse can have a number of implications; economic, cultural and spatial. Artefacts of the built environment such as cuttings, bridges, viaducts, tunnels, level crossings, etc., all carry both a monetary value, and crucially from the perspective of this research, place-based meaning (Relph, 1976). This can potentially be of great consequence to the feasibility stage of a recycled railway corridor; the cost to renovate a viaduct, for example, can be considerably less than having to construct a new structure of similar purpose. Further, an existing structure can carry cultural significance (Calthorpe, 1993) through being a landmark (Lynch, 1960). Perhaps most importantly to this research, an existing piece of infrastructure brought back to use can be a weighty urban design challenge, one which represents the act of 'recycling' beyond being solely a transport intervention or a cultural intervention into the built environment. As well as carrying vital meaning within regions, pre-existing engineering infrastructure can also be of high value in pragmatic design terms. For example, bridges separate the (recycled)

permanent way alignment from roads and other thoroughfares meaning that both pedestrian permeability (Calthorpe, 1993) can be either maintained or increased and the benefits of grade separation for both road traffic and public transit can be achieved.

The table below summarises the node context typologies categories for analysis as derived from the above theories in relation to the land use aspects, urban morphology characteristics and urban design criteria used in Chapter Five to examine the case studies at the regional scale, along-the-lines of RRCs.

ECOLOGICAL FEATURES ALONG-THE-LINE OF RECYCLED RAILWAY CORRIDORS				
Ecologically Important Features	Country Parks	Agriculture Between Nodes		
STRATEGIC GROWTH & RECYCLED RAILWAY CORRIDORS				
New Communities	Balancing Development Along Transit Corridor			
URBAN MORPHOLOGY & RECYCLED RAILWAY CORRIDORS				
'Lynchian Edges'	Permeability & Linear Transit Elements			
RECYCLED RAILWAY CORRIDORS & BROADER TRANSPORT NETWORKS				
Creation of Dedicated Public Transport Routes	Regional Metros & Recycled Railway Corridors	Non-Reinstated Disused Railway Corridors	Main Roads & Recycled Railway Corridors	Parking Emphasis at Nodes Along-the-Line
INTERRUPTIONS TO DISUSED / RECYCLED RAILWAY CORRIDORS				
Unnecessary Severing of Disused Railway Lines	Blockages Along-the-Line of Recycled railway corridors			
LAND USE & RECYCLED RAILWAY CORRIDORS				
Urban Regeneration & Selective Urban Expansion	Mixed Use & Recycled Railway Corridors	Industrial Areas & Recycled Railway Corridors	Brownfield Sites & Recycled Railway Corridors	Strategic Refusal of Certain Planning Permissions
CYCLE PATHS & RECYCLED RAILWAY CORRIDORS				
Accommodation of a cycleway along-the-line of Recycled Railway Corridors	'Human Locomotion' & Recycled Railway Corridors			
TOPOGRAPHY *ALONG-THE-LINE* OF RECYCLED RAILWAY CORRIDORS				
Natural & Human Made Topographies	Recycled railway corridors as 'Lynchian Paths'			
PRE-EXISTING ENGINEERING INFRASTRUCTURE & RECYCLED RAILWAY CORRIDORS				
Existing Railway Networks & Recycled Railway Corridors	Rationalisation & Duplication at Recycled Railway Corridors			

Table 2.8: Summary of Theoretical Themes Pertaining to Territories Along-the-Line of RRCs

2.6 The Neighbourhood Scale; At-the-Node

This subchapter uses Breheny and Rookwood's six 'area types' of an S.C.R. (1993) and uses them as node contexts in order to differentiate between alternative T.O.D.s in distinct contexts. This is in line with place specificity principles (Relph, 1976) laid out in the conceptual framework. Here finer-grain urban design theories are discussed in order to form the basis for the examinations made further in this research (Chapter Six) regarding transit-supportive urban design at the neighbourhood scale of an RRC pertaining to spaces at-the-nodes.

'City Centre' Node Context Typology

This research adopts the below 'area type' from Breheny and Rookwood's S.C.R. (1993) as a 'City Centre' node context typology. Although critical regionalism (Frampton, 1992) as in the conceptual framework is opposed to a model indicating a dominant centre with subordinate satellites, the S.C.R. acknowledges the City Centre as a component of a sustainable region, where a convergence of transport and commercial services occur in proximity. The diagram below shows a Major Transport Interchange at the confluence of a variety of transit modes: heavy rail, tube, bus and cycle. There are no tube networks within the case study territories of this research; however, if 'tube' is replaced with 'light rail', then the conceptualisation below holds relevance. This Major Transport Interchange is surrounded by High Density Commercial land uses. For the purposes of this research an important matter is highlighted: to what extent, in urban design terms, does the commercial land use 'feather' into the transport interchange.

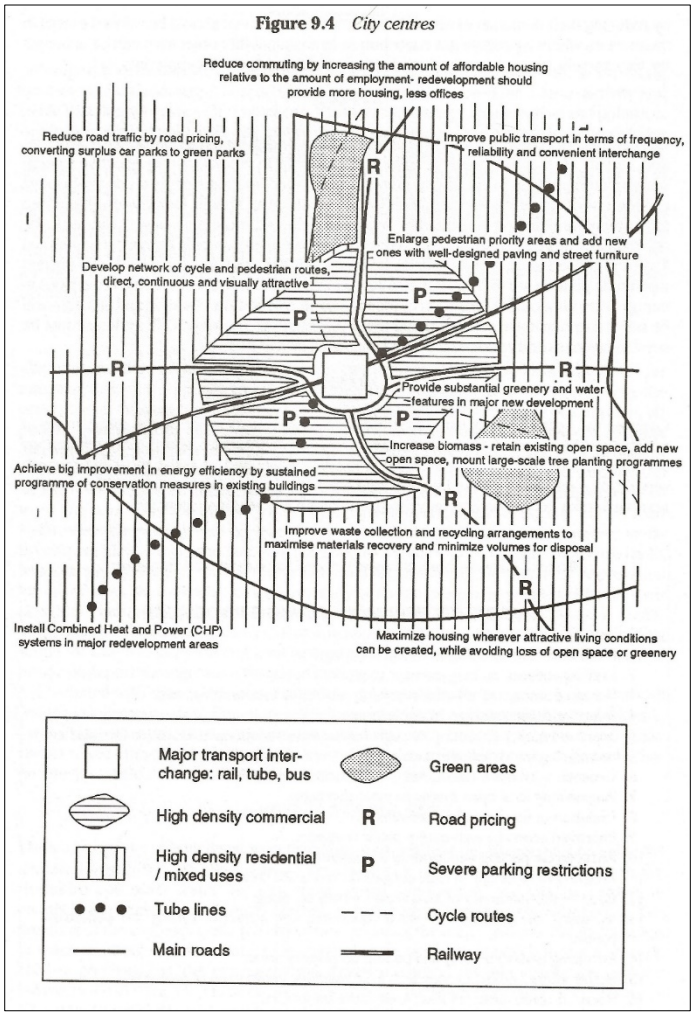


Figure 2.10: Breheny & Rookwood's 'City Centre' Area Type

Source: (Breheny & Rookwood, 1993, p. 164)

This research, at this node context typology, concentrates upon the urban design of the Major Transport Interchange. This land-use type is most likely to be at its most complex within the City Centre context; this research examines how the tensions between transit node design and human scale urban design manifest in the case study built environments. This utilises urban design theory concerning legibility and imageability (Lynch, 1960), the pedestrian negotiation of both natural and manufactured topographies (Frampton, 1992) and issues of authenticity of place (Ford, 1999; Relph, 1976) in the design of such daily-use 'ordinary' places.

This research will consider Major Transport Interchanges at-the-nodes of recycled railway corridors in terms of Lynchian legible 'districts'. Ford (1999) in *'Lynch revisited: New urbanism and theories of good city form'*, argues for a revisiting of imageability principles with the purpose of analysing 'New Urbanism', which is a closely associated urban design theory to T.O.D.. Given the position of recycled railway corridors in historic centres (Calthorpe, 1993) where connections between modes often occur, it is prudent to examine Major Transport Interchanges in legibility terms.

Lynch (1960) describes a district as a section of the city that can be '*entered inside of*' and *'as having some common identifying character'*. This research will examine where two or more modes connect at city centre contexts of recycled railway corridors in order to see if the above characteristics have occurred. Further, Lynch (1960) writes that a district is both identifiable from the inside and distinguishable from the outside and there are a variety of urban design characteristics, discussed here, which will enable the comparative analyses in this research to discern whether or not the Major Transport Interchanges being studied perform as legible districts. This research aims to gauge the role urban design has played in the seizing of opportunities at recycled railway corridors. If a Major Transport Interchange is operating as a legible district then one might argue this is a component of a transit-supportive urban design 'whole' (Calthorpe, 1993).

Further, the materiality of building material can be a crucial facet of the construct of a legible district, an area with a 'common identifying character'. Given the temporal aspect of RRCs, this research will examine Major Transport Interchanges in order to ascertain the urban design approach to contemporary vernacular building materials. Such discussions can point to considerations of authenticity in urban design, and whilst Ford urges caution *"There is almost no way to win (or lose) a debate that is so couched in emotional issues and ideologies." (Ford, 1999, p. 256)*. This research has paid close attention to the limits of such discussions. As stated in Chapter Three of this research, this examination is focused upon the generation of truths pertaining to the field of urban design, not indubitable facts.

Whilst Lynchian landmarks and paths are also applicable to recycled railway corridors in this context, a further imageability category used in this research to examine the urban design at-the-node of RRCs is a 'Lynchian node'[34]. 'Genius loci', is key to the conceptual framework of this research (Frampton, 1992; Tzonis & Lefaivre, 1996) and the presence of a 'Lynchian node' can, either independently or together, increase the imageability at-the-node of a recycled railway corridor. A node has a broad definition; Lynch characterises a node as "*the strategic spots in a city into which an observer can enter, and which are the intensive foci to and from which he is travelling" (Lynch, 1960, p. 47)*. Buildings, engineering features or natural elements can act as nodes. This research will examine the urban designs that constitute the Major Transport Interchanges at-the-nodes of the case study recycled railway corridors in order to establish if they act as 'Lynchian Nodes'. For instance, is there an archetypal 'transport grand hall' or an historic listed building present at the Major Transport Interchanges, signifying foci of both pedestrian and public transit travel?

[34] A 'Lynchian Node' is distinctly different from a transit node. A 'Lynchian Node' is any strategic point within a city, whilst a transport node is a point on a network.

'City-Inner Area' Node Context Typology

The onus put upon the 'City-Inner Area' area type by Breheny and Rookwood (1993) with the most relevance to this research are *'reduce commuting by better balance of homes and jobs'* and *'more mixed developments and homeworking'* (Breheny & Rookwood, 1993). This area type is being used by this research as a node context typology in order to examine finer-grain transit-supportive urban design criteria at the case study nodes that resemble this settlement pattern.

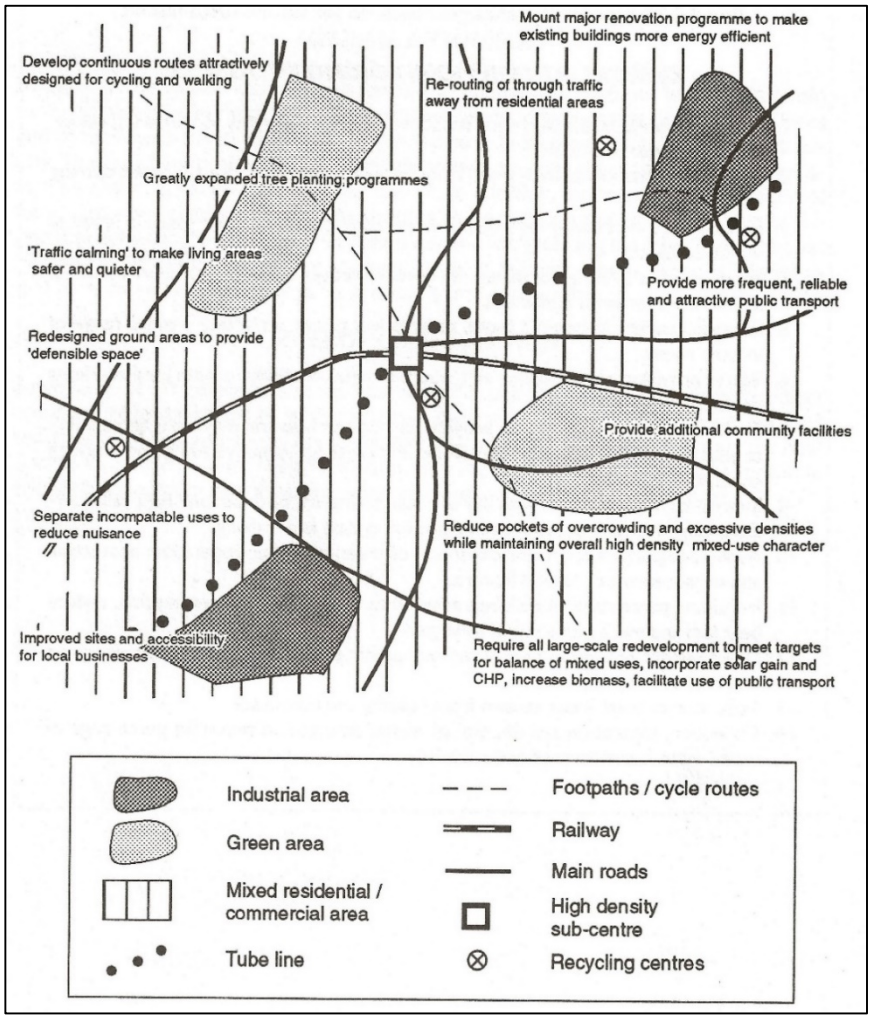


Figure 2.11: Breheny & Rookwood's 'City–Inner Area' Area Type

Source: (Breheny & Rookwood, 1993, p. 168)

The diagram above shows Breheny and Rookwood's (1993) spatial intentions for the City Inner area which is focused upon high-density sub centres at the confluence of a number of transit modes: main road, railway, tube line and the human locomotion (Marshall & Lorimer, 2013) modes of walking and cycling. This relationship carries significant urban design implications. The majority of this area type is taken up by the land use of mixed residential/commercial with industrial and green areas breaking up this configuration. Each of the four examples of these land-use types on the diagram below have a transit corridor as

an edge (Lynch, 1960), the industrial areas using the tube line as a boundary and the green areas using both the railway and the main road. Given that this research is focused upon RRCs, the case studies will examine the relationship between high-density sub centres present and brownfield land (Calthorpe & Fulton, 2001) associated with the public transit corridor.

This research focuses upon the role of place in the urban design of such high-density sub-centre districts (Breheny & Rookwood, 1993) situated at the node of recycled railway corridors. As previously referred to, human scale urban design (Calthorpe, 1993; Gehl, 2010) is crucial in this context especially where high-density residential[35] is concerned. In order to avoid 'cramming' (Hall & Ward, 1998) and create transit-supportive places, the urban design must be carefully considered. Further, the importance of any identifying characteristics at this context node is highlighted in order to differentiate this node context (Tzonis & Lefaivre, 1996) from both city centres and other contexts within the region.

Lynch (1960), as previously stated, describes a district as a section of the city that can be '*entered inside of'* and *'as having some common identifying character'*. This research seeks to identify case study examples where common urban design characteristics can be observed at-the-node of City-Inner area contexts associated with recycled railway corridors. The comparative analysis in this research will discuss whether or not there has been consistency in the urban design responses across the case studies or if disparities are apparent. For example, the observations made of the cases studies will be used in order to examine whether the block form (Dittmar, 2008) creates an area which can be interpreted as one that can be entered into and exited from, in relation to the RRC node. At a finer grain, the manner in which these blocks can/can't be traversed is an issue relating to permeability (Barton et al., 2003) where architectural detailing (Gehl, 2010) and corner treatments become crucial aspects of the townscape (Cullen, 1971) when assessing if a transit-supportive urban design is manifest at-the-node of an RRC. Where such architectural detailing is examined, consideration will be given to any vernacular response to materiality (Frampton, 1992). These components are crucial to the configuration of such a 'mixed-use sub-centre' (Breheny & Rookwood, 1993) as seen in the diagram above.

'City Suburb' Node Context Typology

A key aspect that has relevance to this research of Breheny and Rookwood's City Suburb area type (1993) is 'increase intensity in suburbs and small towns and public transport nodes' (Breheny & Rookwood, 1993). This is reflected in the diagram below where a high-density sub-centre surrounded by intensive commercial development exists,

[35] The measure of high density is taken to be 55-90 d.p.h. (Barton et al., 2003).

and as with the previous two area types, at the confluence of a variety of transport modes. In this instance railways, main roads, foot and cycle paths, but also in this instance a new and different transport network is suggested. This 'suburb to suburb public transport' network (Breheny & Rookwood, 1993) traverses the main land-use typology of residential, and according to this diagram, as well as connecting with the other transport modes at the high-density sub-centre, it also connects to neighbourhood centres (each with their own recycling centres) which are situated in the position where this 'suburb to suburb' transport network intersects with the main road network. There are a number of further neighbourhood centres which are each associated with main transit corridors, are separated by green areas, and interconnected with all the features present on this diagram by the footpath and cycle routes (Fleming, 2012).

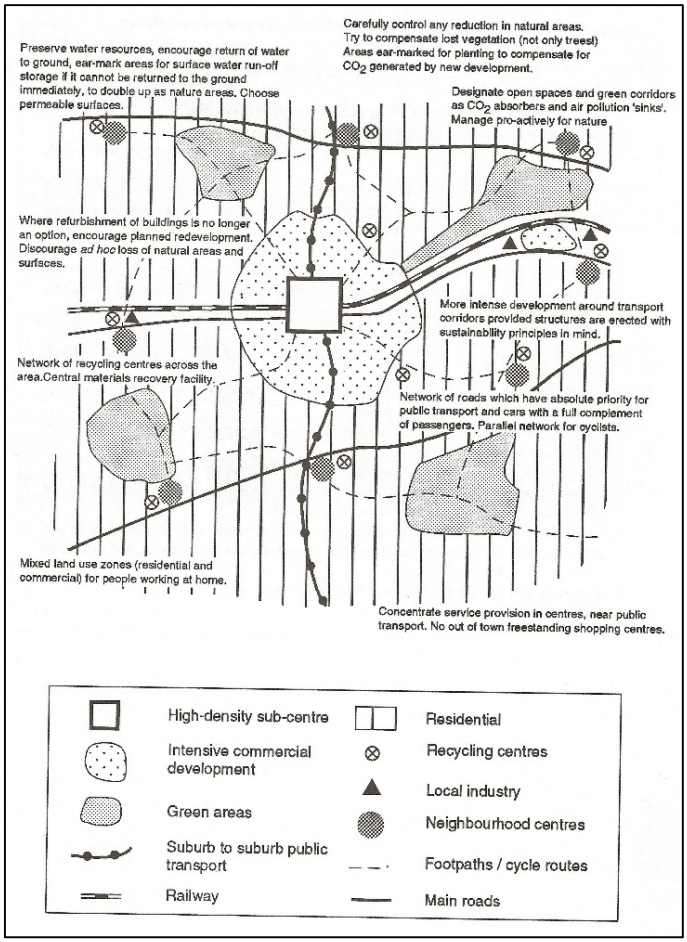


Figure 2.12: Breheny & Rookwood's 'City Suburbs' Area Type

Source: (Breheny & Rookwood, 1993, p. 172)

Much existing residential building stock is present in the suburban area type (Calthorpe, 1993), and this trend is anticipated to be the case in the instance of a RRC territory. Suburban contexts offer the combination of the opportunity to live in individual family homes combined with the relative proximity to the countryside (Breheny & Rookwood, 1993). Consequently, low-density housing is prevalent which in turn means low levels of public transport accessibility/high reliance upon automobiles. This can be

considered the antithesis of transit-supportive urban designs (Calthorpe & Fulton, 2001; Hall & Ward, 1998). This research will examine what role urban design plays in the centralisation of housing (Hall & Ward, 1998) into the solution and what these urban design configurations mean for the comfort (Barton et al., 2003) of pedestrian environs, focusing at-the-node of RRCs. According to Barton et al. (2003) there are three criteria for a comfortable pedestrian design: a pedestrian route that is wide enough to provide easy passing without conflict with vehicles, overlooking which provides a sense of surveillance, and good lighting design providing a sense of safety as opposed to intimidating places where the routes are featureless and poorly lit.

As suburbs are typically automobile-dominated spaces, the configuration of any car parking at-the-node of the RRC will be taken into account in the cross-case analysis carried out with special consideration to the balance of the arrangements directly adjacent to the nodes (Jacobson & Forsyth, 2008). This is a conjoined issue with walkable qualities (Barton et al., 2003; Calthorpe, 1993) within the pedshed. Typically, suburban dwellings are at densities of 25-35 d.p.h. (Barton et al., 2003) and this research will examine if there are instances where this is higher in relation to the case study transit node and what place (Relph, 1976) implications, if any, there are for the transit-supportive nature of these urban designs. The corollary of these two aspects, residential form and street pattern (Marshall, 2005), is an implication for the directness and connectivity (Barton et al., 2003) of pedestrian routes within the pedshed of the node. Issues of dwelling (Pallasmaa, 2005; Zumthor, 2006) and natural surveillance (Gehl, 2010, 2011) are pertinent here also. Although this may mean market forces are not strictly adhered to (O'Toole, 2009) place-specific responses to medium-low residential land uses can accommodate the theoretical principles of rootedness set out in critical regionalism (Frampton, 1996; Relph, 1976) and transit-supportive walkable (Calthorpe, 1993) urban design at the node of RRCs.

'Small Town & New Community' Node Context Typology

The following four criteria are the most salient from Breheny and Rookwood's (1993) 'Small Town/New Community' area type to this research. The issues of density (Calthorpe, 1993), restrictions and control of car usage (Banister, 2002) and its urban design implications (Hall & Ward, 1998; Jacobson & Forsyth, 2008), and an emphasis towards cycling infrastructure (Fleming, 2012) and pedestrian infrastructure (Calthorpe & Fulton, 2001; Richer & Hasiak, 2014; Soderstrom, 2008). All have significant urban design implications.

- *"More compact mixed-use new settlements to take urban growth*
- *Road pricing and parking charges to restrain private car use*
- *Restrictions on new car-based development*

- *More attractive cycling and walking routes and pedestrian areas"* (Breheny & Rookwood, 1993)

These aspects are reflected in the diagram below (Breheny & Rookwood, 1993) which shows a mixed retail commercial and residential area being the central point of a 'figure of eight' bus routes whilst being traversed by light rail and heavy rail network. This mixed-use core has an adjacent high-density residential area which is surrounded by lower density residential development. This diagram illustrates this lower density residential development having clear lines of containment. As with the suburban area type, recycling centres are placed at the convergence of main roads and public transport networks and there is also a significant green area partially within the line of containment of the lower density residential land use. There are also instances of retail pockets dispersed around the Small Town & New Community beyond a mixed-use core and a smallholding beyond the line of containment of residential but adjacent to a main road and a light rail system.

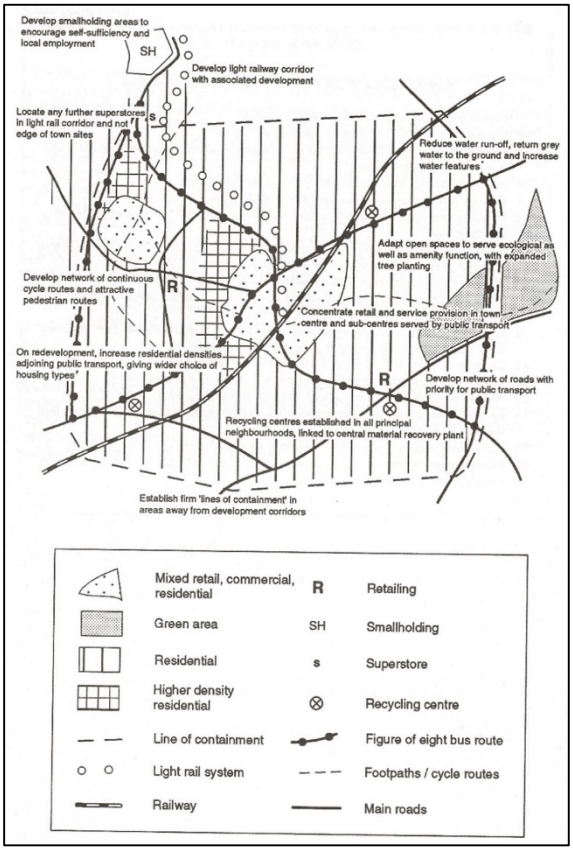


Figure 2.13: Breheny & Rookwood's 'Small Towns & New Communities' Area Type

Source: (Breheny & Rookwood, 1993, p. 176)

Given that according to Breheny and Rookwood (1993) the confluence of transit modes should occur at the centre of a 'Small Town & New Community' within a 'mixed retail, commercial, residential' core, this research considers a way of signifying any station could be through the determination of a Lynchian Landmark (Ford, 1999; Lynch, 1960) or a 'focal point' (Cullen, 1971) at-the-node. Cullen (1971) describes a focal point as somewhere that *"crystallises the situation, which confirms 'this is the spot'."* (Cullen, 1971,

p. 26). This research will examine instances of this within the case studies and observe the inter-relationship of these spaces with other such urban design characteristics as balance of parking (Jacobson & Forsyth, 2008), any complementary relationship to adjacent land uses (Calthorpe, 1993; Dittmar, 2008) and transport connectivity (Banister, 2002; Breheny & Rookwood, 1993). Authenticity (Ford, 1999; Relph, 1976; Tzonis & Lefaivre, 1996) is also a key aspect for consideration at-the-node of a RRC.

A link between such focal points and landmarks is drawn between that and mixed-use residential/commercial/retail (Breheny & Rookwood, 1993) in that the combination of activities, through careful urban design prioritised to what happens in the space (Gehl, 2010), can be mutually supportive. This, as argued in T.O.D., can be a positive relationship accentuated when this occurs at a public transit node (Calthorpe, 1993; Dunphy et al., 2004; Jacobson & Forsyth, 2008). When this is considered in conjunction with plot and street patterns (Dittmar, 2008; Marshall, 2005) an additional strengthening in this relationship can be achieved. A plot pattern can generally be distinguished by two overall categories, the dendritic plot pattern and the grid plot pattern (Marshall, 2005). A grid plot pattern (or a derivation thereof) is conducive to walking, choice of routes and an increase in opportunity for commercial or sociable encounters and is therefore aligned with transit-supportive urban design principles. Conversely, a dendritic plot pattern is difficult to penetrate, has relatively fewer choices (if any) of routes and lends itself to mono-use land patterns.

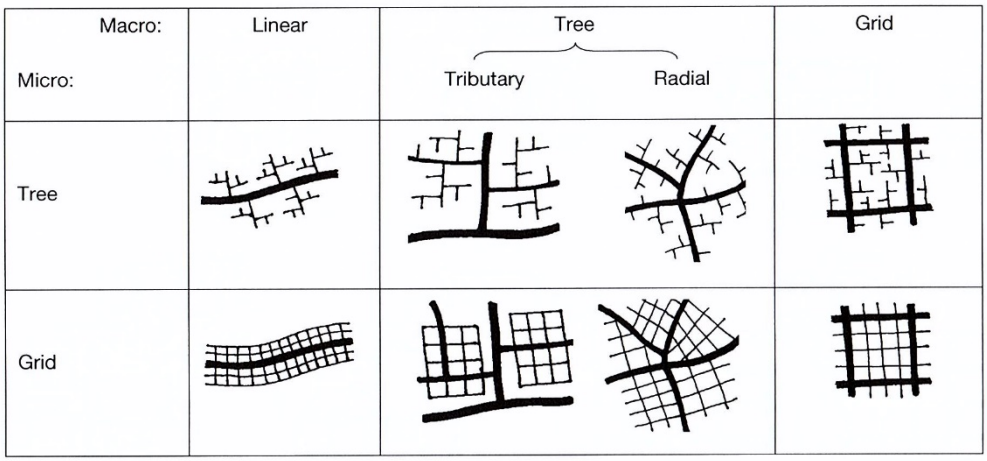


Figure 2.14: Choice of Route and Street Pattern

Source: (Marshall, 2005, p. 96)

These considerations of street patterns have significant urban design implications when the public transit mode used in the recycling of a railway corridor is contemplated. Light rail and guided bus can integrate with 'standard' road types whereas a heavy rail crossing at grade is less than ideal for convenience and safety reasons. The prioritisation of cycleway provision is also linked to street pattern (Fleming, 2012). This research will examine the inter-relationships between these modes of public transit and their urban design implications. The complex relationship between the public realm, the RRC, and the

associated buildings raises issues pertaining to Defensible Space (Gehl, 2010) where a balance between privacy and natural surveillance is paramount to the walkability of such places.

'Mixed Urban-Rural' Node Context Typology

The complexity of the 'mixed urban-rural' area type is illustrated in Breheny and Rookwood's (1993) diagram below. This shows a number of centres of intense activity linked by both the public transport routes and the main road. These centres are, in the main, surrounded by existing settlements which are in proximity with each other but separated by areas of diverse activity. A new settlement (Calthorpe, 1993; Hall & Ward, 1998) is illustrated on this diagram below which is connected by two main roads and the public transport routes and adjacent to a community forest (Calthorpe & Fulton, 2001). This area type shows a further main road type illustrated as a dual carriageway which has a further land-use type of Distribution Park. This research is concerned with examining the urban design of the centre of intense activities, their relationship to the recycled railway corridor public transport route and the extended settlements with which they are associated through a synthesis of Jacobson and Forsyth's (2008) concept of a 180° station in conjunction with ideas surrounding the walkability (Ann Forsyth, 2008) and conviviality (Barton et al., 2003) of pedestrian environments.

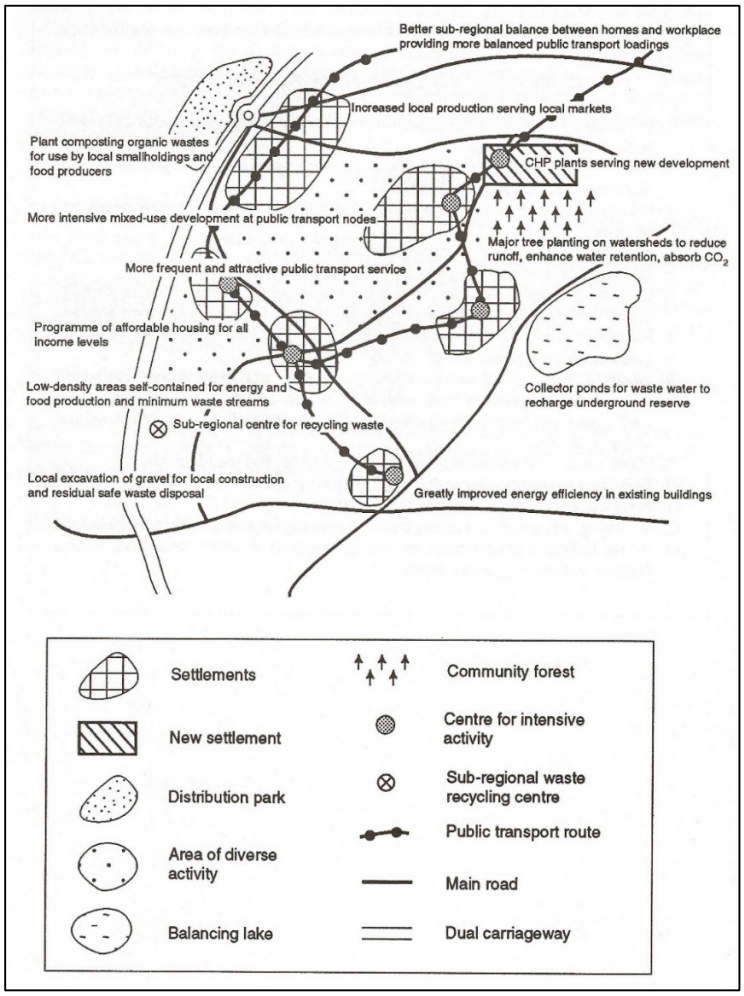


Figure 2.15: Breheny & Rookwood's 'Mixed Urban-Rural' Area Type

Source: (Breheny & Rookwood, 1993, p. 180)

The notion of a 180° station (Jacobson & Forsyth, 2008) is based upon observations of a negative phenomenon charted by Jacobson and Forsyth (2008) in their journal paper *'Seven American T.O.D.s: Good practices for urban design in Transit-Oriented Development projects'*. This notion is exemplified at their case study 'Fruitvale'. Although this case resembles many of the traits of what Jacobson and Forsyth (2008) argue to be best practice urban design at transit nodes – a 'pleasant pedestrian environment', a 'mix of uses' and a 'high proportion of residential' – the criticism levied towards Fruitvale by Jacobson and Forsyth (2008) is that these positive traits exist only to one side of the station. On the opposite side of the node the bus station and car parking are situated, as if one side of the line is designed in line with T.O.D. principles and the other side dominated by transport engineering parameters (Jacobson & Forsyth, 2008). This has the result that, according to Jacobson and Forsyth (2008), commuters rarely use the station facilities on the opposite side of the transport hub (Jacobson & Forsyth, 2008). This effectively means the station becomes a park-and-ride for many users. This phenomenon is termed a 180° site (Jacobson & Forsyth, 2008). This research will use the case studies to examine whether this phenomenon is apparent in recycled railway corridors. This 'pitfall' (Jacobson & Forsyth, 2008) of urban design at transit nodes represents a loss of opportunity for the full advantages possible through T.O.D. to be achieved and by extrapolation this applies to the context of this research: an RRC.

> *"In this regard, the Transit Village has failed to take complete advantage of the benefits of the station, much to the disappointment of many people who had high hopes for the area."(Jacobson & Forsyth, 2008, p. 69)*

It is unrealistic within the scope of this research to survey the case studies and make definitive comment on whether or not the hopes of people have been met, or otherwise. However, it is possible to observe the built environment and establish where such opportunities have been utilised, and where further options might exist, in lieu of the realisation of the counterpoint to a 180° station: a '360° station'. The idea of a 360° station can only be achieved if the transit line as an 'edge' (Lynch, 1960) is articulated as a seam as opposed to a barrier. This could be done in a number of ways – the edge could be broken for automobiles and/or pedestrians (although in normative urban design terms preferably pedestrian-prioritised), and 'destinations' could be strategically placed either side of the line to encourage crossing the 'path'. Residential land uses could be prioritised at either side of the station, in lieu of surface car parking[36].

Walkability permeates this discussion of transit-supportive urban design and the aspect of this notion considered at this node context in conjunction with a 180° station is

[36] Station parking and connectivity to bus services is acknowledged to be crucial (Jacobson & Forsyth, 2008); however, each use can be designed to be subservient as opposed to dominant in urban design terms, for example multi-storey parking as opposed to surface car parking.

that of conviviality. This is described as (Barton et al., 2003) a situation where a pedestrian route allows for casual meetings to occur away from excessive noise and fumes, with the provision of aesthetic enjoyment in the midst of a variety of landscapes. Conviviality (Barton et al., 2003) as a component of sense of place (Frampton, 1992) has relevance to this research into the urban design of recycled railway corridors. One such landscape might be a station where the railway tracks can be traversed by foot, the casual meetings increased by the natural footfall created at a transit node (Read, 2005). This research will examine if, when this happens at a recycled railway corridor, the urban design of the place takes advantage of the opportunity for 'rooted' (Relph, 1976) 'aesthetic enjoyment'.

'Remote Rural' Node Context Typology

The diagram below shows Breheny and Rookwood's (1993) conceptualisation of how a Remote Rural area type would exist within a Social City Region. The two main built environment typologies within this area are 'villages' and 'key villages'. These are separated from one another although connected primarily by main roads, although the three key villages are closely related to the railway line. Forestry, in order to increase biodiversity and protect watersheds, is featured highly within this area type. These land-use types are interspersed with wind farms and areas of diversified low-density development. Given the importance public transport has to rural communities, this research will examine the urban design at the confluence of the key village and railway elements. Issues of prominence (Richer & Hasiak, 2014) of the station and its pedestrian environs (Barton et al., 2003) are crucial to this discussion. Further, although Breheny and Rookwood (1993) do not show topography in the diagram below, this is a key element to urban design (Tzonis & Lefaivre, 1996), especially in potentially hilly rural contexts. The diagram below shows a clear relationship between the transport infrastructure and land-use types where both roads and the railway form barriers (Lynch, 1960) between forestry and other elements. Although not indicated on the diagram below, it is reminiscent of a river valley and one can imagine the white central area where the settlements exist being a floodplain between two hilly areas where the forestry has been indicated.

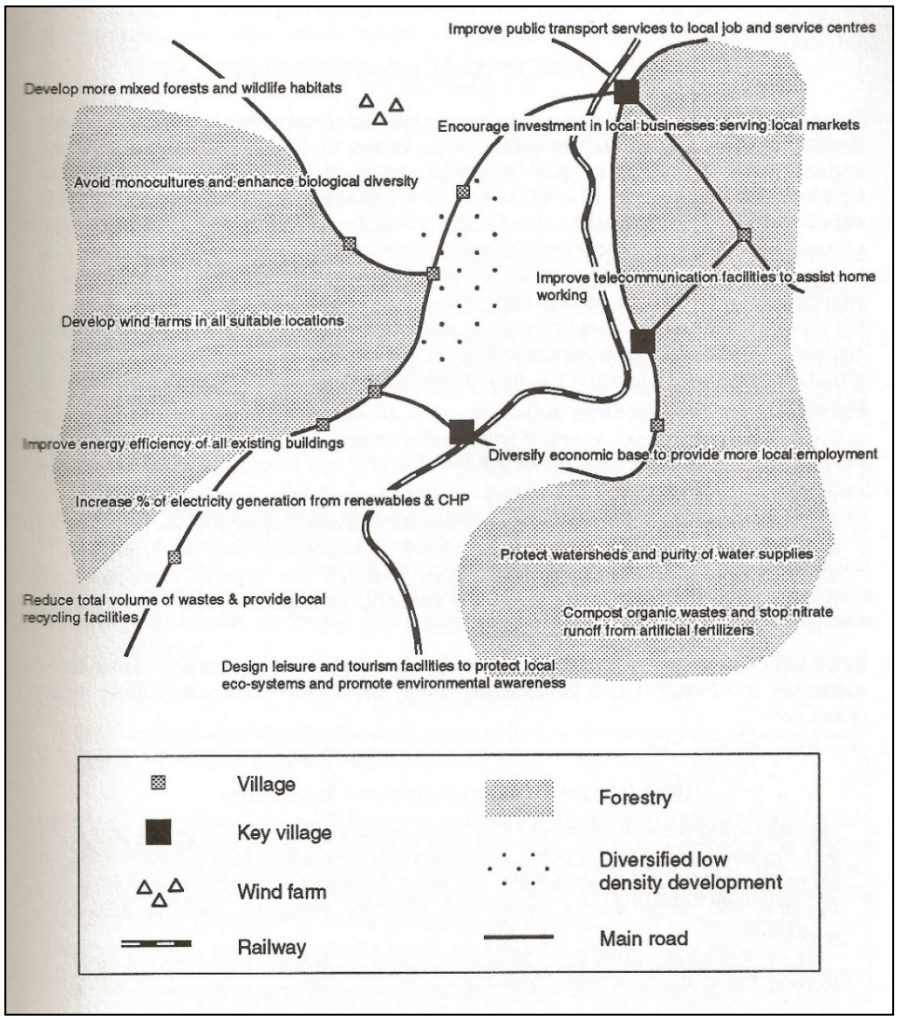


Figure 2.16: Breheny & Rookwood's 'Remote Rural' Area Type

Source: (Breheny & Rookwood, 1993, p. 183)

The conceptualisation that a station can be either introverted or extroverted to varying degrees based upon the quality of the public space, as asserted in '*Territorial opportunities of tram-based systems: a comparative analysis between Nottingham (UK) and Valenciennes (FRA)'* Richer and Hasiak (2014) is of relevance to this examination of the urban design at the node of recycled railway corridors. This concept is applied to the remote rural node contexts in this research, although it is acknowledged this conceptualisation could be applied to all node contexts. This concept of introversion/extraversion is closely linked to Lynch's concept of node legibility and in this research context acquiesces with the concept of conspicuous walkable environments (Barton et al., 2003). If an urban design responds positively to these two conceptualisations, especially given the often-difficult terrain to inhabit of a remote rural situation, then a significant step towards a transit-supportive urban design could be argued.

Connectivity is a connected aspect of whether a station exhibits introverted/extroverted traits and the examination of the pedestrian approach is crucial in this research. A conspicuous pedestrian environment is described as being 'easy to read'

and 'distinctive' including such landmark features as 'trees or public art' (Barton et al., 2003) and in this research context it might be considered that one such landmark could be an 'extroverted station' (Richer & Hasiak, 2014). An 'introverted' node is defined as a place that has little impression upon its direct and associated environs (Richer & Hasiak, 2014), satisfactory in terms of mandatory engineering standards yet not taking full advantage of place-based opportunities that mass transit can afford an area. Where the recycled railway corridor/node has been used as an urban planning tool and the node is explicit about its purpose through architectural and urban design, then traits of extraversion in the urban design could be claimed (Richer & Hasiak, 2014). These two interesting strategies of anthropomorphism crystallising a set of urban design ideas will be used to consider the Remote Rural context cases in this research.

The table below summarises the node context typologies (as derived from B&R area types) in relation to the land-use aspects, urban morphology characteristics and urban design criteria used in Chapter Six to examine the case studies at the neighbourhood scale, at-the-nodes of RRCs.

'CITY CENTRE'						
Major Transport Interchange						
'CITY-INNER AREA'						
'Lynchian District'				High Density Residentially-led Development		
'CITY SUBURBS'						
Centralise Housing into Node Solution				Comfortable Pedestrian Environment		
'SMALL TOWN & NEW COMMUNITY'						
'Lynchian Nodes'	Focal Point	Complementary Development Forms	Plot Pattern	Mix of Residential/ Commercial/Retail	Grid Street Pattern	Defensible Space
'MIXED URBAN-RURAL'						
Convivial Pedestrian Environment				Connected Pedestrian Environment		
'REMOTE RURAL'						
Introverted / Extroverted Station				Conspicuous Pedestrian Environment		

Table 2.9: Summary of Theoretical Themes Pertaining to Area Types At-the-Node of RRCs

This chapter has discussed and explained the theoretical background underpinning the claims made in this research. This carefully considered collection of theories frames the response in this thesis's conclusion to the primary research question: *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?*' The conceptual framework focused upon ideas of authenticity and place-specificity in urban design, then transit-supportive urban design theories were discussed with reference to wider normative urban design theories concerning 'human scale' and walkability. These aspects were then discussed in detail in direct reference to the two key scalar territories of enquiry established in this research, along-the-line and at-the-node.

3. Research Conceptualisation, Design & Execution

This chapter explains how the development of this research contributes to research techniques and approaches in the field of urban design at RRCs, through the conceptualisation, design and implementation of this inquiry. Underpinning philosophical assumptions are initially set out which leads to the formulation of the conceptual framework for this research, where a regionally oriented architectural design paradigm is synthesised with an argument for a set of complementary, and predominantly visual methodologies. The potential innate to this framework in terms of claims to knowledge in the above field is then outlined.

The research design argues for the adoption of a case study method, the specific outline of which is explained by making reference to the rationale and selection process used in choosing the areas upon which to focus this empirical study. The considerations given to the three sources of data that constitute the case study evidence are subsequently discussed, and the execution of this research is then explained. This explanation states how the sources were gathered making reference to such issues as meaning, accuracy, representativeness, credibility, authenticity, solicited/unsolicited data, authorship/bias, access, ethics, logistical considerations and field considerations. A comparative cross-case synthesis is then defined as the analytical strategy.

The way in which the claims to knowledge have been arrived at in this research is then evaluated. The validity of the sources collected is discussed in conjunction with issues surrounding the position of the researcher. Certain adjustments were made as part of the on-going research design, these were made due to unforeseen issues and the strategies adopted addressing these issues are discussed. This explanation then progresses to examine the ethical issues that permeate this research. Lastly, the broad criticisms of case study method are addressed and by analysing this counter position, an argument is made asserting that this

is an appropriate method for this research context through this theoretical lens. This chapter describes the systematic way in which the methodological positions and technical approaches have led to the conclusions drawn in this research.

3.1 Philosophical Assumptions

The imperative of this research is to contribute to the existing body of knowledge in the matter of urban design at RRCs. Concerning the philosophical foundations of knowledge Audi writes: *"If we learn enough about knowledge and justification conceived philosophically, we can better search for them in matters that concern us and can better avoid the dangerous pitfalls that come from confusing mere impressions with justification or mere opinion with knowledge."* (Audi, 2011, p. 11). The above quotation raises two fundamental questions for the 'matters that concern' this research. What is justification in urban design? What is knowledge in urban design? It is argued here, from an ontological perspective of pragmatism (Creswell, 2009), that the process of empirical study can yield justifiable knowledge pertaining to urban design.

Justification in urban design is like the discipline as a whole: pluralistic. The built environment, and within that urban design, can be seen as, not exclusively, but certainly as an applied field of enquiry (Andrew Knight & Turnbull, 2008). This research adopts the position that knowledge in an applied field can be justified through observing phenomena. These phenomena exist in a real world setting and can be considered using the collection of information through human senses. This points to an empirical study: *"Generally speaking empiricists believe that knowledge is derived through the five senses; namely, sight, smell, hearing, touch and taste."(Andrew Knight & Turnbull, 2008, p. 65)* It is asserted therefore that an empirical study is justified in the pursuit of experiential knowledge in the context of the urban design at RRCs. This type of empiricism is given attention in Sociable Cities (Hall & Ward, 1998). Discussing sustainability in 1998, Hall highlights the difference between theory and practice by emphasising 'everyday decisions' and 'everyday urban contexts' as a focus of study.

> *"In 1998 we might say that we are fully briefed, almost over-briefed, on the subject of sustainable urban development. But there is a problem: though everyone knows that much quoted in generally accepted general definition of sustainability, from the Brundtland Report of 1987… it is not clear how this maps into actual everyday decisions in everyday urban contexts." (Hall & Ward, 1998, p. 123).*

Although this research is not ostensibly about, but is intrinsically linked to theories of sustainability, this quotation is used here to underline the importance of the territory of enquiry for this research: 'everyday urban contexts'.

Justification in urban design therefore, through the lens by which this research has been carried out, is defined as a characteristic, artefact or place, that can be pointed to in a

real world setting and experienced through at least one of (or more probably all of) the five senses. The theoretical underpinnings and protocols for how these observations are made in this research are discussed throughout this chapter. How these observations, recordings, depictions and analyses of such characteristics, artefacts, and places are treated is also discussed.

This raises epistemological issues surrounding objectivity and subjectivity. Using Audi's framework, does subjectivity lead to 'mere impression' and objectivity lead to justification in urban design? Certain schools of thought argue thus. However, there are strategies that can elevate qualitative, subjective inquiry beyond impression to justification. It is argued this research executes such strategies. The intention of this research is not to eliminate ambiguity in order to make absolute claims. The intention is to collect evidence which in the first instance leads to a set of conclusions that stand alone and hold a high level of firmness, but in doing so present a corpus of evidence that can be used and interpreted by others, ideally with alternative outcomes. This reflects the plurality of urban design. This openness to alternative explanations, it is argued, does not weaken but strengthen the research. Quantitative studies on the same phenomena would no doubt yield differing results, but it is argued here both have a place in urban design spheres. Therefore the position asserted by the researcher is one that corresponds to the adage *'quantities count – qualities matter'*.

Research methods are not intellectually neutral (Bryman, 2004) and this is acknowledged in this research's attempts to avoid 'mere opinions' (Audi, 2011) in its generation of knowledge. The purpose of this research: to generate knowledge in urban design has two components. The first component is an awareness that something exists. This can be something existing within the real world that can be seen, touched, etc. or it can be something more abstract, for example within a 'modelled world'. The second component of knowledge within urban design is the relationship of the first component to its context. Context can be the immediate physical environment, the scale at which the knowledge exists, etc. The third component of knowledge in urban design is related to extrapolation. This is subservient to the ambiguity of context. It is a knowledge that can be held as a truth as opposed to a rule, a principle as opposed to a law that can be applicable across social, cultural, political and economic contexts. In an effort to avoid Bryman's 'intellectual neutrality', the worldview under which this research was conducted is applicable to urban design knowledge as discussed above and made explicit: a pragmatic worldview.

Creswell (2009) describes pragmatism as a legitimate philosophical foundation for specific types of research. He states that research based in situations as opposed to antecedent conditions is suited to those that hold a pragmatic worldview. It is argued that this piece of research is driven by a curiosity regarding the situation of urban design at

RRCs. This research collects urban design evidence within this context, as opposed to seeking to prove that a theory is correct through the exploration of this context. This has led to the prioritisation of the research problem before research methods. Part of the exploration of this research has been to recognise and establish appropriate ways in which to examine the research context with a view to yielding knowledge for the field of urban design. Although Creswell (2009) states that a pragmatic worldview is relevant to mixed methods research, and this is a qualitative piece of research, it is argued that this is still a useful worldview to adopt as a discipline of urban design which in itself is influenced by quantitative and qualitative stimuli, and exists in a multiplicity of disciplines which strike their own quantitative and qualitative balance. Creswell (2009) states there are many forms of pragmatist worldview; this research attempts to provide a contribution to pragmatist urban design research.

Philosophically, urban design makes a lot of assumptions: that a world exists external to the mind, that a world exists perceptible to the mind, that this world is susceptible to shared experiences, that society exists and that people can be patients and agents (Rykwert, 2000) of this physical reality. According to Creswell (2009), a pragmatist worldview accepts reality as existing both within and external to the researcher, and therefore, in the aforementioned philosophical context, appropriate to a piece of research conducted through this urban design lens. Adopting this position allows for the acceptance of the existence of socially experienced and constructed realities (such as the built environment) with an appreciation that every person's perspective on a built environment differs to at least some degree.

Further to these philosophical arguments, Creswell states that the purpose and consequences of a piece of research are crucial to the position of the pragmatist worldview researcher (Creswell, 2009). The purpose of this research is to be of use to urban design in the context of RRCs in the United Kingdom. As a consequence of this, it was the intent of this research to create a body of information that can be used in this context, primarily by urban designers, but also those involved in the consideration, procurement and execution of the built environment in this context. This was done by the mapping of normative urban design codes across the real world context of RRCs in the United Kingdom. The adoption of the pragmatist worldview, attuned to the specific research problem, allows for this outcome.

The concept of truth to one of a pragmatic worldview is based upon *"what works at the time"* (Creswell, 2009, p. 11). This implies two key factors: what works; and a temporal factor. It is argued that the data collection sources and the analytical procedures used work for urban design; they are long established and have been given consideration with regard to contemporary contexts and technologies. In terms of collecting evidence of

urban design at RRCs, if truth is what works at the time, then a truth is a legitimate way of collecting, depicting, analysing and disseminating the contemporary condition of place in that context.

These philosophical stances lead to a problem prompting the consideration of methods, techniques and procedures adopted (Creswell, 2009). Case study method was chosen as it helped structure, delimit and pinpoint real-world phenomena. The data collection techniques reflect the nature of urban design, being split between written and visual data. The procedures used to synthesise and analyse these datasets are explicitly applicable to the production of empirical truths in the built environment. The combination of this suite of established ways of thinking and working combine to produce a robust system of data collection and analysis which underpins justifiable findings in the context of urban design and RRCs.

It is argued that this research provides both justification and knowledge in the context of urban design at RRCs. Empiricism allows for the collection of evidence from real world situations. These data collected in real world situations are controlled through the case study method. Pragmatism is therefore put forward as a legitimate worldview under which to collect, depict, analyse and disseminate the accumulated evidence. It is argued that responding to these two key issues of justification and knowledge, in the ways set out above, give robustness, legitimacy and an appropriate degree of replicability to the findings of this research.

3.2 Conceptual Framework & the Research Conceptualisation

The key underpinning ideas of this research set out in this conceptual framework incorporate the nature of knowledge in urban design, the limitations of this knowledge and the manner in which this knowledge is acquired. Knowledge in the field of urban design is rarely entirely objective nor absolute and due to it being a field of design, subjectivity is inherent. This has necessitated, as part of the conceptual framework, a mediation between the epistemological imperative for truth in an intellectual territory that is real world centred, complex and often ambiguous. This does put limitations on the claim to knowledge made as part of this research, however, it is argued that the truths produced in this research are both valid and useful to the discipline. In order to arrive at these urban design truths this research draws upon two key existing paradigms; critical regionalism and visual methodologies.

The nature of knowledge in urban design from the perspective of this research, is conceptualised in the theory ‘critical regionalism’. This theory, although primarily concerned with architecture (Frampton, 1992; Tzonis & Lefaivre, 1996), formulates a framework for assessing the aesthetic of built environments as the meeting point of cultural,

economic and political influences. As it is an architectural theory operating at the regional scale it covers the traditional scale of urban design. Inherent in this is a capacity to make observations and assessments of the built environment from the detail scale design to the regional scale design. Critical regionalism is therefore inherently complex, as is the territory of inquiry in this research. It is argued this theoretical framework allows for detailed consideration over a broad scale, reflecting the breadth inherent in the territory of inquiry.

This theoretical framework comes with limitations, especially when adopted in parallel to established research operations. Subjectivity is a core issue concerning observations made of the built environment, specifically normative notions of urban design. The scope of critical regionalism is geographically large which causes problems for a piece of research, for instance where procedural guidance suggests that a piece of research should 'say a lot about a little as opposed to a little about a lot'. This 'bigness' in critical regionalism is endemic of the complexity of this theoretical framework. The complexity is not limited to geographical territory, it is inclusive of cultural elements, political elements, temporal elements, etc. These limitations are firstly acknowledged, and secondly it is argued that significant measures have been introduced into the research protocols with a view to mitigating the detriment of these limitations through use of predominantly visual methodologies.

Both the theoretical framework in combination with the territory of inquiry inspire the acquisition of knowledge through a visual methodology. This approach acknowledges that the collection of data in the built environment can be biased to the visual. Once this data has been collected, it is argued that an appropriate way of analysing this visual information, in the field of urban design, is to scrutinise the content of these visual datasets. These visual datasets can then, thanks to contemporary technology, be shared and disseminated readily. Due to these inherent advantages, it is argued the visual methodology adopted in this research contributes to understanding at the forefront of urban design at RRCs.

This conceptual framework is a synthesis between critical regionalism and visual methodologies and this subchapter will set out the appropriateness of this. Critical regionalism is complementary in outlook to an urban design study of RRCs. It also points to the usefulness and legitimacy of a specific visual methodology for the generation of knowledge in this context. This methodology sets out the structure of the inquiry, arguing its validity and rigour. This conceptual framework is driven by the two key components of the research: the nature of the object of study (RRCs); and the discipline for which the research results are intended (urban design). The following subchapters explain the key components of the conceptual framework in more detail and how critical regionalism and the visual methodology adopted lead to epistemological claims.

Critical Regionalism

This research argues that critical regionalism is an appropriate theoretical framework through which to conduct an inquiry into urban design at RRCs. Critical regionalism is discussed in further detail in chapter 2.1 in relation to the research questions and other salient theories. Here, critical regionalism is discussed as a theoretical underpinning to the research and subsequently how this informs the visual methodology. This chapter summarises the parallels between critical regionalism and urban design at RRCs. It is not claimed that critical regionalism and urban design at RRCs are analogous, however there are a number of threads that correspond in the way in which the problem has been conceptualised in this research, that exist in critical regionalism. It also briefly discusses the relationship between urban design in critical regionalism and how this has informed this research. It is argued that critical regionalism as a concept is at a scale equitable to this research; the scale of RRCs. The ideas contained in this summary have significant implications for the methods and methodologies adopted in this research.

There are a number of conceptual parallels between critical regionalism and the object of study. Both critical regionalism and RRCs have significant aspects that involve looking retrospectively whilst considering contemporary built environments. In both instances this is a critical re-evaluation of previous events. Critical regionalism rejects nostalgia, so a RRC is endemic of contemporary requirements, as opposed to a heritage railway line that represents nostalgia – two different approaches to what is ostensibly the same geographical type of terrain. Critical regionalist designs are responsive at the intersection of global forces and local conditions. The same could be said of an urban design at a RRC. These urban designs exist at the intersection of a number of pressures. These aspects have ramifications for how the built environment can be observed, mapped, depicted and cross-synthesised using visual means.

Visual and aesthetic traits of the physical environment are central to critical regionalism. This research uses a number of these traits with which to form the basis of evaluations of visual data. Critical regionalism offers a framework where the regional implications of such aesthetic traits can be considered on a number of levels. Places can be considered individually, concurrently within a set of coalescent examples, and also at the regional scale as a whole. Critical regionalism introduces such tensions in the built environment as kitsch and authenticity. This is something that can also be evaluated through the use of visual data. Critical regionalism discusses a response to a regional topography, something that is rich in discussions surrounding RRCs. This, again, is something that can be evaluated through the processing of visual data, for example topography maps, photography and the cross-synthesis between cases of pertinent examples. Regional design, place characteristics, ideas of authenticity and topographical responses all manifest in real

world scenarios and built designs. These can legitimately be focused upon through the visual domain.

Fundamentally, this theoretical framework allows for the scale of 'the region' to be considered as both a unit of design in itself, and concurrently with a number of components and/or constituent parts. Regions never exist as one homogenised settlement typology. Implicit in critical regionalism is an acceptance, and perhaps celebration, of the variety of settlement typologies within an overarching region. There is also further variety in terms of cultural activities, political boundaries and attitudes, and visceral aspects, all of which can be encapsulated within the aesthetic. This underpins what can be seen as an inherent paradox central to critical regionalism: its framework for a place-specific regional identity. It is argued that this paradox is inherent in this research also, using a RRC as the basis for collecting urban design evidence.

There are, however, a number of limitations inherent in using critical regionalism as a component of the conceptual framework for this research. Critical regionalism is an architectural paradigm not an urban design paradigm. This leaves the framework used in this research potentially open to criticism. Whilst it is acknowledged that architecture and urban design are different disciplines, in the specific context of this research it is argued there are enough crossovers to mean that the principles of critical regionalism are still relevant. Critical regionalism opposes the prioritisation of the visual over the other senses. This research relies heavily on the visual, although this is for scoping and technical reasons, as opposed to philosophical reasons. A further limitation of critical regionalism is that, at this stage of investigations into this particular territory, the observations rely on the researcher's subjective perspective. These limitations are acknowledged; further, it is argued these issues are mitigated via the use of the specific visual methodology and the protocols instilled in the research techniques.

It is for the above reasons that critical regionalism is utilised in the conceptual framework. It is relevant to the object of study, the anticipated audience of the findings of the research, and works at the scale of a RRC. This has prompted the visual methodology adopted as part of the conceptual framework, as explained in the following subchapter.

Visual Methodologies

The purpose of this research is the acquisition of knowledge in urban design, and as such a visual methodology is posited. This follows the process set out by Banks:

> *"Ideally, one should formulate an intellectual problem, then consider the most suitable subject or empirical context for investigation, and then consider which methods within that context are most likely to yield data that will address the problem." (Banks, 2007, p. 8)*

The intellectual problem formulated revolved around urban design and RRCs. Following the above format, three RRCs were identified as the empirical context of this research. It is argued that primarily visual methods are appropriate in yielding data for the consideration of urban design at RRCs. It is impossible to claim that urban design is an entirely visual discipline. This research does not attempt to do this, however what it does say is that urban design exists in a world that can be interpreted through the ocular. This research relies on a sympathetic position to Gray and Malins following appeal for visual evidence to be given credence in research that operates within design disciplines.

> *"The argument in this topic has been for a wider acceptance of the visual in the research process, especially for researchers in the visual disciplines, but also in others where it might be appropriate, for example engineering, information sciences."(Gray & Malins, 2004, p. 97)*

This acceptance implies a responsibility for research, such as this research, to demonstrate attention to the foundation of the adopted visual methodologies. Researchers that operate within the qualitative tradition argue a legitimate trajectory of enquiry is to employ the making of 'visual data' as part of a systematic enquiry (Rose, 2007). This requires significant methodological attention as it differs from the traditional use of photographs in research (e.g. photo elucidation). What differentiates photography as part of this research process, as opposed to the traditional use of photographic research (found or solicited photographs for instance), is that the photographs are created by the researcher, firstly as a thing in themselves and also in order to be used in conjunction with other data.

This research is exploratory as opposed to confirmatory. It will collect urban design evidence across a number of RRCs. There is no hypothesis on this subject to refute. This approach is in line with Banks' explanation of visual methodologies.

> *"That is, visual methodologies are not so much employed as a method to gather data of predetermined size and shape that will confirm or refute a previously posited hypothesis, but as a method designed to take the researcher into realms that she may not have considered and towards findings previously unanticipated." (Banks, 2007, p. 10)*

Unanticipated findings is what this research sought, with a view to collecting, organising, comparing and disseminating empirical evidence regarding urban design at RRCs. If it is accepted that urban design falls within the sphere of design, Gray and Malins (2007) propose a starting position that considers the assumptions behind research. In doing so, they raise three key questions to the formulation of a methodology:

> *"So how should you start to consider your research approach? ...We must start from first principles and examine our assumptions about research. We must consider basic questions such as: What could research in Art and Design be? Why might artists and designers do research? Before we ask. How might artists and designers do research?" (Banks, 2007, p. 18)*

To paraphrase from the first question above, research in urban design can be rooted in real world contexts, complex and subjective. Urban design research can benefit from the visual. The summary answer to the second question is that a designer might conduct research in order to utilise the advantages of the practitioner-researcher (Gray & Malins, 2004): experience of the field can lead to credibility. Being an 'internal' not an 'external' researcher can increase trust and reflexivity. As a reflexive researcher-practitioner, thorough inquiry establishes an appreciation for the forces acting upon the real world situation under study.

These advantages highlighted also come with significant drawbacks. These drawbacks relate to how a piece of research can claim truths and the systems of inquiry associated with attaining such truths. These issues are crystallised by Gray and Malins (2004) who urge for a prioritisation of methodologies and methods that relate to practice. Research protocols are offered as a mitigating technique to questions regarding rigour and validity:

> *"What might be more useful is the notion of 'protocols' (Langlois, 2003) – explicit 'rules of conduct' specifically related to an individual's research project, allowing a clear understanding of procedure (transparency), but acknowledging that complete transferability is not achievable, nor perhaps desirable." (Gray & Malins, 2004, p. 18)*

The research achieves such a transparency; as the protocols are explained later in this chapter. It is argued these protocols are appropriate to the research questions, the territory of inquiry, the researcher's abilities and the field to which any findings apply. This research relies upon reification of visual data. Although the claims to knowledge through the findings of this research are based on the comparison between these data, the visual data collection, storing, analysis and presentation processes are given close attention.

Considering that visual sources are accepted as genuine sources of data (Flick, 2009) the generation of this data is focused upon. Using photography as an example, the relationship between the researcher and the artefact is crucial. Barthes (1982) sets out a number of relational frameworks between the photographer, the photographed and the user of the photography. In this research, the researcher observes phenomena using photography, and these images are analysed individually and collectively. Concurrent with any visual methodology, the visual data in this research is used more than solely for illustration purposes. It is intrinsic to the cognition and observation of the selected places.

> *"Importantly, these are not images that simply illustrate some aspects of the research project: what Marcus Banks (2001:144) calls a 'largely redundant visual representation of something already described in the text'." (Rose, 2007, p. 237).*

This research process is composed of predominantly visual sources, comprising at least two thirds of the data; photographs, maps, urban design drawings and urban design diagram overlays. Although these visual data are crucial to this research it should be stated that there

is still an interdependency (Rose, 2007) between the visual data and the text: the visual data is made evident via a textual relationship back and forth between the literature.

This research adopts a visual methodology that uses an array of multiple methods (Gray & Malins, 2004) that are predominantly derived from urban design practice. This ensures relevance to the real world centred problem under study, correlation with the underpinning theories of the study and usefulness to the intended audience of the study.

An Epistemological Stance

This subchapter sets out the epistemological stance upon which the claimed truths in this research into urban design and RRCs rest. It is not claimed, akin to the quotation below, that this research's pursuance of knowledge and justification draws into being any ideals in human life. However, this research follows the balanced position of simultaneously 'trying to achieve knowledge' whilst refraining from forming unjustifiable beliefs:

> *"Well developed concepts of knowledge and justification can serve as ideals in human life. Positively we can try to achieve knowledge and justification in relation to subjects that concern us. Negatively, we can refrain from forming beliefs where we think we lack justification, and we can avoid claiming knowledge where we think we can at best hypothesize." (Audi, 2011, p. 11)*

This following section defends the foundations upon which the claimed truths made in this research are based. This defence relies upon being explicit about what constitutes grounds for belief concerning urban design and RRCs. The 'positive' (Audi, 2011) claims made within the findings of this research are based upon observations of real-world scenarios of the urban design of RRCs. To this effect, the claims to knowledge within this context mean that this research's findings rely on empiricism. It is argued this research goes beyond what Bryman (2004) describes as naïve empiricism: the 'accumulation of facts as a contribution to knowledge'. Although in this research context such an accumulation can prove useful, it is argued that the knowledge gleaned in this research's findings goes beyond this. These findings are grounded in experience and observation, which have been accumulated under rigorous research protocols. This means it is viable to extrapolate trends through cross-case synthesis, which is argued an appropriate strategy within this research context. This research reflects upon the complexity of urban design in these empirical situations, especially regarding the aforementioned epistemology of this research which informs commensurate methods used in the collection data.

It is important to delimit the claims to knowledge made in this research. These delimitations are based upon the nature of the evidence collected, the manner in which it was collected and the way in which it was analysed. The findings of this research stop before beliefs are forwarded that lack justification (Audi, 2011). It is acknowledged that much of

the data collected is subjective, but argued that this is necessary due to the scope of existing knowledge regarding urban design and RRCs. Had a pre-existing corpus of visual data on the urban design of RRCs been prepared, then this research would have been carried out in a very different manner. For example, stakeholders, decision makers and policy makers in the respective territories of inquiry would have been solicited for their perspectives. Unfortunately, any corpus of such data was not uncovered and therefore it was decided this task required the primary focus of this research. Inherent in this process is an appreciation of the limitations of the parameters set out in the research methodologies and protocols. Therefore, the findings are necessarily circumspect, not making claims that go beyond justification. It is argued that this is a strength of this research, as one of the stated purposes is to contribute to the suite of analysis techniques applicable to urban design and RRCs.

This section explains the 'grounds of belief' underpinning the claims to knowledge made in this research. Audi (2011) sets out three separate kinds of 'grounds of belief': the causally grounded belief, the justificationally grounded belief and the epistemically grounded belief. Whilst these kinds of grounding often coincide (Audi, 2011) the treatment(s) of data in this research can be justified through consideration of these three criteria. Audi (2011) equates causally grounded claims as an answer to the question of 'why do you believe that?'. The findings of this research point to cross-case synthesis carried out in the comparative analysis; 'I believe 'that', because examples exist in 'XYZ' places and correspond/contradict with 'ABC' normative urban design theories.

Audi (2011) equates 'justificationally grounding' to the questions 'what is your justification for believing that? Why should I accept that?' This research points firstly to the process of triangulation adopted throughout the comparative analysis. The third kind of 'grounds for belief' as set out by Audi, 'epistemic grounding' is explained as a response to the question 'how do you know that?'. The findings of this research are reliant upon the observations of the 'reflexive practitioner-researcher' (Gray & Malins, 2004). This draws upon a corroborative perspective drawn from the researcher's professional practice and review of normative urban design/architectural theory. If the findings of this research were claiming to be 'absolutes', then this approach would be abhorrent. However, they are not. The data collection protocols mitigate to a degree the inherent subjectivity of the observations made and further, the findings present a breadth of evidence which is intended to both generate knowledge and inform future inquiry. It is argued the findings in this research further the knowledge in the territory of urban design and RRCs through this 'preparatory exercise'. A degree of value lies in the findings themselves, and how they could be used as an inception point for further study that progresses to address the major criticism to this methodology concerning subjectivity and bias, by inviting and soliciting the views of stakeholders on the visual data.

In summary to the conceptualisation of this research, it is acknowledged that an inquiry into the urban design at RRCs could be carried out in a number of ways. This chapter discusses what, for the purposes of this research, can constitute legitimate and useful knowledge in urban design. The links between the theory of critical regionalism and the adopted visual methodology are stated. This has both benefits and limitations which are informed by this epistemological stance. It is argued the conceptualisation of this research is appropriate to the territory of inquiry, the findings are relevant primarily to the field of urban design and that the research methods and their respective protocols complement and inform the researcher's worldview, having both validity in research terms and to urban design in general.

3.3 Qualitative Inquiry & Case Study Design

The territory of enquiry, the anticipated primary audience for this research and the practitioner-researcher's worldview all point towards a qualitative strategy of enquiry being an appropriate approach to the research questions. It is acknowledged that this is not the only strategy of enquiry applicable to an urban design analysis of a RRC; however, the following subchapter will demonstrate that this research design does hold enough warrant to yield knowledge in the field. Flick (2009) writes as part of setting out the case for qualitative strategies of inquiry in a continually evolving and pluralistic world: *"Locally, temporally and situationally-limited narratives are now required." (Flick, 2009, p. 12)*. It is pointed out here that there is an interesting relation between this idea and the theory upon which the conceptual framework is based. Critical regionalism, as a way of analysing designs in the built environment, has a very particular stance that sits between the situationally-limited context of an urban design at RRCs, its temporal issues and its position within 'local – regional – global' debates.

Flick (2009) calls for a set of inductive strategies with which to complement more widely adopted deductive strategies. For the specific piece of research the inductive qualitative strategy is case study. This 'linear yet iterative process of investigation' (Yin, 2009) is adopted in order to accrue urban design knowledge at the territory of RRCs. This strategy of enquiry is not without limitations or criticisms; however, these are addressed and mitigated through the case study design and data collection protocols.

The diagram below by Yin (2009) describes case study research as *"a linear but iterative process" (Yin, 2009, p. 1)*. This is reflected in the design and execution of this research. It was linear in relation to moving towards the goal of producing the findings. However, this progression relied upon constant reflexivity: reflection upon the phenomena under study, towards the manner in which the phenomena were studied and the depth of findings secured in regard to these phenomena. Accommodation of the iteration process is

also useful bearing in mind the lack of previous study of urban design at RRCs, it allowed for the to-ing and fro-ing between real-world situation and analysis. In this spirit, research methodologies evolved as this research progressed. There are also parallels between this iterative process and the field to which the findings of this research apply: urban design. The process of urban design (arguably as a form of design) is highly reiterative. These parallels point to a degree of appropriateness between the selection of case study method, the territory of enquiry and the field to which the findings will be of most relevance.

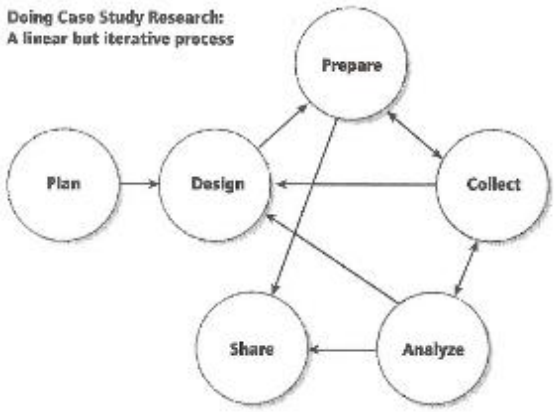


Figure 3.1 Yin's Case Study Research Diagram

Source: Robert K. Yin (2009)

It is acknowledged that a qualitative strategy of enquiry using a case study is not the exclusive path to generation of knowledge regarding urban design RRCs. Proverbs and Gameson (2008) set out a number of key issues to consider during the process of selecting a research strategy; a crucial one is that where quantitative methods are not to be employed, but that they still be considered and that there is robust explanation for their elimination. This research did just that. The position at the beginning of the research was a completely open mind as to how to best examine the topic. Case study method was arrived at after visiting real-world situations and relating the observations to relevant theories. It is through this iterative process, informed by the territory of enquiry, that case study method was arrived at. Once the case studies had been identified the case study design followed a similar thought process.

This process of reiteration that guided the research design was constantly mindful of the inherent limitations of case study method. Yin (2009) sets out four primary bases for concerns regarding case study method; a lack of rigour leading to the distortion of evidence (used to prove a point), a lack of potential from which to draw generalisations, scoping issues, and fourthly that case studies rarely define causal relationships. The second criticism noted by Yin is that case studies lack the potential from which to draw scientific generalisations (2009). Although this is agreed, it is argued that there are other types of generalisations that can be both valid and indeed valuable to urban design.

> *"The short answer is that case studies, like experiments are generalisable to theoretical propositions and not to populations or universes. In this sense, the case study, like the experiment, does not represent a 'sample,' and in doing a case study, your goal will be to expand and generalise theories (analytic generalisation) and not to enumerate frequencies (statistical generalisation)"(Yin, 2009, p.15).*

Regarding this specific research, it is argued the comparative analysis bears a number of generalisable findings. Scoping issues, or 'the potential for completing the study in a realistic timeframe' is the third main criticism of case study strategy summarised by Yin (2009). It is noted that case studies can be overly descriptive, and unnecessarily long in narrative with consequently fewer or limited conclusions. It is acknowledged that this research does contain long narratives regarding the respective case studies. However, it is argued this is necessary due to the complexity of the topic being studied and the lack of existing background in this area.

Yin (2009) states that critics of case study research strategy object to the nature of case study enquiry as it is not randomised, field trials not being 'true experiments'. The argument here is that a 'true experiment' is looking to establish 'causal relationships'. This research is not aiming to prove causation relationship, it is aiming to collect, analyse and disseminate empirical evidence in a field where there is relatively little previous study.

It is therefore argued that a case study is an appropriate way of achieving the aims of a qualitative study into urban design at RRCs. A case study method represents a synergy between the inherent nature of the territory of enquiry, the applied field to which any findings will be relevant and to the reflexive-practitioner-researcher conducting the study. Within this specific piece of research it is therefore argued that a case study strategy is appropriate due to its narrative nature, the requirement to draw upon multiple sources of data and, the critical triangulation between the sources of data (Proverbs & Gameson, 2008). All these aspects suggest a system of enquiry that could be potentially of use and generalisable to any further real-world context. "Case study research appears to be highly relevant to industry that is project-driven and made up of many different types of organisations and businesses." (Proverbs & Gameson, 2008, p. 100). Urban design is certainly project-driven, these 'projects' are the conflation of many organisations or perspectives.

The opportunity inherent in case studies allows for both broad-brush contextual analysis whilst concurrently taking into account detailed place-specific issues and exploring their interaction with each other. Case studies allow for the 'provision of meaning in context' (Proverbs & Gameson, 2008). Therefore case study is, it is argued, ideally suited to this research examining the urban design of RRCs. The following subchapters explain the process that was undertaken in designing the case studies.

A Rationale for Case Study Method

This subchapter sets out the reasons for and intentions inherent in the use of the case study method in this research. A case study method has been adopted in this research because it best enables attention to real-world examples of urban design at RRCs. It is the intention to use these case studies to search for the endemic trends that are generalisable to other urban designs at RRCs other than those focused upon as part of this research. This is intrinsically linked to the protocol of case study design; how the cases are circumscribed, what constitutes a completed case and how the phenomena within the particular cases can be justifiably observed using an urban design lens. The reasons, intentions and procedures used in this research will now be explained.

A primary reason for choosing the case study method in this research is that, it is argued, the findings will be generalisable beyond the limitations of the specific case studies. Although these findings are necessarily circumspect they are nonetheless endemic of trends beyond the three selected case studies. Further to that, the findings could also be useful to the practice of urban design at RRCs in either alteration to existing formulations or future conditions. Another reason for choosing case study for this research is that, as Flick (2009) argues, case studies are most fruitful when used to frame the triangulation of several methodological approaches. This runs parallel with the practice of urban design and its many influences. It also allows the accommodation of the visual methodologies adopted in this research alongside other more widely adopted textual approaches.

The intention to produce a piece of rigorous research led to the case study method being adopted. A case study method requires a clear set of protocols with regard to what is studied, how it is studied and how it is analysed. These processes are described in the rest of this chapter. It is also the intent of these case studies to be fair and representative of the facts, as perceived through an urban design lens. This has prompted the consideration of the role of the researcher in the research; complete objectivity is impossible. Further, is it genuinely desirable within the field of urban design? As part of the case study into the real-world phenomena, the researcher has entered physically into these territories. This has intrinsically changed the territories under study; however, it is argued that the data collection protocols, set out subsequently in this chapter, mitigate these interruptions to the point that the findings remain valid.

A further important aspect of the rationale behind case study method is its capability to form the framework for an inductive piece of research. This research is about going out into a field of enquiry, collecting evidence and then synthesising that evidence into findings. Criticisms of the case study method argue that this can lead to chance or conjecture influencing findings. This has been reduced as much as possible in this research by the data

collection protocols. It is argued that this inductive approach is appropriate to this piece of research into urban design at RRCs.

The foremost procedural concern of case study design is the circumscription of the specific area of enquiry. The process of definition of the object of study has been one that is akin to that of filtration. It was broad at the beginning and was refined throughout the course of the research. This process was considered from the outset, perhaps even before the decision was taken to adopt case study method; it was an instinctive choice, not without continual critical assessment, but a process that began with a pragmatic approach to engagement with the initial research question. *"Although the case study is an inductive approach, perhaps even the ideal inductive approach, that does not mean the definition of the object matter is of chance or conjecture."* (Hamel, Dufour, & Fortin, 1993, p. 41). This process of filtration had three main phases. The first phase looked at creative and international use and reuse of disused railway infrastructure. This was then narrowed to focus on the United Kingdom and more pragmatic uses of disused railway lines. The third phase was the selection and justification of the three cases adopted in this research. It is argued this process added value to the research. It helps paint the larger picture of the topic of study by placing it within a creative and global context. Once the three case studies had been selected, this iterative process of filtration adds further value as the contexts of the respective cases are examined. Deeper understanding of these contexts at the macro scale adds credibility to the findings at the micro scale. Referring back to the criticism of case studies highlighted by Yin (2009), that case study method can be used to distort evidence; the fact that this research puts forward as much macro scale evidence as possible is intended to allay such criticisms from this research's audience.

The other salient consideration in terms of case study procedure is that of completeness. Every effort has been made to 'complete' the case studies. Completeness, for Yin (2009) is characterised in three ways: when the case of the boundaries are given explicit attention, when exhaustive efforts have been made in the collection of relevant evidence, and the study is not constrained by artificial conditions (such as time or expense). It is argued this has been done in this research. This extent of 'completeness' can be scrutinised in the case study database in the appendix. The boundaries of the selected cases are clearly defined and are consistent across the differing cases selected. The collection of relevant evidence has been exhaustive, both in terms of entries into the field and evidence collected at the desk. It is argued this has not been constrained by artificial conditions.

The rest of this subchapter explains the case study design by highlighting the selection process behind the three case studies that were used. Phase one of the selection of the case studies for this research was the contextual review (Chapter 1.2). This contextual review covered an international selection of reused, repurposed and recycled railway

corridors that exhibits a variety in terms of urban design response. This variety includes elevated linear parks through city centres and moving master plans where buildings utilise the disused railway tracks in order to perpetually reconfigure the built environment. However, in terms of the overall research question *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?'*, these examples where are the differing International context and, crucially for this research, were somewhat unique and therefore held less potential for generalisations to be made through analyses.

Phase Two therefore concentrated upon reused, re-repurposed and recycled railway corridors within the context of the United Kingdom. This review of potential case studies was carried out with regards to the overall research question (stated above) and the three detailed research questions that look to examine recycled railway corridors at the regional scale, the neighbourhood scale and in terms of transport mode. Within the United Kingdom there are three light rail networks which were discounted as potential case studies for this research due to the fact that the majority of their routes are not along previously disused railway corridors. Although 10% of the 'Sheffield Supertram' network is along recycled railway corridors this research sought examples where a higher proportion of the network relate to reconsidered previous railway alignments. The Blackpool and Edinburgh tram networks do not utilise previous railway alignments. There are two public transport networks that do utilise previous railway alignments that have been discounted as potential case studies for this research; the 'Tyne & Wear Metro' and the 'Manchester Metro'. Whilst these networks have a certain percentage of their routes upon previous railway alignments, these two instances where more akin to conversions than recycled railway corridors. Both the 'Tyne & Wear Metro' and the 'Manchester Metro' saw their respective alignments closed only for engineering work to be carried out (over a relatively short period of time) in order to facilitate the adjustments in transport mode. This research sought examples of recycled railway corridor where prolonged periods of dormancy were apparent in the disused railway alignment. This was done in order to highlight any large-scale strategic development that was carried out in parallel to the recycling of the railway corridor.

This process reduced the pool of potential case studies to seven; three heavy rail networks, three light rail networks and a guided busway:

- Robin Hood Line (Nottinghamshire)
- South Wales Rail
- Borders Rail – Waverley Line
- Nottingham Express Transit Phase 1
- Midland Metro (Wolverhampton)
- Croydon Tramlink
- Cambridge Guided Busway

Of this selection the Midland Metro and Croydon Tramlink were discounted due to the fact their routes only pass through city area types. Within phase three therefore, the Robin Hood

Line / Nottingham Express Transit Phase 1 (that share a RRC, as illustrated in Chapter Four), the Cambridge guided Busway and Borders Rail – Waverley Line address the research questions in the following manner.

The research question concerning place qualities at the regional scale calls for a variety of regional landscapes within which to observe urban design responses along R.R.C.s. there is variety in the adopted case studies from the relatively isotropic Cambridgeshire Fens to the mountainous Scottish Boarders. The three selected case studies traverse a variety of area type contexts (Breheny & Rookwood, 1993) from the city core to the rural periphery meaning the research question concerning place qualities at the neighbourhood scale can be addressed. These three selected case studies have a variety of transit modes adopted. Heavy rail in the Boarders Rail-Waverley Line, the emerging guided busway mode in Cambridge and the parallel configuration of heavy and light rail in the Nottinghamshire RRC. This enables focus upon the research question pertaining to transit mode and the urban design of RRCs.

3.4 Data Collection Sources

This research sets out to collect data regarding the built environment. Evidence for this research was collected using three of the six potential data sources set out by Yin (2009): documents; archival records; and direct observation. Each of these three sources have different data collection procedures which are set out subsequently in this chapter. Whilst ordinarily a study would set out to collect data regarding actual human behaviour (Yin, 2009), this research looks at how the decisions of human beings, through the process of urban design, manifest in the built environment. It will collect data on these built environments. The passage by Joseph Rykwert (2000) below, likens cities to a game of 'chance and rule'.

> *"The Greeks, who used the word polis for the city, used the very same word for a dice-and-board game that, rather like backgammon, depends on an interplay of chance and rule. The players' skill is shown by the way they improvise on the rule after every throw of the dice. If the analogy works, it would follow that we are agents as well as patients in the matter of our cities. Cities and towns are not entirely imposed on us by political or economic direction from above; nor are they quite determined from below by the working of obscure forces we cannot quite identify, never mind control." (Rykwert, 2000, p. 5)*

Adopting this analogy, this research is not looking to find out how the various actors played the game but what the results of this 'interplay' are in the context of RRCs. Perceptions and attitudes towards these results are for further study, this research concentrates on collating and exploring empirical evidence. Yin's (2009) three key principles regarding case study

sources will be followed: multiple (and ultimately convergent) sources are used; a case study database is created (see appendix); and a chain of evidence is argued from the beginning of the research questions, carrying on through the data collected into the conclusions presented.

This thesis seeks to examine a blend of multiple sources appropriate to the field of urban design in the built environment. The nature of the research questions and the disciplinary orientation of urban design exacerbate the requirement of case study design. The phenomena under study have a temporal aspect, therefore the collection of a certain amount of archival records has been necessary. These phenomena also cover a variety of scales from the regional design to the detail design. This has necessitated the collection of document sources that cover policy at these scales. Furthermore, it is argued that a valid source within the field of urban design is that of observation. Observations made at precise points in the case studies are taken and argued to be evidence of certain design-based criteria.

It is argued that a certain quantity of data has to be collected so as to allow confirmatory evidence to be cited, e.g. any claim is backed up through evidence derived from a minimum of two types of source, often more than two. None of the sources selected for this research have primacy over any other. They are complementary and attuned to gathering data to specifically answer the research questions. Archival records aid the appreciation of the cycles inherent in recycling railway corridors. Documents provide evidence of policy intentions and proposed masterplanning interventions. Direct observations provide empirical evidence of how the built environment has come to fruition within the territory of recycled railway routes. Within these categories, a further variety of sources are used, reflecting the complexity of the territory under study. The following three subchapters take these sources in turn: documents, archival records and direct observations.

Document Sources

The document sources chosen in this research are: White Papers; Current National Planning Policy (NPPF); Regional Planning Policy; Formal Studies/Evaluations; Masterplan Planning Application Submissions; and Public Construction Progress Reports. These sources were chosen for their breadth in that they respect that RRCs are a national scale concern, but recognise that they transcend the regional, conurbation and local scales. Evidence is drawn from both written and visual types of document, reflecting the nature of information created during the process of urban design.

The following passage shows how the documentary sources chosen for this research are scrutinised in terms of accuracy, bias, purpose and usefulness to the research questions. The following documents are used to corroborate evidence from the other two types of sources used in this research. The collection of information augments the information gathered through the archival records and the direct observations. There are, however,

instances where results have been contradictory between two differing kinds of sources as opposed to corroborative. In these instances, the other types and forms of sources have been examined.

The nature of place and urban design as executed in the real world is intrinsically linked to planning policy. Therefore, it is argued that planning-based documents are a valid source for addressing the question: *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?*'. The unsolicited documents selected for this research are: White Papers; National Planning Policy; Regional Planning Policy; and Reports/Evaluations specific to the case studies. This list is not exhaustive but broad enough to constitute a review of the most salient sources for the research questions.

These documents are often a mix of written and visual documents with larger scale national planning policy documents being predominantly written documents and conversely masterplan planning applications being predominantly visual documents. It is rare that a planning policy document is bereft of any form of visual information, equally a planning application will contain much written information but the core proposition will be a visual one. To ensure consistency across the case studies the documents were collected systematically, the precise protocol for this is discussed further in this chapter. It is argued that in the context of the research question, this procedure amounts to a thorough review of relevant documentary evidence.

Although crucial and integral, documents are not unduly relied upon in this research. Nor are they considered 'bias-free', 'meaning-neutral artefacts' that contain, as Yin (2009) puts it, the unmitigated truth. Generally however, planning policy documents follow a strictly adhered to process of governmental scrutiny before they are published, be it at the national, regional or local scale. The respective bias/purposes/audiences of each type of document are discussed in more detail within the specific protocols below. Integrating these documents into the research design (and including the archival records) is used as a counterbalance to the direct observations made at real-world examples in the case studies. By vicariously setting out the intentions of policy makers and design practitioners as a foil against the direct observations made, it is argued that a balanced (although not exhaustive) set of sources is established. There are inevitable discrepancies between broad-scale policy documents and finer-grain masterplan planning applications which highlight the issue that documentary evidence can mislead a research process (Yin, 2009). The identification of the objectives of the documents, as discussed below, has the intention of avoiding such diversions through the continual reflection of the documents against the research questions.

Both the sets of documentary sources below are not exhaustive in the field of enquiry. It has been necessary to triage the broad corpus of information regarding planning

policy and salient masterplan planning applications and sort these sources into the respective categories of either predominantly 'written' or 'visual'.

Archival Record Sources

Temporal factors are crucial to the conceptual framework of critical regionalism and the theoretical lens of urban design through which this research has been carried out. Therefore, archival documents have been important. The following archival record sources have been used: Beeching Report (Part 1 The Report); Superseded Planning Policy Documents (e.g. PPG13); Historical Rail Atlas (Cobb, 2006); Historical Photographs; Digimap/Ordnance Survey Data; and 'General Arrangement' Construction Drawings. These archival sources cover a sixty-year period between the publishing of the Beeching Report in 1963 and the Digimap Ordnance Survey Data, which is updated continually via electronic means.

Archival records are treated in a similar way to documents in this research. The selected sources are scrutinised in the same way as documents in terms of accuracy, bias, purpose and usefulness to the research questions. A further aspect that requires consideration, due to their temporal nature, is when these archival records were created/published and how this context affects their accuracy. Also worthy of significant consideration is the period of time over which their influence presides.

As with documents, it is argued that archival records are prescient in the approach adopted here with regard to the research question, '*Why is urban design important in the case of the UK's recycled railway corridors' built environments?*'. When considered in conjunction with the selected documents and the direct observations made, the archival records below provide insights. Implicit in the concept of a RRC is the notion of palimpsest, the analogy of the cyclical process of writing, erasing, and re-writing upon a stone tablet. Also, critical reappraisal of previous conditions as a formative and informative element in design is central to a conceptual framework rooted in critical regionalism (Frampton, 1996) therefore, a balanced use of archival records with other more contemporary and immediate sources is argued to be appropriate within this research context.

As with the documents, archival records are divided into two distinct categories of archival record; written archival records and visual archival records. The written archival records relate, rather like the written documents, to the broad-scale policy. The visual archival records provide data on previous physical/geographical conditions. Again, as with documents, these archival records are not without bias/purpose and are created for a variety of audiences. The critical appraisal of these issues continues through to these sources. One of the visual archives is notably important to this research; the recent Ordnance Survey mapped data gleaned through Digimap downloads. This was subject to extensive retrieval

under academic use licence. Without this, neither the analysis nor the interpretations made in the conclusions would have been as broad nor as far-reaching.

Direct Observation Sources

Direct Observation sources are crucial to this research. An intrinsic aspect within urban design is the idea of experiencing place from a human perspective. Despite being somewhat problematic methodologically, the observations made in this research are made using photography at crucial eye-level by a practitioner-researcher. Gehl discusses below how crucial such observations are to pragmatic research into public space.

> *"Direct observations are the primary tool for studying the interaction of public space and public life. The point is to see the city at eye level from the perspective of pedestrians, not as an abstract configuration seen from an airplane or as computer-generated lines on a screen. Being able to see the city at eye level requires several skills in order to qualify the interplay of life and space in the city in dialectic between research and practice. It is primarily Anglo-Saxon and Scandinavian researchers who are involved with this type of public space-public life studies. They are known for a pragmatic approach that is only loosely tied to theory, understood to mean that they are not bound by the established academic discourse." (Gehl & Svarre, 2013, p. 78)*

The context of this research is a natural setting: the physical environs of RRCs. Therefore, the opportunity has been taken to utilise direct observations as a significant source of data. This emerging empirical context is one that could benefit from, in the first instance, close attention via direct observation. The direct observations in this research are formal, as opposed to informal observations[37]. The observations carried out are ingrained in the case study protocol in order to collect evidence pertaining to the research question, *Why is urban design important in the case of the UK's recycled railway corridors' built environments?*'. In the simplest of terms, this research is founded on the act of visiting RRCs and observing the occurrence of certain urban design characteristics.

Within the broader research context, the primacy of direct observation can be considered problematic. The review of the literature and specific methodological literature rarely centralises this type of source; *"Observational evidence is often useful in providing additional information about the topic being studied" (Yin, 2009, p. 110)*. In this research observation is beyond useful; it is central, intrinsic and, as argued here, required. The review of high level policy documents highlighted the need for 'robust evidence' (Department for Communities and Local Government, 2001, 2012). Due to issues regarding bias and generalisability, visual sources based upon direct observation can be questioned in terms of

[37] Informal observations being those that accrued as a by-product of the collection of other sources (Yin, 2009)

their robustness. There are, however, those that argue the visual can be valuable, where appropriate. Making an argument for visual inquiry, Gray and Malins write:

> *"The argument in this topic has been for a wider acceptance of the visual in the research process, especially for in the visual disciplines ... The logical conclusion to this is the development of a more visual research methodology, and an accessible range of visual or 'artistic' methods in response to a growing need for alternative research paradigms." (Gray & Malins, 2004, p. 97)*

Whilst urban design does not sit entirely within the 'visual disciplines', as discussed in the introduction urban design interacts with a number of disciplines which give varying degrees of credence to the visual. It is argued in this specific research context, with these specific research questions, that direct observations are crucial to the seeking, thinking through, recording, discussing and communicating to a distant audience, the empirical evidence of urban designs at RRCs. It is necessary to be explicit that the position adopted here is not to argue for a visually dominated inquiry in order to replace, eschew or counter any studies of similar territories, but with an alternate methodological disposition. The position adopted here is to argue for a visually dominated inquiry in order to accompany, embrace and complement those alternate methodological dispositions, just as those entrusted with the formulation of the built environment deal simultaneously with quantitative and qualitative stimuli.

These direct observations are an invaluable component of the suite of sources created along with the documents and the archival records. The archival records provide temporal evidence, the documents provide evidence regarding policy and the direct observations provide evidence of the real world urban design at RRCs as summarised in the table below.

DOCUMENTS		
Written Documents		
White Paper & Policy Reviews	Position Urban Design and Closed Railway Lines within a National Context	PRQ
Current Planning Policy Documents (e.g. NPPF)	Contextualise	PRQ / RQ 1 / RQ 2
Regional Planning Policy	Position RRCs within Regional Political Perspective	PRQ / RQ 1 / RQ 2 / RQ 3 / RQ 4
Formal Studies / Evaluations	Contextualise Transport Planning / Urban Design Strategies	PRQ /RQ 3 / RQ 4
Planning Application Statements	Policy Response || Provide design intent	PRQ / RQ 1 / RQ 2 / RQ 4
Visual Documents		
Planning Application Drawings	Policy Response || Provide design intent	PRQ / RQ 1 / RQ 2 / RQ 4
ARCHIVAL RECORDS		
Written Archive		
Beeching Report (Part 1 The Report)	Contextual Reference || Methodological Context	PRQ / RQ 4
Superseded Planning Policy Documents (e.g. PPG13)	Position Closed Railway Lines within a National Policy Context	PRQ / RQ 1 / RQ 2
Visual Archive		
Cobb Rail Atlas	Contextual Reference Showing All UK Railway Lines	PRQ / RQ 1 / RQ 2 / RQ 3 / RQ 4
Historical Photographs	Contextual Background to Case Studies	RQ 2 / RQ 3
Digimap / Ordnance Survey Data	Existing Electronic Cartographic Data || Basis for Analytical Drawings	PRQ / RQ 1 / RQ 2 / RQ 3 / RQ 4
'General Arrangement' Construction Drawings	Assessed as a Commitment to Build Environment	RQ 1
DIRECT OBSERVATIONS		
Written Observations		
Field Notes	Continually Reflect Upon Research Contexts & Techniques Throughout	PRQ / RQ 1 / RQ 2 / RQ 3 / RQ 4

Visual Observations		
Drawings - Topography	Explain Territory of Inquiry || Examine the relationship between Regional Topography and the Routes of the RRCs	PRQ / RQ 1 / RQ 2
Drawings – Figure Ground / Pedshed	Examine Building Pattern in Relation to Nodes || Ascertain Broad Walkable Territory of Nodes || Quantify Land Uses	PRQ / RQ 1 / RQ 2
Digital SLR Photography	To Mentally Process Observations of Aspects of Place || To Collect Evidence of Urban Design Qualities & Morphological Characteristics from Real World Contexts || To Create a Visual Record to Contribute to that which Already Exists at the Case Studies	PRQ / RQ 1 / RQ 2 / RQ 3 / RQ 4
Digital Camera Phone Photography	To Mentally Process Observations of Aspects of Place || To Collect Evidence of Urban Design Qualities & Morphological Characteristics from Real World Contexts || To Create a Visual Record to Contribute to that which Already Exists at the Case Studies	PRQ / RQ 1 / RQ 2 / RQ 3 / RQ 4 /
Primary Research Question (PRQ)	Why is urban design important in the case of the UK's recycled railway corridors' built environments?	
RQ 1	*How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?*	
RQ 2	*How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?*	
RQ 3	*How does the urban design differ across a variety of transport modes used in recycled railway corridors?*	
RQ 4	*What techniques / approaches, applied to the varying territories of built environments along recycled railway corridors, can be used to survey, describe and interpret the urban designs?*	

Table 3.1 Data Source and Research Question

3.5 Data Collection Protocols

Flick (2009) highlights four criteria that should be considered in the case study data selection process; 'meaning', 'representativeness', 'credibility' and 'authenticity'. These concepts will be used in this explanation regarding the choice of the sources adopted in this research. These concepts will be considered through an urban design lens focus upon addressing the research questions. Perspectives on meaning (Relph, 1976) in urban design are discussed in the conceptual framework in relation to both place qualities and transit supportive strategies. Therefore, the various sources used in this research will be considered in terms their author, their intended audience and the contents of the data. The question of the levels of representativeness (Flick, 2009) inherent to the data collected in this research will be focused on whether or not the source represents an empirical urban design truth at a given point in time. This truth may be typical or atypical and instances of each will be discussed in chapters five and six as part of the comparative analysis that focuses upon the opportunity of urban design at recycled railway corridors. Issues of credibility (Flick, 2009), where the accuracy of the sources of data in this research will be considered, are important to the findings upon which this research's conclusions are based. Further, authenticity (Flick, 2009) as a concept has been discussed in the conceptual framework with regards to a place specific environment. Within the context of this sub-chapter authenticity of the data source will be scrutinised through discussions of authorship, bias and whether or not the source was solicited or unsolicited.

Logistically, access to a number of the sources used in this research has been relatively straightforward with the only major issue being downloading and storing of the data. Due to the relative transparency of the design of the built environment, many of the sources used in this research are either made public or observations of actually public places. Further, planning policy is readily available via Internet searches, from national planning policy to local plans, as were planning applications specific to the case study nodes. Therefore, access to this data is also relatively straightforward in terms of access, yet somewhat complicated in terms of audience. Safety has been an issue in the data collection as part of this research as discussed in chapter 3.6 where a number of scenarios that tested the researchers professional conduct and transparency in the field are described. When undertaking fieldwork at least one independent person was informed of the details of the field trip (place of visit, approximate time of return, et cetera) and the law of trespass was always respected throughout. This research has involved a high number of field visits which has accrued an inherent cost, and although this was an issue this factor has not been prohibitive in terms of data collection. The appendix of this research acts as a corpus of data collection where much of the sources gathered remain 'intact' (Flick, 2009). This subchapter

will now take each of the differing source material types used in this research and explain their data collection protocols.

Written Document Protocol

The written document sources collected as part of this research include current national planning policy, regional planning policy and master plan planning application submissions. Attention has been paid to the intertextuality of the above documents. Any relationship between these documents and other theories/ policies has been taken into account in the analysis stage in order to contextualise other evidence.

> *"Documents represent a specific version of reality is construct it for specific purposes. It is difficult to use them for validating interview statements. They should be seen as a way of contextualising information. Rather than using them as information containers, they should be seen and analysed as methodologically created communicative turns in constructing versions of events." (Flick, 2009, p. 259).*

Although Flick (2009) argues here that it is difficult to use documents to validating interview statements they will be used in translation with other data sources gathered in this research.

The current national planning policy; National Planning Policy Framework (NPPF) (Department for Communities and Local Government, 2012) is readily available and can be accessed and then stored digitally via an internet search. Logistically, this document can be downloaded in a variety of electronic forms which makes reviewing, searching and using the document highly efficient. This document carries a strategic level of meaning for this research into urban design a recycled railway corridors and although referenced sparingly throughout this thesis it is particularly useful in contextualising the research. In terms of representativeness (Flick, 2009) his document is crucial as it is a primary source that sets out the highest level planning aspirations contemporaneous to this research. Being a government document it is also highly accurate and is a credible, unsolicited source of data. This source can be considered relatively free of bias as it is intended for a wide variety of audiences from developers through to local planning authorities, stakeholders through to urban designers. However, the political bias inherent is acknowledged. Similarly to national planning policy, regional planning policy is also readily available by internet searching and this source shares similar traits with the above in terms of meaning and importance to this research, credibility, et cetera. Masterplan planning application submissions (written components) are again readily available through internet searches of the relevant local planning authority websites. The 'Planning Portal' website has also been useful in the collection of this data. These types of data have been particularly relevant to this research as the written element of a master plan planning application explains the underlying principles behind the design decisions. These however cannot be considered free from bias as their intention is to secure planning approval for the particular scheme. Whilst this means

there is a legal obligation to submit genuine arguments, the statements within this type of source have not been taken at face value within this research as the purpose of these documents is to win a planning application. However, these type of documents still have a high level of credibility within this research as they can be considered to hold a significant degree of professional integrity and necessarily reflect precise urban design intentions.

Visual Documents Protocol

Visual documents sources are often contained within the same documents as written document sources, for example in 'masterplan planning application submissions'. However, they require consideration in their own right as a form of communication (visual as opposed to textual) and in the terms of an urban design perspective can illustrate place orientated intentions in a more sophisticated way. This research uses masterplan planning application submissions and engineering general arrangement drawings within the category of visual documents. These two document sources are laden with urban design intentions and although they are not a substitute for completed built environments they do illustrate legally binding commitments to build.

The visual components of masterplan planning application submissions are similarly accessible as the previously discussed written components, however through the methodological lens of this research i.e. a visual methodology this type of document is particularly useful. They can be considered accurate representations of urban design intent and often as well as illustrating final proposals, they show diagrammatic summaries of the design process that led to these propositions. This process of laying bare the urban design thinking behind a particular masterplan provides vital data for this research to use in the triangulation process adopted as part of the comparative analysis. This data can be considered credible as it is the culmination of a number of stakeholders input; usually developers, urban designers, transport planners, landscape designers, et cetera. Once these documents have reached the public realm, from where they were procured in this research, they will have usually been scrutinised through a dialogue involving planning authorities. As similarly discussed above, these documents are not free from bias as the purpose is to secure a planning application, however, in terms of being useful data for this urban design research they can be particularly explicit with regards to urban design intent.

A further data source under the visual document category used in this research is the engineering general arrangement drawing. These are specifically used in CS03 'Borders Rail-Waverley Line' because at the time of writing of this research this recycled railway corridor was under construction[38]. Therefore, this publicly available resource was a reliable

[38] The 'Borders Rail-Waverley Line opened on the 6th September 2015.

way of seeking urban design intent of this particular case study. Similarly to the masterplan planning application documents these general arrangement drawings can be considered authentic in terms of a commitment to an urban design. These drawings, as well is being published for public consideration, will have been used in the construction work of CS03. These unsolicited visual documents can be considered relatively free from bias as they are instructions, with inherent legal implications, to carry out building works on a number of structures along the line of the recycled railway corridor. Due to this direct link between the urban design intention and the final built article these document sources can be considered authentic in urban design terms.

Written Archival Records Protocol

Written archival records have been used as sources of data within this research, namely expired planning policy documents (PPG 13) (Department for Communities and Local Government, 2001) and the 'Beeching Report'(British Railways Board, 1963a). These have been used to contextualise the process of recycling of railway corridors. PPG13 was a particular usefulness to this research as within its contents exist a specific clause regarding disused transport corridors and their protection. Given that this is a national planning policy document, although expired, this clause holds specific meaning to the foundations of this research; that disused railway corridors have transport and urban design opportunity (Department for Communities and Local Government, 2001). In terms of bias, the political era within which the planning policy guidance document was produced must be considered. This is in contrast to the political agenda inherent to the contemporary planning policy framework (NPPF). Although these political differences are apparent (Hambleton, 2011; Rydin, 2011; Shepley, 2011), issues regarding credibility and authenticity are relatively minor with these being unsolicited government produced documents. As with the previously discussed documents PPG13 was accessed via an internet search and is readily and economically available to be retained by the researcher in a digital format. A further piece of written archival record was Part One of the Beeching Report (British Railways Board, 1963a). This was particularly useful to the context of this research as it set out the methodology and results of the 'Reshaping British Railways Report' which led to the closure of circa 6000 miles of railway route (Henshaw, 1991). Whilst the contents of this report, which again is readily available via an internet search, can be considered accurate as a data source questions exist over the bias and reliability of the points made within the text. The following quotation appears in the reshaping report;

> *"Nevertheless, it was obvious, even before detailed investigation started, that neither modernisation nor more economical working could make the railways viable in their existing form, and that a reshaping of the whole pattern of the business would be necessary as well." (British Railways Board, 1963a, p. 3).*

The wording of this section, a direct quotation taken from the early pages of the report, cast doubt over the recommendations put forward in the report. However, from this research's perspective this is a point of consideration and contextualisation for this research, not a reason to exclude the data.

Visual Archival Records Protocol

A number of visual archival records have been used as sources of data within this research; 'Beeching Report' (Part 2), '*The Railways of Great Britain; Historical Atlas (Second Edition)'* (Cobb, 2006), historical photographs and raw ordinance survey mapping data. The second part of the 'Beeching Report' contained 12 maps of Great Britain illustrating, most importantly for this research *"the proposed withdrawal passenger train services" (British Railways Board, 1963b)* although such aspects as station gate receipts, weight of freight traffic and density of passenger traffic were also included in this set of data (see appendix). These maps were both useful to contextualise redundant and recycled railway lines and were important for such aspects of the analysis as considerations over duplication of service. They can be considered accurate representations of the data collected as part of the 'Beeching Report' (British Railways Board, 1963b)discussed above and as such, considerations of the authenticity and bias previously discussed apply to this data source also.

The *'Railways of Great Britain; Historical Atlas (second edition)'* (Cobb, 2006) has been particularly useful throughout this research as it shows all the railways that have existed in Great Britain, including date of opening, date of closure, for both railway lines and stations. Importantly from the perspective of this research, this information is overlaid across ordinance survey maps. This has been crucial in this research as it visually links railway routes to built urban patterns. Due to the method used where these railways were overlaid across actual maps (as opposed to the far more common route diagrams which rarely show built environment contexts) this source can be considered particularly accurate. Furthermore, the authorship can be considered free from bias as this is a referenced visual historical record. During the latter stages of this research this data source was augmented by the website: '*http://maps.nls.uk/geo/explore/sidebyside'* which is run by the National library of Scotland. This website enables parallel viewing of contemporary satellite mapping against a variety of historical maps.

These two unsolicited pieces of data were used to contextualise and check claims made this research, although unfortunately this source was identified too late to be comprehensively included into the case study data base comprehensively for each node. This is a point for of consideration for further study which would more than likely require liaison with the National library of Scotland.

In order to create the urban design drawings in the appendix it was necessary to download ordnance survey mapping data from the Digimap service under the following license:

> *"The citations in this document should be used to reference the maps and data when they have been included in any essays, dissertations or other academic works. You should cite the data even if it doesn't appear as an image or map in your work if it has been used to generate findings or a new dataset that is used." © Crown Copyright and Database Right 2016. Ordnance Survey (Digimap Licence).*

These ordinance survey data files are kept electronically in their original state as downloaded. This repository of ordnance survey map data has been essential to the way in which this research has been carried out. In terms of meaning and accuracy this downloaded data, which is available via University of Nottingham subscription, can be considered robust. These maps consist of developed pre-existing ordnance survey data which is relatively up-to-date (as can be seen in the citations index in the appendix). Although there were discrepancies between the data downloaded as part of the Digimap service and the empirical observations this was limited to instances where construction was ongoing. To mitigate this, certain map areas were revisited throughout the course of the research in order to update the maps data. These unsolicited data are considered free from bias due to the authorship being to facilitate public record. These Digimap ordnance survey maps are available in *.dwg* format and come complete with the information divided into a number of layers, for example building, railway, road, et cetera. The scale at which this ordnance survey data is received is at 1:1000 and this is retained in the unaltered archive copies, before being compiled and join together to create figure ground drawings where new data sets are created specific to this research.

Visual Direct Observations Protocol

This research uses both written and visual data. However, because of the phenomena understudy and the field to which the conclusions relate, visual methods (Rose, 2007) are prominent within this research. Visual data sources will primarily consist of photography, as a record of observation and intrinsic part of the researchers thought process, and urban design drawings. Gehl (2013) reflects upon the use of photography within urban design research stating that the process goes beyond illustration and can be 'enlivening' to the data.

> *"While the human eye can observe and register, photographs and film are good aids for communication. Photographing and filming can also be a good tool for fast-freezing situations for later documentation and analysis. By later studying photographs or film, it is possible to discover new connections or to go into detail with otherwise complex city situations that are difficult to fully comprehend with the naked eye. Photographs often illustrate and enliven data." (Gehl & Svarre, 2013, p. 31)*

Validity is linked to truth (Audi, 2011) and deep consideration has been given in this research as to whether photographs actually portray urban design truths. The actual act of framing a photograph, the issues of what is inside the frame and also what is left outside was considered during the fieldwork stage of this research. These issues are impossible to be circumvented, however explanation of the reason for the framing combined with triangulation with other methods should mean that a degree of validity can be achieved through a comparative analysis using photographic evidence. In this research the actual physical act of taking a photograph was considered as an intervention into a field; the situation being changed by the researcher through their presence and their action. It is argued however that this is not overly problematic in this research context. The built environment was the focus of observation in this research and although this is intrinsically linked to human behaviour, it is reasonable to argue that a certain place is not altered to a detrimental degree by the presence of the researcher. It is acknowledged this is not an unequivocal position.

Limitations of photography are acknowledged in the built environment research context. The over prioritisation of the scenographic at the expense of all the other senses is deeply ubiquitous (Frampton, 1992; Tzonis & Lefaivre, 1996). In research terms the composition of the photograph is dependent upon the editorial bias of the maker of the photograph. However photographs are useful in research as they contain vast amounts of visual data within a relatively concise form and, any bias aside, they can be taken as relatively reliable sources of material (Rose, 2007) regarding such research territories as the built environment.

Although photographs can fairly be seen as a representation of a physical truth, the act of taking the photograph is an act of interpretation. A photograph as part of this research is never treated as if it was taken as a meaning neutral artefact. Temporally photographs act in this research in a number of ways: as archival record of events (the recycling of railways and their built environments), as a tool in the iterative observation process and as a record of the world in a certain place and time. A photograph is an attempt to represent ‘the now’ accepting the fact that the act of taking a photograph is an interpretation, timing of the photograph must be considered carefully in the above contexts. The primary concern surrounding photography as an instrument of research has been how to record the information, and how to analyse information (Flick, 2009). In this research the act of taking a photograph was always overt, from public property, attempting to respect privacy and capture the images with as few members of public in as possible. This was done with a variety of digital photographic equipment, but never film photography.

In the taking of the photographs selective decisions were inevitably made. Careful thought was put into this subjective process; the selection process of deciding what subject

was photographed and when it is photographed. This relies upon a mindful consistency in terms of which urban design criteria to 'capture' which is related to transit supportive urban design theory. This has inherent problems due to the act of taking a photograph being an intrinsic part of the researchers thought process. A linear process of: *'observe phenomena - photograph phenomena - present photograph as evidence' is avoided in this research'*. A reiterative process of *'observe phenomena - photograph phenomena – consider photograph – reconsider phenomena – re-photograph phenomena (continue until consideration stalls) - present photograph as evidence'*, has been adopted in this research. This may have inherent weaknesses in terms of consistency; the terms of 'the next' photograph cannot be identical to the terms of 'the previous' photograph, as 'the previous' photograph is engrained in the thought process of the author, to the extent that it has changed the author and also the previous moment cannot be reclaimed. Although this makes absolute consistency impossible, this is sacrificed for the benefits of an iterative process. An iterative process that allows the use and act of photography to form and reform the criteria for observation. This has practical implications; certain sites have been visited and revisited because of this process, meaning extra cost in both terms of time and finance. However, this has been embraced as useful to the research, any built environment is so complex it is difficult (if not impossible, to ever fully) to conceive in one visit and therefore repeat visits always uncover new learnings and observations (see appendix 2.04H – 2.04K). It has been difficult to judge when to draw a line under this process as it never has a natural conclusion.

However, once a photograph has been taken it can be seen as a 'truthful artefact', representative of that specific place in the world at the time of 'capture' (Rose, 2007). There are benefits to this aspect of photography. Unlike the human taking the photograph, the image does not suffer fatigue, or shifting opinions (Banks, 2007; Gray & Malins, 2004; Rose, 2007). In order to get the digital image out of the camera and into a place for debate manipulation is necessary. The process in this research uses either 'Word' or 'Adobe InDesign' in the presentation of the images. Whilst no image manipulation software has been used scale, size and cropping has been necessary so as to fit the images within University of Nottingham thesis regulations. Often this has resulted in a loss of quality and legibility. The files themselves however, remain intact, backed up electronically and can be used at a further date if called upon.

The other form of visual document created as part of this research are urban design drawings. These include regional diagrams, regional topography drawings, figure ground which indicates the extent of each node's pedshed and overlays to these figure ground drawings which indicates Lynchian legibility elements (Lynch, 1960) and brownfield sites. These drawings have been crucial to the research. Firstly, they form a corpus of urban design data relating to three case study recycled railway corridors. Secondly, they are useful independently of any other data as a means within which to consider individual nodes.

Thirdly they are useful interdependently as a data source for the comparative analysis of this research. These visual documents are representative of the built environment territories that are within the pedshed of recycled railway corridor nodes and are as such of high value in terms of meaning to this research. They are based upon the previously mentioned ordnance survey data, are drawn using millimetre perfect AutoCAD software and can therefore be considered accurate. Although, like the photographs produced and discussed above, they have been produced by the researcher and are therefore susceptible to criticisms regarding authorship bias and authenticity, this is mitigated through the triangulation as part of the comparative analysis.

3.6 Methodological Literature & Analytical Strategy

The following subchapter explains how pre-existing literature has been used in order to contextualise the contribution to knowledge made as part of this research. This has been achieved through a careful consideration of previous studies within related fields to this research in methodological terms. Subsequently, and analytical strategy of comparative analysis is explained, which has been informed through this review of appropriate methodological literature.

Use of Methodological Literature

Pre-existing theories have been used in a variety of ways Flick (2009) within this research. The literature review examines theoretical propositions pertaining to the relationship between public transit and the built environment. These theories are synthesized into a set of criteria with which to analyse the three case studies. In doing so, this provides a general background to the normative ideas of urban design that were used to examine the area selected as case studies. This literature review also acknowledges the counterargument to these concepts and theories. This piece of research uses these paradigms to examine an area that has not yet been studied, the urban design at RRCs.

This is the main way in which literature is used in this research, to form the contextual knowledge regarding the area for examination. There are two particular studies however that set out a particular methodological tradition that has been followed in this research. Although the findings of these two pieces of literature are crucial to the contextual underpinnings of this research, the methods and methodologies are also of use. These two studies will be discussed in the rest of this chapter in relationship to the adopted methodologies and methods of this research.

The first piece of literature useful to this research in terms of methodology is ‘Seven American T.O.D.s: Good Practices for Urban Design in Transit-Oriented Development

Projects' by Jacobsen and Forsyth (2008). The second is: 'Territorial opportunities of tram-based systems: Comparative analysis between Nottingham (UK) and Valenciennes (FRA)' by Richer and Hasiak (2014). These two studies will now be discussed in comparison with the methodologies adopted in this research.

The intentions of the two studies differ from each other and from this research. The intention of 'Seven American T.O.D.s' is to formulate and refine a set of normative urban design criteria applicable to transit-oriented developments whereas the intention of 'Territorial opportunities of tram-based systems' is to primarily highlight opportunities taken by the introduction of a tram network. It is the intention of this research to collect evidence regarding urban design at RRCs. Although these are three differing approaches, it is argued that the consideration of their adopted methodologies is valid as the topic of enquiry is similar; the urban design at a public transit network. The selected real world contexts for these two studies is interesting. 'Seven American T.O.D.s' selected the site studied from three states across America: Virginia; Illinois; and California. This relates to this research in two regards. Firstly, that these sites were selected as part of an iterative process (chapter 3.3), as was the selection of case studies in this research.

> *"The study team selected the cases through an iterative process: developing a comprehensive list of transit examples; finding those that had some base of evaluation or description; then selecting examples to show a range of circumstances." (Jacobson & Forsyth, 2008, p. 58)*

Secondly, these sites were selected as they represented differing typologies of T.O.D.s. This research also aimed to examine a variety of settlement typologies, while similarly acknowledging that in doing so the findings are not universally representative. It is also noteworthy that the places studied in this piece of literature in a different country to this research could arguably undermine any comparison. However, in terms of scale, American states are broadly equitable to European countries. Therefore, a comparison between Virginia, Illinois and California is not entirely dissimilar to this research in that this research traverses important borders; one of the case studies is in Scotland and two of the case studies are in England. This also corresponds to 'Territorial opportunities of tram-based systems' (Richer & Hasiak, 2014) that compares transit lines in England and France.

It is argued that empirical research in the form of the case study adopted in this research is reinforced by the two publications under comparison here. Both studies are, to differing degrees, concerned with physical manifestation of urban design in the built environment. Therefore, the decision has been taken to enter the field and observe design characteristics. The case studies are configured differently however. The seven American T.O.D.s investigated by Jacobsen and Forsyth have been presented based upon their illustrative or evaluative value. In 'Territorial opportunities of tram-based systems' (Richer & Hasiak, 2014) the two main cases where the whole route is studied are Nottingham and

Valenciennes, concentrating on two termini at Hucknall and Denain. This shares the territory of the Robin Hood Line and Hucknall with this research.

The research in this thesis sits somewhere between the two publications with regard to what are selected as case studies; three entire routes are considered, with attention being paid to the nodes along these routes with focus on the detail urban design at two of those particular nodes. This therefore covers the regional scale, the neighbourhood scale and the human scale of RRCs. A common theme throughout the two methodological examples is the use of urban design assessment tools. The use of these tools is clearly related to the resources available to the projects. Jacobsen and Forsyth (2008) use the following six urban design assessment tools:

- *urban design score sheet;*
- *urban design inventory;*
- *design workshops;*
- *community representative workshops;*
- *GIS-based analysis; and*
- *photographic visual assessment.*

This ensures that a variety of perspectives are represented in the sources upon which the claims to knowledge are made within this publication. The urban design score sheet is based upon criteria derived from T.O.D. practitioners and theories, and the urban design inventory is based on 160 components of urban design such as 'pleasurability' or 'ease of movement'. This research then uses urban design assessment tools to engage with people outside of a particular piece of research: the design workshops and the community representative workshops. This research then uses visual documents to examine the phenomena. GIS maps were used to look at the networks and land use of the case studies. Photographic visual assessment was also carried out which adopted a cross-case synthesis analysis. Within this, photographs were used to compare issues such as colour, form and scale across different case studies. The last two urban design assessment tools that employed creating maps and drawings and observations through photography have the most in common with this research. The research carried out by Jacobsen and Forsyth has a distinct advantage for this research as it engages with both professionals and stakeholders in regard to the places at their selected T.O.D.s. This research has a wider scope than the work identified above. It is acknowledged that if this research had more time, funding and credence then a similar approach involving such strategies as stakeholder involvement and urban design assessment tools would have been adopted. However, it appears there is a methodological trade-off. Based on what has been published, it appears that this research goes into more detail, both in terms of quantity and depth, with the visual methodology adopted.

Richer and Hasiak (2014) adopt a similarly broad approach to their territories of enquiry as in this research. The observation of urban transformations is key to this publication, 'impressions' of the urban design along the tramlines are allowed importance

and qualitative judgements[39] are made based on investigator experience and backed up with photographic evidence. This points to a similar attitude to visual methodologies as adopted in this research: the acceptance of the importance of the visual (Gray & Malins, 2004; Rose, 2007). This is a journal paper and there is no room for the corpus of photographic evidence collected to be presented by Richer and Hasiak (2014); this is not the case in this research and the full case study database, including visual documents, is presented in the appendices.

In summary, these two journal papers point to a shared methodological approach concerning the examination of urban design at built environments relating to public transit. Clearly these three studies are not identical, and there are aspects of the other studies that this research would have ideally included[40]; however, it is argued that the breadth of this research and the detail the applied methods went into covering this breadth, mitigate the criticisms surrounding lack of stakeholder engagement.

Analytical Strategy: Comparative Analysis

The purpose of this research's analytical strategy is to derive the best possible answer to the overall research question, *'Why is urban design important in the case of the UK's recycled railway corridors' built environments?'*. In order to achieve this a comparative analysis of the case studies was carried out based upon themes and categories generated from the case study data and transit supportive urban design theory. The process of making comparisons within and across the three cases studies has meant an analysis of a number of transit supportive urban design factors relating to the phenomena of RRC has been possible. This has highlighted a number of associations and differences across the cases that are recognisable in a number of place-centric urban design terms. This comparative analysis has illuminated the following patterns present (Gibbs, 2007; Yin, 2009) in the case study data:

- 'similarity',
- 'difference',
- 'frequency',
- 'sequence' and
- 'correspondence'.

These patterns (Saldana, 2009, p. 8). serve to show a number of ways that urban design at RRCs show both similarities and differences with reference to reasons for such variations.

Whilst a practical necessity for the handling of the large amounts of data contained within this research's case studies has been to carry out qualitative coding, this process has

[39] For example, Figure 3 on page 227 showing examples of the differing rolling stock between the cases as evidence of aesthetic judgements made. A further example is Figure 5 on page 230 contrasting a view of Hucknall station and Denain station.

[40] Urban Design Assessment Tools that involved engagement with those external to the research.

also acted as an act of analysis in itself prior to the cross case analysis. This analytical activity has led to the two conceptualisations of along-the-line and at-the-node which relate to the two scalar based research questions. This categorisation of specific research territories has led to a deeper understanding of the data due to focused upon certain criteria at specific scales. Further, within these two categories certain themes have been used to group urban design attributes into closely linked groups in order to facilitate the analysis of related ideas applicable to urban design and RRCs. Coding, the twofold act of 'deciphering / decoding' and 'labelling / encoding' of data (Saldana, 2009) has been an inherent part of the qualitative data collection / analysis process of this research. This exercise of coding as meant a refining of notions from the data collected with reference to the conceptual framework, T.O.D. (Calthorpe & Fulton, 2001) and S.C.R. (Breheny & Rookwood, 1993):

> *"A code in qualitative enquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence capturing, and / or evocative attribute for a proportion of language-based visual data. ..... Just as a title represents and captures a book or film or poem's primary content and essence, so does a code represent and capture a datum's primary content and essence." (Saldana, 2009, p. 3)*

The essence of urban design at RRCs can be characterised in the two key conceptualisations around which this research is constructed; along-the-lines of RRCs and at-the-nodes of RRCs

These two key categories and the themes within them were derived through an iterative process. This process involved a constant 'toing and froing' between the ideas put forward in transit supportive urban design theory and the examples highlighted within the case studies. The categories and themes that were a result of this process represent a hierarchy that is apparent in the structure of this thesis, both in the arrangement of the literature review as seen in chapters 2.5 and 2.6 and the organization of the two discussion chapters. This structure has afforded one way of classifying the multi-dimensional and multifactorial data recorded in the case studies, whilst the data remains intact within the case study database (see appendix).

Some may argue that a weakness of coding is the use of the researchers 'tacit and intuitive senses' (Saldana, 2009). However, given the current extent of knowledge regarding urban design and RRCs the stance adopted in this research is that the utilisation of the practitioner / researcher's sensitivity to, and consideration of place is an appropriate strategy in this specific research context. This inherent subjectivity is mitigated through triangulation.

Triangulation on this research has been carried out across samples and datasets from geographically disparate territories using observation and documentary evidence (Gibbs, 2007). The purpose of adopting a multiple case research design has been to strengthen the robustness of the findings within this research (Yin, 2009). Whilst

triangulation is also open to criticism, Gibbs (2007) argues that it is nonetheless a useful purpose within a qualitative study; "*... however, whilst triangulation cannot be used in any ultimate sense to create a single, valid and accurate interpretation of reality, there are still practical uses for it"* (Gibbs, 2007, p. 94). Triangulation has been essential in this research in highlighting inconsistencies (Gibbs, 2007) between approach to urban design at RRCs across the differing cases. This process has also highlighted a number of potentially fruitful further lines of enquiry (Gibbs, 2007).

There were some instances of duplication within the themes and categorisations of this research. For example, 'mixed use' where differing specific definitions existed across separate theories. However, the overall category was retained with the nuanced descriptions of this phenomena being discussed in at a finer grain detail within the overall hierarchical structure. Both coding and triangulation have been essential components of the process of this research by enabling the theming and categorisation of differing aspects into a coherent framework with which to analyse the urban design of RRCs.

3.7 Reflection and Evaluation of the Research Process

This subchapter on evaluation demonstrates the continual process of evaluation and re-evaluation that permeated this research. The issues in this subchapter were pertinent through the conceptualisation, design and implementation of this research and intrinsic to this were a certain amount of adjustments that due to unforeseen issues were made as part of the execution of this research. Firstly, this subchapter discusses the issues of validity in regard to the findings of this research. This is done by referring the themes of construct validity, external validity and reliability to the procedures adopted within this research. This is intrinsically linked to the subsequent subchapter that discusses the position of the researcher within this research. Here visual thinking is reflected upon with regard to the understandings of urban design at RRCs collected in findings of this research.

There were two key adjustments to the research process that were not initially anticipated. The first is the removal of interviews from the research design. The methodological explanations for this decision, although potentially controversial, are set out in this section. The second adjustment was the consideration and ultimate exclusion of pedestrian and cycle audit techniques from the research design. The fourth and final subchapter of this reflexive evaluation of the research process explained the ethical considerations that informed the research design. This section also illustrates how the researcher behaved ethically through three key examples of unexpected issues that arose during the implementation of the research. This chapter will demonstrate that this research has been carried out in an honest and dutiful manner with consideration to the onus of

finding truth in urban designs at RRCs without any maleficence to others. It is argued that this research has been conducted and presented in a responsible manner.

Validity and Validation

Yin (2009) writes that the judgement of a research design lies upon four tests: 'construct validity', 'internal validity', 'external validity' and 'reliability', with internal validity being applicable only to single case studies (Yin, 2009) and therefore is not considered in this evaluation of the validity of this research. It is argued that this research makes logical statements, based on secure findings, due to the way in which it responds to the three appropriate tests of research design as set out. Issues regarding trustworthiness and credibility are dealt with by the consideration of construct validity. The operational methods are attuned to the research questions, to the case study protocol and to the worldview of the researcher. The generalisations of this research are applicable to the field of urban design and RRCs, therefore external validity is considered in order to add further credibility to the research. Further, the data collection procedures and protocols are made clear and can therefore be carried out by others. This implies reliability of findings through confirmability and dependability. These notions are discussed in more detail here.

Yin states that criticisms of case studies often arise due to accusations of perceived overly-subjective judgements. Previous subchapters (3.5), dealing with the data collection plan and data collection procedures, explain the mitigation strategy in response to such assertions. Whilst it is fair criticism of the direct observations made in this research that they represent the investigator's impressions of the various places, the act of photography (although not free from bias) does represent a record of a specific scene at a specific point in time. It is argued that this record not only gives basis to claims made of that observation but also allows the scrutiny of others to be applied to that record.

In relation to case study approach Yin (2009) offers a number of 'tactics' for increasing construct validity. In line with these suggestions this research utilises a broad range of data sources that indicate convergence at the territory of inquiry. This involves the setting out of a chain of evidence which responds to the two key scales of the topic under study; the regional scale and the neighbourhood scale. This chain of evidence relies upon a minimum of two types of source. In the analysis, the case study examples are compared across at least two cases either within one overall case study or more often, across at least two case study territories.

The normative urban design theories used in this piece of research have at their core a notion of place specificity. External validity (Yin, 2009) puts the onus upon research findings that they be applicable beyond the case study delimitations. This implies a contradiction, at least at some level, although considerations such as those levied in the

discussion on critical regionalism imply a consistent approach which can manifest in different instances dependent on context. It is through these underlying considerations that it is argued that this research has external validity. One strategy that has been employed to allay the criticism that this research lacks external validity is the use of more than one case study. This research covers three case studies, this allows for a high degree of, what Yin (2009) terms, analytical generalisation. The data collected in this research is generalised towards broader normative urban design theory through the use of cross-case synthesis analytical strategy. This highlights one of the problems inherent in this research. Ordinarily, Yin states that the theory that points to the selection of the case studies will point to other contexts where the findings can be reasonably generalised. There is little theory regarding urban design and RRCs. This means further work is necessary in the conclusion so as to be explicit in setting out the contexts to which the findings are applicable, as well as which theories apply.

This leads to a further difficulty for this research regarding replication logic (Yin, 2009). This was the reason for choosing three case studies; to increase the chances of either literal replication or theoretical replication. It is emphasised that this is a high proportion of the overall pool of potential case studies with there being seven RRCs in existence in the United Kingdom. This hurdle was overcome by establishing a rich theoretical framework (chapter two). Within this theoretical framework the conditions for urban design at RRCs is set out, thus pointing to where generalisations from the findings could be applied. It is argued that in conjunction with the previously discussed 'construct validity' and 'reliability' (discussed below) that the findings are valid, leading to conclusions and plausible propositions for further study, that, if resources allow, could address the deficiencies outlined above.

The notion of the case studies carried out in this research being conducted again by an alternate researcher, and coming to the same findings, has been considered throughout the research design. It is acknowledged that the greatest threat to the reliability in this research is the quantity of researcher-made direct observation used and its inherent bias. The issue of bias has been considered rigorously in the way that this case study has been explicit regarding the case study protocol and case study procedures, meaning that any further investigator could carry out this research again. One problem however, might be that the built environment is in constant flux (especially in the instances where development was taking place over the course of the study) thus the situation may have changed. Epistemologically this is complex, as an acceptance of situatedness and changeability is required to gain useful insights into urban design at RRCs, particularly through the theoretical lens of critical regionalism adopted in this research. Also, the situations examined as part of this systematic enquiry will have changed due to seasons, time of day, weather, etc. This problem and reliability is insurmountable in these instances, however, it

is argued to be unreasonable that this is cause to undermine the reliability of this research entirely.

Consistency is another key element respected in this research in order to stand up to rigorous testing and criticism. Although similar to reliability, consistency is more commensurate with the openness of process (Arksey & Knight, 1999). This process is explained in 3.5 and the 'thick description' of the data collected is presented in the case study database (see appendix). This acts as a permanent record of the majority of data collected as part of the research.

Position of Researcher in this Research

Standpoint theory, as defined by Morton and Wilkinson (Morton & Wilkinson, 2008), represents marginalised perspectives: *"Standpoint theories characterise the world from a specific socially-situated perspective that can lay a claim to epistemic privilege or authority."(Morton & Wilkinson, 2008, p. 44)*. This research has not sought out perspectives on urban design at RRCs from those systematically disadvantaged from society. The researcher is from a marginalising, not marginalised category: a white, middle-class, able-bodied man. It is therefore impossible to separate the findings of this research from this bias, arguably an androcentric (Morton & Wilkinson, 2008) position of privilege. Furthermore, the tradition of normative urban design in which this research is authored is broadly populated by people from a similar, androcentric category. The category highlighted in the image below:

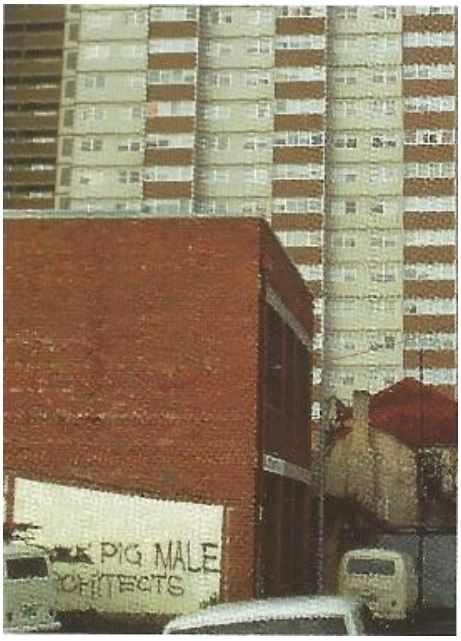


Figure 3.2 Reaction to Androcentric Urban Design

Source: "If a team of planners was asked to radically reduce life between buildings, they could not find a more effective method than using modernistic planning principles." Jan Gehl, Cities for People p.4

Morton and Wilkinson (2008) set out three types of epistemic privilege that underrepresented groups have over dominant groups; character, cause and consequence of social inequality. According to standpoint theory, this research is only capable of producing 'surface regularities' in regard to urban design of RRCs due to the researcher bias, whereas a researcher basing findings on an underrepresented group would yield 'deep over surface' knowledge regarding these phenomena. Standpoint theory claims 'better quality knowledge' (Morton & Wilkinson, 2008) due to the inclination of the androcentric to argue for the present situation being based on notions of necessity, as opposed to the disadvantaged extolling how inequalities could be overcome.

The notion of 'universal human interest' in the discussion surrounding standpoint theory is most salient to this research. According to standpoint theory, the privileged will argue for only those things where the privileged benefit, as opposed to what would benefit humankind:

> *"Third, it claims to offer a portrayal of the social world in relation to universal human interests. In comparison, the standpoint of the privileged portrays social phenomena relative only to the interests of the privileged, but ideologically misrepresents these interests as corresponding with universal human interests." Morton and Wilkinson, 2008, p.44*

It is this point where it is argued that a criticism based in standpoint theory aimed at this research can be contested. Although the researcher is, at face value, from the pool of people that have led to an androcentric society, there are two key aspects of the researcher that can point to legitimacy in terms of claims to knowledge made in this research. The first is the researcher's persuasion in favour of walkable environments. Standpoint theory and its intrinsic link to feminism is laid out by Morton and Wilkinson (2008), the argument being that feminism is sensitive to all those underrepresented:

> *"She wanted gender to be seen as key, but also to acknowledge that gender exists within other realities such as class, race and individual characteristics – supporting the feminist assertion of being sensitive to diversity rather than professing a single female perspective." (Morton and Wilkinson, 2008, p.44)*

There are a number of works that take the territory of automobile-prioritised environments versus public transport and associated pedestrian-prioritised environments to be an argument of equity (Calthorpe, 1993; O'Toole, 2009). There are sections of society that, it can be argued, are marginalised, or underrepresented, by an automobile-oriented built environment.

Calthorpe and Fulton argue in their manifesto for T.O.D. that the 'regional city' of their terms would be one that is designed with 'walkability' as a core principle: *"This ethos provides a specific aesthetic of place – scaled to the human body, timed to a stride, patterned to ceremony, and bonded to nature."* (Calthorpe, 1993, p. 11). Although this is stating

walkability as 'a place timed to a stride', as an aesthetical concern, which in its realisation as urban design it surely is, the debate surrounding T.O.D. expands walkability and its principles as an issue of equity in society. Rice argues explicitly that T.O.D., through the clustering of services around public transport, equates with a design paradigm that facilitates those who are not as well provided for in automobile-oriented landscapes:

> *"Support for T.O.D. fits in with a broader concern about sustainable lifestyles, the future and others, and a concern about social justice and equity issues, as T.O.D. enables the young, elderly, poor and disabled to access services where services are clustered together and served by efficient public transport." (Rice, 2009, p. 174)*

This clustering is an example of how walkability, in land-use terms, can be beneficial to those who cannot make the most of the autonomy that car ownership can provide; the young, the old, the financially less well off, people with certain disabilities, and those who will not: the environmentally and sustainability principled. This is an equity issue at the neighbourhood scale as well as the regional scale. Dittmar and Ohland specifically link the opportunity to choose to walk with the success of a neighbourhood:

> *"Choice is the defining feature of the best neighbourhoods. A well-designed neighbourhood offers many activities within walking distance for those who do not drive (e.g., the young and the elderly), people who cannot afford cars, and people who choose not to rely on cars to get around. Providing a mix of uses within neighbourhoods helps make communities more convenient, because several errands can be completed in one trip, and more affordable because a car is not needed for every trip."(Dittmar & Ohland, 2004, p. 25)*

This quotation, like the quotation from Rice beforehand, reflects the sectors of society who are less well provided for in places designed for the automobile than those designed for walkability (ideally linked to some form of public transport). Social exclusion in relation to transport is a complex problem (Titheridge, Achuthan, Mackett, & Solomon, 2009). Dittmar discusses the choice that can be afforded in walkable environments; however, whilst discussing 'transport social exclusion among the elderly', Titheridge et al set out what can be the societal loss through transport disadvantage:

> *"Transport can contribute to social exclusion by limiting access to jobs, education and training, health services, sports and recreation facilities, and social networks whether due to the cost of transport or the availability of appropriate transport." (Titheridge et al., 2009, p. 31)*

As previously discussed (chapter 2.4), walkability is a core tenant of this research and Titheridge et al (2009) discusses the need for inquiry into 'journey perception', highlighting a section entitled 'walk journeys'. The specific datasets (applied to St Albans, Hertfordshire) show important built environment features pertaining to walkability and journey perception were:

- *"Buildings;*
- *Characteristics of the footway;*

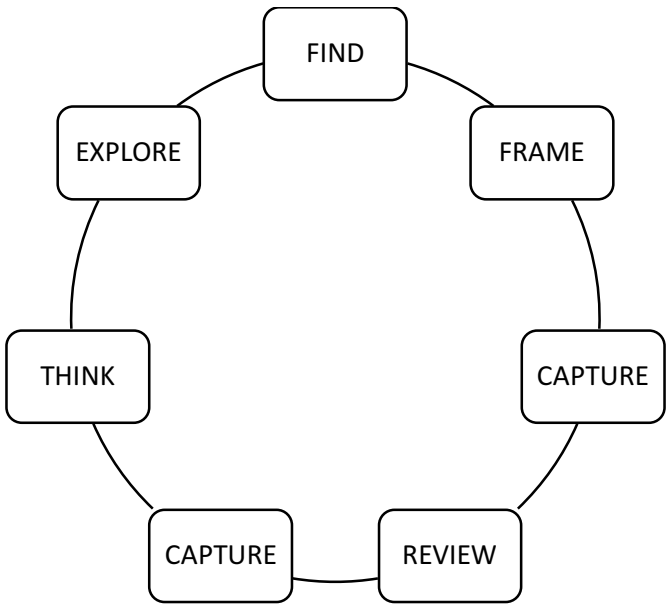
- *Road crossings;*
- *Bus stops;*
- *Car parking; and*
- *Features." (Titheridge et al., 2009, p. 35)*

There are those who would disagree: those who argue that the automobile and its manifestation in the built environment are the rights of freedom and choice in society (O'Toole, 2000, 2009). This argument is referred to in more detail in Chapter Two. The position of O'Toole et al. is not accepted by this researcher. Instead, a professional and ethical bias in favour of walkable environments is adopted. However, the researcher is not attempting to claim to be operating from a feminist or advocacy perspective – this research, as acknowledged, does not give voice to those marginalised by automobile-oriented environments. Nonetheless, the draw of walkable environments and their relationship between public transport (in this instance on RRCs) is more than a mere aesthetic choice. Further reflection on the researcher's position, however, identifies that perspectives on the public spaces under study are still susceptible to the expectations of the marginalising sector of society from which he comes.

Although ideas of what is good urban design can neither be identical between two people nor wholly applicable to more than one specific place, the findings of this research can be used with extant notions of normative urban design. Further mitigation occurs with the findings made by this researcher; no urban design rules are attempted to be established; examples are collected, compared and synthesised into generalisations. These generalisations are caveated with the considerations above. The reason that this approach has been adopted is that the territory of study is emerging; there are a limited yet slowly increasing number of RRCs in the United Kingdom and in parallel related built environment developments are also emerging. The principle behind this research is that it is at the beginning of the surveying process of these phenomena, searching for salient examples and testing different research techniques with which to examine these examples. In this vein, findings as opposed to conclusions are presented.

With a view to producing an honest, reflexive discussion surrounding the way in which this research has been carried out, it is necessary to explain some certain personal aspects of the researcher here in order to establish any epistemic legitimacy to the findings. This is an discussion of the researcher's inclination towards 'visual thinking' (Rose, 2007). The recognition of the inherent bias of the researcher, with its pros and cons, is explained here. Taking photographs is more than a process of recording observations to the researcher – it is a practice within which deliberation is facilitated. Whilst Sketching was the preferred manner of visual data collection in architectural education, the researcher always preferred photography as this method could keep up with the speed of thoughts: the rapid accumulation of information through photography can crystallise and contain what might

be hours' worth of sketching or thousands of words of writing and is more a kin to experience. The fieldwork in this research followed this pattern:



This process is evidenced by the amount of photographs that have been created as part of this research: circa fourteen hundred. This is why the appendix, which contains a high proportion of these (omitting only repeated recomposed views), is so large. This is, however, apparently at odds with how technical literature advises images are used within research:

> *"The observations can be so valuable that you may even consider taking photographs at the case study site. At a minimum, these photographs will help to convey important case characteristics to outside observers (see Dabs, 1982)."*

Photographs are not separated from the thoughts and observations of the researcher, they are an intrinsic part of the cognitive process – a process that is visual. Further, in a study such as this, with its breadth and focus upon establishing the manifestation of normative urban design criteria, it is not a case of 'considering' taking photographs but there is an imperative to do so.

Eide (Eide & Eide, 2011) characterises four different types of reasoning that are common strengths amongst dyslexic brains[41] : material, interconnected, narrative and dynamic reasoning, and these perceptive means have relevance to the study of place and the built environment. Material reasoning, according to Eide (2011) is the ability to reason about the physical material world, the three-dimensional characteristics of things, their temporal positions and the interactions between. There is a clear parallel between this type of reasoning and the topic under study, the urban design of RRCs. The built environment under

[41] The researcher was diagnosed dyslexic at the age of 29, less than a year before the commencement of the research. Although this is considered by some a false unscientific term, there are traits of dyslexia (Eide & Eide, 2011) that the researcher has noticed about himself.

study is a complex three and four-dimensional context. Given that the researcher has a propensity for visual thinking, the observing and capturing of these thoughts through the process of photography, perhaps crossover between the thought processes of the researcher and the topic of study exists. This is not an argument for the exclusion of textual or numerical interpretations of built environments; it is merely putting forward the case that this type of interpretation and this type of reasoning can contribute some value to the intellectual field of urban design.

Interconnected reasoning (Eide & Eide, 2011) is the process of noticing connections between objects, ideas, or perspectives through similarity, correlation or causality. This has a synergy with the analytical strategy of this research (chapter 3.6). Narrative reasoning, or as Eide (2011) describes it 'the structure of experience' is another type of reasoning applied in the analysis of this research. Eide (2011) coins the term 'N-strengths' and defines narrative reasoning as:

> *"N-strengths are the ability to construct a connected series of mental scenes from fragments of past personal experience (that is, from episodic or personal memory) that can be used to recall the past, explain the present, stimulate potential future or imaginary scenarios, and grasp and test important concepts." (Eide & Eide, 2011, p. 114)*

It is argued that there are strong parallels between narrative reasoning and Cullen's theory of townscape (chapter 2.4). The first sentence of the above quotation could feasibly be considered as a description of 'serial vision', a constructed series of mental scenes from a personalised experience of the built environment. It is the intention within this research to document this episodic experiential experience using photography in order to explain a variety of urban design at RRCs. Further, the findings in this exercise are likened to normative urban design literature; it is argued that this shows an exercise in 'testing against important concepts' (Eide & Eide, 2011) as described above.

Eide (2011) suggests the previous four types of mental reasoning might be an advantage to a dyslexic brain. It is also made explicit that these advantages coming at a cost. This following discussion, through being brutally honest with regards reflexivity in this discussion, illuminates the researcher's limitations. Gray and Malins (2004) use the analogy of 'fish and fishing' to describe the importance of certain skills in academic research. Stating that the journey is more important than the destination, 'that today's knowledge is tomorrow's joke' and that being 'able to fish' is more important than 'the fish itself', the point made is that the process of accruing knowledge is more important than the knowledge itself. All the aforementioned 'types of reasoning' (Eide & Eide, 2011), relate to the final product of research: the findings. Summarised below are two contrasting statements of Eide and Eide (2011) and Gray and Malins (2004).

Eide and Eide (2011) highlight the advantages of their 'types of reasoning': the ability to engage with situated and large contexts, the ability to recognise a variety of perspectives, the ability to draw connections between seemingly disparate yet related aspects, et cetera. All of these strengths are useful in targeting the generation of knowledge. However, the traits which they highlight being present in the non-dyslexic brain are more akin to a proficient researcher: precision, accuracy, efficiency, speed, reliability, replicability, focus and expertise in detail. There are parallels here with this researchers skill set.

> *If research is a process, then learning about research is about learning how to research. We could almost say that the process is more important than the product – the journey is more interesting than the destination. Knowing how to research is perhaps much more valuable than finding out a particular thing, gaining a particular piece of knowledge, particularly as 'Knowledge keeps as well as fish' (anon.). All knowledge is tentative. today's knowledge is tomorrow's joke – the earth is the centre of the universe and is flat! If knowledge has a sell-by date, then the most important thing is meta-knowledge – knowing about knowledge, knowing how to acquire, manage, analyse, synthesise and communicate knowledge. Research is about searching for alternatives. Being sceptical and critical are crucial research characteristics in progressing from one piece of knowledge to a better, more 'fit' version. If we accept the 'fish' argument then 'fishing' – knowing how to do research, knowing about methodology – is perhaps the most important part of the research process." (Gray and Malins p.17)*
>
> **********
>
> *"For many nondyslexic brains, excellent function consists of traits like precision, accuracy, efficiency, speed, automaticity, reliability, replicability, focus, concision and detailed expertise.*
>
> *For dyslexic brains, excellent function typically means traits like the ability to see the gist or essence of things or to spot the larger context behind a given situation or idea; multidimensionality of perspective; the ability to see new, unusual, or distant connections; inferential reasoning and ambiguity detection; the ability to recombine things in novel ways and a general inventiveness; and greater mindfulness and intentionality during tasks that others take for granted." (Eide & Eide, 2011, p. 42)*

Throughout this research, the researcher has considered himself as a conduit, a way of presenting evidence and tentative findings in the field of urban design and RRCs. Considerable effort has been paid to the traits that could potentially undermine this research and mitigating measures applied. In addition, this is where the pragmatic worldview is considered particularly relevant. Used as a guide, a methodological route that demonstrates reliability and validity whilst preserving the object of study as the centre of the research focus, Creswell writes concerning the pragmatic worldview:

> *"Instead of focusing on methods, researchers emphasize the research problem and use all approaches available to understand the problem." (Creswell, 2009, p. 10)*

It is argued that this methodological stance is an appropriate position with which to undertake this research, centered upon this territory of enquiry at this time. Although there are many quantitative and qualitative approaches relevant to investigations into the built environment, it is argued that the way in which this research has been carried out yields useful and trustworthy knowledge in the area of urban design at RRCs.

Amendments to Research Made During Study

As this piece of research evolved it was necessary to adjust its design due to unforeseen circumstances. These adjustments involved removing unstructured interviews, semi-structured interviews and street auditing research techniques from the research design. Although these research techniques are relevant to the topic of study, their removal from the research design benefited the research overall. It allowed for the application of the adopted methodologies to be applied to a broader range of case study subjects. However, both of the aspects removed from the research design are considered as components of potential future study.

Interviews were a part of the initial research design, and in the early stages a handful were carried out. It was learned very quickly from these interviews that the conversations were of a very abstract manner. They required concrete examples in order to be more meaningful. Such examples were not found in the literature review, they were produced as part of this case study research. The small number of interviews that were carried out were still of use to the research. One of the case studies examined in this research was suggested by an interviewee. Also the process of preparing to 'learn from strangers' Weiss (1994) was beneficial to the research methodologies. It involves the preparation of their protocols, the consideration of the research as part of research, and ethical behaviour on the part of the researcher. Therefore, it is argued none of this work was wasted even though this research method was removed from the research design. Now the case study evidence has been collected, semi-structured interviews are considered for potential future research. Adopting this order of implementation has three benefits. The data collected can be used as the basis of future interviews. The act of carrying out the case study has identified potentially more fruitful interview subjects based on specific places, hopefully leading to more meaningful interviews. The data and findings of this research could also be used, during interviews, to make generalisations with regard to other RRCs not covered as part of this research. This could prompt further findings in other situations that either confirm or contradict the findings of this research.

As this research design progressed, street auditing techniques were considered so as to provide a foil to the observations used in the serial vision section of this research. The particular street audits considered whether pedestrian and cyclist auditing methods were

offered by TRL (PERS/CERS). Although these street auditing techniques are very well respected in transport and land-use circles, the economic limitations of this research meant the adoption of their method was impossible. Although Yin (2009) rightly states that case studies should not be impaired by such false constraints as financial ability, unfortunately it was impossible to overcome this in this case. Moreover, there are beneficial aspects to removing street auditing from this research. In doing so, the scope of application of the adopted research techniques was able to be much broader.

In an ideal world, the data collected as part of this research would have existed prior to the commencement of this research and could have been used as part of semi-structured interviews and compared and contrasted with street auditing techniques. It is argued that one of the strengths of this research is that this corpus of information exists now, and has potential to be of use to further research.

Ethical Considerations

It is argued the researcher adopts an ethically justifiable position, professionally and personally. Inherent in this research has been a degree of investigation into ethical theory and in the broadest sense the researcher and the practices in this research identify with utilitarianism. King and Horrocks discuss utilitarian ethics as follows:

> *"According to utilitarianism, actions are judged right or wrong in proportion to their propensity to produce the most happiness or pleasure, for the greatest number. This model of ethics is founded upon the ability to predict the consequences of an action with rightness or wrongness being dependent on the consequences of an act." (King & Horrocks, 2010, p. 105).*

The fundamental reason for this research is adopting a career in the built environment, and consequently researching the built environment and its aspiration 'to produce happiness or pleasure'. Although it is acknowledged that the act of building will always be of detriment to somebody, somewhere, in some form, perhaps constructing buildings is a useful analogy for utilitarianism: the short-term pain of noisy inconvenient building sites for the potential long-term gain of, hopefully, an improved place to inhabit. This is a principle that has influenced the research design. It is argued that this research has potential to be of use to practitioners in the urban design field and the sphere of the built environment. At the beginning of the research it was not anticipated that any maleficence to others would occur. There were, however, four distinct incidents during the carrying out of this research that tested these principles. These were discussed, by way of example, in this subchapter.

As discussed earlier, the visual methodology of this research relies on photography. Ethically, the practice of taking photographs in the context of a study in the built environment highlights some interesting issues. For example, to examine and illustrate a

mixed-use land-use function adjacent to a transit node, it has been necessary to take photographs of private buildings and often there have been people inhabiting the streetscape. As trespass has been wholly avoided, any photograph has been taken from the public highway and as such, permission to photograph has not been legally required. This has also been useful as it illustrates the act of taking the photograph, in the full view of anyone who happens to be passing by, cannot be considered covert. Likewise, where it has been necessary to take photographs that include residential accommodation, efforts have been made to treat the framing of the photograph so that any windows are shown at the most oblique angle possible. Due to these measures, and hopefully this attitude is apparent in the photographs in this research, no permissions have been sought from anyone caught obliquely in a photographic image. Only once was the researcher challenged by a member of the public about taking photographs. This occurred on Orchard Park in Cambridge where a polite enquiry was made to the researcher as to the reason why they were seemingly wandering round a residential area taking photographs. The researcher explained the research to the person who enquired. Although this explanation was seemingly accepted, the researcher showed the member of the public his University of Nottingham identification card, offered the research supervisor's email address for corroboration, and if they would like to be kept informed of my research through the forwarding of a final draft. The member of the public did not ask to be sent any further information, seemed to accept the researcher's explanation at face value and to the best of the researcher's knowledge, a corroborated email was not sought by the member of the public.

There are three other situations where the ethical protocols in this research was shown to be limited. One situation caused the researcher to be in physical danger, one situation caused the researcher to be in reputational danger and the third situation could have been of potential benefit to the research if it had been handled more appropriately.

The first example occurred in Newstead. The researcher was taking photographs approximately 200m from the railway station when shouted at across the street by three people in the approximate area of the image below. These people made a threat to the researcher (1.00 N, see appendix). Although this threat was not taken seriously, and no conversation was entered into, it did alter the collection of data. The researcher stopped taking photographs in that area and returned another day to complete the data collection. This incident did prompt a critical reappraisal of the safety of the researcher entering the field on their own. However, it was decided not to alter this data collection protocol as this was an isolated incident. All photographs were collected in broad daylight, in public places in proximity to busy areas and although the situation was not pleasant, it was not considered a serious enough threat to alter the data collection protocols, especially given the amount of natural surveillance in the places where data is being collected.

The second way in which the ethical credibility of the researcher in this research was tested was at Cambridge railway station. The image below shows the construction of a mixed-use development with a number of bus stops directly adjacent that serve both conventional services and buses that use the guided busway.

Figure 3.3 Position where Researcher Venerability was Tested

Source: Authors own (2013)

This image perhaps does not illustrate that relationship as best it could. Whilst attempting to take photographs that would show this relationship better, the researcher was focusing on an empty bus stop with the new construction in the background. At the adjacent bus stop were three teenage women who, like the person at Orchard Park, challenged the researcher as to why they were taking photographs of what must appear to the layperson as a peculiar subject. The researcher explained the research, but one of the three teenage women changed the subject of the conversation to 'how much they enjoyed having their photograph taken'. This was incredibly awkward to the researcher, although thankfully two of the three women were urging the other to cease by pointing out the danger of asking strangers to photograph them. The researcher briefly agreed with this point, closed the conversation and walked off at the earliest opportunity. In terms of this research this situation had a similar impact to the altercation at Newstead; the researcher made a swift exit and did not recommence taking photographs until, at the earliest, those to whom one had just spoken were completely out of eye shot. Ideally, both situations would have been far less likely to cause any damage to the researcher, either physically or reputational, by the presence of another person by way of either 'safety in numbers' or as a witness. Unfortunately, the resources of this research did not allow for this, however, the researcher would insist upon this if any further research is conducted in this manner. It is worth reiterating at this point that the researcher behaved entirely ethically and properly in all of these situations.

The last instance where the ethical behaviours of the researcher were tested in the field, as opposed to the previous examples where harm could have conceivably come to the researcher, shows that the research could have benefited had more thorough protocols been

in place and the researcher been better prepared for chance encounters. This occurred at Stow on the Waverley line after the taking of the photograph below.

Figure 3.4 Position where Chance Encounter with Local Resident Took Place

Source: Authors own (2011)

A retired gentleman enquired into the reason for me taking a photograph, and as in the previous examples, the researcher explained the research. This instigated a very interesting 15-20 minute conversation[42]; he had lived in Stow all his life and could remember the railway in its previous incarnation. Unfortunately, none of this can be presented as evidence as the conversation was not recorded, his details weren't taken in order to formally request permission, and although many of the topics crossed with ideas brought up in the literature, no previous interview protocol was established. In hindsight, it would be preferable to enter the field with at least one other researcher for the sake of safety, and consent forms for recording equipment should be carried at all times so as to make the most of chance encounters.

The second crucial ethical issue has led the researcher to question the utilitarian stance on ethics. Jacobson and Forsyth's (2008) seventh principle out of twelve is to: 'Use design and programming strategies to increase safety'. Along the Robin Hood Line/Nottingham Express Transit the question of safety issues, urban design and public transit has been raised. There is one site where there has been a fatal accident prior to the commencement of this research and a further fatal accident during the course of this research. This is at the site where a pedestrian crossing traverses both the heavy rail and the light rail tracks. The first image shows the condition of the crossing during both of the

[42] The topics of conversation ranged from the politics of reinstating a railway line to how one of his cherished childhood memories was seeing a diverted train pulled by the speed record holding Mallard locomotive using the Waverley Line; how the reinstatement will change his life by increasing his access to Edinburgh whilst reminiscing about how he used to make the same trip as a boy on the 'football special' that used to run; how he used to go to the station with his friends to catch newspapers as they were delivered to Stow by being thrown off passing trains and how lamentable the initial closure of the line was in the late 1960s.

accidents and the further images below shows the remedial action taken: the construction of a bridge.

Figure 3.5 Position of Fatal Accident and built reaction to the incident. The top left image shows the at grade pedestrian crossing to the heavy and light rail tracks, taken prior to the fatal accident. The top right and central images show the response to the incident and the extent of the new infrastructure (including 2 x 120m ramps) Source: Authors own (2011, 2016 & 2016)

This research looks into RRCs as elements that divide differing districts. Ordinarily the researcher would adopt the stance that in urban design terms, traversing such 'paths' and 'edges' at ground level would be the ideal solution. This would be backed up by the utilitarian ethical standpoint as the vast majority of crossings will happen safely and be the most convenient. However, two people have lost their lives at this point. This prompts the researcher to question whether or not this is an appropriate position to adopt.

3.8 Summary

This research aims to find truths in the built environments of RRCs relevant to the practice of urban design. The focus of this chapter upon the conceptualisation, design and implementation of this inquiry has summarised the underpinning philosophical assumptions and explained the reasons for such a 'visual methodology' (Rose, 2007). This rationale has been applied to the case study method undertaken, where careful consideration has been given to the three sources of data that constitute the case study evidence. The logic behind

a comparative cross-case analysis as the analytical strategy has also been explained. Validity and ethical considerations of this research have also been examined. This chapter has identified the systematic way in which the methodological positions and technical approaches adopted in this research have led to the conclusions set out in chapter seven.

4. The Three Case Studies

Chapter Four introduces the three case studies that comprise the territory of inquiry for this research. The configuration of these RRCs is initially described, highlighting the following aspects: 'distances covered by the route', 'distribution of and types of nodes', 'what proportion of these routes follow/deviate from previous railway alignments'. After this description each of the three cases are taken in chronological order of their opening, and are examined in more detail focusing on their more contextually specific aspects. This will include reference to the use and re-use of the region's railway corridors, the position and configuration of settlements that relate to the RRCs and the inter-relationship between these nodes. The full dataset of the three cases is included in the appendix and includes specific historical narratives behind the process of the 'recycling' of the respective routes, and the policy context specific to each individual region.

This research is concerned with three case studies that in total run for 152.23km of transport network route, 124.55km of which is along reinstated railway corridors (81.9%). This necessitates applying attention at varying levels of detail to 48 nodes in total, described as stations or stops depending on which transport mode they relate to. Although this is an unusual level of breadth for this type of study, the lack of pre-existing work in this field through the perspective of a built environment design-focused lens has necessitated this wide approach. Whilst the axiom for research states *'a study should say a lot about a little'*, this would not have made complete sense in this context, at this time. Future studies could utilise this research by refining the scope and methods adopted in this research by focusing in closer detail on a smaller field of specific places whilst also applying a broader range of research techniques. A further aspect to this research is that the territory implicit in a RRC is at the regional scale and therefore inherently broad. This piece of 'scoping-work' does, however, highlight certain key and interesting examples of urban design at RRCs, where examination is applied at a finer grain.

The case studies in this research are listed below in chronological order of (re)opening:

- Case Study 01 - the Robin Hood Line/Nottingham Express Transit Phase 1 (opened 1993 / 2004 respectively);
- Case Study 02 - the Cambridge Guided Busway (opened 2011); and

- Case Study 03 - the Borders Rail-Waverley Line (opened 2015).

These represent the current incarnations of these transit routes. Case Study 01 comprises two transport networks, whereas Case Study 02 and Case Study 03 are made up of singular transport networks. The reason for the decision to have one case comprising two networks and two cases that comprise singular networks, is that the purpose of these case studies is to examine the RRC and its constituent built environs, focusing on the inter-relationship between the urban designs and the transport infrastructure, as opposed to solely the transport networks. This difference provides insights that would not be gleaned if the dual network case were excluded. These four networks, in terms of public transit configuration, illustrate complex histories spanning circa one hundred and fifty years. The historic contexts of each of the respective case studies is summarised in the appendix.

Table 5.1 'RRC/Node Summary' can be read in conjunction with figure 'Case Study Route Diagram'. Together, these illustrate the characteristics of the three case studies in terms of their route lengths, quantity of nodes and the inter-relationship between these nodes.

	CS01 Robin Hood Line/ Nottingham Express Transit		CS02 Cambridge Guided Busway	CS03 Borders Rail- Waverley Line
	RHL	NET P1		
Line				
overall length (km)	51.66	13.6	33.33	46.07
total length: reinstated lines (km)	46.48	9.38	26.72	40.33
% of route on reinstated line	90 %	69 %	80 %	87 %
total street-running / non 'grade separated' (km)	0	4.22	5.1 (varies upon operator)	0
parallel permanent way (km)	9.05		0.96	0
mean average between nodes (km)	3.97	0.85	2.08	7.6
median average between nodes (km)	4.12	0.91	2.05	4.5
highest distance between nodes (km)	8.78	1.61	3.92	20.73
lowest distance between nodes (km)	1.70	0.43	0.62	2.09
Node				
overall tally	13	12	16	7
combined mode	3		1	0
single mode	10	9	15	7
non reinstated node	1	/	0	1
new developments directly related to the RRC	0	0	4	1

Table 4.1 RRC / Node Summary

There is variety in the distances covered in the overall length of network of these RRCs, although each route can be considered regional.

Case study 01 (CS01) includes two networks that operate substantially side-by-side, a combination which has both the longest and the shortest routes of the case studies used in this research. These networks share a RRC, therefore exhibiting traits of duplication to a large degree. The Robin Hood Heavy Rail line covers a total distance of 51.66km between

Nottingham and Worksop, with the Nottingham Express Transit Phase 1 tram line extending 13.6km between Nottingham and Hucknall. The second longest network at 46.07km is Case Study 03, the Borders Rail-Waverley Line. This network runs between Tweedbank and the point at which the route joins with the national rail network to the south east of Edinburgh. The overall length of Case Study 02 (CS02) the Cambridge Guided Busway network, is 33.3km, extending from Cambridge Railway Station south-westerly towards Trumpington and north-westerly towards St Ives. These differences across the cases are illustrated graphically on the 'Case Study Route Diagram'.

There is a correlation between the length of network and the proportion of recycled railway alignment, as evident in table 5.1. The longest network the Robin Hood Line, encapsulated in CS01, uses the highest percentage of previous railway alignment at 90%. This figure is similar to the corresponding length on the Borders Rail-Waverley Line measurement where 87% of the network is on a previous railway alignment. The third longest network, the Cambridge Guided Busway, also has the third highest proportion of its route utilising previous railway alignments at 80%. These three networks therefore show that over four fifths of their total network lengths occupy disused railway corridors, whereas the NET P1 network, also encapsulated in CS01, uses disused railway corridors along less than three quarters of its length. It could be speculated that the heavy rail networks use a higher proportion of disused alignments due to the inherent flexibility of the 'lighter' forms of transport (tram and bus). However, if that were strictly the case then the more flexible guided bus would have a lower proportion of disused alignment utilisation than the tram. The table 'RRC and Node Summary' and the 'Case Study Route Diagram' show that in fact it is the tramline of NET P1 that uses the lowest proportion of disused railway alignment.

The lengths of the respective networks do however reflect what would be expected of the differing transport modes; the heavy rail routes being the longer, with the lighter forms of transport covering considerably shorter distances. The two heavy rail reinstatements also show the highest proportion of grade separation[43], with the entirety of the Borders Rail-Waverley Line being grade-separated along with the vast majority of the Robin Hood Line. The only exception on the Robin Hood Line are the fifteen[44] level crossings that are spread across its length. Of these fifteen, four are situated directly adjacent to their relative stations: Basford North (CS 1.04), Bulwell Forest (CS 1.09), Newstead (CS 1.13) and Worksop (CS 1.22). As well as the level crossings at Basford and Bulwell Forest, the NET P1 has 4.22km of grade-shared running. The tram route deviates from the previous Great Central railway alignment just after Nottingham Station (CS 1.01) and runs along mainly pedestrianised or

[43] Grade separation meaning where two transit networks cross at differing levels without interference with each other.

[44] Worksop, Creswell, Sutton-in-Ashfield x2, Kirkby-in-Ashfield, Newstead x2, Hucknall x5, Bulwell Forest, Phoenix Park, Basford.

automobile-restricted streets through the city centre and the Victorian-era suburb of Radford before re-joining the previous route of the Midland Railway at Wilkinson Street (CS 1.02).

In comparison with CS01 and CS03, the Cambridge Guided Busway, CS02, is relatively more complex in terms of grade separation. Other forms of transport utilise the historic railway infrastructure (such as road/rail bridges) in order to traverse the RRC, which occurs at seven instances along the alignment. Grade integration is observed to be more common, with seventeen instances. This offers the opportunity for a quasi-hybrid transport solution, where the benefits of higher speeds and reduced traffic congestion can be utilised along the grade-separated sections of the route whilst also maintaining flexibility in the opportunity to interact with the main road network at every junction. As well as providing a high level of redundancy in the network, this configuration allows for more options in the structure of the network, decreasing the negative impacts of maintenance or accidents. This flexibility is useful for a number of built environment reasons. It can open up the use of the busway to a number of proliferating routes, which in turn can support more transit-focused town patterns. In urban design terms, this transport configuration helps considerably in the supporting of new developments through:

- developments not having to rely upon a close proximity to the RRC in order to benefit from the reinstatement of the disused railway corridor;
- new spurs from the historic railway alignment being feasible; and
- the high frequency of nodes, with buses being able to provide more nodes in relation to large developments.

Currently, the services that operate along the busway utilise this grade integration at five specific instances. There are two park-and-ride sites at either end of the network: Trumpington (CS 2.01) and St Ives (CS 2.15). The Cambridge Station Area (CS 2.04) acts as an interchange point between the busway and the city road network[45]. The varying services then re-join the RRC after approximately 5km of street-running at either the A1309 adjacent to Cambridge Science Park (CS 2.05) or at the new Orchard Park development (CS 2.07 & CS 2.08). These five points are the key sections of the RRC where grade integration occurs. This grade integration necessitates a variety of built environment/urban design responses to such issues as the coming together of various vehicular/non-vehicular rights of way, appropriate land uses for such transport confluences and the integration of the transport network and the public realm.

One of the core justifications cited for the execution of the Beeching Report's recommendations[46] is the argument that high levels of duplication of service existed throughout the rail network. This duplication of service, which was primarily due to the

[45] As well as being a hub that includes national rail and significant cycle park.
[46] Other reasons including low patronage and low revenue generation, high maintenance costs, difficulties in modernisation from steam to modern traction, competition from the evolution of road-based freight traffic, etc.

development of the railways being driven by market forces[47], is barely disputed. What is examined here is whether or not duplication can be of benefit if the terms of analysis are broadened beyond the fiscal to include built environment implications.

The three case studies reveal interesting data when the concept of 'duplication of service' is considered. CS03 Borders Rail-Waverley Line shows zero instances of parallel permanent way networks along its 46.07km length[48]. CS02, the Cambridge Guided Busway, also shows a very low amount of parallel permanent way network, 960m as part of an overall length of over 33km. CS01 is very different to these other two case studies in that a high proportion of NET P1 is in a parallel permanent way network configuration, 9.35km out of a total 13.6km or 96% of the RRC portion of the network. This in turn equates to 18% of the 51.66km length of the RHL. This is illustrated in the Case Study Route Diagram. The only section of NET P1 that uses previous railway alignments that is not configured in a parallel permanent way is the last 300m before the Nottingham Station terminus (CS 1.01), where the elevated route of the closed Great Central Railway's viaduct is adopted from the street-running section through the town centre.

In the context of this research 'duplication' has been considered carefully. For example, the NET P1 shares a RRC with the RHL and therefore from certain perspectives duplication, in the pejorative sense, occurs. The arrangement and characteristics of the nodes along this parallel permanent-way configuration would then mean a different urban morphology. A duplication of route, but not of service, can be observed in this case. Although there is a variety of provision in terms of nodes, with there being a larger number of tram stops than train stops and distributed at a higher frequency, this duplication configuration is 'space intensive'.

A four-track configuration of parallel permanent way is in operation for a 3.65km length between Wilkinson Street (CS 1.02) and Bulwell (CS 1.08). Assuming a 20m cross-section for a four-track configuration, the arrangement that exists occupies 7.3ha. If this configuration was executed using the principles of the Tram-Train[49] model with an assumption of 10m cross-section for a two-track configuration, then the used land would be circa half the amount – 3.65ha. Although there are clear operational and jurisdictional reasons for this parallel permanent-way configuration, it is possible to speculate from an urban design perspective as to what other amenities might occupy this corridor[50]. The

[47] These market forces often were down to the transportation of mineral resources to manufacturer/finished goods to market (Mathias, 1983). Public transport, at the time of the inception of most lines, was a secondary revenue stream to freight.

[48] Although the Waverley Line was seen as a duplicate route of the East/West Coast Mainlines in terms of the national rail network.

[49] Principles of the Karlsruhe model are discussed in chapter five. There are examples of this configuration in the UK, for example sections of the Newcastle Metro and the proposed extension of the Sheffield Tram to Rotherham.

[50] Amenities such as 'linear' parks, cycle paths or increases of adjoining developments.

principles in the Tram-Train model are especially pertinent given this specific length of corridor and its close relationship with the River Leen, particularly in terms of its aesthetic and ecological characteristics which hold the potential to act as a 'green artery' within the city's overall infrastructure.

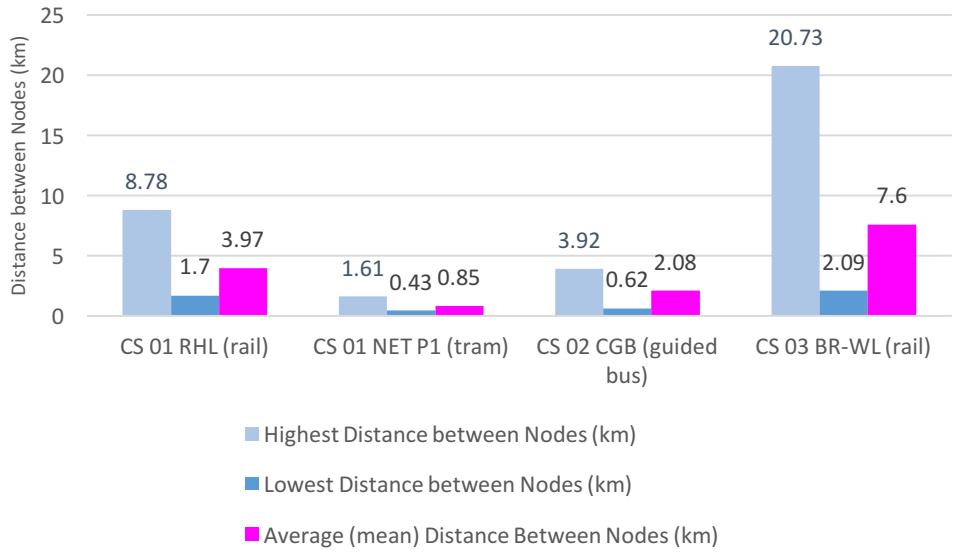
The concept of 'duplication' in this research is derived from the Beeching Report (British Railways Board, 1963a) and as such is imbued with negative connotations. However, if viewed from a contemporary urban design perspective, as opposed to the historical political-economic perspective behind the report, then certain further opportunities conceivably become apparent. For example, CS02 the Cambridge Guided Busway has under a kilometre of parallel permanent-way configuration[51]. This is based on the assumption that motorised public transit is the primary occupier of permanent-way configurations. If this assignation is expanded to include the forms of transport considered to be 'human locomotion' (Marshall & Lorimer, 2013) then the outcome for this measurement is very different. This is especially pronounced in the case of the Cambridge Guided Busway. Practically the entirety of the Cambridge Guided Busway has a cycleway/bridleway running concurrent to the tracks, all within an overall cross section of circa 10 metres. As with public transit, cycling benefits from being separated from roads. Public transit benefits predominantly from lower journey times, whereas cycling benefits predominantly from increased safety. This separation from standard road networks can be significant in urban design terms in relation to RRCs. Therefore, certain types of duplication, when considered in built environment terms, can elicit opportunities that have the potential to reinforce more sustainable modes of travel, crucially, in conjunction with complementary urban design.

In terms of number of nodes along the network length, CS02 the Cambridge Guided Busway has the highest tally of the three case studies (sixteen stops) although it is the third longest route. Of these sixteen nodes, only CS 2.04 Cambridge Station Area shows a combination of public transit modes (guided bus and rail). The two components of CS01 RHL/NET P1 both have fewer nodes each than the Cambridge Busway, thirteen and twelve respectively, although they cover differing network lengths. The RHL is 51.66km long with thirteen nodes (stations) and NET P1 has twelve nodes (stops) across a 13.6km network. A high proportion of these two networks share a RRC and there are three examples of nodes that show a combination of public transit modes (rail and tram), CS 1.01 Nottingham Station Area, CS 1.08 Bulwell and CS 1.12 Hucknall. CS03 the Borders Rail-Waverley Line has the fewest number of nodes of the three case studies: seven stations along a network which is 46.07km long. Each of these seven stops is a single mode node, which are all stations.

[51] To the south of Cambridge Railway Station (CS 2.04) where the busway runs alongside the continually operated railway heading south towards London, until it separates and follows the previous railway alignment in a westerly direction.

The relevance of these corridors' figures to urban design considerations of recycled railways is that the more nodes there are along a recycled railway route the more opportunity there is for the recycled railway's integration into the region associated with the network.

The longest distance between nodes across the three case studies is in CS03 on the BR-WL at 20.73km between CS 3.03 Stow and CS 3.04 Gorebridge, as illustrated on figure 'Case Study Route Diagrams' (0.00 see appendix). Although this diagram is not to scale the distances between the nodes illustrated are proportional. Conversely, the shortest distance between two nodes is on CS01 NET P1, CS 1.03 Basford South and CS 1.04 Basford North at 430m. In terms of average distances between nodes the longest distances are in CS03 on the Borders Rail-Waverley Line. In this case the mean average is 7.6km between nodes. The next highest average length between nodes is on the RHL component of CS01. Although this distance is around half the equivalent length of CS03 Borders Rail-Waverley Line at 3.97km in-between nodes, it is still notably higher than CS02, the Cambridge Guided Busway, where the mean average length is 2.08km in between nodes. The average distance between nodes of CS01 NET P1 is 850m. This is the only network within the case studies where the average distance between nodes is within the 1km-10 minute pedshed. These relationships are illustrated on the following chart:



Relationship between the Distribution of Nodes Along the Three Case Studies

The above chart illustrates interesting differences and similarities between the case studies in terms of distribution of nodes along the RRCs. For instance, whilst both the heavy rail networks, as would be expected, show the highest distances between nodes compared with the lighter modes of mass transport, there is a considerable difference between the RHL and the BR-WL. The average distance between nodes on the BR-WL is circa one kilometre lower than the highest distance between nodes on the RHL. The greatest distance between nodes on the BR-WL is approximately two and a half times that of the same measurement

on the RHL. The two rail networks are similar in the category of the lowest distance between nodes, RHL being 1.7km and BR-WL being approximately 400m higher at 2.09km.

Although there is a pronounced difference between the distribution of nodes along the case study networks between the heavy rail and the other modes of transport, there are also noticeable differences between the tram network of NET P1 and the CGB. Whilst the shortest distances between nodes along these two routes are not dissimilar (a difference of approximately 200m) there are considerable differences between the respective highest distance between nodes, the CGB being 3.92km whilst the highest distance between nodes on the NET P1 being 1.61km. There is also a significant difference between the average distances between nodes. The average distance between nodes on the tram network of NET P1 is 850m, whereas this figure is over double that on the guided bus network of the CGB at 2.08km. This shows that differing transport modes can lead to differing spatial configurations of the built environment at RRCs. This has implications for such urban design issues as land use and urban morphology. The urban design evidence collected in order to examine such issues further is discussed in Chapter Five.

In terms of the consideration of RRCs as structuring elements to regionally significant residentially-led developments (as espoused in the discussed theory (Dunphy et al., 2004) there are differences across the case studies. CS01 RHL/NET P1, although covering the greatest geographical territory, is not directly associated with any regionally significant residentially-led developments. The second largest case study in terms of geographical territory, CS03 BR-WL is associated with one regionally significant residentially-led development, a proposed town at CS 3.07: Shawfair. Despite being the smallest case study in terms of overall territory covered, CS02 CGB is directly associated with four regionally significant residentially-led developments: CS 2.01 Trumpington, CS 2.02 Trumpington (Clay Farm), CS 2.07/8 Orchard Park East/West and CS 2.11 Northstowe (proposed town). These developments are at the time of study in differing stages of development.

The conceptual framework of this research (Chapter Two) is predicated upon critical regionalism, which highlights a key aspect of a regionally responsive design to be one that responds to topography. Across the three case studies there are contrasting topographies within which the RRCs exist, and these are introduced here. The three case studies' topographies are summarised in the diagram below and drawings 1.00B, 2.00B and 3.00B (see appendix) derived from Ordnance Survey data. Using these pieces of documentary evidence the following characteristics are described:

- the longitudinal profile of the RRCs (measured at their height in metres above sea level);
- the broad nature of the topographies through which these routes pass; and
- the position of the RRCs within their topographies.

The table below can be read in conjunction with the diagram 'Comparative Longitudinal Topography of the Three Case Studies' seen below. Both explain the lower and upper heights above sea level and the longitudinal profiles of the three case studies.

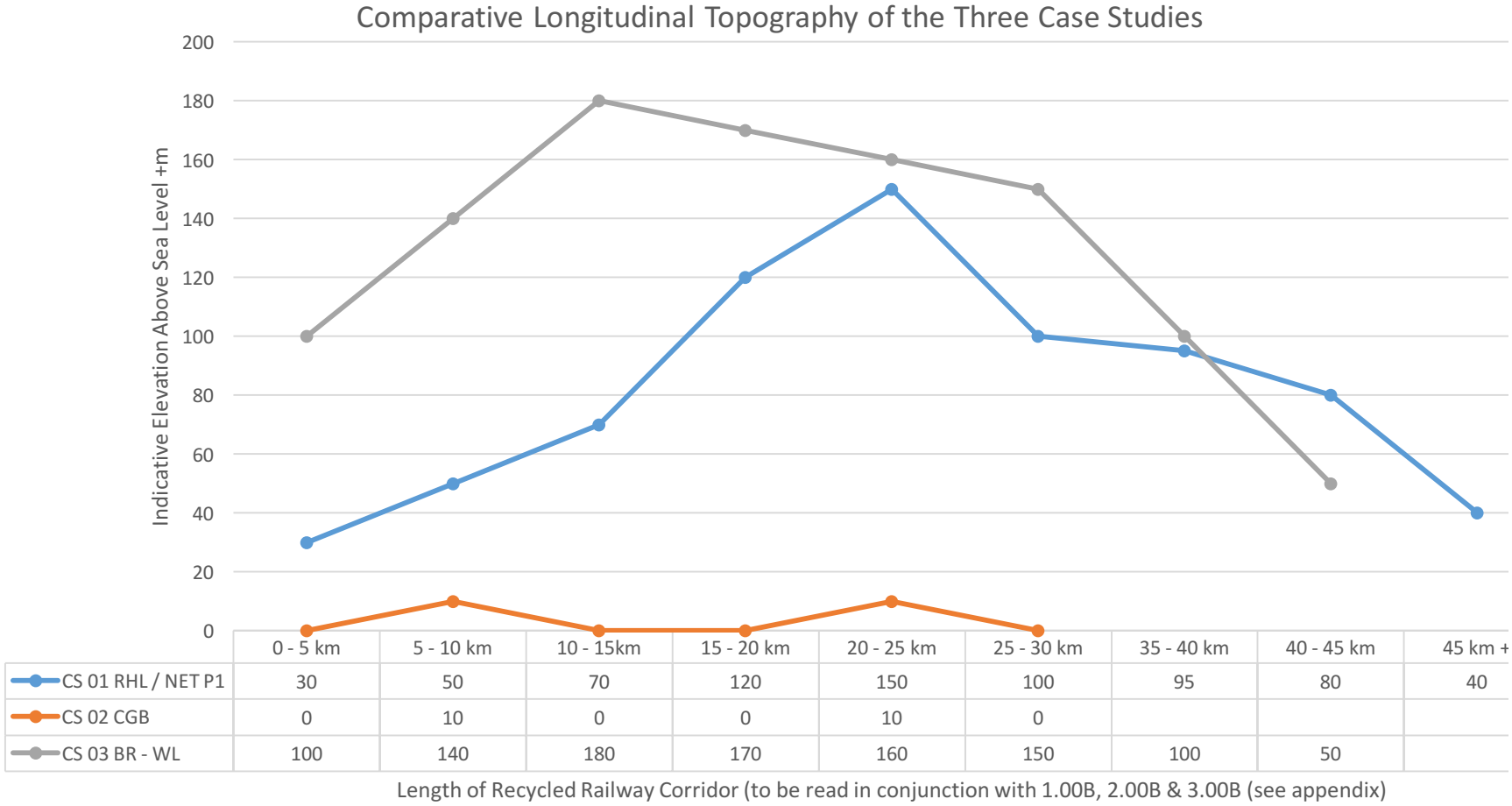
	CS 01 RHL / NET P1	CS 02 CGB	CS 03 BR - WL
Lowest Node Height	CS 1.01 Nott'm Stn. Area + 30m	All Nodes between +0m & +10m	CS 3.07 Shawfair + 50m
Greatest Node Height	CS 1.14 Kirkby-in-Ashfield & CS 1.15 Sutton Parkway + 150m		CS 3.03 Stow + 180m
Range	+/- 120m	+/- 10m	+/- 130m

Figure 4.2 Elevation Range of Case Study Topographies

Comparatively, a large range of elevations can be seen between the three case studies. Overall, CS02 the Cambridge Guided Busway exists between +0 and +10m above sea level whereas CS01 is between +30m and +150m and CS03 BR-WL is the most elevated and varied between +50m and +180m. CS03 Stow on the Borders Rail-Waverley Line is the most elevated of all the nodes of the three cases studies at +180m above sea level, with the lowest nodes being numerous along CS02 CGB at between +0m and +10m. The lowest respective elevations on CS01 RHL/NET P1 and CS03 BR-WL are 20m different between their elevations: CS 1.01 Nottingham Station Area at +30m and the lowest elevation CS 3.07 Shawfair being +50m. The greatest range of elevation is evident along CS03 BR-WL at +/-130m with CS01 RHL/NET P1 being +/-10m less with a range of +/-120m.

The following diagram 'Comparative Longitudinal Topography of the Three Case Studies' illustrates a number of things:

- CS01 and CS03 are undulating whereas CS02 is relatively flat;
- Each case illustrates a differing grade profile; and
- CS01 and CS03 have definite 'peaks' along their routes whereas CS02 has no distinct 'peak'.



	0 - 5 km	5 - 10 km	10 - 15km	15 - 20 km	20 - 25 km	25 - 30 km	35 - 40 km	40 - 45 km	45 km +
CS 01 RHL / NET P1	30	50	70	120	150	100	95	80	40
CS 02 CGB	0	10	0	0	10	0			
CS 03 BR - WL	100	140	180	170	160	150	100	50	

It is worth noting the scale of the diagram below and the lens through which this research is conducted. Whilst this diagram serves to illustrate regional scale measurements, the 10m increments in which the measurements are divided are more nuanced in terms of urban design. Through the urban design lens +/-10m can be highly significant, for example two/three normal storeys in a building. However, when conveying topography at a regional scale on an A4 sheet of paper, this reduction is necessary.

Summary of Three Case Studies

This descriptive chapter introduced the territories of inquiry adopted in this research. This was done by setting out: the 'distances covered by the route'; the 'distribution of and types of nodes'; and 'what proportion of these routes follow/deviate from previous railway alignments' of the three cases. The three case studies were then described individually in chronological order of opening, focusing upon more contextually specific aspects such as the configuration of the RRC and its relationship to main roads, built-up areas and topography. The full dataset of the three cases is included in the appendices. This description is followed in the next two chapters with cross-case analyses focusing upon issues pertaining to the two key urban design scales examined in this research: the regional and the neighbourhood.

5. The Urban Design of Recycled Railway Corridors at the Regional Scale

This chapter is a comparative analysis of the urban design along-the-line of the respective case studies. This will highlight the importance of urban design to RRCs which are inherently regional scale networks. This cross-case analysis uses themes derived from the theory as discussed in the Literature Review which have been synthesised into the following categories:

- Ecological Features Along-the-Line of RRCs;
- Strategic Growth and RRCs;
- Urban Morphology and RRCs;
- RRCs and Broader Transport Networks;
- Interruptions to Disused and RRCs;
- Land Use and RRCs;
- Cycle Paths and RRCs;
- Relationship between Topography and RRCs; and
- Pre-existing Engineering Infrastructure and RRCs.

These categories are discussed in the above order in this chapter and show how urban design can contribute to place qualities along-the-line of RRCs, thus highlighting opportunities through a 'joined-up thinking' approach which includes urban design considerations, within this specific context.

5.1 Ecological Features and Recycled Railway Corridors

The urban design of the RRCs in each of the three case studies exhibit a broad range of ecological features. This is reflected in the literature such as Luccarelli's (1995) 'Lewis Mumford and the Ecological Region', Calthorpe's (1993) 'The Next American Metropolis' and Breheny and Rookwood's (1993) 'Social City Region'. This literature posits regions to be 'environmentally contained systems' (Luccarelli, 1995). This research considers the urban design of RRCs, if the three case studies are considered as such systems. The table below summarises the key points from this literature:

BROAD REGIONAL CONTEXT
Protect natural ecosystems, biodiversity, wildlife
More tree planting on watersheds, field boundaries, urban areas
Community forests to increase biomass
RURAL NODE TYPOLOGY
Develop more mixed forest and wildlife habitats
Avoid monocultures and enhance biological diversity
Develop wind farms in all suitable locations
Design leisure and tourism facilities to protect local eco-systems and promote environmental awareness
Compact organic waste and stop nitrate runoff from artificial fertilizers
Protect watersheds and purity of water supplies

Table 5.1 Summary of S.C.R. 'Ecological Features'

The joint-mode station at Bulwell (CS 1.08) is adjacent to an ecologically important feature known as 'Bulwell Bogs'. This area is illustrated in below. Here the historic bridge over the River Leen acts as the pedestrian and vehicular link between Bulwell station and the town centre/market square/bus station. This ecological feature is an example of the combination of both a flood attenuation measure and a public recreation space. This area is prone to flooding; however, when river levels are normal this area is a well-used public amenity. The urban design here is characterised by the culverting of the River Leen with concrete steps, which simultaneously acts as capacity for high river levels and gives space for informal seating. A more formal park with paths, benches and lawns is adjacent to this channel. This place within a mature city suburb reflects Breheny and Rookwood's (1993) notion of:

> *'Design leisure and tourism facilities to protect local eco-systems and promote environmental awareness.' (Breheny & Rookwood, 1993, p. 183)*

The area could be identified as a 'pocket' leisure facility that protects the local eco-system through its retention and maintenance, especially considering the land use-pressures at

transit nodes. Although this area complements the station/stop on the RRC, the amenity existed before their reintroduction.

Figure 5.1 Ecological Feature – 'Bulwell Bogs'

This composite photograph shows the culverted River Leen, adjacent to the Bulwell joint tram and train stop, being used as public amenity. This area is used for flood attenuation. Note the historic bridge used as the pedestrian and vehicular access to the station and its associated surface car park.
(Author's own, 2012)

The relationship between RRCs and brownfield sites is discussed further on in this chapter; however, an issue with such sites is their ecological value through an inherent high level of biodiversity and the potential loss of such biodiversity through development. When the RRC is considered as a brownfield site in itself, then the ecological value in dereliction can be appreciated. This value can be lost through the process of reinstatement. A mitigation-measure for this issue is evident on the CGB: Figure 5.2 shows the planting of a new hedgerow as the boundary of the cycle track that runs adjacent to the guided busway.

Figure 5.2 Ecological Feature – Biodiversity along a RRC

These two images illustrate the mitigation of loss of biodiversity through the repurposing of a brownfield corridor, in this instance along the CGB. There are numerous instances of hedgerow planting along this RRC. (Author's own, 2010)

This practice was surprisingly rare across the case studies researched. A tramway offers the opportunity to 'green' that particular corridor which numerous examples of trams running through landscaped areas demonstrate, both urban and peri-urban, such as those illustrated in den Haag and Rotterdam below. However, just south of the Bulwell node (within the 400m pedshed) the following image shows a ballasted track bed, adjacent to a linear park that runs along the bank of the River Leen:

Figure 5.3 Tram track bed as ecological feature

These images show tram track beds being used as ecological features in an urban setting (Rotterdam) and a suburban setting (den Haag). The third image shows a comparison to this strategy evident in NET P1 where chemically treated ballast is used as the tram track bed.
(Author's own, 2012)

A further facet to the integration of RRCs within their 'ecological regions' is the issue of how to connect the reinstated transport node with the ecological features. Image 5.4 shows that the bus stop for Fen Drayton Lakes is directly associated with the nature reserve and that the character of the node differs from all the other stops (it is completely made of timber). Instead of a standard bus shelter, there is no covered area provided to wait for buses, presumably in order not to restrict views across the lakes to fit in with the specific nature of the place. Instead, there is a bird hide situated adjacent to the stop, overlooking the lake. This is the only node along the busway where this specificity of place has been acknowledged through the node design, despite the RRC passing through a variety of differing contexts.

Figure 5.4 Unique Design of Guided Bus Stop

This image shows a bespoke design for the stop at a nature reserve on the CGB. As opposed to the proprietary bus shelters along the rest of the CGB this stop has no shelter which reduces the visual presence of the stop in relation to the lakes. Also, the platforms are non-slip timber which can be considered 'in keeping' with such a 'natural' context (Author's own, 2013)

Newstead Country Park, on the RHL, exhibits a differing relationship to its RRC, in contrast to Fen Drayton Lakes. In this instance the visitor centre of the Newstead Country Park (illustrated below) is approximately 550m from Newstead Station. Although this is still well within the 10 minute pedshed, the country park is poorly signposted and is situated along a convoluted, uninviting route that goes through a car park and along a muddy path to an incomplete visitor centre.

Figure 5.5 Struggling visitor centre to new Country Park

This image shows the incomplete visitor centre to Newstead Country Park. The country park is open and its entrance is within the five minute pedshed of Newstead station; however, in urban design terms the two elements are not mutually supportive. (Author's own, 2012)

Perhaps this (at the time of writing) recently designated country park might benefit from a strengthening of links to the town's railway station? Specific surface treatments (conducive

to all users, including cyclists[52]), planting of trees, lighting and street furniture along the route between the country park and the station could improve its appeal/ patronage.

Both of these two examples, Fen Drayton Lakes and Newstead Country Park, are attempting to 'repair' the environment from the effects of mineral extraction: ex-gravel pits at Fen Drayton and ex-coal extraction at Newstead. Calthorpe (1993) highlights how T.O.D. can support riparian strips/areas. These examples show that in land-use terms such areas can coexist with RRCs, but they also show that considered urban design responses are required in order for their accessibility through public transport to be maximised.

There are numerous examples of agriculture between nodes evident in the three case studies. This is a concept put forward by Breheny and Rookwood (1993) as part of their Social City Region. The collected evidence shows that the structure of these types of areas is less formal than might be expected. Diagrammatically it is expected that a transport node is situated centrally to a conurbation with agriculture surrounding the built-up area in a greenbelt type configuration. In analysing the urban design along-the-line of RRCs, examples have been found where agriculture exists in other configurations in relation to the transport network/urban morphology.

One such example seen in the image below shows agricultural land directly adjacent to the Butler's Hill (CS 1.11) tram stop. This node is to the periphery of the built-up area of Butler's Hill. This configuration relates to urban design theory in two key ways: in terms of the '180° station idea (Jacobson & Forsyth, 2008) and as a Lynchian Edge (Lynch, 1960).

Figure 5.6 Agriculture between Nodes: Butler's Hill Tram Stop. This image illustrates the farm fields adjacent to Butler's Hill (CS 1.11) tramstop. This piece of agriculture sits between a commercial site to the left of this image, the Robin Hood Line, NET P1, Butler's Hill tram stop and the Butler's Hill residential area to the background and far right of this image. (Author's own, 2011)

[52] Newstead Country Park is 650m off National Cycle Route 6, with Newstead Station being 300m shy of this network.

Although this instance is evidence of 'agriculture between nodes', as set out in the Social City Region (Breheny & Rookwood, 1993), a finer-grain urban design analysis shows contradiction with other normative urban design theory. Jacobsen and Forsyth are critical of stations that are focused to only one side of the transport corridor. Butler's Hill is a distinct example of this '180° station' phenomena. Situated across the tracks, allotment gardens are directly opposite the platforms, followed by the thin sliver of farmland visible in the image, with the rest of the 400m pedshed being taken up by non-transport supportive commercial development.

The reinstated railway alignments (both a tram route and a heavy rail route) act as a physical division between the residential zones to the west and the agricultural/ commercial land to the east (see figure ground in appendix). This is an example of how a Lynchian Edge (1960) can be created unintentionally by a RRC, in this instance meaning Butler's Hill represents a 180° station form. Normative, transport-related, urban design theory would suggest Butler's Hill represents a dormant opportunity to balance agriculture and residentially-led development along this RRC through the utilisation of the adjacent industrial farming land.

There are, however, examples where this research shows land-use patterns that represent what might be expected in terms of agriculture between the nodes of RRCs: greenbelt land between conurbations. The next two images show livestock on agricultural land, the first being close to Oakington (CS 2.10) on the Cambridge Guided Busway and the second being approximately halfway between Gorebridge (CS 3.04) and Stow (CS 3.03) on the BRWL. It is interesting to note that despite the two very different topographies[53], a similar form of agriculture (sheep farming) is evident.

Figure 5.7 Agriculture between Nodes: Oakington (left) and Fountainhall (right)

These images illustrate typical examples of agriculture between nodes along the CGB and BRWL. (Author's own, 2010 & 2011)

These two examples are indicative of the two case studies where agricultural land is common along the CGB and the BRWL. There are more examples of agriculture between

[53] Oakington in the Cambridgeshire Fens and Gorebridge/Stow in the Moorfoot Hills in the Scottish Boarders.

nodes than other priorities set out in the social City Region, such as 'community forests'. These do exist however, as can be seen below at Histon (CS 2.09).

Figure 5.8 Guided Busway, tree plantation and link to nearby residential area

This image, with a residential area behind the position of the photographer, shows the pedestrian way across the guided busway to a path through a tree plantation: an ecological feature and leisure amenity. (Author's own, 2010)

This shows a recently planted forest directly adjacent to the guided busway, illustrating one of the urban design benefits of a guided bus configuration. Due to the differing corridor perimeter treatments of railways and guided busways, the community forest is more accessible to the adjacent residential area. This shows how busways are weaker in terms of being Lynchian Edges, which has design implications.

The collection of evidence presented here shows that RRCs have a complex and interesting relationship with the ecological features of their respective regions. These varying relationships can be strengthened through finer-grain urban design decisions, such as those evident in the design of the station at Fen Drayton Lakes CS 2.14 or the amenity space using the River Leen at Bulwell CS 1.08. The RRL has a number of country parks directly associated with its RRC, due to its relationship with previous mineral extraction works, with these sites now being used to repair the environment through the designation of country parks as curated landscapes. Newstead Country Park is an example of where more robust urban design strategies, through greater attention to the public realm between the station and the visitor centre, could strengthen the relationship between the RRL and the ecological feature.

5.2 Strategic Growth and Recycled Railway Corridors

The broad notion of (to) '*Organise Growth at a Regional Level to be Compact and Transport Supportive'* is derived from the work of Peter Calthorpe (1993) and is one of the central overriding principles behind his Transit Oriented Development. This is of clear

relevance to this research, specifically this discussion on urban design implications along-the-line of RRCs. The presence, type, scale and detail of growth patterns concerns many disciplines not least urban design, the perspective from which this research is carried out. This next section initially considers how the regional planning for the case studies has treated the RRCs, in terms of how they have been used to organise growth and whether any such growth exhibits 'transport supportive' urban design.

Case studies CS01 and CS02 are both within an English planning context and as such, their regional planning contexts are set out through regional key diagrams. CS03 is in a Scottish context, having a structure plan as the equivalent document. These diagrams/plans have finer-grain policy diagrams of the respective areas, which are collected in the appendix.

The 'Regional Key Diagram' for the East Midlands shows considerations that relate directly to CS01[54]. Nottingham is indicated on this map as the 'principal urban area' with 'growth points' indicated at Hucknall (CS 1.12) and the Mansfield Area (CS 1.16/CS 1.17). Worksop (CS 1.22) is classified in the next level down this hierarchy as a 'sub-regional centre'. As well as linking these towns, the RRC of CS01 also passes through the green belt surrounding Nottingham and Derby. North of Hucknall up to Worksop, the East Midlands key diagram also shows the RRC passing through the 'Northern Sub-Area'. Further, the entirety of CS01, from Nottingham in the south to Worksop in the north, is within the 'Sherwood Forest Regional Park'. Although 'Regional Transport Priorities' are illustrated, there is no specific reference to either the RHL or the NET tramline.

[54] Either individually as the RHL/NET P1 or a combination of both.

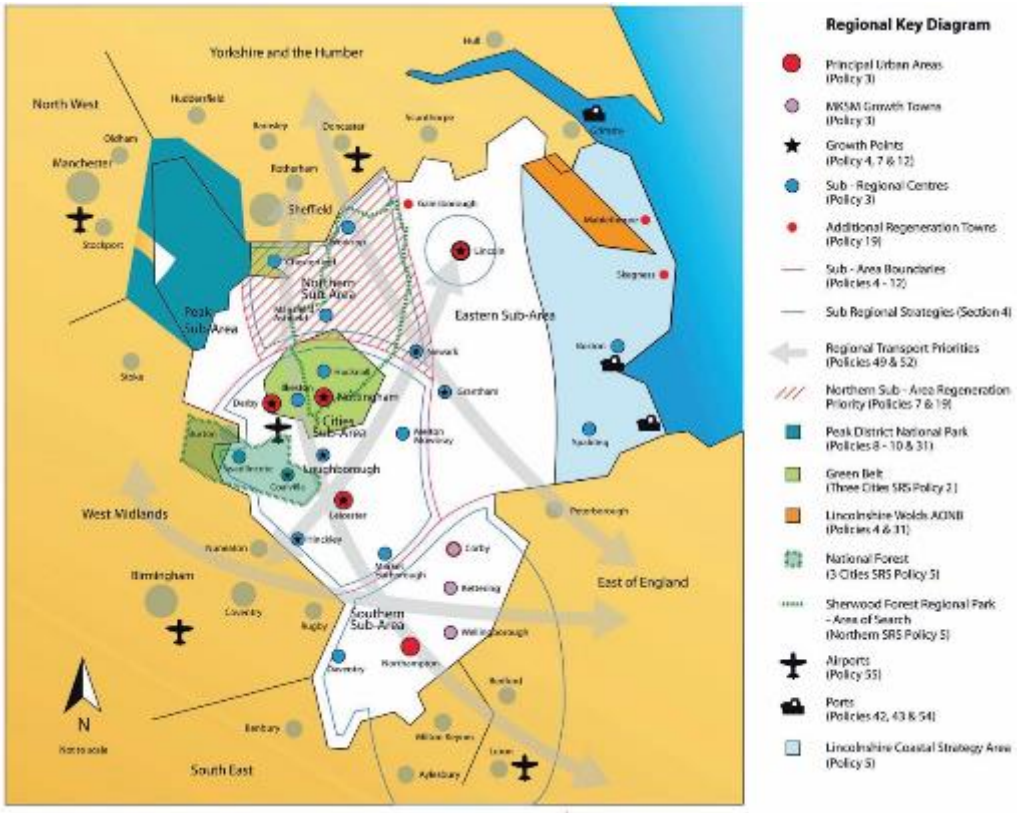


Figure 5.9 East Midlands Regional Key Diagram

This Regional Key Diagram from the East Midlands Regional Plan shows the defined growth areas for the region. (Department for Communities and Local Government, 2009)

Similarly to the East Midlands Regional Plan, the 'East of England Regional Key Diagram' (Department for Communities and Local Government, 2009) does not make reference to its respective RRC, the Cambridge Guided Busway. Cambridge itself is noted as a regional centre with reference to a housing growth target of 36,000 dwellings during the period 2006 to 2021. Cambridge is shown as being surrounded by green belt and being under its own specific Cambridge Sub-region Policy.

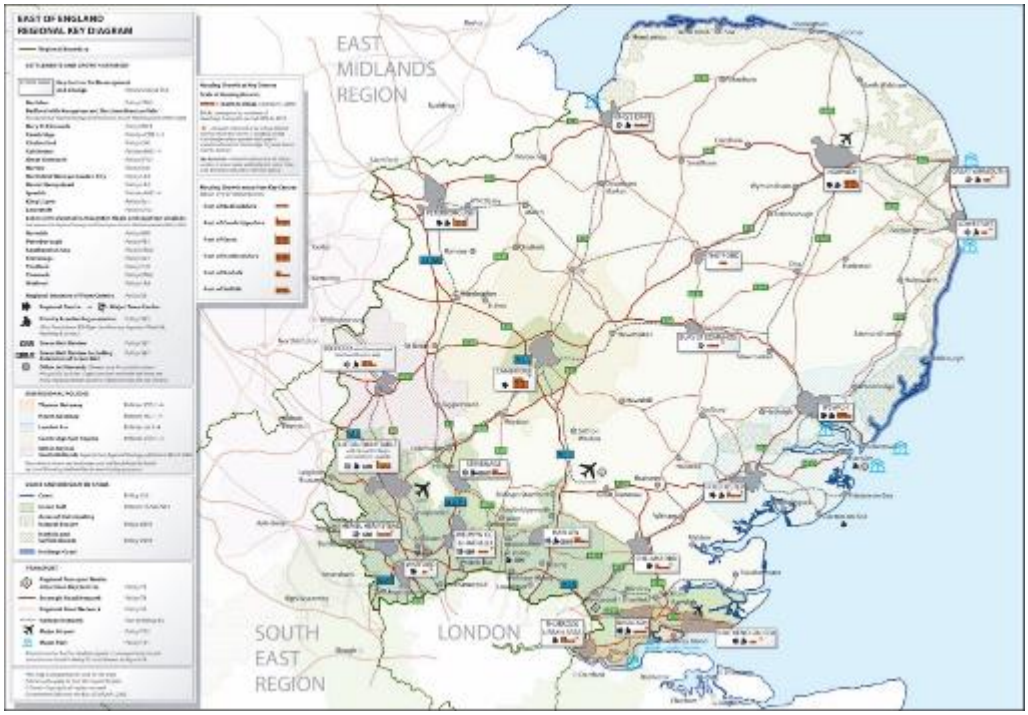


Figure 5.10 East of England Regional Key Diagram

This Regional Key Diagram from the East of England Regional Plan shows the defined growth areas for the region. (Department for Communities and Local Government)

It is notable that the only other town situated on the RRC used by the CGB featured on this Key Diagram is St Ives (CS2.15).

The territory that CS03 BRWL traverses is covered by two structure plans, the Scottish Borders Structure Plan and the Lothians Structure Plan. Unlike the previous English examples where the case study RRCs do not feature on the regional plans, the two Scottish examples both feature the RRC.

The Borders Structure Plan features the BRWL as a proposed rail service that continues beyond its presently constructed configuration where it terminates at Tweedbank. The route is shown to pass through Newtown St Boswells to the south and continue towards Carlisle. The core area of development for this region, termed as 'substantial new development' is directly related to the RRC, featuring Tweedbank (CS 3.01) and Galashiels (CS 3.02). This suggests a correlation with this particular regional principle of Transit Oriented Development. Other than this focus however, no further specific reference to the territory of CS03 is made.

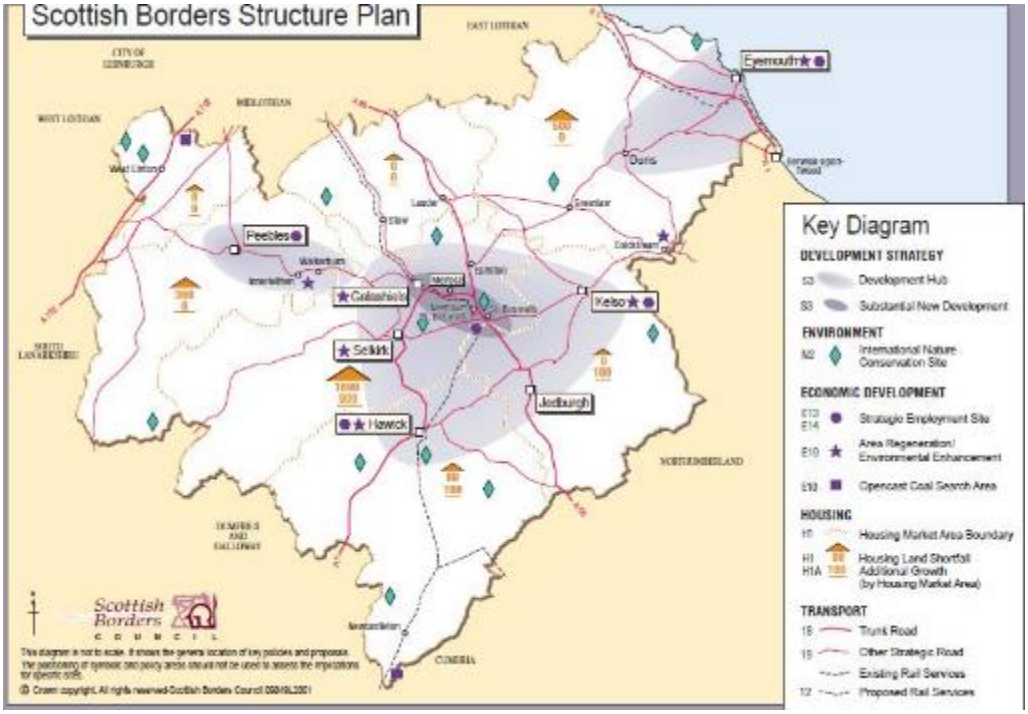


Figure 5.11 Scottish Borders Structure Plan

This Structure Plan shows the concentrated regional growth planned for the RRC.

Of the four regional planning documents analysed as part of this research the 'Lothians Structure Plan' is the regional growth plan that makes the most explicit reference to the RRC case study in its text, with the BRWL being a stated structuring element. This structure plan's southerly edge is at Gorebridge (CS 3.04) and it extends north past Newtongrange (CS 3.05), Dalkeith (CS 3.06 Eskbank) and the proposed town of Shawfair (CS 3.07) to Queensferry in the north. Specific reference to the BRWL RRC is made in this structure plan.

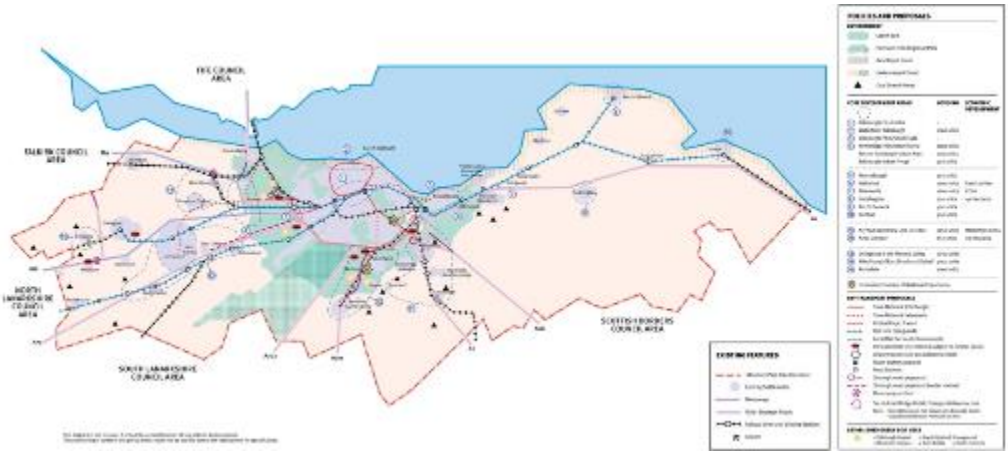


Figure 5.12 Lothians Structure Plan

This Structure Plan shows the relevance of the RRC to the growth of the Scottish Borders region.

Within the text of the Lothians Structure Plan it also states safeguards are in place where disused railway track beds, other than the case studies, are to be protected.

These four regional strategies show a marked difference in terms of the relationship between regional level planning and the RRCs under study. The documentary evidence here shows the BRWL reinstatement has had the most strategic importance placed upon it. Next, in terms of strategic importance, is the Cambridge Guided Busway and the case study with the least importance, based upon this documentary evidence, is the RHL/NET P1. However, there is further finer-grain urban design evidence discussed later in this chapter, which demonstrates that this may not be entirely reflective of the extent to which the RRCs have been used to structure growth through regional land-use planning strategies. The regional policy summary as part of the case study descriptions (see appendix) shows that there are clear strategic growth intentions for the BRWL[55]. In contrast it is the *sub-regional* plans for the Cambridge Guided Busway that shows the RRC is pivotal in, what is termed on the East of England regional key diagram, the Cambridge Sub-region.

The evidence collected from these relevant policy documents shows a variety of responses to RRCs and the organisation of growth. This evidence shows that it is possible for a reinstated railway corridor to be completely absent from a regional plan. This is the case in both the East of England and the East Midlands regional plan. Further in this chapter however, the evidence from CS03 shows that the organisation of growth using a RRC may be absent from the regional plan, yet highly influential in a sub-regional plan.

The data regarding the BRWL however shows that a RRC can be a significant element of a regional growth strategy. This specific case also reflects national policy guidance PPG13 clause 41 through the regional key diagram, where disused railway corridors outside the geographical scope of this research are safeguarded. In conclusion, there is no consistent approach evident across the analysed documents in terms of organising growth in direct relation to RRCs at the regional scale.

The concept of new communities in relation to public transit is recurrent throughout the literature: T.O.D. (Calthorpe), Sustainable Social Cities of Tomorrow (Hall) and the Social City Region (Breheny and Rookwood). There are a number of similar terms used, for example ‘new settlements’, developments, etc. However, for the purposes of this discussion ‘new communities’ will be used to describe substantial developments associated with nodes along the RRCs. Of the forty-four nodes covered by these three case studies, nine have developments that could be identified as new communities. These nine instances differ greatly from each other. Two instances are proposed towns (CS 2.11 Northstowe and CS 3.07 Shawfair) which at the time of writing have planned commencement dates. Two other instances are city centre sites adjacent to national rail stations (CS 1.01 Nottingham and CS

[55] The policy intentions of improving commuting into Edinburgh from the Borders and improving tourist travel towards the borders, primarily from Edinburgh.

2.04 Cambridge Station Area). The remaining examples can be themed 'urban extensions'[56] and although they all fall within the 1km pedshed of their respective nodes they have differing urban design relationships within these nodes.

CS01 RHL / NET P1 (1993 / 2004): 3 OF 22 NODES NEW COMMUNITIES (13.6%)				
CS 1.01 Nottingham Station Area		CS 1.13 Newstead	CS 1.15 Sutton Parkway	
CS02 CGB (2014): 5 OF 15 NODES NEW COMMUNITIES (33.3%)				
CS 2.01 Trumpington (P&R)	CS 2.02 Trumpington (Clay Farm)	CS 2.04 Cambridge Station Area	CS 2.07 / 2.08 Orchard Park	CS 2.11 Northstowe
CS03 BR-WL (2015): 1 OF 7 NODES NEW COMMUNITIES (14.3%)				
CS 3.07 Shawfair				

Table 5.2: Nodes Associated with New Communities

This table shows the three case studies and their respective New Communities

The greater number of new communities are found along the Cambridge Guided Busway with five instances, the Robin Hood Line/NETP1 shows three instances and there is one instance of a new community associated with the Borders Rail-Waverley Line. Considering the opening date of the transport networks, one might expect a greater number of new communities to be established along-the-line of CS01; however, CS02 exhibits the majority of the new communities across the three case studies despite having the lowest overall length.

In urban design terms, CS 1.15 Sutton Parkway is interesting in terms of being a new community. The urban design of this place stretches the definition of what is a 'new community'. Whilst there is new residential development within close proximity to the railway station, and therefore technically a new settlement in land-use terms, the term 'new community' has more connotations. The term 'community' implies a degree of social cohesion, which, in urban design terms, would ideally mean the provision of some place to 'commune'.

In several of these spaces, the place has not been configured in order to support community. For example, there is a high-density residential development adjacent to the transit node at Sutton Parkway, which is in close proximity to the transport node – circa 100 metres. However, this distance is occupied by a surface car park, which in terms of urban design place-criteria is arguably the antithesis of a walkable environment. Although this

[56] CS 2.02 Clay Farm at the time of writing being a proposed urban extension, at an early stage in construction.

means direct access from this residential development towards the railway station is possible, in normative urban design terms this route can be identified as hostile to the pedestrian, prioritised for automobiles.

Figure 5.13 Sutton Parkway Station Node

These two images of Sutton Parkway station illustrate the hostile pedestrian environment dominated by the space intensive necessities of surface car parking. (Author's own, 2013 & 2013)

It could be perceived that it is unreasonable to expect a transport node that has Parkway in the title to exhibit built environment characteristics beyond surface car parking. However, scrutiny of this place through an urban design lens shows that there are still many opportunities at Sutton Parkway station. If the two surface car parks immediately either side of the tracks were to be condensed into a multi-storey parking structure, then valuable land could be released for either mixed-use residentially-led or mixed-use commercially-led development. There is even scope for some of this land to be landscaped, with potential for a relationship to the wooded area (to the background of the images above). It appears, based on the urban design evidence at Sutton Parkway station, that although there is a new settlement in relation to the RRC, there is little to suggest that this settlement offers much in the way of a place to dwell, to commune: a new community.

In a similar fashion to Sutton Parkway station, Newstead (CS 1.13) also shows a land-use pattern of residential development within the pedshed of the RRC node. This development is on a larger scale than that shown at Sutton Parkway. This residential development also shows an urban design that is not transport supportive, whilst occupying land within the 1km pedshed. Further, this development shows neither an integrative response to the existing Newstead morphology nor the immediate region's vernacular.

Newstead occupies a brownfield plot at the edge of the 1km radius pedshed of the Newstead Station. However, when the actual measured pedestrian distance between the entrance to the settlement and the node is taken, this distance is circa 1500m. In terms of time, this broadly equates to an increase from 10 minutes to 15 minutes at average walking speeds. It is noted that this is the distance to the entrance of the site and that the dendritic nature of the street pattern would add, for the furthest parts of the site from its entrance, up to a further five minutes to the pedestrian journey to the station. This means quite plausibly that the amount of time it takes to walk from the edge of the 1km pedshed to the station is

potentially twice that of a more direct route. This is evidence that this development is not a transport-supportive settlement, despite being situated within walking distance of a node on a RRC.

Figure 5.14 New Community at Newstead

This masterplan illustrates the dendritic form of the new community emerging at Newstead. Low levels of permeability mean an increase in distance to the transit node. (Persimmon Homes)

When this route back and forth between the station is analysed in terms of townscape principles (Cullen, 1971) the empirical evidence shows little in the way of urban design strategies aimed at reinforcing connections between the new community and the railway station. This settlement is mono-use as opposed to mixed-use.

Figure 5.15 Urban Design Character of New Community at Newstead
and its Connection to the Railway Station. These images show a mono-use residential development, configured with the automobile as a priority, separated from the nearby railway station by featureless, poorly lit roads and alleys. (Author's own, 2013, 2011 & 2011)

The streets that comprised the public realm of this new settlement are prioritised towards the car, both in terms of their dendritic configuration and detailed design. The streets beyond the settlement, on the most direct route to the railway station, are also poor in terms of urban design walkability features. There exist long stretches of poorly lit, featureless roads that continue through poorly lit alleyways (as shown in the images above). It is not until three quarters of the way through this journey that any mixed-use plots occur. These exist in the stretch along the Victorian street pattern, where the terraced houses have their corners accentuated with commercial shops. However, this soon transitions into a barren, dimly lit, poorly surfaced landscape with no natural surveillance. Significantly, this is the final 200m of the journey towards the railway station.

Figure 5.16 Urban Design Character of Connection between new community at Newstead and the Railway Station

These two images illustrate the contrasting special characteristics close to Newstead railway station. Image on the left shows a Victorian terrace where the corners are accentuated with small retail units. The image to the right illustrates the barren nature of the public realm directly adjacent to Newstead. station. This image was taken at the foot of the steps to the station platform looking towards the town centre. (Author's own, 2011 & 2011)

Apart from the 300m stretch through the old Victorian core of Newstead, this node exhibits traits that are both individually and collectively counter to transport-supportive urban design. As with Sutton Parkway, the design evidence at Newstead clearly shows there is a new settlement relating to the RRCs node. In these two instances, the urban designs can be seen to be not transport supportive environments. There were, however, examples found in the three case studies where transport supportive urban design was evident.

Orchard Park demonstrates that a very different approach has been adopted to the urban design of place along this RRC. Whilst there are some similarities between Newstead and Orchard Park, for example the extent to which both the new settlements fall within the 1km pedshed of their respective transit nodes, there are significant differences between the executions of the urban design at these two settlements.

The first key difference is that Orchard Park has two transit nodes, both of which are new introductions as opposed to Newstead's one node at the site of one of the town's three previous stations. These two guided bus transit nodes are positioned strategically at either end of the site's east-west axis, whereas at Newstead the node is positioned towards the southern extent of the town. This has two key implications for the pedshed. Firstly, that

the vast majority of the Orchard Park site falls within not just the 1km pedshed but inside the 400 metre immediate, five-minute pedshed. Secondly, the positioning of these transport nodes means that adjacent existing settlements also fall within the 1km pedshed radius.

The street patterns of the Orchard Park settlements are also more conducive to pedestrian connectivity than at Newstead. Figure 2.9 (Barton et al., 2003) demonstrates how far into the 400m pedshed radius an actual 400 metre walk penetrates. Whilst in most cases it will be impossible to reach the 400 metre radii as this is measured 'as the crow flies', Orchard Park comes close to achieving this optimal configuration whilst maintaining a balance between interest along the route and directness.

The townscape (Cullen, 1971) analysis of Orchard Park reinforces the argument that its urban design is more transit supportive than the urban design at Newstead. Whilst there are a variety of routes in this new community that could be taken from any number of positions of interest to the two transit nodes, each of the routes examined exhibit differing place-based urban design characteristics. For example, on a route taken from any one of the hotels positioned in the north-west corner of the site to the closest transport node, before arriving at the transit node, one passes:

- a variety of high density residential blocks;
- along streets of varying widths with differing landscape treatments;
- through a prominent and formal 'circus'; and
- into the enclosure of a mews-based housing typology pattern.

A similar variety of experience occurs when walking from the edge of the 400m pedshed towards the transit node at the eastern end of Orchard Park. In this instance the station is adjacent to a playing field which continues to the extremis of the site which is at the extent of the 400m pedshed:

- A public amenity space is passed that is situated towards the northern edge of the site, acting as a buffer between the relatively dense residential area and the busy A14 trunk road;
- past a variety of types and tenure residential blocks;
- past a more formal landscaped area; and
- towards the transit node stop along streets that have a variety of landscaping elements and surfaces.

The sequence of spaces evident at Orchard Park shows a plethora of urban design strategies, techniques and executions leading to a suggestion that this is a transit-supportive development. In contrast, it was argued that at Sutton Parkway and Newstead, whilst clearly new settlements, they were not 'new communities' in every design term. In these instances, the space commune was absent, however, in Orchard Park the spaces to commune are in abundance. The streets, squares, circuses, mix of uses and variety in residential typology, all exist within the pedshed of a node on a RRC. This points to a transit-supported urban design.

The Cambridge Guided Busway has five new communities associated with the RRC, which is more than the other two case studies combined. Given this fact, and other analyses within this research, it is evident that significant residential growth through the planning of new communities is a core purpose of the act of recycling the railway corridor. This has prompted further consideration of the other two case studies in order to examine why there are proportionally fewer new communities along these RRCs.

One potential explanation for the RHL/NET P1 having proportionally fewer new communities than the Cambridge Guided Busway is that this strategic focus on the RRC was aimed at a different land-use typology. Four of the 22 nodes in case study 01 exhibit the land-use pattern of 'edge of town' commercial developments. Cumulatively, this is one more than the tally of new developments within this particular case study. Furthermore, there is more of this land-use type along this particular RRC than the other two case studies combined.

CS01 RHL / NET P1 (1993 / 2004): 4 OF 22 NODES 'EDGE OF TOWN' CONFIGURATION (18.2%)			
CS 1.09 Bulwell Forest	CS 1.12 Hucknall	CS 1.16 Mansfield	CS 1.22 Worksop
CS 02 CGB (2014): 1 OF 15 NODES 'EDGE OF TOWN' CONFIGURATION (6.7%)			
CS 2.01 Trumpington (P&R)			
CS 03 BR-WL (2015): 2 OF 7 NODES 'EDGE OF TOWN' CONFIGURATION (28.6%)			
CS 3.06 Eskbank		CS 3.02 Galashiels	

Table 5.3 Nodes associated with 'edge of/out of town developments'

This table shows the nodes within the three case studies that are associated with either 'edge of town' or 'out of town' commercially-led land-use types.

In summary, the three case studies show differing strategies with regard to new communities along their RRCs. The Cambridge Guided Busway not only has the higher number of instances of new communities along its length but also, when these new communities are scrutinised at a finer scale through an urban design lens, they exhibit a far richer variety of spaces at a higher level of urban design intention.

This shows that the creation of a new settlement within the 1km pedshed of a transit node of a RRC does not automatically mean that a transit-supportive urban design will occur. It demonstrates that both strategically at the regional scale along the RRC and at the public realm scale, to-and-from the node, close attention to the urban design is required in order to achieve a walkable, mixed-use, dense, residentially-led built environment. One note to a potential piece of further study is that these findings are based upon this researcher's

examinations, depictions and analyses of the case studies' urban designs. Resident surveys could be carried out in order to ascertain, for example, whether or not people feel like they live in a new community or a new settlement, how important to them the proximity to the RRC is, and what role urban design plays in their perceptions of the relationship between their home and the public transport network which they live in proximity to.

Breheny and Rookwood (1993) introduce the notion of balance in terms of considering development along transport corridors. Whilst the above shows that this could be any development typology, other aspects of the literature highlight residential as the primary transport-supportive land use. The table below summarises the number of homes developed in relation to the respective RRCs across the three case studies.

CS01 RHL / NET P1				
CS 1.13 Newstead: 125 Homes				
CS 02 CGB				
CS 2.01 Trumpington (P&R): 1200 Homes	CS 2.02 Trumpington Clay farm: 2586 Homes	CS 2.04 Cambridge Station Area: 331 Homes	CS 2.07 & 8 Orchard Park: 1120 Homes	CS 2.11 Northstowe (P&R): 9500 Homes
CS 03 BR-WL				
CS 3.07 Shawfair: 4000 Homes				

Table 5.3 Number of New/Proposed Homes Associated with RRC

Of the three case studies, CS02 (the Cambridge Guided Busway) exhibits the greater amount of urban design evidence in terms of balancing development along its respective RRC. The plan below is taken from the 'Cambridge City Council Growth Area Plan' and demonstrates how a significant amount of the planned development of Cambridge is oriented by the reinstated railway. Seven of the twelve sites on this 'Cambridge Areas of Major Change Composite Plan' are either closely related or directly related to the RRC.

There are two other significant areas of growth not associated with the Cambridge Guided Busway. The first is the University to the west of Cambridge, which, according to these figures, will accommodate 5830 homes (3000 of which to be student accommodation). The other significant development area is labelled the Cambridge Eastern Fringe (labelled F on the image below), where approximately 10,000 homes are proposed. Adding these together, a quantity of 15,830 is accrued. This is approximately three times the amount of homes in these two areas that relate to the RRC.

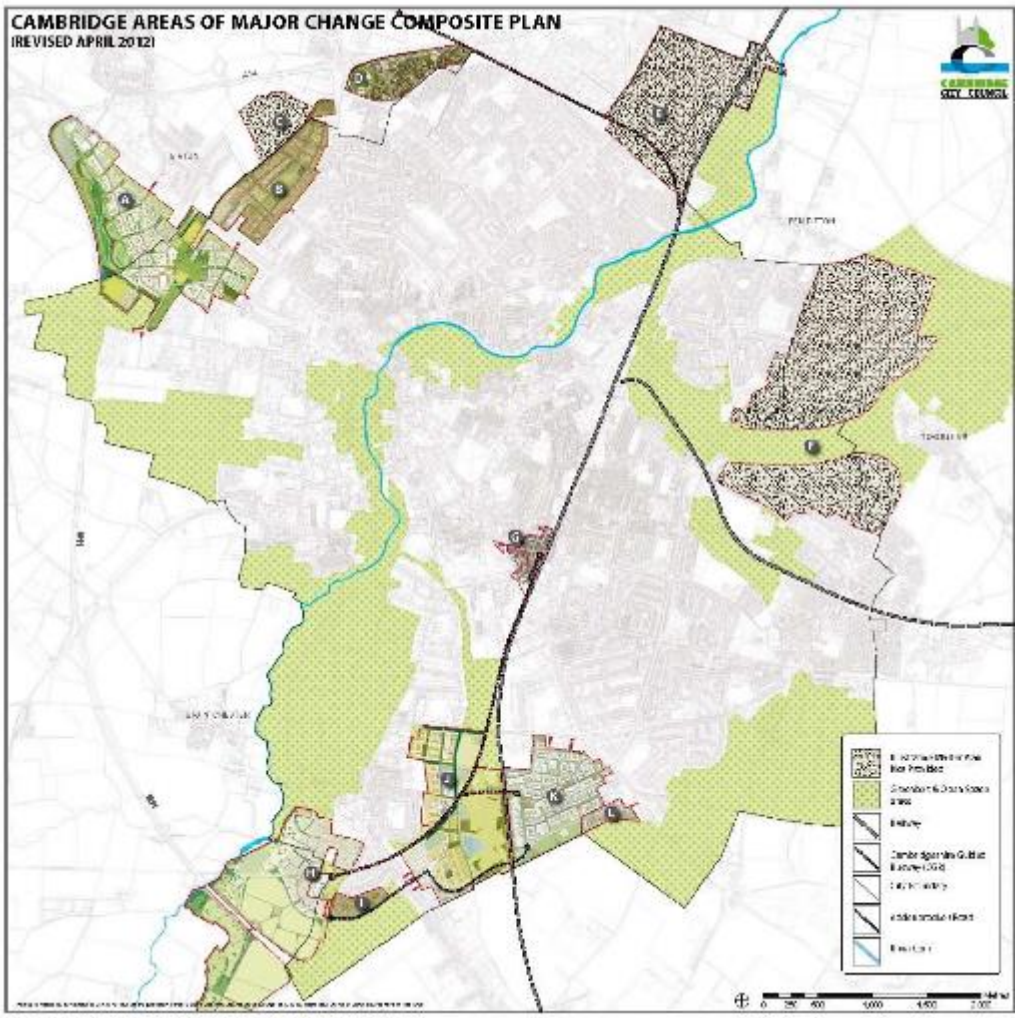


Figure 5.17 'Cambridge Areas of Major Change Composite Plan'

The image above shows the close relationship between the Cambridge Guided Busway and significant development sites in Cambridge (Cambridge City Council, 2013)

Although fewer in quantity, the number of proposed new homes along the RRC is still substantial at a figure of 5237: Orchard Park (1120), 'Station Area' (331), Trumpington Meadows (1200), Glebe Farm (286) and Clay Farm (2300). Perhaps this could be interpreted in such a way as to suggest that the priority for development within Cambridge was not necessarily to 'balance development along corridors'. The argument against this would be twofold.

Although residential land-use types are taken here to be a key indicator as to the extent to which 'developing along corridors' has occurred, there are in this specific instance other important factors. There are two significant sites in this growth area plan that have little or no residential land use: the 'Cambridge Northern Fringe East' and the Addenbrooke's medical science development area. Both of these have a close relationship to the RRC.

The 'Northern Fringe East Area' has the RRC as its southerly boundary. Whether or not the Cambridge Guided Busway would extend past here is unlikely, however the plan

does allow for a railway station to be built on the line between Cambridge and the railway to the north at the disused Chesterton sidings. Whilst Addenbrooke's is some distance from the RRC (approximately one kilometre) there is a spur taken off the guided busway.

The second counter-argument against the interpretation that the 'Cambridge City Council Growth Area Plan' plan does not prioritise 'balancing development along corridors' is based geographically beyond the boundaries of Cambridge City Council. Whilst the growth areas within the city boundary total 5237 adjacent to the RRC with 15,830 separate from it, if the proposed Northstowe development, circa six kilometres further along the RRC is included, this extra 9500 homes brings the total count of the homes associated with the RRC up to 14,737. This figure is comparable to the quantity of homes not adjacent to the RRC. It would therefore seem that if the RRC were viewed as the common factor in Cambridge's growth, as opposed to the city boundary, then development is, in terms of quantity of new homes, balanced along this RRC.

Often opponents of T.O.D. (O'Toole, 2009) argue that public transport investment can skew housing markets. This example in Cambridge shows that a different angle towards that debate is possible, that perhaps a balanced housing market can be one where those searching for accommodation have a choice between dwellings within walking distance of a permanent way public transport network or a dwelling without such access.

In summary, the three case study RRCs of this research show differing urban design evidence with regard to strategic growth along their transport corridors. CS02, the Cambridge Guided Busway, shows the greater level of policy intention, master planning and quantity of new communities. The evidence gathered in this research suggests this case has the strongest relationship between growth and RRCs. CS03, the Borders Rail-Waverley Line, shows some evidence for the transport corridor being used for strategic growth. The proposed new town of Shawfair, just to the south of Edinburgh, shows urban design intent that is both compact and transport supportive. The primary policy stated for the Borders Rail-Waverley Line however is to improve commuting from the borders to Edinburgh and to improve tourism from Edinburgh into the borders. CS01 RHL/NET P1 shows the least amount of evidence in terms of balancing developments along the RRC with one example of a small-medium scale residential development associated with the RRC. The urban design of this development is not evidently transport supportive.

5.3 Public Transit Corridor and Urban Morphology

The iterative cycles of urban morphology inherent to a RRC are intensely complex. It would be impossible to investigate fully all three case studies in these terms within the scope of this PhD. However, using urban design theory regarding 'imageability' (Lynch, 1960), useful insights can be gleaned regarding the substantial morphological implications

of reinstating a previously disused railway line as a permanent way public transit route. This is discussed in terms of transit supportive urban design principles in chapter 2.5.

The stretch of RRC between CS 1.03 Basford South and CS 1.04 Basford North exhibits four instances of three types of Lynchian edges. The following image illustrates a wall, a railway corridor and a river acting as one such 'linear break in continuity'. This means that a strong barrier has been created between the Victorian residential suburb of Basford to the east and the potentially developable brownfield land to the west of the RRC.

Figure 5.18 RRC as a Linear Break in Continuity

This image, from left to right, shows a circa 600m long wall, the double track configuration Robin Hood line, the double track configuration NET P1 and of the River Leen to the far right. These elements together act as a distinct Lynchian edge. (Author's own, 2012)

At this stretch of track along the RRC, the first aspect of the boundary-like Lynchian edge is the 600 metre long wall visible to the far left of the image above. This wall is an historical feature which dates back to the implementation of the first railway line at this site. Its purpose was to protect horses that were pulling carriages on the adjacent road from being startled by the then new technology of steam trains. The next aspect of this Lynchian edge is the Robin Hood Line, the double track configuration heavy rail corridor. Directly adjacent to that, reinforcing this Lynchian edge is the – again – double track configuration, NET P1. Directly to the right of this tramway is the culverted River Leen. The combination of these aspects, in urban design terms, creates a strong linear element that divides two areas and is difficult to penetrate by foot or by vehicle.

The overriding majority of the Lynchian edges observed in the case studies of this research act as linear breaks. However, Lynchian edges can also act as 'seams' between two areas (Lynch, 1960). Clay Farm (CS 2.02) on the Cambridge Guided Busway is an example

of where the RRC and its strategically positioned node act as one such seam. The image below 'Development Proposal Parameter Plan, PP2 Access. REV B' shows the Cambridge Guided Busway running in an arc from the top right corner to the bottom left through the middle of the development site.

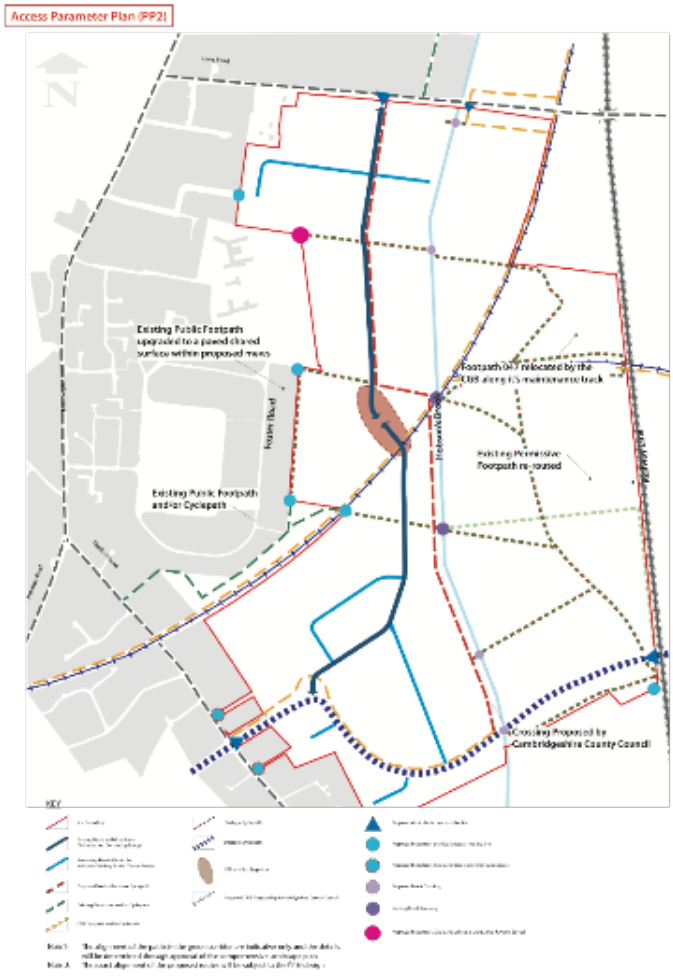


Figure 5.19 Clay Farm 'Development Proposal Parameter Plan, PP2 Access. REV B'

The RRC acting as an urban seam (Countryside Properties)

There are two key elements of this access plan that together mean this instance exhibits traits of a Lynchian edge acting as an urban seam: the 'Primary Route with Bus Route' indicated on the plan as a deep blue arrowed line, and the 'CGB and Bus Stop Area' indicated as a brown oval. Together they work on an asymmetrical axis with the guided busway in order to create a clear focus for the development. This concept of an urban seam complements Jacobsen and Forsyth's ideas with regard to avoiding what they term a 180° station. A dual aspect to the node, as shown in the image above, can reinforce connections to the pedshed on either side of the transport corridor. Transport modes can have implications for a RRC's potential to act as an urban seam. A busway is easier and safer to traverse, and at more points, than a heavy rail line.

The urban design evidence collected in this research shows that RRCs often act as Lynchian edges. The predominant type is an edge that exists as a linear break in the morphology, creating a barrier between different areas. The instance of a Lynchian edge at Clay Farm shows that an urban seam, when considered with other normative urban design concepts, can help draw together sites either side of a RRC, which means a RRC can be central to a new community and not only a boundary. These examples show contrasting instances of edges (Lynch, 1960) where in the example of Basford (CS 1.03, 1.04) opportunities have not been taken advantage of due to the urban design response that accepts the RRC as a barrier type edge. The contrary can be seen at Clay Farm (CS 2.02).

5.4 Relationship to broader transport network

RRCs have complex relationships within the broader transport networks within which they coexist. These transport networks can be a combination of the following:

- Permanent way network of the same transport mode as the RRC;
- Permanent way network of a different transport mode to the RRC;
- The road network (including predominantly freight sections);
- Cycle path network; and
- Pedestrian network.

These already complex inter-relationships become even more multifarious where the urban design implications are considered. Initially, the removal en-masse of permanent way transport provision is considered in urban design terms, which hints at the potential inherent in both recycled and dormant railway corridors. The urban design of RRCs is then considered within the concept of increasing public transport use. The role of a RRC is then discussed within the concept of a 'Regional Metro'. The focus of the case studies within this research has been upon RRCs as opposed to reinstated railway lines. This has meant that there are areas of the railway corridors that remain disused and are not reinstated. These uniquely awkward stretches of land are important to an urban design study of RRCs. The crucial interaction between the RRCs and the automobile network is also examined both in terms of broader main road networks and the interaction between car parking as a land-use category and the place imperatives of a public transit node.

The phenomena of RRCs would not exist without large-scale closures of sections of what was a previously far more expansive rail network, conceived over a period or approximately 50 years in a market-led piecemeal fashion. The background to the morphological implications of these railways' inception, evolution and closure are important to this research's examination of contemporary RRCs.

There are circa 10,000 miles of disused railway in the United Kingdom (Association of Train Operating Companies, 2009) meaning that as well as the case studies

in this research, there are potentially further contexts where the urban design considerations of RRCs may be of use.

When railways are considered in urban design terms such as Lynchian paths/ edges/districts in combination with land use categories such as disused marshalling yards/ depots/stations, then the resultant fallow nature of significant quantities of this land-use type are important. These types of spaces can potentially impact certain areas and their associated urban fabrics for extended periods of time.

There are various different ways in which permanent way transport provision can be removed:

- The service to a particular station can be reduced;
- The service to a particular station can be cancelled with the retention of the line upon which that station sat; and
- The service to a particular line can be reduced or cancelled.

Even if the cancellation of service along-the-line occurs it does not necessarily mean that that line is closed as freight services can still operate along the alignments, albeit at probably a far reduced frequency. There is also the full closure of a line.

These factors, however, do not necessarily mean an alteration in the urban morphology as in many instances the track bed can remain and the area of land taken up by the disused railway corridor continues to act as a barrier between separate areas. This means that even though traffic ceases on a particular railway corridor, alignments can still act as if there was a full service, at least in the urban design terms identified above. This scenario is not ubiquitous; the removal of permanent way transport provision can be a factor in evolving urban morphologies. In this instance, when a railway route is completely closed, for example, the tracks can be taken up and the previous alignment built upon, severed or repurposed (for example turned into a road). Each of these instances can impact upon the potential type of transport mode adopted in any reiteration of a previous permanent way network. This implies two ways in which a RRC could influence the urban morphology of the particular area: through land use and transit mode choice. The three case studies used in this research demonstrate a variety of examples in these terms.

CS01 is particularly intricate in terms of its formulation as a RRC. The three railway lines that have been amalgamated together into the RHL (Midland Railway, Great Northern Railway and Great Central Railway) were closed to passenger traffic as a result of the Beeching Report recommendations in the late 1960s. However, coalmining and other forms of mineral extraction continued in the area, to varying degrees, up until the late 1990s. As such, parcels of the line remained open allowing coal trains to serve the various collieries.

The NET Tramway uses the same combined railway alignment north of the city centre. Whilst it uses a new transport configuration for the majority of the route through the

city centre, the last 300m towards the Nottingham railway station terminus uses the old routes (and the old infrastructure, the viaduct) of the Great Central Railway. This demonstrates an example of the railway route being closed and sitting dormant as a feature of the built environment, but its presence influencing the form and growth of the city.

At the point where the tram deviates from the route of the Great Central Railway there is evidence of a different kind of removal of permanent way transport provision,, where the route is completely closed and the alignment built upon. The tunnels that previously carried the Great Central Railway under the centre of Nottingham were first severed through the use of utility pipes, associated with the waste incinerator to the south east of Nottingham. This powers a district heating system serving much of the city centre. The distribution centre for this district heating system also sits across the old track bed occupying the basement of the building that forms its own perimeter block in the city centre. Just north of this area is where the old Nottingham Victoria station has been removed and replaced with Victoria Shopping Centre/flats above (a recipient of heat from the district heating system). This example shows that arguably some benefit can be accrued from the blockage of a disused alignment. The tram route, by use of street-running, now stops at four key city centre sites, which would not have otherwise been served if the previous route had been strictly adhered to.

CS02, the Cambridge Guided Busway, is similar to the RHL in its historical process of closure. Passenger services ceased, again, as a result of the recommendations of the Beeching Report in the early 1970s. Where this case differs however, is the tracks remained in situ and were used for infrequent freight services. The tracks remained along this railway alignment and were only lifted as part of the preparatory works for the Cambridge Guided Busway system, while the actual rails were reused by a heritage railway elsewhere. There were advocates of this route being a heavy rail reinstatement; however, the CHUMMS study analysed this as one possible scenario but came to the conclusion that a guided bus route was a preferable solution.

Of the three cases, CS03, the Borders Rail-Waverley Line, is the case which might be considered closest to being a full closure/reopening. The ceasing of the passenger services meant that the lines were closed and the rails lifted in one event. The RRC only deviates from the previous alignment between Dalkeith and Edinburgh, although this is a significant deviation as it forms a key factor in the situating of the station serving the new town of Shawfair.

These three instances of closure/reconfiguration demonstrate different combinations of removal/renewal of permanent way transport provision. Each has differing implications for the urban morphology of their respective territories, in some instances limiting and in some instances increasing opportunity. Broadly, the way in which a railway

was closed informed the configuration of RRCs and their respective urban morphologies in the following key ways:

Firstly, that the type of closure can influence the manner in which the surrounding built environment can coexist with the redundant alignment; edges can be penetrated and lost, paths can be lost and new ones can occur and districts can be created or degraded. Although each of these instances have ramifications along-the-line of RRCs, they also all imply urban design responses. These can be positive, such as the opportunities at Shawfair or in Nottingham city centre.

Secondly, when a decision has been made to consider a reinstatement, the degree to which the removal of the permanent transport way provision occurred in the first place can, but does not necessarily impact upon, that decision. For example, the RHL was reinstated as a heavy rail line, in part because much of the infrastructure required was either in existence or needed relatively little upgrading. The evidence from the Cambridge Guided Busway contrasts this however, showing that existing rail lines do not necessarily lead to a heavy rail reinstatement. This means that contemporary requirements for the public transit system can be calculated through sophisticated transport and land-use modelling, to be more important than the potential savings of engineering upgrades.

Thirdly, continuing evolution of urban morphology during a disused railway alignment's dormant phase can impact the configuration of future iterations of the transport network. The situation along the NET tramline, just to the north of Nottingham station where the route is forced to deviate from the old Great Central Route is an example of this. However, the combination of change of transit mode (heavy rail to light rail) and forced redirection of transit corridor in this instance mean a stronger connection with the city centre and greater accessibility to the dense mix of land uses in this situation.

By definition, the act of recycling a railway corridor means an increase in dedicated public transit routes, relative to recent history. The configuration and urban design implications of these increases in transit choice merit attention. None of the cases examined in this research are like-for-like reinstatements of the historic railways. Each of these cases respond to contemporary needs in their creation of more dedicated public transport routes. Within their respective regional systems, the urban design implications along-the-line of these RRCs are varied.

Within CS01 the RHL is, if considered in isolation, the example closest to resembling a like-for-like reinstatement. Due to it being of a heavy rail transit mode it is grade-separated from other traffic and therefore is inherently a dedicated transport route. However, its reinstatement as a heavy rail line may have precluded other potential dedicated transport route options. As identified previously, the RHL is an amalgamation of three

separate lines that ran in close proximity to each other. Each of these lines, as well as running passenger services, also served a number of coal mines. With the reinstatement being heavy rail, it is highly unlikely that any of the remnants of these spurs are to be utilised for public transport routes. Had the reinstatement been light rail, perhaps the spurs from the mainline could have been integrated into the system with the light rail, thereby instigating regeneration at the old colliery heads and carrying on deeper into the associated residential territory via further street-running.

Still within CS01, much of the NET tramline runs adjacent to the RHL along a shared recycled railway alignment. However, one such coal mine spur, previously serving what used to be Babbington Colliery, is now the site of Phoenix Park CS 1.07. This branch is approximately one kilometre in length, off the main tramline and connects a park-and-ride/commercial office/industrial site. This is a strategy that, had the RHL been accommodating of light rail, could have been utilised throughout the region. The precedent for this transport configuration is the Karlsruhe model (Hall, 2014; Hall & Ward, 2014) and in the instance of the RHL, if these principles had been adopted then significant quantities of potentially developable land could have been examined through urban design.

A further type of 'creating a dedicated public transport route' on the NET P1 is where the route deviates from the RRC and joins the road network at the Wilkinson Street (CS 1.02) node. Here the versatility of light rail is apparent; there are a further thirteen densely distributed nodes between this point and the terminus at Nottingham railway station (CS 1.01). If this is compared to the RHL, the heavy rail reinstatement has no nodes on its equivalent stretch until CS 1.01, although the route passes two disused sites and a potential site at an adjacent university campus.

The way in which the Cambridge Guided Busway is configured means as well as an increase in 'dedicated public transport routes', there is also a high degree of scope for integrating wider services into this aspect of the network. Every time the track of the busway crosses a road there is an opportunity to engage with the broader road-based bus network. Although these 'hybrid' routes may only be dedicated transport routes in part, they nonetheless increase (or potentially increase) transport accessibility.

The Cambridge Guided Busway has a cycleway incorporated along its length. A cycleway can be considered a dedicated public transport route. Although a cycleway is used by individuals, the cumulative quantity of individual usage means, especially in a city with such a cycle culture as Cambridge, it can be legitimately considered in public transit terms. The separation from the road network offered by the RRC generally means lower travel times for motorised transport but for cycling, more importantly, this separation means a safer travel environment. In urban design terms, this dual usage of the RRC has been relatively space efficient, the cross-sectional width of the busway still being comparable to

that of the parallel sections of the RHL NET P1. This research has not collated the numbers of users on this cycleway; however, as part of continuing investigation this will be sought either through third parties or first-hand evidence collection.

CS03, the Borders Rail-Waverley Line, similarly to the RHL portion of CS01, is to a large degree less a like-for-like reinstatement using a heavy rail transport method along its RRC. CS03 however, is a partial reinstatement. The BRWL terminates at Tweedbank (CS 3.01) whereas the RHL continues along the entirety of the previous route to Worksop (CS 1.22). For the BRWL to be a complete reinstatement the route would need to continue all the way to Carlisle/Berwick-upon-Tweed. The BRWL does not suffer the previous criticism made of the RHL, where choice of transport mode inhibits potential growth. Due to the more accentuated topography of the Scottish Borders in combination with far fewer spurs deviating from this line, there are relatively fewer opportunities for a dendritic network. Whereas a light rail network might have been applicable along the RHL, in the case of the BRWL there is little land use/urban design benefit to this in terms of opening up potential development sites.

In summary, although each case study represents a clear 'creation of more dedicated transport routes', these RRCs show distinct differences in how these new routes manifest in the built environment. These differences have important land use and urban design implications. The transit mode choice, as well as the obvious transport planning implications, can close off or open up development potential and increase or decrease accessibility to the network. The transit mode configuration of the RRC can prevent proliferation of further dedicated transport routes (in the case of the RHL). However, NET P1 and the Cambridge Guided Busway demonstrate that the recycling of a primary corridor can lead to branches that contribute to an accumulation of dedicated public transport routes. This is key to the conceptualisation of these networks as 'recycled' railway lines, as opposed to reinstated railway lines.

The guided bus shows a higher degree of integration with the road network than the other transit modes studied in this research, with far less engineering requirements than light rail. This integration allows for a high level of flexibility in terms of ordinary operation and also in terms of contingency where exceptional circumstances may occur (for example accidents or engineering works).

The question of urban design occurs along-the-line of RRCs and cannot be separated from the networks within which the said RRCs exist. Hall and Ward (1998), whilst discussing components necessary in achieving a 'Sustainable Social City Of Tomorrow', highlight the importance of these transport networks which they term a 'Regional Metro'. Whilst individually a RRC cannot be conceived as a regional Metro, its importance within such a structure should not be understated and in turn, can be considered a key.

> *"it will prove another spectacular example of the Colin Clark rule: again, transport will make the city." (Hall & Ward, 1998, p. 162).*

The two heavy rail components of the case studies (RHL/BRWL) are considered in this research to be inter-regional transport networks, part of the national rail network. NET P1 and CGB however, can be considered part of self-contained regional metros.

NET P1 tram system, that for much of its first phase runs parallel to the RHL, is part of a Regional Metro system, with two further tramlines finishing construction and commencing service during the writing period of this research. This tram system operates within one region, Nottingham and its related suburbs. It consists of sections built along RRCs, new permanent way corridors and shared alignment transit corridors.

In the same vein, the Cambridge Guided Busway, whilst maintaining most of its routes on RRCs, integrates into a wider public transit system, the Cambridge bus network. This mode of public transit is the easiest to integrate RRCs into as part of a Regional Metro, as the guided bus can leave the permanent way and join the standard road system at any junction between the two grades. In urban design master planning terms this means that there is great opportunity with this transit mode to integrate new communities with the RRC as any junction (all vehicles or bus and cycle only) can become a spur serving multiple nodes in large-scale developments (e.g. Northstowe CS 2.11).

These two examples show how 'lighter' forms of transit are capable of dovetailing into the urban fabric. Although a tram system still requires the laying of track and this carries inherent infrastructural issues (construction inconvenience, integration with road and pedestrians, etc.) a guided bus can integrate almost seamlessly into the local network while still utilising the advantages of significant lengths of permanent way grade-separated running[57]. This notion is reflected in sociable cities:

> *"…bus transit systems have an advantage over light rail in that they can fan out in dendritic fashion to serve medium density residential areas more widely spread out from the transit stops, as in Adelaide." (Hall & Ward, 1998, p. 162).*

A guided busway RRC therefore, has greater inter-operability with broader regional Metros. However, the importance of the 'image' of a transport network to a city should not be overlooked (Sudjic, 1992). Due to the very infrastructural issues that make a tram network more onerous to install, through its urban design presence and sense of permanence (especially in a street-running configuration), a tram network can conceivably contribute to a strong image (Lynch, 1960) of its respective city. It could be argued that the guided busway rails give a similar sense of permanence: however, these rails are only present along the RRCs section of the network as opposed to a tram network where they are required for the

[57] circa 50mph dedicated transport corridors.

entirety. This engineering necessity through an urban design lens can conceivably contribute to future decisions regarding transit mode choice of RRCs.

In summary, RRCs may be parts of a national rail network or regional Metros and it is more likely, based on the evidence gathered in this research, that if the transit mode used is a lighter form, then the transport network is more likely to be regional than national. This research shows that there are further implications beyond the infrastructural for RRCs and their relationship to regional Metros. Differing transport modes mean different things in terms of the image of the city through their urban design implications.

A RRC is differentiated from a reinstated railway line because it is not required to use the previous alignment in its entirety. This means that RRCs potentially have areas of disused non-reinstated railway lines associated with them. As with the new public transit corridors, these areas have transport planning, land-use planning and urban design implications.

Within National Planning Policy Framework (Department for Communities and Local Government, 2012) (NPPF) a key phrase is used with regard to the protection of disused corridors for future transport scenarios: 'robust evidence'. This research analyses visual and written documents regarding the empirical contexts of the three RRC case studies.

The image below shows the point at which the northern section of the guided busway leaves the RRC and the buses join the standard road network. This means a disused railway corridor can be seen across the road in this image, which continues for approximately 1km where the junction with the Cambridge to Ely mainline used to exist.

Figure 5.20 Disused Non-reinstated at CS 2.05 Cambridge Science Park

This image illustrates a number of points. It shows the ease by which a guided bus route can plug into a standard road network, utilising what is effectively a normal, at grade, road junction. To the background of this image however, the disused non-reinstated railway corridor can be seen to continue beyond the road. In this instance the disused railway is fenced off and overgrown at the time this photograph was taken. (Author's own, 2013)

There a number of transport and land-use planning reasons for this configuration. The first reason for this section of disused track bed not being reinstated is the clash in transport modes between rail and guided bus 1km east, where the previous two railway lines shared a junction. It would have been unfeasible to run the guided busway adjacent to to the mainline railway due to space constraints.

Further to this point, by deviating from the redundant railway corridor at this position, the buses have the benefit of being able to use a variety of routes towards and through the centre of Cambridge. These routes can, and do, continue on to the Cambridge railway station (CS 2.04) where they again make use of a RRC, terminating at Trumpington (CS 2.01). It is interesting to note that although not reinstating the disused line as a guided busway, the brownfield sites where these two railways once met is being utilised as part of the 'Cambridge Areas of Major Change Composite Plan' (Cambridge City Council). This plan incorporates a new railway station, which will serve both the existing Cambridge Business Park (adjacent to the site) and a new park-and-ride area. This station and park-and-ride occupies a brownfield railway site: a disused railway sidings site.

A different type of 'non-reinstatement of disused railway line' is evident in CS03 the Borders Rail-Waverley Line. 3.01A (see appendix) shows the point in Tweedbank (CS 3.01) at which this RRC terminates. Should this heavy rail reinstatement have carried on beyond Tweedbank then the area would be connected not only to Edinburgh in the north but Carlisle to the south-west and Newcastle to the south-east. This would have also connected settlements of similar sizes to Galashiels (CS 3.02) in the Scottish borders. There are significant 'blockages' just south of Tweedbank however; a main trunk road occupies the previous railway corridor which is surrounded by a difficult topography to traverse with a heavy rail line. The advantage of this non-reinstatement is that given the importance assigned to tourist cycling in the Borders Structure Plan, the national cycle network will remain between Tweedbank, Melrose and Newtown St Boswells.

Regarding 'disused non-reinstatements' there is a distinct difference between these two cases. The instance of non-reinstatement in Cambridge is to maximise the utilisation of the redundant railway land: sending the guided busway through the city, using the old sidings as a park-and-ride site and introducing a new railway station on this land. The example from the Borders Rail-Waverley Line contrasts this: restriction of public transit opportunity as opposed to a maximisation.

CS 1.13 Newstead shows a further type of non-reinstatement of disused railway alignment. Here three separate lines existed, which were linked financially and physically to different collieries. Since the closure of these collieries the only conceivable purpose would be to serve local conurbations, which do not contain a critical mass population to sustain three railway lines. Therefore, these three lines that traverse the area have been

rationalised into one route, the RHL. This means that the landscape is littered with segments of the other two lines that are not, and conceivably never will be required. The RHL is an example of how a number of disused railway corridors can be combined, 'recycled', together to make a public transit service. This process of consolidation that relinquishes sections of disused corridors means purposes other than transit can be considered. Newstead shows a number of examples such as commercial land, a country park, land for housing and the utilisation of part of one of the disused railway corridors as part of the national cycle network.

In summary, the data analysed in this research shows three key aspects to sections on disused railway corridors which are non-reinstated. Firstly, as in the example from CS02 CGB, a non-reinstatement can be used as a strategic planning device as much as in the instance of an actual RRC. Secondly, as in the case of CS03 BRWL, a non-reinstatement can be prohibitive to transit network expansion, in this instance based on the physical 'blockages'. Thirdly, as in CS01 on the RHL at Newstead where the rationalisation of a duplication of provision into a singular transit corridor means that the other routes that are left as remnants of this process can be released and repurposed for a variety of land-use types.

Whilst considering RRCs within a regional context, the relationship between the 'main road' network[58], the public transit network and their inter-relating urban designs is an aspect worthy of attention. Main Roads are included in Breheny and Rookwood's (p.161, 1993) Social City Region and are seen on the conceptual diagram (Breheny & Rookwood, 1993) to form arterial routes focused towards city centres. These main roads are accompanied by the annotation *"Road pricing and parking charges to restrain private car use"* (Breheny & Rookwood, 1993, p. 161). As part of the complex infrastructural system that is a contemporary transport network it is impossible to separate main roads from the urban design issues of RRCs. However, the consensus found within this research's literature review is that the dominance of the automobile with detriment to other modes of transport is unsustainable.

Sections of the reviewed literature go further, advocating the position that there should be a reversal of this hierarchy of automobiles first through a prioritisation of human locomotion over the primacy of the car, but also public public transit (Calthorpe & Fulton, 2001; Marshall & Lorimer, 2013). This section of the discussion surrounding the urban design implications along-the-line of RRCs looks at main roads and their inter-relationships with the case studies.

[58] In this research a main road is considered either a Motorway or an A-road.

CS02 CGB shows the importance of regional scale traffic problems in the conceptualisation of a public transit route along a RRC. The northern section of the Cambridge Guided Busway that runs in a broadly east-west axis between Cambridge and St Ives is, at a regional scale, a corridor that runs parallel to a section of the A14 trunk road. This is the main road that links Cambridge to the North Midlands areas of the UK (via its connection with the A1 at Huntingdon). This route has a history of being subject to high levels of commuter traffic congestion. Exacerbating this, there is also significant cross-Cambridge and cross-regional traffic between the shipping ports on the east coast and the north-south vehicular arteries of the A1 and M1 motorways. This is illustrated in figure 3.00 D (see appendix) that contextualises the Cambridge local area plan regionally, nationally and internationally.

This problem prompted the Cambridge to Huntingdon Multimodal Study (CHUMMS) to be carried out. This research reviewed the transport options for the RRC that existed north of, and approximately parallel to the A14, with the guided busway option pursued to completion[59]. The conclusions of this research and realisation of this project have had a number of land-use planning and urban design implications. A significant development site[60] has been facilitated at Northstowe (CS 2.11) by the RRC which has been conceived with a number of transit-supportive urban design components: a grid-based street pattern, consideration of the edges of these streets through massing strategies, a mix of uses and shared spaces at public spaces, and all with a prioritisation for public transport, cycling and pedestrian transit.

Due to a variety of reasons, not least the topography of the Scottish Borders and the Gala Water river, CS03 the Borders Rail-Waverley Line has a close relationship with the A7 trunk road. In comparison to the previous example of the CGB where the A14 is configured of relatively straight sections[61], the A7 follows the 'path of least resistance' created by Gala Water along the river's floodplain. This almost symbiotic relationship between the BRWL RRC, Gala Water and the A7 has, in urban design terms, been implicated by the process of 'redundancy-dormancy-renewal'. The issue for the RRC in this instance is how reinstatements can deal with physical interventions that occurred since the closure of lines. The image below shows the old railway embankment that has been severed by a roundabout, the built environment manifestation of increased automobile traffic during the 46 years between the closure and re-opening of this railway alignment.

[59] Heavy rail and light rail options were considered.
[60] Circa 10,000 homes upon completion of all phases, situated upon a disused RAF airfield.
[61] With a number of Roman Settlement Sites in proximity.

Figure 5.21 BR-WL and the A7

This image illustrates a stage in the redundancy-dormancy-renewal process of a RRC coming to fruition. Here, the substantial embankment of the Waverley Line can be seen in a dormant state. During this period of dormancy, the increase in automobile traffic has meant the road network has assumed the former territory of the railway line. Whilst elsewhere in the BRWL the old pieces of engineering infrastructure have been utilised (e.g. the Lothian Bridge and Glenesk viaduct), in this specific instance a significant piece of engineering was required in order for the railway line to bridge this road junction. (Author's own, 2011)

This roundabout has been bridged, one of the larger engineering tasks of the reinstatement. This involved the closure of the road for an evening whilst the bridge span, that had been prefabricated adjacent to the site, was moved into position on the newly constructed supports (see appendix 3.00Jj and 3.00Kk).

This situation is poignant in terms of past and current national planning policy that relates to dormant, potentially recyclable railway corridors. PPG13 states that disused railway corridors should not be 'unnecessarily severed' (Department for Communities and Local Government, 2001) and the National Planning Policy Framework requires, after the production of 'robust evidence', the protection of routes for future transport choice. Had these policies been in force at the time of the A7's expansion, then perhaps the road might have been configured in a manner that would not have 'severed' the previous railway's alignment. This could, potentially, have saved money and inconvenience. Further to this, the complexity and expense of navigating this problem could conceivably have resulted in the reinstatement not taking place at all. This would have had significant land use and urban design implications for the region as a whole, not least jeopardising the transit supportive new town of Shawfair (CS 3.07).

Developments along-the-line of the RRCs have, in the instances examined in this research, potentially interesting relationships with main roads from an urban design perspective. Orchard Park (CS 2.07 & 2.08) has a close spatial relationship with a main

road. The site itself is approximately 3km from the junction between the M11[62] and the A14, which makes the development regionally accessible without the necessity of having to enter Cambridge. At the local scale the A14 actually forms the majority of the northern boundary of the Orchard Park site.

This adjacent relationship between the development plot and the main road has a variety of implications. Firstly, in terms of construction sequencing: the site has been built out from the south, the opposite side of the site to the A14. Secondly, the land use has also been affected by this proximity to the main road; little permanent residential development has occurred adjacent to the boundary with hotels, schools, sports fields and landscaped areas creating 'buffers' between the A14 and the development as a whole.

The fact of the A14 acting as a 'Lynchian edge' to Orchard Park has had strategic implications. This plot was reclassified under the local plan from green belt land to developable land. It is unlikely that this would be the case without the strong boundary created by the A14. The RRC further contributes to this strong edge, creating, in another Lynchian term, a defined district. Therefore, as well as the land-use implications, the A14 and its strong northern edge to Orchard Park produces a sense of containment. Together these aspects add to the sense of place here. This is a crucial, in some senses almost counter-intuitive, point; a main road has been an essential component to a transport-supportive development along a RRC.

The evidence presented here shows that main roads are important aspects in the development of transit-supportive urban designs along-the-line of RRCs. These urban designs can owe their existence to congestion alleviation strategies or share a passable route through a difficult topography. The relationship between main roads and RRCs can be problematic where space demands conflict, although this is interesting if considered with the 'redundancy-dormancy-renewal' process of RRCs. Main roads have also shown to be formative elements to transit-supportive urban designs along-the-line of RRCs, creating strong constraints for developments, affecting land-use decisions within the development and necessitating certain detailed urban design solutions.

The extent to which automobile parking is emphasised at stations and stops along-the-line of RRCs is crucial to whether or not those respective urban designs are transit supportive. In the literature review, Jacobsen and Forsyth (2008) are cited as writing: *"…don't forget (but don't overemphasise) car movement and car parking" (Jacobson & Forsyth, 2008)* whilst describing principles for a Social City Region. This research analyses urban design data through the discussion of various responses to the problem of how to accommodate both space-intensive car parking and dense, mixed-use, walkable places.

[62] The M11 Motorway runs from Cambridge to London, turning into the A14 to the west of Cambridge.

There are three broad types of car parking configurations evident throughout case studies: multi-storey, surface and park-and-ride. Although the park-and-ride sites are also surface car parks, they have been separated in this conceptualisation as the designation of a park-and-ride site is a different land use to the other surface car parks, where the parking is not the focus of the urban morphology at the node.

MULTI-STOREY PARKING CONFIGURATION		
CS 1.01 Nottingham Station Area	CS 2.04 Cambridge Station Area	
SURFACE PARKING CONFIGURATION		
CS 1.08 Bulwell CS 1.10 Moor Bridge CS 1.12 Hucknall CS 1.14 Kirkby-in-Ashfield CS 1.17 Mansfield Woodhouse CS 1.18 Shirebrook CS 1.19 Langwith-Whaley Thorns CS 1.20 Creswell CS 1.21 Whitwell CS 1.22 Worksop	CS 2.10 Oakington	CS 3.04 Gorebridge
PARK & RIDE CONFIGURATION		
CS 1.02 Wilkinson Street CS 1.07 Phoenix Park CS 1.15 Sutton Parkway	CS 2.01 Trumpington (P&R) CS 2.12 Longstanton (P&R) CS 2.15 St Ives (P&R) CS 2.15 St Ives (P&R)	CS 3.06 Eskbank

Table 5.4 Three Types of Node Associated Parking

The above table shows which case study nodes have which type of associated parking.

Although there are fewer nodes along CS03[63] than the other two cases and CS01 has the most nodes, there are still noticeably fewer car parks along CS03 than the other two cases. Further to this, CS01 has the greater number of nodes with car parking provision, however the majority of this is in a surface parking configuration whereas CS02 has the greater number of park-and-ride sites despite having fewer nodes than CS01. Each of these three configurations show differing degrees of emphasis to car parking, which manifest in the built environment with differing urban design implications.

CS 1.01 Nottingham Station Area is an example of a multi-storey car park adjacent to the joint tram and train node. The image below shows the construction of NET P2 (opened

[63] CS01 – 22 nodes, CS02 – 15 nodes, CS03 – 07 nodes.

2015) as it crosses above Nottingham Midland Railway Station, along the elevated alignment of the old Great Central Railway. Situated to the background of this image is a six-level multi-storey car park which is in the position of a previous surface level car park.

Figure 5.22 Multi-storey parking: Nottingham Station Area

The above image shows a six-level multi-storey car park directly adjacent to Nottingham Station. This car park is decorated in hit-and-miss copper cladding, with a variety of patina. (Author's own, 2012)

This multi-storey car park has had attention given to the aesthetic. The copper panels that are attached to all four façades hide the concrete structure, which ordinarily for this type of structure would have remained exposed. These copper panels are fixed in a hit-and-miss pattern laid to differing heights/lengths with various stages of patina. Although this shows a degree of design sensibility, the connectivity between the car park and the station could be more direct. The image below shows the footbridge of Nottingham Station, taken from the upper level of the multi-storey car park. These structures are not connected.

Figure 5.23 Parking Separated from Station Bridge

The above image shows the pedestrian bridge at Nottingham Station and how it is not linked to the recent multi-storey car park. (Author's own, 2012)

Although directly adjacent to platform 6 of Nottingham Station, the pedestrian access between the car park and the railway station platforms (since the opening of NET P2) is via the main concourse. Although operationally, in terms of revenue control/security it makes sense to restrict access to the station platforms, this route is somewhat convoluted. When considered in terms of the walkability of a node and the pedestrian distance travelled, this arrangement makes what could be a 100m walk to the station platforms into a 100-300m walk.

This replacement of a surface car park with a multi-storey car park, although occupying land that could be used for commercial/residential purposes, shows some balance of parking at the node. In finer-grain urban design terms, the façade treatment of this car park is superior to most multi-storeys; however, the connectivity between the station platforms and the parking provision could be more effectively arranged.

CS 1.08 Bulwell is a joint node with both a tram stop and a railway station that shows a surface car park configuration. In this instance a considered approach to balancing the urban design of the parking is evident. Illustrating provision for approximately sixty automobiles[64], the image below shows a balance between the pragmatic necessity of parking at a station and a green park space to the background[65]. Had the approach been to overemphasise the parking in this instance then potentially this green space would have been usurped by car parking, as opposed to the existing condition where the two contrasting typologies balance a useful and pleasant environment.

Figure 5.25 Balanced Parking Emphasis: Bulwell Station & Stop

The above image shows the situation at Bulwell station node in terms of car parking. Surface car parking adjacent to an established ecological area with direct access to the tram stop and pedestrian bridge access to the railway station. (Author's own, 2012)

The image above is taken from the pedestrian bridge that links the railway station platform (to the left of the image) with the car park. Here the difference between the two modes of reinstatement and their pedestrian permission is shown. It is not permissible to walk across

[64] This image was taken on a weekday morning, showing this car park to be full.
[65] Park space featuring an open grassed area, seating and a children's play area.

the railway tracks to access the railway station. However, the tram stop has a break in the fence and a path across one of the tram lines to access the low platform.

The approach to Bulwell station/stop from the town centre/marketplace also exhibits a design that shows a balance between the public realm and vehicular requirements (seen below). Whilst stopping short of being a full shared-surface, some of the principles are adhered to. There is high quality permeable and decorative paving with a low kerb[66] leading past an overlooked, well-lit environment. This demonstrates a balance in priority between the pedestrian and the automobile.

Figure 5.26 Balanced Parking Emphasis: Bulwell Station & Stop Approach

The image to the left shows vehicular approach to Bulwell station: high-quality paving materials in combination with a low kerb to mediate between pedestrian and vehicular space. The image to the right shows the detail of materials and vehicular and pedestrian approach to Bulwell station. (Author's own, 2012 & 2012)

Just as the evidence at Bulwell suggests a balance in emphasis between car parking and the pedestrian public realm, this is also the case at St Ives (CS 2.15). A terminus node on the Cambridge Guided Busway, St Ives is an example where large-scale parking is adjacent to the transit node. Although the adjacent car park is a surface car park, it is the land-use type of park-and-ride site, which has space for 500 cars, situated on the site of the former fabrication plant of the concrete tracks used to construct the guided busway. One of the key policy aims of the Cambridge Guided Busway was to alleviate pressure from the A14 trunk road corridor. This park-and-ride is situated in order to serve both St Ives and the surrounding area and traffic approaching Cambridge from the west and the A1.

What is interesting, from an urban design perspective, is the area illustrated below: the mediation space between the surface car park and the transport node. This space is a public space which is hard landscaped and crescent shaped (in plan). Hard landscaping, in the form of Cambridgeshire brick planters, separates the parking area from the public space. However, the most salient aspect about this area is its potential through flexibility. This space facilitates opportunities for a variety of uses, ones which can benefit from such positions of high 'footfall'. This configuration allows for a place that might otherwise have been sterile and featureless to become a focus of activity (such as a market). This demonstrates that even a park-and-ride site, with care and thought given to the land use and

[66] The kerb height is less than 100mm, with a standard kerb range being 120-150mm.

urban design, can have a balanced emphasis between place considerations and space-intensive surface car parking.

Figure 5.27 A Balanced Emphasis to Parking: St Ives park-and-ride

To the left of this image is the Guided Busway stop and to the right is the surface parking of the park-and-ride. In between these two elements is a flexible public space. (Author's own, 2011)

The three examples illustrated here show interesting urban design responses to the varying degrees of balance shown between car parking requirements and walkable public realms exhibited at nodes along-the-line of RRCs. The multi-storey car park at Nottingham Station shows attention to location and aesthetic of the parking solution but with questionable connectivity to the node. The surface car park at Bulwell shows a balance between the surface car park provision and amenity space and a walkable environment. The park-and-ride site at St Ives, through its flexible public space, shows a different way of balancing parking requirements and urban design imperatives.

5.5 Interruptions to Disused/Recycled Railway Corridors

Although PPG13 (Department for Communities and Local Government, 2001) has been superseded,[67] its influence over the case studies makes it nonetheless relevant. It prohibited 'unnecessary severance' by protecting potential transport routes for future public transport choice. Whilst this clause does not reference disused railway lines exclusively, this land use certainly falls within the stated category. The term 'unnecessarily severed' also implies an opposite state – a situation where severance is necessary. This research speculates, using the case studies, what might constitute a 'necessary' or 'unnecessary' severance.

The image below is not strictly within the bounds of CS01; however, it is a disused alignment of one of the lines[68] that have been combined as part of the RHL. The severance of this corridor means this area was unfeasible for any form of reinstatement. The head of the tunnel from the old Nottingham Victoria station facing a northerly direction towards Mansfield is illustrated. The considerable engineering work that was carried out in the

[67] PPG 13 was superseded by the National Planning Policy Framework.
[68] The Great Central Railway and the Great Northern Railway

realisation of Nottingham Victoria station is evident through the overgrown retaining walls. The current purpose of this void in the urban fabric is also illustrated here: a six-storey car park. The entrance to this car park is at the upper street level, serving the Nottingham Victoria shopping centre. It was this shopping centre/car park development which severed the railway corridor beyond any practicable reuse. There were however, strong arguments for the severing of this route; the two lines that pass through this area were deemed uneconomical (British Railways Board, 1963a) and the removal of the railway station and replacement with a shopping centre and car park seen as necessary in economic terms.

Figure 5.28 'Unnecessarily Severed': Great Central Nottingham Victoria

This image shows what used to be the northern tunnel to Victoria Station on the Great Central Railway line. Whilst contemporary national planning guidance prohibits severing transport corridors that could provide future transport choice, no such protection was offered at the time of the widespread closures. (Author's own, 2012)

The low levels of occupancy of this car park (1.00H see appendix (apart from at peak times such as Christmas) however, suggest this severance as potentially unnecessary and indeed detrimental in terms of transport choice. Whilst the reinstatement of a large station on the scale of the previous Nottingham Victoria (1.00G see appendix) in this situation was never plausible, the principle of 'unnecessarily' severed as set out in PPG13 might be applicable here.

Had the design of the car park (the only land-use type at the level of the disused railway) been in line with the principles set out in PPG13 then the transport options would be very different. The protection of such a route might have allowed for significantly altered transport options in the direct vicinity and the region as whole. This includes potentially very different configurations for CS01 – both the heavy rail and light rail elements. Further

to protecting the route, this might have been an ideal place for a node for the northern fringe of Nottingham centre which although well served by bus routes has no permanent way transport option, a scenario that might have been connected to the shopping centre and high density residential apartments above, linked with some car parking and a place of potentially regional as well as local significance.

Comparing this instance of unnecessary severance with the following example (illustrated below) may initially seem an odd comparison, as they are very different types and contexts of severing. This single private dwelling in Stow (CS 3.03) shows a house built squarely across the disused track bed. The bridge to the right of the picture is a road bridge crossing the previously disused railway alignment linking the two sides of the Stow conurbation (3.03A see appendix). The edge of the old station platform is overgrown, but the position is still visible.

Figure 5.29 'Unnecessarily' Severed: Stow

This image shows a house built in the track bed adjacent to the old platform (still visible in the photograph) at Stow. The BRWL travels under the bridge to the right of the photograph along its old path in place of this single dwelling. (Author's own, 2011)

Unlike the previous example in Nottingham, this building has made way for the RRC – CS03 BRWL. This shows a number of things. The multi-storey car park makes any public transit at Nottingham Victoria unfeasible, yet the single dwelling in Stow is an obstacle that can be overcome. Referring to an initial issue in this section of the discussion regarding unnecessary severance, the issue raised was the difference between unnecessarily severed and necessary severance. The data collected in these two instances suggests it is more a financial decision than an ethical one; the significant investment required to circumvent the problems of the multi-storey car park are insurmountable yet the financial obligation of

removing one dwelling is not. What does this say in ethical terms? What does this say about the prioritisation of urban design terms?

In terms of a claim to knowledge these two pieces of data show that the necessity of severance is subjective; unnecessary, or necessary to whom? This data also shows how important national planning policy can be in safeguarding potential mass-transit alignments in order to avoid such conflicts. If PPG13 had been in existence before these two examples were realised, then the problems of mitigating the severing and the ethical issues associated with any potential reinstatements would probably not have arisen. This data shows that there can be instances of unnecessary severing and that this can impact on the recycling of railway corridors in a number of ways; it could prevent the corridor from being reinstated, it could mean that a deviation from the previous alignments occurs (with positive impacts in some areas, and negative impacts in others) or it could mean disruption to other parties should an 'unnecessary severing' be reversed through the reintroduction of a permanent way public transit route.

Severance of a disused railway line causes blockages of potential RRCs of various kinds[69]. However, these blockages can lead to further route options as well as undermining the feasibility of potential routes. This, potentially, has significant implications regarding the recycling of railway corridors with knock-on effects regarding any chances of transport-supportive places connected by regional transport networks.

The image below shows a NET P1 tram at the precise point where the current configuration deviates from the previous railway alignment of the old 'Great Central' onto the street-running section. Just behind the tram, as shown in the image, is the Nottingham Contemporary Art Gallery. This building was completed in 2009, five years after the opening NET P1 in 2004. PPG13 came into force in 1994 meaning that it was applicable for the planning period of both the Contemporary Art Gallery and the majority of NET P1 tramline.

[69] Such blockages as housing, commercial development, roads along disused corridors, etc.

Figure 5.30 Purposeful Severance of Disused Railway Alignment: Nottingham

This image shows the Nottingham Contemporary Art Gallery built in the track bed of the old Great Central Railway, across the portal of the tunnel that carried the route under the city centre. NET P1 at this point runs along streets until CS 1.02 Wilkinson Street where it re-joins a RRC. (Author's own, 2012)

This means there must have been robust evidence to support the blocking up of the Great Central Railway tunnel head which is situated towards the rear lower storey of the art gallery. This 'blockage' has a clear influence upon the route of the NET tram, changing it from a public transit system that otherwise would have been entirely along RRCs, to a system that partially utilises redundant railway alignments.

It is possible to speculate on the reasons for this transport planning decision. The first reason may be technical; the disused tunnels of the Great Central Railway have been used as a conduit for the pipes that serve a district heating system in Nottingham. Adjusting circa 100m of these pipes was a significant expense during the construction of the art gallery; presumably, this expense would have been greater for any potential rail reinstatement as the distance would have been greater. Perhaps a second reason for allowing this 'blockage' would be the benefit to the public overall. The art gallery is an internationally significant venue in a site of strategic importance for the Nottingham City Master Plan. Factoring in that the diversion away from the disused railway alignment means that the tram travels through the centre of Nottingham (as opposed to underneath it) passing the historic Lace Market with the National Ice Centre, the main Market Square and Nottingham Trent University. The service provision for these areas, amongst others, would have been lessened by the use of the disused tunnel.

The evidence here suggests that there are a variety of types of severing of RRC and that there can be benefits to deviating from the previous routes; the possibility of serving a broader area with a public transit and the utilisation of the land left over by the

reinstatements for an alternate purpose. This evidence does however show a contrasting point: the opportunity to use these tunnels has been lost. Whilst this may be justifiable for the local transit system in question, there might have been other broader ranging opportunities for this railway alignment. To speculate, might this disused tunnel have been a plausible option for the HS2 spur through the East Midlands, as opposed to the route that at the time of writing misses Nottingham city centre by approximately 9.5km.

5.6 Land Use and Recycled Railway Corridors

Creswell[70] (CS 1.20) exhibits scope for urban expansion. However, via examination using the methods applied in this research, the current configuration resembles little in the way of transit-supportive growth despite the site's inherent potential. This north Derbyshire town on the RHL is an example of where a reinstated transit node on a RRC exhibits urban regeneration without traits of a transit-supportive urban design.

The two following images show the urban design at either side of Creswell's two station platforms. Figure 5.31 shows pedestrian and vehicular approach to the station. Exhibited here is a small-scale industrial unit which abuts both the approach and the station platform. This demonstrates, in normative urban design terms, a variety of negative place impacts. Firstly, it is separating elements that crucially need connection in transit-supportive environments; the station, the public approach and the rest of the town. This is both a visual and spatial separation. Secondly, the façade evident in the image can be identified as the antithesis of an active frontage. Aesthetically, this bare concrete blockwork is undesirable. A mixed-use building in this situation, designed to maximise the potential of the footfall of a station for both business and passenger, would make for a more transit-supportive urban design.

[70] The town, not the research design focused author.

Figure 5.31 No Urban Regeneration: Creswell

This image shows the pedestrian and vehicular approach to the northbound platform of Creswell (CS 1.20) station on the Robin Hood Line. (Author's own, 2012)

The next image, again of Creswell (CS 1.20), shows the two platforms and the condition on the opposite side of the railway to the previously discussed approach to the northbound platform. This is a piece of fallow, disused 'scrubland'. Similar to the factory on the opposite side of the track, this scrubland acts as a barrier between the station and the adjacent streets. Whilst this probably has a high level of biodiversity, it does nothing to increase the place characteristics of the station nor the amenity in terms of land use and urban design.

Figure 5.32 Fallow Land Adjacent to Reinstated Railway Node: Creswell

This image shows the derelict land adjacent to the platforms of Creswell Station. (Author's own, 2012)

Creswell station was reopened in 1998, sixteen years prior to the taking of these photographs. Over a ten-year period (2004-2014), the published patronage figures of this station only once dropped beneath 40,000 passengers per annum, peaking at 47,722 in 2011.

This may seem like a large figure but if a rough calculation is carried out to work out the daily usage of the station then the figure may explain the lack of facilities at the station. If the conservative figure of 40,000 is taken and divided by 52 (weeks per year) then a figure of 769 passengers per week is reached. If that is divided by 7 to give an approximate daily usage than a conservative estimate for passengers per day comes to 109. Perhaps this is the reason for a lack of investment in service-based amenities and their related urban design? It does not, however, explain why a detailed urban regeneration plan has not been focused upon the station node, one that might help strengthen the patronage numbers and increase the place-based built environment at the station.

The next collection of examples show a different narrative regarding urban regeneration along the RHL than that seen at Creswell. These examples illustrate the utilisation of either the disused station buildings or the disused railway sidings as small 'business centres'. The image below shows the station building at Shirebrook regenerated as a business centre. This is replicated, although on a much larger scale at Worksop. Mansfield Woodhouse (1.17A,B, D see appendix) does not use the old station buildings but still shows regeneration adjacent to the new station utilising the old railway buildings and the associated brownfield land left over by the railway. This is commensurate with the policy aspirations behind the reinstatement of the RHL: to encourage employment growth in lieu of the closing of major industry in the area (mining) and its associated supply chain. These responses exhibit a variety of urban design.

Shirebrook Business Centre, seen occupying the previously disused station building, creates a somewhat peculiar atmosphere. All of the windows are covered by blinds meaning that a potential sense of natural surveillance is lost. Presumably, this is for the privacy of the occupants of the offices and security; however, this does not fit with place-based notions of natural surveillance. In land-use terms a business centre can benefit from such a position on a railway station; however, in this instance it has come at a cost to passenger amenity.

Figure 5.33 Station Building Regenerated as 'Business Centre': Shirebrook

This image shows the Shirebrook Station Building repurposed as a business centre.
This commercial endeavour is at the expense of passenger amenity. (Author's own, 2012)

The image below illustrates the Mansfield Woodhouse (CS 1.17) Station Enterprise Centre, and the entrance to the heavy industry site on the opposite side of the road. In between these two components is the pedestrian entrance to the station. In this instance the regeneration has detracted from the walkability of the pedestrian entrance to the station through the decrease in legibility of its entrance. Further to this configuration, the street lighting here is poor and there are no natural wayfinding features to follow. Similar to the example seen at Creswell, there are no public amenities at this station. Even though a successful urban regeneration has occurred with the letting of small business units, there are no examples of public service businesses that could contribute to the place characteristics through such urban design concepts as vitality, overlooking, activity, active frontages, etc.

Figure 5.34 No Urban Regeneration: Mansfield Woodhouse

This image shows the main pedestrian entrance of Mansfield Woodhouse Station from the direction of the town. This is subservient to the Enterprise Centre entrance (left) situated in the old station building and an industrial facility (right). (Author's own, 2013)

The Worksop (CS 1.22) Station Business Centre, of these three examples, is arguably the most successful in terms of a combination between the facets of land use, urban regeneration and urban design. Whilst small business units are utilising the station buildings (as in Shirebrook) there are also units left for commercial public use; a small cafe on one side of the platform and, shown in the image, a public house, also using the station forecourt as an outdoor seating space.

Perhaps one reason for this difference is the scale of Worksop station. Not only is it a node on a RRC, it is also at a junction between the RHL and the continually used line between Sheffield and Lincoln, meaning a relatively higher degree of traffic. Worksop is also a larger town than either Shirebrook or Mansfield Woodhouse. There is a pre-existing residential area directly in front of Worksop station, which may have contributed to the mix of uses in this urban regeneration. However, whilst these land uses contribute to a sense of place at the station, it is argued here that this is nonetheless undermined by the treatment of the parking. Firstly, the parking is highly inefficient; there are two rows of parking bays, one directly in front of the building and one at the opposite edge of the car park, leaving a large tarmac area in between. If standard parking dimensions were adopted, i.e. moving the bank of parking away from the station buildings, then the pedestrian approach could be vastly improved, as could the breakout areas of the public uses in the business centre, each of which could enhance the place characteristics of this station.

Figure 5.35 Urban Regeneration: Worksop

The image to the left shows the substantial Worksop Station operating as both a working station and a business centre. The image to the right shows that this is configured with some passenger amenity – a public house spilling out onto a terrace. However, the parking is arranged inefficiently which, if configured more in line with normative urban design ideas, could have meant more pedestrian space, perhaps a flexible market-type area for example. (Author's own, 2011 & 2011)

These examples show the nature of the urban regeneration along the RHL; it is often limited to small business centres, as opposed to maximising the potential of transit-supportive developments through mixed-use configurations. These, and the following example from the Cambridge Guided Busway, illustrate the differentiation in urban design terms between regeneration and selective expansion. As discussed previously, the Cambridge area uses the Guided Busway to structure approximately half the city's planned growth: selective expansion. CS 2.01 Trumpington shows a place that illustrates the difference between the urban regeneration of the RHL and the selective expansion evident along the CGB.

The following image is reproduced from the Trumpington Meadows design code and illustrates the significant urban expansion proposed (at time of writing potentially completed) for Trumpington, the terminus of the CGB along RRC [71] alignments.

[71] The nature of the busway means that services can continue along standard roads beyond this point.

Figure 5.36 Trumpington Meadows Design Code: Scheme and Outline Consent Plan

Source (Grosvenor/Terence O'Rourke Ltd, 2010)

This site is a combination of a park-and-ride (serving the nearby M11 junction), a medium density residential development with some commercial uses and a Country Park to the west of the site which provides amenity space which curtails any outward sprawl. This selective expansion is an interesting development in terms of cooperation between the local authorities: the 1200-home residential area straddles the border between the Cambridge City and South Cambridge Local Authorities jurisdictions, demonstrating a common approach. This is similar to the RHL which crosses the borders between Derbyshire and Nottinghamshire; however, the cooperation in that instance is evident in the RRC, but not in any examples of selective expansion sites such as Trumpington Meadows.

It is argued that the urban design evidence of selective expansion in the Trumpington Meadows masterplan/images created as part of this research show a coherent strategy to make use of the opportunity of recycling the respective railway corridor in order to create a transit-supportive place. This was absent in the evidence collected along the RHL. In land-use terms the Trumpington example illustrates a mix of uses, which according to

transit town literature is key. It also provides all-day activity at the node, something that was observed personally as part of the research and illustrated in the image below.

Figure 5.37 Urban Regeneration: Trumpington park-and-ride

This image (left) shows the southern terminus of the CGB. This is also the site of a tourist information centre. The image to the right shows the northern extent of Trumpington Meadows park-and-ride, high density residential low-rise flats. (Author's own, 2013 & 2013)

This natural surveillance led to a feeling and perception of safety at the Trumpington site, whereas antisocial behaviour (early morning drinking, general thuggery) was witnessed at two of the three examples of the business centres along the RHL. Whilst it is clear that there are very different socio-economic conditions in these two places, the design of the built environment at Trumpington provided a degree of natural surveillance, which was lacking at the other instances on the RHL.

This comparison between the urban design data from the RHL and the CGB show a difference between urban regeneration and selective urban expansion. In the case of the RHL, urban regeneration can be claimed by the presence of land-use enterprise along-the-line of the RRC. However, examination conducted at the finer grain of urban design scale found the majority of the places to be lacking in many normative urban design components. However, the example from Trumpington and other developments along-the-line of the Cambridge Guided Busway show that selective expansion can incorporate the land-use benefits of urban regeneration with the finer-grain place considerations leading to arguably more transit supportive urban designs.

Mixed-use development is a very broad term and is a concept crucial to theories extolling transit-supportive environments (Calthorpe & Fulton, 2001; Dittmar, 2008; Jacobson & Forsyth, 2008). The study of mixed-used urban design is detailed and complex; in this research where the scope is so broad, a very coarse-grain definition of mixed use (2.5) is necessarily used. In order to examine the urban design along-the-line of RRCs, notable examples of different types of mixed use in differing urban contexts will be compared here. These are not exhaustive; however, they are illuminatory. This broad definition of mixed use can include Residential, Commercial, Retail and Industrial. It can also encompass landscaping elements such as Public Utility Spaces: Parks, Precincts or Squares.

The Orchard Park (CS 2.07 & 2.08) development on the Cambridge Guided Busway illustrates an interesting combination in terms of its mixture of uses. The image below demonstrates a number of these. Working from right to left, this image firstly shows a piece of undeveloped grassland. There has been a planning application submitted for this piece of land.

Figure 5.38 Mixed Use: Orchard Park West

This image shows a development site, a hotel, a variety of residential types, and boulevard leading to a circus and the Orchard Park West guided bus stop. (Author's own, 2013)

This planning application includes a small public square with high density residential flanking two of the sides, the third side (to the north of the site adjacent to the A14 Road) to be retail on the ground floor with flats above. The building to the far right of this photograph is of a chain hotel which also borders the A14. Seen directly adjacent to this hotel, the four-storey building with the render flanking wall is apartment accommodation. The road seen on the left leads directly to a school with small-scale sporting facilities (situated out of shot). The next building is a terrace of apartments, which runs at three storeys all the way to the corner plot, turning the corner slightly into the next road. This next road is the most direct link to the Orchard Park West node, a route which goes through the Orchard Park 'circus'. The residential typology changes along this road from three-storey apartments to a terrace of three-storey single-family dwellings. This typology of dwelling continues along this road, into and forming the 'circus'.

This image at Orchard Park shows how the mix of uses relate to each other; they each have a separate plot. These plots however are in close proximity to each other at a relatively tight density, often butting up directly against each other (in the case of the apartments and the single-family dwellings). Comparing this instance at Orchard Park to other nodes shows how a mixture of uses can manifest in different ways in relation to RRCs. For example, the Cambridge Railway Station Area (CS 2.04) has many existing office buildings. However, the new developments taking place on the disused railway sidings show an archetypal mix of use within a single perimeter block; retail on the ground floor and residential above (see image below). This is in contrast to the trend, although not the exclusive pattern seen at Orchard Park where each plot has a single use.

Figure 5.39 Archetypal Mixed Use Design: Cambridge Station Area

This image shows the manner in which a mixed-use development has occurred adjacent to Cambridge Station, situated upon brownfield land which was previously railway sidings. Retail to the ground floor and residential accommodation above. (Author's own, 2013)

An interesting juxtaposition is apparent when these two examples along-the-line of the Cambridge Guided Busway are compared to Hucknall (CS 1.13), the northern terminus of NET P1 and a station on the RHL. The mix of uses here exhibits a mixture of 'big-box retail', dendritic housing and the existing historic housing all within the immediate pedshed of the station. Whilst there are clearly differing uses in this urban design, their inter-relationship in urban design terms is poor. Each plot is entirely mono-use; using the parameters defined in the literature that purport transit-supportive urban design it is impossible to identify the Hucknall node as being mixed use.

Figure 5.40 A series of mono-use plots: Hucknall Joint Node

This image shows surface car parking and big-box-retail in a prominent position adjacent to the transit node of the two networks at Hucknall. (Author's own, 2011)

It is argued therefore, that in comparison to the two examples discussed from along the CGB, Hucknall shows less articulation of the land-use types. Whilst the Cambridge Station Area shows an archetypal mixed-use arrangement, Orchard Park shows a mix of use mainly across its constituent plots. The urban design articulation of these arrangements is what differentiates Orchard Park from Hucknall. It is a consideration and commitment to the design of the public realm that sets these two places apart. Where Orchard Park knits together a number of different uses through its public spaces and streets, Hucknall prioritises the mechanistic demands of cars, buses and the servicing of retail chains.

The comparisons between these data show it is possible to identify a mix of uses at the nodes of RRCs, but this does not necessarily resemble the mixed-use arrangements argued for in transit-supportive urban design literature. However, there is evidence that mixed-use developments exist along-the-line of RRCs and that the inter-relationship between the urban design of these places and the transit node can be mutually supportive.

Whilst a residentially-led mixed-use imperative is a high priority in the literature buttressing transit-supportive urban designs, industrial areas are given importance, most notably in the Social City Region (Breheny & Rookwood, 1993). This research looks at how resurgent industrial areas along-the-line of RRCs work, in urban design terms, as regionally key centres of employment. The image below of Sutton Parkway (CS 1.15) station shows the close physical relationship between the transport node and the adjacent industrial area. This shows pedestrian connectivity across both sides of the RHL. However, there is a rather peculiar segregation apparent in terms of walkable connections between the station and the

adjacent industrial area. It is impossible to walk from where the photograph was taken to the entrance of the visible industrial unit; notice at the end of the platform the sign prohibiting anyone walking beyond that point. Whilst this is the case at any railway station, what doesn't make sense is that (just visible in the photograph) there is a pedestrian crossing approximately 50m down the line.

Figure 5.41 Connectivity between station and Industrial Area: Sutton Parkway

The image above shows the close relationship between the industrial unit and Sutton Parkway station. However, the pedestrian connection between these two elements progresses in the opposite direction, despite there being an at-grade crossing of the double track configuration railway line less than 50m away, visible in the background of this image. (Author's own, 2013)

This configuration suggests that it is not safe to walk adjacent to the railway line, the direct route to the industrial unit, but it is safe to cross both of these tracks to access the same industrial unit. A pedestrian route that occupied the space between the platform and the industrial unit would mean a distance of approximately 120m in length, currently the distance needed to walk to the same destination is approximately 320m. This pedestrian crossing is useful however, as it connects industrial units to both sides of the tracks, breaking the potentially negative impact of the railway line, as a separating Lynchian edge.

Whilst the example at Sutton Parkway shows that industrial areas, especially when given consideration as employment zones, can benefit from connection to RRCs, the example from Newstead (CS 1.13) illustrates an industrial area that is problematic in terms of transit-supportive urban design along-the-line of a RRC. The industrial area at Newstead acts as a district, an edge-like barrier between the significant residential development towards the extremity of the 1km pedshed, Newstead town centre and the station node of the RRC. Should those whose abode is within the new residential development at Newstead

wish to use the train, they are forced to either go through or around this industrial area where the public realm is inhospitable to pedestrians.

Figure 5.42 Industrial Area: Newstead

The image above shows the industrial area between the residential development at the extent of the Newstead pedshed and the Newstead station node. (Author's own, 2011)

There is a significant proportion of land at Newstead which was previously either mining or railway related[72]. These brownfield sites have been attractive to industrial employment land developers. The area in the image above has been established since the 1990s, circa fifteen years before the commencement on site of the residential development. Therefore, it is somewhat unfair to criticise the industrial area for its urban design, as it was functioning before the conception of the residential area. However, it is fair to question whether or not this is an ideal configuration in transit-supportive urban design terms and how a masterplanning exercise could have potentially proposed swapping the positions of the industrial/residential sites. This could have been beneficial in urban design terms. One key consideration here is jurisdictional. The boundary between two local authorities[73] passes through the industrial area and along the boundary of the residential site. Perhaps this contributed to what appears, to those that subscribe to transit-supportive urban design ideals, to be a puzzling land-use configuration.

There are other examples within CS01 however, where industrial areas have been integrated into the urban grain in a more nuanced manner. For instance, Phoenix Park (CS 1.07), which occupies an ex-colliery site on a spur off the main NET P1 route: this site has

[72] These previous uses include: railway sidings, railway junctions (between G.N.R., G.C.R. & M.R.), Engine Sheds, Collieries, Gasometers, Electric Light Works and ancillary buildings/structures.
[73] Gedling Borough Council to the east and Ashfield Borough Council to the west.

commercial office and park-and-ride land-uses as well as an industrial area. The image below illustrates an industrial unit where the only two access/egress points are beyond the tramline. The single track tramline runs through the centre of the site meaning the industrial area could have potentially been cut off by the RRC.

Figure 5.42 Industrial Area: Phoenix Park

This image shows a tram system and an industrial unit operating adjacent to each other. (Author's own, 2015)

This separation however, has not occurred. Large lorries are capable of traversing the RRC. This illustrates a benefit of the lighter forms of reinstatement – this arrangement would not have been possible with a heavy rail configuration. Whilst this sort of industrial area does not offer the same critical mass in terms of employment as a city centre, it is still a regionally crucial area of employment. The fact that it is linked to a broader transit network means that employees of these industrial units have the opportunity to utilise public transport in order to commute. This opportunity does not exist in other industrial areas not linked by RRCs. Although most have bus links, Phoenix Park is also a park-and-ride/commercial office site with a ten-minute daytime tram frequency making it far more accessible than other industrial areas not associated with RRCs.

This evidence shows that whilst many industrial areas exist along-the-line of RRCs, these industrial areas do not necessarily contribute to a transport supportive whole. Pedestrian connectivity between the industrial units and the station was undermined at Sutton Parkway, despite proximity between the industrial unit and the station. At Newstead, an industrial area separated a substantial residential development from the station node. However, at Phoenix Park, light rail has meant that park-and-ride, and commercial and industrial land uses can exist in proximity to one another, on the position of a disused colliery, connected by a RRC.

Calthorpe and Fulton (2001) discuss the potential urban design benefits of old railway alignments being brought back into public transit use; they can be less disruptive, connective of existing areas/historic town centres and can become the catalyst of brownfield redevelopment. This research concentrates upon RRCs meaning, in the above terms, the connectivity benefits are implicit. However, the re-use of a previously disused railway alignment does not necessarily mean, in this research's case studies, that the catalyst effect occurs at the brownfield sites along-the-line of the RRC.

This research found four differing categories of brownfield sites adjacent to the current nodes along the RRCs examined: ex-railway land, ex-factory land, ex-mining/mineral extraction land and ex-military land. The table below summarises which nodes along-the-line of the RRCs under study relate to which type of brownfield land. The case studies highlighted in **bold** are where evidence of transit-supportive urban design was found.

BROWNFIELD SITES – EX-RAILWAY LAND (SIDINGS / GOODS / WORKS / ETC)		
CS 1.03 Basford (South) CS 1.06 Cinderhill **CS 1.08 Bulwell** **CS 1.16 Mansfield** **CS 1.17 Mansfield Woodhouse** CS 1.18 Shirebrook CS 1.20 Creswell CS 1.22 Worksop	**CS 2.04** **Cambridge Station Area** CS 2.10 Oakington CS 2.12 Longstanton (P&R)	CS 3.02 Galashiels CS 3.03 Stow CS 3.06 Eskbank
BROWNFIELD LAND – EX-FACTORY LAND		
CS 1.01 **Nottingham Station Area** CS 1.02 Wilkinson St CS 1.09 Bulwell Forest	CS 2.09 Histon	
BROWNFIELD LAND – EX-MINING / MINERAL EXTRACTION LAND		
CS 1.07 Phoenix Park CS 1.12 Hucknall CS 1.13 Newstead CS 1.14 Kirkby-in-Ashfield CS 1.19 Langwith-Whaley Thorns	CS 2.14 Fen Drayton Lakes	CS 3.05 Newtongrange
BROWNFIELD LAND – EX-MILITARY LAND		
none	**CS 2.11 Northstowe (proposed town)**	none
TOTAL NODES WITH BROWNFIELD SITES ADJACENT TO THE CURRENT NODE		
16 of 22 (73 %)	6 of 15 (40 %)	4 of 7 (71 %)
BROWNFIELD SITES THAT EXHIBIT TRANSIT-SUPPORTIVE URBAN DESIGN TRAITS		
4 of 22 (18 %)	2 of 15 (13 %)	0 of 7 (0%)
6 of 44 total nodes exhibit transit-supportive urban design traits at brownfield sites		

Table 5.5 Brownfield Sites Along-the-Line of the Case Studies

The majority of the nodes along the three case study RRCs do not exhibit transit-supportive urban design on their associated brownfield sites (38 out of 44 nodes). An example of a node where the brownfield land directly adjacent to the node is currently 'left fallow' is at Basford South (CS 1.03).

Basford is a relatively dense, mature suburb of Nottingham and based upon the propensity of transit-supportive literature and the existing urban gain shown in the 'figure ground/pedshed extent drawing' below, one might expect to see a medium-high density, residentially-led mixed-use development to occur adjacent to the tram stop. This brownfield site adjacent to the RRC has the River Leen bounding the opposite extent of the site, which on top of the inherent connectivity of the site, could also be a positive feature. However, this site, although having been cleared at the time of writing, is unoccupied.

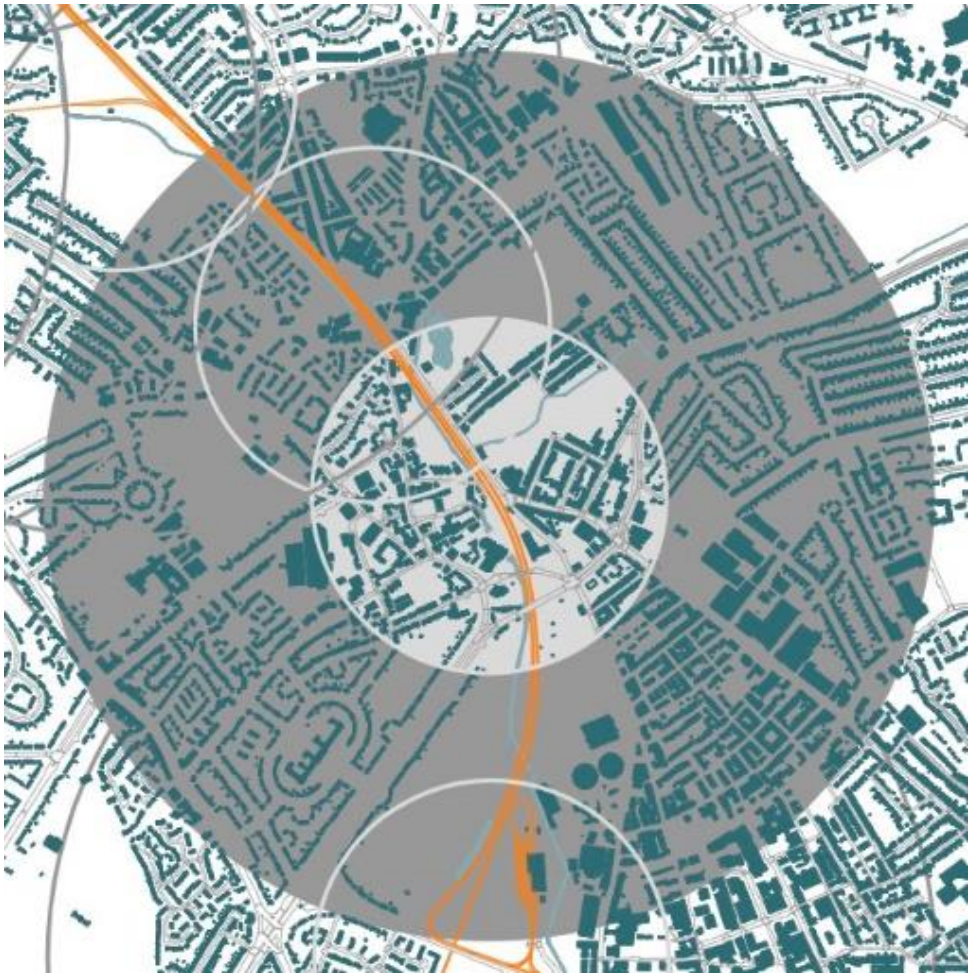


Figure 5.43 Unused Brownfield Site: Basford (South)

The image above (nts) shows the figure ground/pedshed at Basford South on the NET P1. Although the tram was introduced along this RRC this, and other brownfield sites within the pedshed, have remained empty: (Author's own, 2016) © Crown Copyright and Database Right 2016. Ordnance Survey (Digimap Licence).

The image below (taken from the tram stop platform) reinforces the point that this site has excellent connectivity and could potentially be designed in line with transit-supportive urban design principles. Although there are potential problems with the site – the proximity to the

River Leen floodplain – this could also be seen as a positive through its potential for an ecological/landscaping element (like the example at Bulwell (CS 1.08).

Figure 5.44 Unused Brownfield Site: Basford (South)

The image above shows the brownfield site directly adjacent to the Basford South NET P1 tram stop. Not only does this site represent a development opportunity unrealised, but it acts as a barrier between the node and the western parts of Basford: (Author's own, 2016).

The image above does show that dense residential development exists in close proximity to the Basford South node, although the actual pedestrian route to the tram stop from these apartments is convoluted. The dual track RHL must be crossed via a pedestrian bridge as well as traversing a busy commuter road. The brownfield site adjacent would have no such complexities if developed. The 'as the crow flies' distance from the apartments to the left of the above images is 200m; however, the actual pedestrian route from the main entrance of the apartments to the station platforms is almost double at 390m, comparable to the extent of the five-minute pedshed.

In contrast to the example at Basford South where an ex-railway siding brownfield plot adjacent to the RRC node is left empty, the example from Northstowe (CS 2.11) exhibits a strategic use of a brownfield site. In this instance, the brownfield site is of a very different appearance – instead of a set of railway sidings Northstowe uses a disused military airfield[74]. As can be seen below in the Northstowe Framework Masterplan (Gallagher, 2012) the development, which is situated upon an ex-military airfield, is bounded to the east by the CGB. There is a town centre and two local centres connected via a street, which is in turn connected to the CGB at each end of the site. Whilst Northstowe is predominantly residential with a medium-density plot pattern showing numerous housing types (2.11A, C, J, see appendix), the three centres are designed in a manner which reflects the vernacular urban design characteristic: a series of circa 55m x 55m market places (2.11M see appendix). This integration of RRC, brownfield plot and transit-supportive urban design is far more apparent in CS02 than the other two case studies. This is despite there being a higher proportion of brownfield sites per node in cases CS01 and CS03 than along-the-line of the Cambridge Guided Busway (see table above).

[74] Military airfields of this ilk across the east of England are often built adjacent to railway lines as at the time of their construction, munitions, like goods, were more often than not transported by the railway.

Figure 5.45 Military Brownfield Site; Northstowe Framework Masterplan

The image above shows the brownfield site development of Northstowe. Situated upon an ex-military airfield using the CGB as an eastern boundary this residentially-led mixed-use masterplan shows many traits of transit-supportive urban design: (Gallagher Homes / Terence O'Rourke).

A further example of transit-supportive urban design along-the-line of CS02, the CGB, is evident at CS 2.04 Cambridge Station Area. Here, to the west of the continuously operated railway, a brownfield site that was previously of railway siding usage has been replaced with a residentially-led mixed-use development. To the west of this line however, again

occupying previous sidings, is an industrial development. This juxtaposition is illustrated in the image below.

Figure 5.46 RRC Brownfield Land: Cambridge Station Area

The image above shows two contrasting types of urban design on brownfield site – ex-railway land. To the east can be seen a high density residentially-led mixed-use development. In the foreground of this image can be seen an industrial unit occupying an almost identical brownfield plot to the mixed-use development across the line.: (Author's own, 2013).

This image illustrates a contrast between what is achievable, in urban design terms, when transit-supportive strategies are adopted along RRCs and contrasting non transit-supportive development. The development to the east (the left in the above image) shows apartments above ground floor retail at a transport interchange. The foot of this building is where the southern section of the CGB leaves the RRC to run through the centre of Cambridge. This is an excellent position for the guided busway to join the broader road network, at Cambridge's national rail network station. The opposite side of Cambridge Station however, shows an industrial land use typology. This represents a missed urban design opportunity for this specific site, and also the surrounding area. The large scale of the industrial units inhibits connectivity between the established residential area to the west of Cambridge station. It also occupies a brownfield site which could be potentially similar to that across the railway line, meaning a higher population having the opportunity to live close to both the railway and the CGB and increasing pedestrian access between the existing settlement and the station. It is argued that in this context the residentially-led high density mixed-use development is more appropriate at this particular node along-the-line of the Cambridge Guided Busway.

The evidence collected in the three case studies shows that although there are a high number of brownfield site opportunities along-the-line of RRCs it is less common that these opportunities are realised with transit-supportive urban designs. This research also shows

that there are four broad categories of brownfield sites along-the-line of RRCs: ex-railway land, ex-factory land, ex-mining/ mineral extraction land and ex-military land. Ex-railway land was the most frequent and ex-military land the least. The example of Basford South shows a cleared brownfield site undeveloped, immediately adjacent to the tram stop. However, the developments at Cambridge Station Area and at Northstowe show transit-supportive urban designs on brownfield sites, despite being very different in terms of context and configuration. Further, Cambridge Station Area shows two contrasting utilisations of ex-railway brownfield land adjacent to each other.

The notion of *'refusing planning permission for new car-based out-of-town retailing and business parks'* (Breheny & Rookwood, 1993, p. 160) is posited as a mechanism for reducing unsustainable development patterns through the prohibition of ultra-low density sprawl. Previously, this discussion has highlighted the inherent opportunities in RRCs to link ex-industrial brownfield sites and how proportionately few instances within the case studies have been developed to transit-supportive principles. Many of the instances of these brownfield developments along-the-line of the RRCs have been occupied by either edge-of-town or out-of-town type low-density developments.

This section of the discussion will focus upon an instance from the case studies where an edge-of-town retail development was refused planning permission, in subsequent lieu of a residentially-led mixed-use, medium density, transit-supportive permission being granted. Orchard Park (CS 2.07 & 2.08), measuring just over 31 ha, was removed from the North West Cambridge greenbelt in 1994 and was initially subject to a planning application for an out-of-town development, led by Sainsbury's supermarkets. This planning application was rejected, in part due to objections from County, District and Parish Councils. This site then continued to be farmed throughout the early 2000s. Subsequently in 2001, a planning application was submitted by Gallaghers Estates for a predominantly residential development. This planning application broadly resembles the site as constructed at the time of writing. In 2005, the farming of this site ceased as planning permission was granted for the residentially-led mixed-use development comprising approximately 900 homes, a school and some commercial space provision. As an exemplar therefore, Orchard Park has shown that even where commercial pressures exist for low-density development types, more compact forms of transit-supportive development can prove successful, both in terms of commercial development and in urban design terms.

This example at Orchard Park is contrasting with the evidence along-the-line of Case Study 01 where 10 of the 22 nodes have low-density developments associated with the nodes and, to a lesser degree, Case Study 03 where four nodes have closely associated low-density developments. The table below shows which of the nodes along-the-line of the three

case studies are in proximity to low-density developments (16 of 44). It divides these types of low-density developments into three categories: retail; industrial; and business.

LOW DENSITY DEVELOPMENT – RETAIL		
CS 1.09 Bulwell Forest CS 1.12 Hucknall CS 1.14 Kirkby-in-Ashfield CS 1.16 Mansfield	none	CS 3.01 Tweedbank CS 3.02 Galashiels CS 3.05 Newtongrange CS 3.06 Eskbank
LOW DENSITY DEVELOPMENT – INDUSTRIAL		
CS 1.07 Phoenix Park CS 1.13 Newstead CS 1.15 Sutton Parkway CS 1.17 Mansfield Woodhouse CS 1.18 Shirebrook CS 1.22 Worksop	CS 2.04 Cambridge Station Area	none
LOW DENSITY – BUSINESS		
none	CS 2.05 Cambridge Science Park	none
TOTAL NODES WITH LOW DENSITY DEVELOPMENT ADJACENT TO THE CURRENT NODE		
10 of 22 (45 %)	2 of 15 (13 %)	4 of 7 (57 %)
16 of 44 total nodes have low density developments within their pedshed		

Table 5.6 Low Density Developments at RRC Nodes

CS 1.09 Bulwell Forest shows a number of low-density developments directly adjacent to the tram stop. The image below shows a tram travelling along the edge of the car park relating to the adjacent Morrisons supermarket. This supermarket was built and opened in the mid to late 1990s and whilst it provides employment and amenity, its proximity and spatial relationship to both the RHL and the NET tramline are broadly in contradiction to the example of Orchard Park, i.e. not transport-supportive.

Figure 5.47 Out-of-town type development: Bulwell Forest

The image above shows the proximity of the tram network to a supermarket. This proximity is undermined by the urban design configuration. (Author's own, 2011).

This image was taken from the far end of the car park[75] , with the tram stop approximately 30m behind the position of the photographer. This stop is separated by the 2m high security fence visible. This means an 'as the crow flies' measurement of the distance between the tram stop and the supermarket entrance of circa 100m is compared to an actual walking distance of over 400m. This incongruous relationship between the land uses adjacent to this node and the RRC is compounded by the development adjacent to the tram stop.

Figure 5.48 Out of town type development: Bulwell Forest

The image above shows the incongruous relationship between the tram stop and the adjacent land use: (Author's own, 2011)

[75] This image was taken at mid-morning on a weekday and shows the surface car park sparsely populated.

The image above shows a building merchant's yard occupying the land which, if transit-supportive urban design theory had been adopted, would be occupied by a higher density mixed-use residentially-led development. Whilst a supermarket in proximity to the transit node, dependent upon the spatial configuration, can be argued to open accessibility to a broader customer base, this argument cannot be stretched to the builder's merchant adjacent to Bulwell Forest.

This inharmonious relationship between the transit node and the adjacent land is continued at Hucknall (CS 1.12). The image below shows the relationship between Hucknall station on the RHL, the adjacent terminus of the NET tramline and further out-of-town supermarkets. The chronology here is important. The railway station at Hucknall was reopened in 1994. The Tesco supermarket was opened in 2003 and the tramline became operational in March 2004. As with the case in Bulwell Forest's Morrisons, the Hucknall Tesco's example shows almost the exact polar opposite of a transit-supportive development. The planning application for this out-of-town, car-based development was processed and approved at the same time as the recycling of the railway corridor. These configurations show examples where out-of-town developments have taken precedence over denser development types.

The evidence collected here regarding 'the refusal of planning permission for out-of-town developments' shows what can be achieved in urban design terms and has highlighted opportunities in other areas. For instance, had the out-of-town supermarket planning application not been refused on the Orchard Park site then, as opposed to the relatively dense, residential-led, transit-supportive mixed-use development that is coming to fruition, a low density mono-use development would have occurred. Similarly, where planning permission has been granted for out-of-town developments in both Bulwell and Hucknall, scenarios that are almost the polar opposite of normative urban design have manifested.

5.7 Cycle Paths and Recycled Railway Corridors

RRCs, in principle, offer the opportunity to accommodate a cycleway along-the-line of the reconfigured alignment. If the relationship between a cycleway is closely designed with a train/tram/guided bus route, then a number of potential benefits can occur due to grade separation from the standard road network:

- Quicker, more direct routes for cyclists to centres
- Gradients more amenable to the bicycle
- Safer journeys due to grade separation from cars
- Healthier cycling due to increased distance between cyclist and car fumes

The literature review shows that within normative urban design theory the concept of dedicated cycle routes are a key feature of future sustainable development, with certain

authors promoting cycling as a formulating element of sustainable morphologies (Calthorpe, 1993; Fleming, 2011). In the three case studies examined in this research, the Cambridge Guided Busway has a cycle path adjacent to the entirety of the route situated upon a RRC. The other two case studies do not have associated cycle paths, despite in some instances (Newstead CS 1.13 for example) being in close proximity to the national cycle network.

Marshall, whilst discussing the concept of human locomotion (Marshall & Lorimer, 2013) couples cycling with walking (amongst other non-motorised forms of transport). Walkability and the relationships between this design quality and RRCs is discussed separately in Chapter Six as it has more relevance to a discussion of urban design relating to nodes upon RRCs. A cycle path however, is an aspect that has urban design implications along-the-line of RRCs.

The image below shows the point of interaction between CS 2.05 Cambridge Science Park, its node and the cycle path adjacent to the CGB. It illustrates how the adjacent cycle path, beyond its mere provision, is generously proportioned allowing for comfortable 'social cycling', surfaced with quality materials and integrated with the design on the guided bus stop.

Figure 5.49 Cycleway: Cambridge Science Park

The above image shows the consideration paid to cyclists throughout the Cambridge Guided Busway. This is the main entrance to the Cambridge Science Park, and although bicycles are banned on this campus, the entrance is adjacent to the Cambridge Guided Busway and considerable covered cycle parking is provided (this image was taken on a Sunday - hence the lack of bikes). (Author's own, 2013)

This is a relatively dense environment in comparison to CS03 BRWL. In the instance of the CGB at Cambridge Science Park, the RRC is hemmed in on either side by built-up areas. The instance in the following image at Heriot, along-the-line of the Borders Rail-Waverley Line, is far more spacious. This shows that there is arguably ample opportunity to have a

cycle path adjacent to this RRC, however this does not form part of the design of reinstatement. Policy Aspirations for the BRWL were for the railway to facilitate commuting to Edinburgh from the Borders' towns and increase tourism from Edinburgh to the Borders. A cycle path adjacent to the RRC could have reinforced this by facilitating 'human locomotion' commuting and cycle-based leisure. However, there is no cycle path provision along-the-line of the Borders Rail-Waverley Line.

Figure 5.50 No designed Cycleway: Heriot

The image above shows the alignment where the Waverley line will be reinstated. To the best of the author's knowledge there are no plans for an adjacent cycle path, although regional policy in the area stated that one of the reasons for the reinstatement was to encourage cycling in the area. (Author's own, 2011)

This lack of cycle path provision along-the-line of the RRC of CS03 is replicated in CS01. The image below shows the width of the RRC at CS 1.04 Basford North. Here, when the River Leen, the double track configuration of the tram, the double track configuration of the RHL and the road that exists the other side of the wall are added together, the transport corridor is between 45m and 50m in cross-sectional width.

Figure 5.51 No Cycleway Provision: Basford North

The image above shows the condition at Basford North. Visible is a culverted river, four lines of railway track, a main road and no cycle path. This is despite a corridor of circa 45m in width with no high quality provision for cyclists. (Author's own, 2012)

A cycle path has a nominal width of approximately three metres. This could conceivably have been introduced into both case studies where cycle paths are absent, if not for the entirety of the route as with the CGB, but certainly for long, meaningful stretches of the RRC – the places where 'human locomotion' (Marshall & Lorimer, 2013) could be of most benefit.

The gradients of railway lines are broadly compatible with the gradients possible for cyclists which is one of the reasons why Sus-Trans use many disused railway lines as part of their cycle network. It is worth mentioning here that part of the Sus-Trans Charter is that if any of the cycle paths were to be demonstrably beneficial and reinstated, they would be relinquished by the organisation. The evidence of the Cambridge Guided Busway demonstrates that the two types of transport, mechanical and human locomotion, need not be 'mutually exclusive'. It is possible, via the kind of careful urban design seen along the CGB at the regional scale, to conceive and configure cycle paths along-the-line of RRCs.

Comparing Orchard Park (CS 2.07 & 2.08) and Newstead (CS 1.13), two different approaches to cycle path provision is evident. A cycle path runs adjacent to the bus-only route that forms the southerly boundary of the Orchard Park site. This is a relatively dense residential site and the cycle path is, in part, used as an urban design strategy[76] to separate buses from the windows of adjacent properties. To the interior of the plot, traffic-calming measures and shared spaces aid a human locomotion supportive urban design.

[76] In conjunction with planting and soft landscaping.

Figure 5.52 Cycle path and compact residential development pattern: Orchard Park

The image above shows a cycle path associated with the bus-only spur that runs along the border of Orchard Park. (Author's own, 2011).

Newstead, however, shows an urban design which does not support human locomotion, despite being in close proximity to a National Cycle Route. The excerpt from the Newstead figure ground drawing (5.53) below, shows the station node in the centre of the drawing and the extent of this node's 400m pedshed. To the right of the RRC a track is indicated. Here, National Cycle Route Six veers away from its north-south axis along this track towards Newstead Abbey.

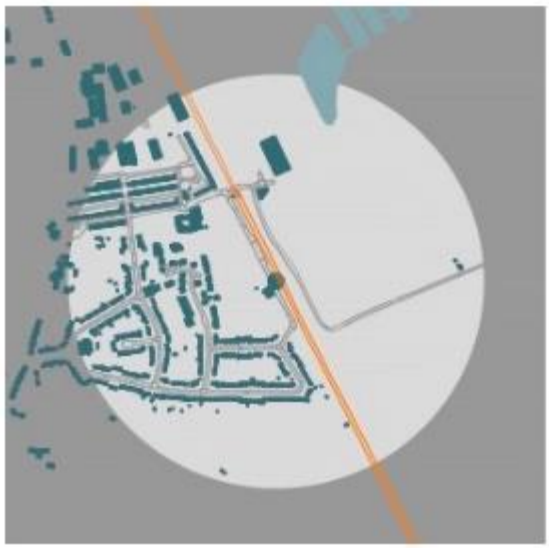


Figure 5.53 National Cycle Network Bypassing Newstead

The image above shows that although a National Cycle Network Route passes through the 400m pedshed of Newstead, it does so in a manner which bypasses the town and does not utilise the RRC. (Author's own, 2016) © Crown Copyright and Database Right 2016. Ordnance Survey (Digimap Licence).

This route therefore completely bypasses the town of Newstead. Whilst there is clear touristic sense to having the national cycle route heading towards the once home of the famous poet Lord Byron, there are also cycle-oriented development (Fleming, 2012) opportunities lost in relation to the RRC. The heavy rail configuration is single track at this point, with the below image illustrating only half of the RRC being utilised by track.

Figure 5.54 Potential Cycle Path?: Newstead

The image above shows a single track railway along a previously two-track RRC.
If the design solution apparent along-the-line of the Cambridge Guided Busway was adopted, then a cycle path could be provided for. (Author's own, 2011)

This space could conceivably be utilised with a cycle path. This could mean, in conjunction with medium-high density residential development, a transit and cycle supportive urban design along-the-line of the Robin Hood Line RRC. Just as the relatively dense residential development at Orchard Park creates a critical mass, which makes sense of a cycle path provision, so might be the case in Newstead. The urban design at Orchard Park is mutually reinforcing with a cycle path along-the-line of a RRC; however, the opposite is evident in Newstead.

The evidence collected from this research shows a variety of urban design responses to the opportunity for RRCs to accommodate cycle paths along their lengths. The Cambridge Guided Busway could be taken as an exemplar as to how to integrate a cycle path along-the-line of a RRC. The other two case studies, despite having evidently spatial opportunities, have not embraced the opportunity inherent in a RRC to accommodate a cycle path along the line. A design exercise, as a piece of further work, would be interesting along both the RHL/NET P1 and the BRWL to examine possibilities for 'bicycle-oriented developments' (Fleming, 2012) along their corridors.

5.8 Relationship between Topography and Recycled Railway Corridors

The Conceptual Framework of this research (2.1) relies upon critical regionalism which holds design responses to topography as important facets of authentic, place-considered built environments. The RRCs which constitute the three case studies of this research respond to very different topographies. These topographies are identified in Chapter Three and the appendices. The engineering of railways often alters landscapes, through cuttings, embankments, etc. The way in which RRCs utilise, or otherwise, these built environment artefacts is discussed further in this chapter. The implications of ex-mining landscapes, relatively isotropic landscapes and hilly/ mountainous landscapes upon the urban design along the RRCs of this research are discussed here. The image below illustrates three cross sections at the nodes of Hucknall, Histon and Galashiels. Each of these three dimensional sections are grounded at sea level, therefore showing the contrasting elevations of each case study. Also visible within this diagram are highly contrasting topographies. These have significant implications for the respective urban designs.

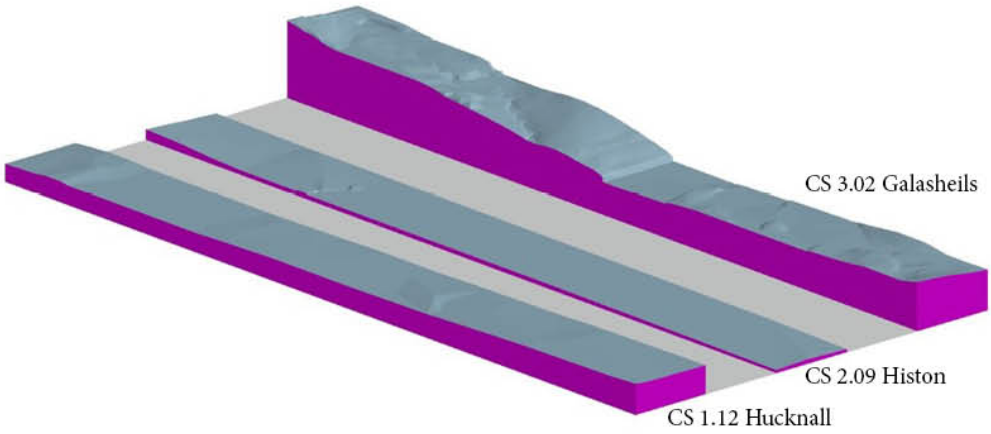


Fig 5.55 Topographical Comparison

Given that the RRC of the respective topographies is central to each of the cross sections above, with the topographies extending 1.5km either direction from the centre, the most pronounced example of a topography and its relationship to a RRC is seen at CS 3.02 Galashiels. This is compared to the relatively slight elevational change exhibited at the Histon with Hucknall showing some elevation. A key topographical element identified is the floodplains visible at Hucknall and pronounced at Galasheils.

The implications of the natural topographical elements of the floodplain of Gala Water and the Borders hills in combination with the constructed retaining wall are

significant in urban design terms. The image below (taken from the top of said retaining wall) illustrates how the built development is limited to the flat floodplain and the lesser slopes, with the upper areas of the Borders hills remaining undeveloped.

Figure 5.56 Human Occupation of Floodplain: Galasheils

The image shows the Gala Water Floodplain occupied by development. (Author's own, 2011)

These hills are farmed and as evident in the image above a managed forest occupies the crest of the hill to the background.

This retaining wall is a piece of pre-existing railway infrastructure and the image below is taken from a position that is now track bed. Whilst this topographical response facilitates the recycling of this RRC it also acts as an edge-barrier (Lynch, 1960). Some residential development exists to the top of this retaining structure but the connectivity between this area is impinged by the topography.

Figure 5.57 Man-made Topographical Feature: Galasheils Retaining Wall

The image shows the RHL from a spoil heap at Newstead. This image was taken from well within the pedshed of the node, illustrating a difficult topography to develop. (Author's own, 2011)

This limitation however, adds to the sense of containment at Galasheils, a constraint that necessitates a degree of density which in turn makes for a regionally important (Chapman, 2010) urban design response. This prominence is reflected in the design for the new transport exchange building (3.02D see appendix). The topography at Galasheils is both complex in its own right and complex in relation to the RRC, necessitating bespoke urban design responses at-the-node of the RRC.

As discussed previously (5.1), there a number of country parks along-the-line of CS01. These occupy, in the main, ex-mining territories which are often either man-made topographies constructed of spoil heaps or areas of land susceptible to subsidence. A country park solution offers a number of benefits in these instances. Seen below are the examples from Newstead Country Park and Poulter Country Park (CS 1.19 Langwith-Whaley Thorns), both of which are situated substantially within the 400m pedshed of their respective station's nodes.

Figure 5.58 Man-made Topography: Newstead

The image shows the RHL from a spoil heap at Newstead. This image was taken from well within the pedshed of the node, illustrating a difficult topography to develop. (Author's own, 2013 & 2012)

Newstead Country Park (left, above) shows a post-industrial landscape which has been 'reclaimed', at least to an extent, by nature. This view looking southerly towards Newstead is within the 400m pedshed of the station and the dark black coal spoil which makes this hill is visible in the track in the foreground of this image. This area would be impossible to develop without significant remediation works, illustrating how a man-made topography dictates land use and urban design potentials along-the-line of a RRC. A similar case exists at Langwith-Whaley Thorns (CS 1.19). The image to the right, above, shows a guide to the country park which occupies the spoil heap of this ex-mining operation. Notice that the RHL passes through this country park (to the right of the above drawing), with the station situated within the boundary of the park also. There is, however, little in terms of urban design connectivity between the station and the town, although potential exists for some form of transit-supportive leisure driven development in this location.

Whilst it can be considered a positive that there are riparian areas along-the-line of RRCs, such as those along the RHL, the inherent nature of this topography limits transit-supportive urban design. The topography of the Cambridgeshire Fens however, within which the CGB exists, has no such limits. Although there is nonetheless significant human impact upon the topography through the draining of the fenland for industrial farming purposes, resulting in a number of man-made open drains, this does not impinge upon development potential to the extent of mining.

The urban design evidence reviewed in this cross case analysis shows natural and engineered topography to be both (and sometimes simultaneously) a prohibitive aspect and a stimulus to transit supportive place specific urban design at-the-node of RRCs.

5.9 Pre-existing Engineering Infrastructure

The recycling of a railway corridor implies, at a minimum, the consideration of the reuse of pre-existing engineering infrastructure. This act of reuse can have a number of implications, economic, cultural and spatial. Cuttings, bridges, viaducts, tunnels, level crossings, etc., all carry a monetary value. This can potentially be crucial in the feasibility stage of considering a RRC: the cost to renovate a viaduct, for example, can be considerably less than having to construct a new viaduct. Further, an existing structure can carry cultural significance through being a landmark (Lynch, 1960). Perhaps most importantly to this research, an existing piece of infrastructure brought back to use can be an urban design challenge, one which represents the act of 'recycling' beyond being solely a transport intervention or a cultural intervention into the built environment.

The majority of the pre-existing engineering elements found in the three cases studied here are in excess of 100 years old, and therefore required modernisation as part of the 'recycling' process. However, there are certain pre-existing engineering elements which are of a much more recent epoch which nonetheless have economic, cultural and spatial implications along-the-line of the RRCs. Further to the important aspects of the use of pre-existing engineering elements outlined above, the reuse of these structures can also protect grade separation, which is crucial to the lowest possible mass-transit journey times. This is a crucial aspect for the feasibility of any major transport system, and can have significant implications for such urban design issues as walkability.

The image below is a bridge on the RHL section of CS01 situated 1250m to the north of the Newstead CS 1.13 station. This bridge previously carried the Midland Railway over a spur to Annesley Pit, which used to occupy the mud track now used predominantly by adjacent farms. This spur looped back upon itself and terminated at the colliery sidings, which are now the site of the residential development to the extent of the 1km Newstead pedshed.

Figure 5.59 Pre-existing Engineering Infrastructure: Newstead

The image above shows an existing bridge on the RHL that was adapted as part of the preparatory engineering works. (Author's own, 2013)

This image shows a combination of the historic infrastructure and contemporaneous remedial work; the pre-existing Victorian brick arch and the addition of a concrete parapet, as part of the early 1990s heavy rail reinstatement along this route. It has not been possible to put an exact figure on how much money utilising this bridge saved in comparison to the construction of a new embankment bridge, although it is a fair assumption that there is a cost saving involved. This is an example which, due to the location of the piece of pre-existing infrastructure, is predominantly a financial, as opposed to cultural or spatial benefit. The example below of Newbattle Viaduct along CS03 BRWL is comparatively stronger in terms of being a landmark.

The image below, taken from the A7 trunk road, shows the Newbattle Viaduct crossing the south Esk River Valley between CS 3.05 Newtongrange and 3.06 Eskbank. This structure can be considered a regional landmark, due to its scale, brickwork detailing and presence within the immediate topography. The recycling of this railway corridor and the commensurate rail traffic across its span will reinforce these characteristics through the animation of this pre-existing structure.

Figure 5.60 Pre-existing Engineering Infrastructure: Newbattle Viaduct

The image above shows the Newbattle Viaduct shortly before engineering work commences on the BRWL. (Author's own, 2011)

The process of recycling this corridor required significant surveying and testing work to ensure that the current structure meets the standards of contemporary usage. The image below, a general arrangement layout plan from the engineering works of the BRWL points to the complexity of the process of reusing this viaduct.

> *"Masonry repairs to be carried out throughout structure. Arch banding to be repaired if necessary. Pier banding to be repaired and replaced. Appearance of new parapet handrail to be agreed with Historic Scotland." (Network Rail, BAM)*

Whilst the convergence of this complexity between structural, safety and heritage requirements makes for a solution that requires a high degree of expertise, it is argued that a new structure would have been more, and perhaps prohibitively, onerous.

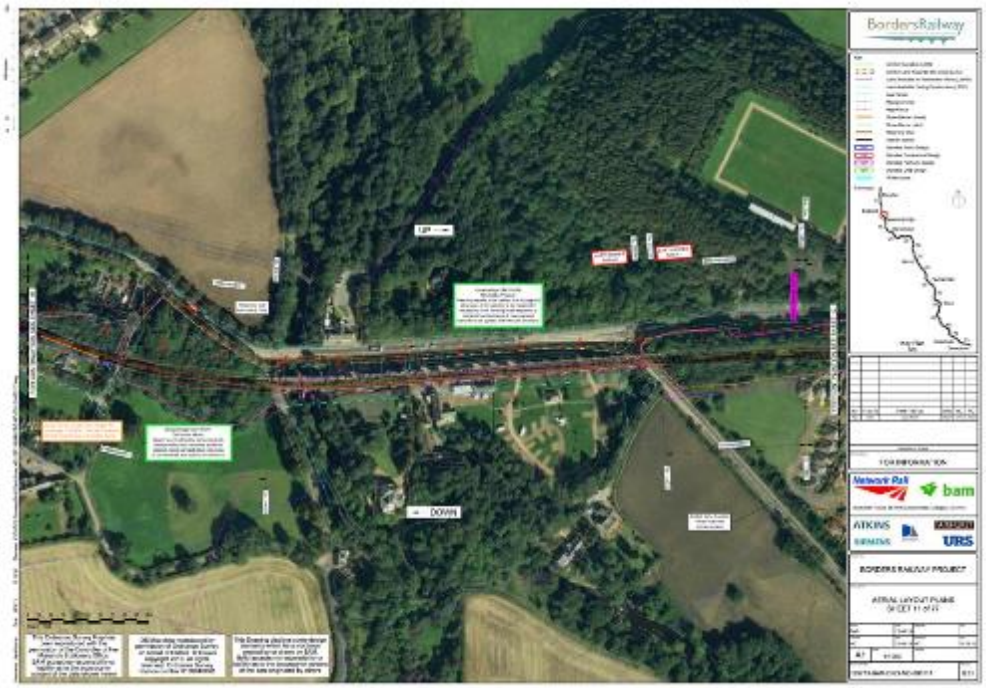


Figure 5.61 Pre-existing Engineering Infrastructure: Newbattle Viaduct G.A. Drawing

The image above is a General Arrangement Drawing setting out the extent of remedial work required to bring this historic structure back into use. (Network Rail & BAM, 2013)

This viaduct is 350m long and if this were to be a new construction, the build cost would be several millions of pounds. Considering that the financial context for this reinstatement, where the initial tender was priced at £115 million (in 2006) and rose to a possible ceiling of £348 million, this cost saving inherent in utilising the pre-existing engineering infrastructure as opposed to commissioning new build engineering elements, is crucial to the project. In terms other than financial, the reuse of this structure has importance. Culturally, the reuse of this landmark as a signifier of transport regeneration is prominent. In urban design terms, the reuse of this viaduct ensures, through its continued use, the retention of this landmark whereas continued redundancy would have left the structure/landmark at risk.

The examples of pre-existing engineering infrastructure taken from the Cambridge Guided Busway, as opposed to the two previous examples, show the previous railway alignment traversing underneath a road bridge. The image below shows that although a pre-existing engineering infrastructure feature can be utilised as part of a RRC, the disparity between past and contemporary requirements can have implications for both the transport configurations and the urban design.

Figure 5.62 Pre-existing Engineering Infrastructure: Trumpington P&R

The image above shows a single-track guided busway along a previously two-track RRC. This configuration, utilising the pre-existing engineering infrastructure enables a grade-separated route for both bus and cycle across a busy arterial route between Cambridge and the M11. (Author's own, 2013)

This bridge, just before CS 2.01 Trumpington, demonstrates how pre-existing infrastructure can be used to ensure grade separation from the road network. This image also highlights a contemporary urban design configuration that accommodates two forms of transit. Although the section of route in the photograph shows where the initial iteration was configured to a double track railway formation, this instance shows that both buses and cycles have been accommodated. Further, in land-use terms, this grade separation enables the development at Trumpington Meadow to maintain a direct connection to the CGB without interruption.

Further to these examples of the existing railway infrastructure from the Victorian era, the image below demonstrates that there are more recent pieces of pre-existing engineering that can also be utilised. This is a bridge over the Cambridge Guided Busway that carries the B1049 Histon Bypass, which adjoins the A14 to the North of Orchard Park (CS 2.07 & 2.08).

Figure 5.63 Pre-existing Engineering Infrastructure: Histon

The image above shows that a pre-existing piece of engineering infrastructure need not be an historic element. Here, a relatively recent road bridge which forms the Histon bypass travels over the CGB, just to the eastern extent of Histon. (Author's own, 2010)

Similar to the example from Trumpington, this separation between the CGB/cycle path and the main road network is crucial to enabling development along-the-line of the RRC. In this instance, Northstowe CS 2.11 retains an uninterrupted grade-separated permanent way connection to Cambridge, which without this piece of pre-existing infrastructure would be far more problematic, both in terms of traffic management and cyclist safety.

These four examples from across the case studies illustrate a variety of examples of how pre-existing engineering infrastructure can be beneficial to the conceptualisation and realisation of RRCs, in economic, cultural and spatial terms. The presence of these dormant structures can add to the potential of dormant railway corridors, their physical characteristics can act as distinct local or regional landmarks and their positions, through reuse, can enable transit-supportive urban designs across a broader regional morphology.

Summary: Urban Design Along-the-Line of Recycled Railway Corridors

This chapter used a comparative cross-case analysis to highlight the importance of urban design along-the-line of RRCs. Rich and varied examples of ecological features were observed featuring country parks, flood attenuation/landscape features and agriculture as a formative element separating nodes. New communities featured in the cases which showed that development can be balanced along-the-line of RRCs as part of strategic growth. Also, evidence was observed which characterised the RRC as a 'Lynchian Edge' both in terms of being a separating element and as a seam between two elements. The relationship between

the RRCs and the broader transport networks was observed to be complex, both in terms of how the RRC interacted with the broader mass-transit networks and the road network. Where RRCs were interrupted by development, a range of circumstances were observed with some instances illustrating benefits to the network and the urban design by deviating from the previous railway alignment, yet still retaining the majority of contemporary transit routes along historic alignments.

Land use played a key role in the examination of urban design along-the-line of RRCs, and observations of selective expansion, mixed-use developments, industrial areas and brownfield sites provided evidence of a range of urban design responses. RRCs were also observed to accommodate human locomotion methods of travel, although again not all the RRCs made the most of the opportunity to employ cycle paths along their routes. Topographies, both human-made and natural, had interesting relationships with the respective RRCs despite the three cases having highly differing landscapes. This related to the type and frequency of the pre-existing engineering infrastructure adopted as part of the RRCs, from at grade 'level-crossings' to tunnels and viaducts.

These categories illustrated differing urban design approaches across the case studies; some showed concerted efforts to take the opportunities afforded by place-quality considerations along-the-line*,* offered by the act of recycling railway corridors (CS02). However, other cases (CS01) illustrated a relative lack of joined-up thinking between the transport planning necessary to open a RRC and the urban design thinking necessary to ensure that the spaces connected by these routes become authentic, rooted places.

6. The Urban Design of Recycled Railway Corridors at the Neighbourhood Scale

The previous chapter highlighted how urban design opportunities were addressed along-the-line of RRCs; this chapter continues this thinking in the neighbourhood context at-the-nodes of RRCs. The literature review detailed a number of transit-supportive urban design characteristics through the exploration of transit-oriented development and transit town theory. These theories were not nuanced in terms of different settlement typology contexts, which is why Breheny and Rookwood's Social City Region has been used here. This theory sets out six settlement typology contexts, each with specific planning aspirations, which are argued to be applicable to RRCs as regionally significant networks. The use of these settlement typology contexts also allows for the disaggregation of urban design criteria into more nuanced context-specific categories which are relevant to different node types within both a broad regional context and along a transit corridor – in this case a RRC. Each of the policy context typologies will be discussed in their own right in each

subchapter; the table below shows the spread of the case study nodes of the three cases in the different node context typologies.

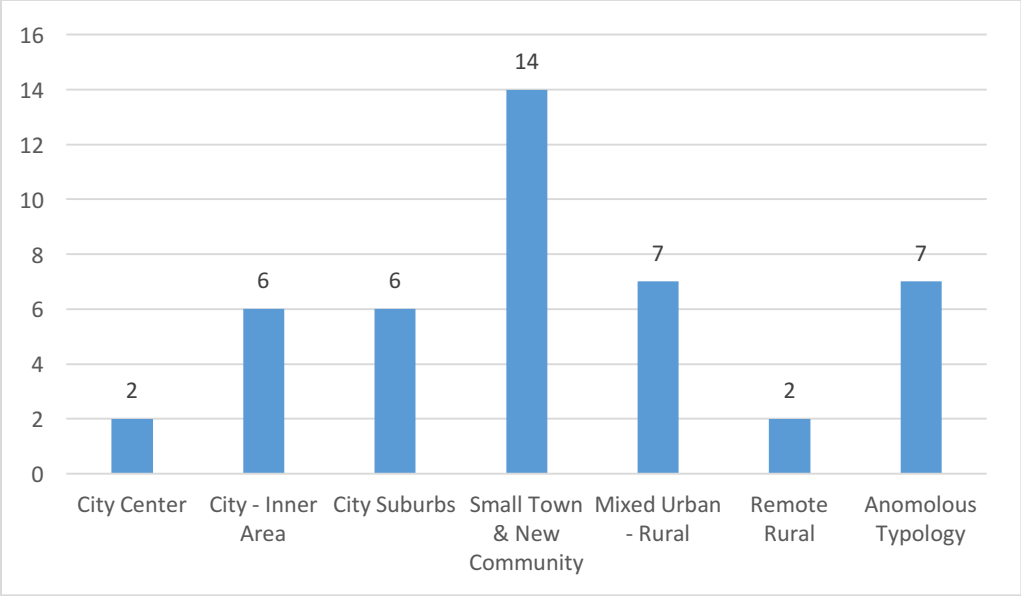


Fig 6.1: Node Context Typology Tallies

This graph shows the spread of case study nodes across the node context typologies

Small Towns and New Communities are the most common context typology with City Centre and Remote Rural being the least common across the three case studies. The node context typologies focus upon appropriate urban design characteristics for each setting. Within the City Centre context, the discussion focuses upon the urban design of Major Transport Interchanges. Designing to the human scale is the focus of the City-Inner Area node typology where Lynchian Districts and High Density residential developments are also examined. In the City Suburbs context, comfortable pedestrian environments and whether or not housing is central to the urban design solution is considered.

As the highest number of nodes fall within the Small Town & New Community context, so too most of urban design criteria are discussed relating to this context. Landmarks and focal points are considered in relation to the transit nodes, and plot patterns and transit complementary development forms are also examined. This leads to a variety of mixes of use at transit nodes across the case studies, which are also examined. At the finer-grain urban design scale, defensible space in relation to the RRC and its adjacent dwellings is considered. Walkability, a ubiquitous concept throughout the considered theory, is discussed in relation to the Mixed Urban-Rural context and the notion of Introverted/Extroverted Stations is focused upon at the Remote Rural context. Whilst it is acknowledged many of these design characteristics apply beyond the node context typologies they have been assigned to, for the purposes of this discussion salient examples have been compared within the node context typologies to increase fairness of the comparisons.

This discussion shows how urban design can contribute to place qualities at-the-node of RRCs and that different site-specific responses exist at differing node contexts within a transit-supportive whole. This discussion also points to examples where the opportunities of urban design at public transit have been ignored in preference to more homogenised design strategies. When taken in conjunction with the previous chapter, this discussion illustrates the importance of including urban design when considering joined-up thinking strategies of RRCs.

6.1 'City Centre' RRC Node Context

This node context typology focuses upon major transport interchanges. Whilst transport interchanges can occur across a variety of contexts within a RRC, the convergence between differing transit modes and routes is most likely to occur at the city centre context. Without consideration for urban design these spaces can be dominated by the transit modes to the detriment of the pedestrian. This subchapter examines the human scale urban design of converging transit spaces and how they relate to adjacent land-use typologies. The table below shows which case study nodes have been categorised under the city centre context.

CITY CENTRE CONTEXT TYPOLOGY		
CS01 Robin Hood Line / NET P1	CS02 Cambridge Guided Busway	CS03 Borders Rail-Waverley Line
Nottingham Station Area (CS 1.01)		
Mansfield (CS 1.16)		
% of Total Nodes Per Case Study Examined as Within the City Centre Typology		
9 %	0 %	0 %

Table 6.1 Case Studies Examined Under the 'City Centre' Typology

This highlights a low number of the overall case study nodes being categorised as City Centre contexts, with nine percent of CS01 being the only nodes throughout the three case studies.

A Major Transport Interchange is an important nodal aspect of a RRC, which, in the cases studied as part of this research, occurs infrequently. However, when one does occur it is within City Centre contexts. These transport interchanges are complex both spatially and operationally. This inherent sophistication can often lead to, in the tradition of transport architecture and urban design, significant landmarks and districts (Lynch, 1960) within the urban grain. This research examines the urban design at-the-node of the major transport interchanges situated within the case study RRCs. The two examples of major transport interchanges compared here are both taken from CS01: Nottingham (CS 1.01) and Mansfield (CS 1.16).

Of all the places observed throughout the case studies, Mansfield is arguably the clearest example of a major transport interchange. In terms of land use, a newly completed bus station, opened during the course of this research, is situated adjacent to the reinstated railway station. The images below illustrate this proximity and the significant attention paid to connectivity between the two elements.

Figure 6.2 Transport Interchange Pedestrian Options: Mansfield

The image above shows the pedestrian bridge between Mansfield railway station and Mansfield bus station, with the alternative pedestrian route via the steps in the foreground. (Author's own, 2013)

The view above, taken from the railway station looking towards the bus station, shows a distinct urban design problem: the difference in levels between the points of access between the train and the bus networks. The solution here is interesting. There are two routes that can be taken. The historic steps can be taken down to the bus station apron, or, the covered 80m pedestrian link bridge can be taken to the bus station concourse. The image below taken looking in the opposite direction, from the bus station towards the railway station, reinforces this point.

Figure 6.3 Transport Interchange: Mansfield

The above image shows the direct relationship between Mansfield bus station and Mansfield railway station. (Authors Own, 2013).

This shows that the pedestrian access using the steps is far less direct than the covered pedestrian footbridge. Also evident is the significant Victorian railway infrastructure retained and refurbished as part of the recycling of the RHL. A similar stone finish, although clearly not as weathered, has been used to clad the new bus station. The pedestrian bridge, although built to a gradient, still connects to the bus station at an elevated level. The image below illustrates this connection.

Figure 6.4 Mansfield Bus Station Hall and Pedestrian link to RRC

To the left of the above image is the covered pedestrian bridge between the Mansfield bus station and Mansfield railway station. To the right of this image is the generously proportioned indoor bus waiting area. (Author's own, 2013).

Here, a very interesting urban design solution occurs. What was potentially a problem has been turned into a benefit. Where the bridge connects to the bus station, the shared roof continues over the concourse, undulating down towards the far end of the concourse. This provides a generous two/three storey space which has a number of fully-let associated retail concessions. With the successful contemporary structure occupying one portion of the transport interchange, and the 1872 Grade II listed railway station (1.16D,E,F,G,H see appendix) situated at the other, the urban design that facilitates this major transport interchange extricates opportunities from the site:

- The combination of natural and engineered topographies navigated in a way that generates a grand transport space;
- A direct, accessible and safe pedestrian experience between the two transit stations; and
- Complementary aesthetic between the historic and contemporary structures.

In terms of being an example of a major transport interchange at-the-node of a RRC station, Mansfield can be considered successful from a number of perspectives, not least in terms of its urban design.

Nottingham Railway Station, like Mansfield, demonstrates a transport interchange that requires a mediation between both the natural topography and the transport engineered topographical levels used by two differing public transit modes. The image below shows the NET P1 tram network utilising the remnant structure of the old Great Central Railway (the engineering brick viaduct) as a terminus to its first phase route[77]. This image shows two distinct access/egress points to this light rail stop. The first is the lift tower (seen in grey with the NET logo in green at the top) that takes people to and from the street level and the elevated platform. In the foreground, the lift tower can be seen linked to the pedestrian bridge that links the light rail station directly to the Nottingham Railway Station pedestrian bridge.

Mansfield Railway Station was closed in 1964 and reopened in 2000, whereas comparatively, Nottingham Station remained open throughout the widespread closures subsequent to the Beeching Report. This means that the working station has been a part of the continuing evolution of the built environment at-the-node. For instance, this development has seen the closure of a factory, replaced by a large-scale office block (visible to the right of the above image).

[77] Phases 2 & 3 have been completed during the writing of this research, some utilising previous railway alignments. These further phases could become case studies in future research.

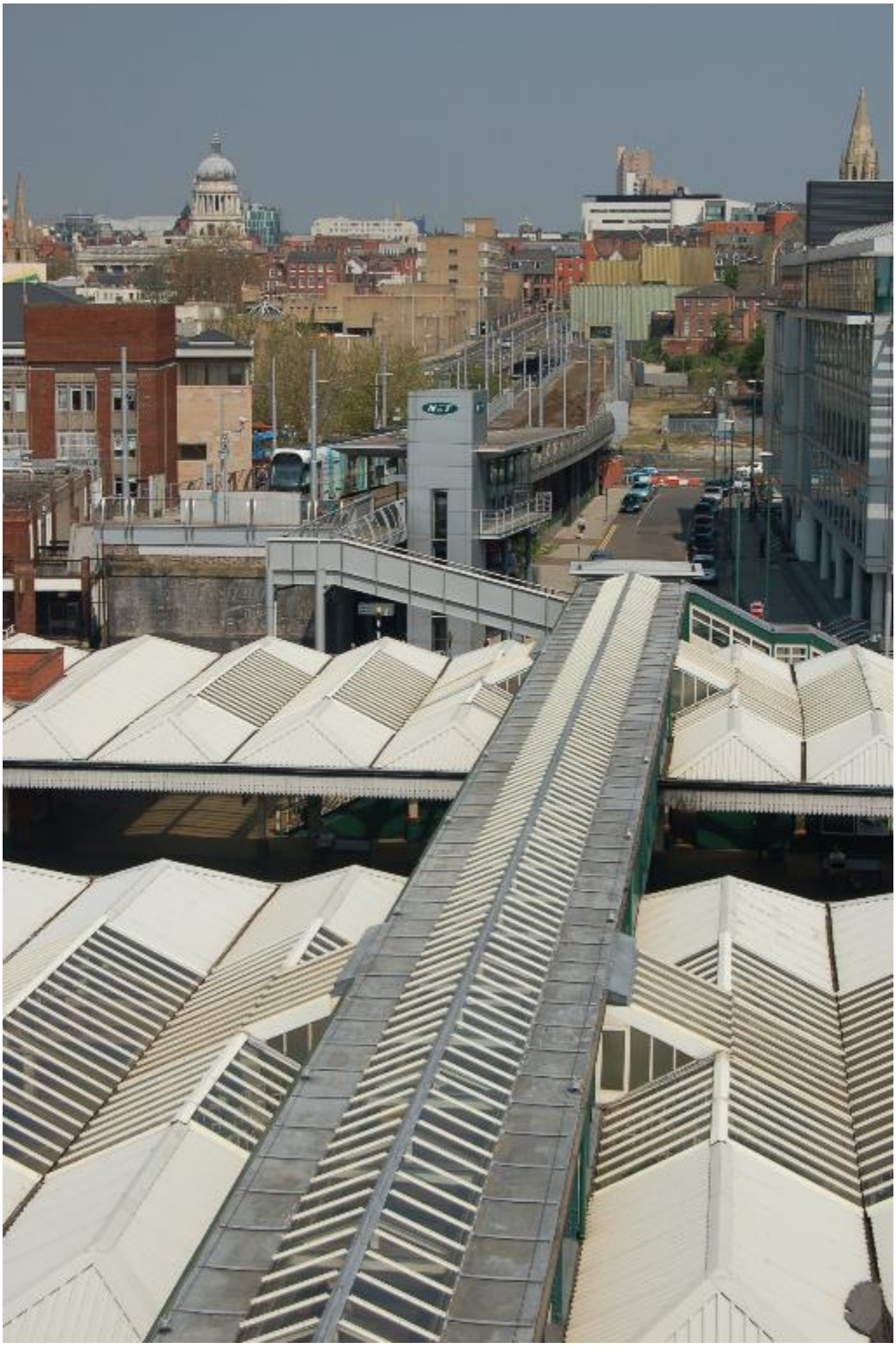


Figure 6.5 Transport Interchange: Nottingham

This image shows the close relationship between the Nottingham express transit tramline terminus and Nottingham railway station. Note that the tram terminus is utilising the remnant of the Great Central Railway, the engineering brick viaduct. (Author's own, 2012).

This continued use however, has meant that little in the way of transport interchange renewal has occurred at Nottingham station. The opposite is the case at Mansfield Station, where the reintroduction of the RHL has been the catalyst for the construction of the new bus station. Whilst further extensions of the tram network do traverse Nottingham Railway Station, the

bus network in Nottingham has no such centre. There are two bus stations in Nottingham at either end of the city, with the closest being approximately 250m from Nottingham railway station. Local bus services perform a 'loop' around the city centre, as opposed to a terminus; however, this does not pass the railway station/tram stop directly. Mansfield acts as an interchange between all the available public transport modes, whereas at-the-node of Nottingham Station, only two of the three available transport modes interchange.

These two examples of transport interchanges at-the-nodes of RRCs show that topography, both of the man-made and natural kind, can influence the urban design. This influence can lead to opportunities for more prominent, mixed-use developments at the interchanges with the example from Mansfield showing a 'grand hall' in the vein of the transport node archetype. Without the close relationship to the RRC and Mansfield Station's reinstatement, it is questionable to what extent the bus station would exhibit such interesting urban design traits.

6.2 'City-Inner Area' RRC Node Context

The City-Inner Area node context typology focuses upon the concept of Lynchian Districts and High Density Residentially-Led Development within the immediate pedshed of the respective nodes. As discussed in Chapter Two, Social City Region theory expects to see a variety of transport infrastructures converging at a high-density sub-centre; main roads, rail networks (light and heavy), footpaths and cycle routes. The interrelationship between these spatial elements is examined in order to gauge how urban design has been used in regionally specific places at-the-nodes of RRCs. The table below shows which case study nodes have been categorised under the City-Inner Area context.

CITY – INNER AREA CONTEXT TYPOLOGY		
CS01 Robin Hood Line / NET P1	CS02 Cambridge Guided Busway	CS03 Borders Rail-Waverley Line
Wilkinson Street (CS 1.02)	Cambridge Station Area (CS 2.04)	
Basford South (CS 1.03)		
Basford North (CS 1.04)		
Highbury Vale (CS 1.05)		
Cinderhill (CS 1.06)		
% of Total Nodes Per Case Study Examined as Within the City - Inner Area Typology		
27 %	7 %	0 %

Table 6.2 Case Studies Examined Under the 'City - Inner Area' Context Typology

This table shows six nodes categorised under the City-Inner Area context typology, although they are not evenly spread across the three case studies. There are no examples on CS03, one crucial example situated on CS02 and five examples from CS01.

Lynch (1960) describes a district as a section of the city that can be 'entered inside of' and 'as having some common identifying character'. This research surveyed the three case studies in order to identify where 'districts' occurred at-the-node of stations/stops along RRCs. This normative urban design conceptualisation states that a district can be both identifiable from the inside and distinguishable from the outside (Lynch, 1960). This research identifies specific cases where this identification can be made in relation to the spaces at-the-nodes of RRCs. The Cambridge Railway Station Area (CS 2.04) can be identified as Lynchian Districts, however they demonstrate contrasting urban design responses to their respective RRCs and in their response to human scale urban design (Gehl, 2010). The close relationship between Cambridge Railway Station Area (CS 2.04) and the CGB is discussed in Chapter Five where the various sites of the 'Cambridge Areas of Major Change Composite Plan' are explained as coexisting strategic elements. This section examines CS 2.04 as a district at a finer urban design scale, referencing normative urban design concepts that carry implications for human scale urban design (Gehl, 2010): block form, mixed-use configuration, 'inside-outside' space, corner treatments, permeability, architectural detailing, etc.

The development of this area has been coming to fruition throughout the course of this research. It is arguably highly identifiable as a district; there are common characteristics between the buildings with clear entrances into and out of the spaces. These factors exist in close proximity to the point at which the CGB leaves the previous railway alignment and commences its section of street-running through Cambridge city centre. This district occupies land that had previously been railway sidings (5.6), comprises residentially-led, dense, mixed-use perimeter blocks and the extremis of this site is within three hundred metres of the entrance to Cambridge Railway Station.

The image below shows the 'inside', or the *interior* of the Cambridge Station Area district. There are a variety of urban design *parti* exhibited in the configuration of the buildings as seen in the foreground, either side of the access road:

- Ground floor retail clad in Cambridge Gault brick with large areas of glazing;
- Two storeys of apartments in matching Cambridge Gault brick; and
- Third storey of apartments set back from building line and clad in vertically laid standing seam metal panels.

This shows a focus towards the public realm with active frontages framing the entrance to the district. The massing of these mixed-use perimeter blocks reflects Gehl's (Gehl, 2010; Gehl & Svarre, 2013) 'important threshold' for designing to the human scale: four storeys (Figure 2.5). This massing also reflects the scale of the neighbouring buildings along the

road which forms this specific perimeter of the site. Although defined as a district, these public amenities open up this area by inviting those not resident to the district to use the retail provision. A further aspect to the public realm worth highlighting is the clear access for cycles situated to either side of the road, contrasting with the automatic bollard protected entrance for motor vehicles. This cycle priority corresponds to the configuration of the CGB.

To the background of this image can be seen an architecturally differing response that exhibits consistent urban design traits. These two[78] blocks, solely apartments, are constructed with a similar brick and have a stepped-back top storey, again addressing issues of human scale (Gehl, 2010).

Figure 6.6 District: Cambridge Station Area

This view is towards the 'interior' of the Cambridge Railway Station area district. High density mixed-use with commercial on the ground floor, ample cycling, all within the immediate pedshed of transit nodes. (Author's own, 2013).

These two components of this district differ however, in terms of their relationship with the public realm. The apartment blocks face primarily onto landscaped spaces as opposed to streets. In the image, where site hoarding is visible, a park is to be situated. Below are the key urban design traits of these blocks:

- A feeling of natural surveillance through both the fenestration and balconies;
- Orientation towards two types of urban landscaping (linear park and courtyards); and
- Prominent corner treatments.

The fenestration of this block also highlights an important aspect of medium/high density residential accommodation. The windows to the park are full height and accompanied by balconies. This makes use of the best views for the inhabitants and provides a sense of natural surveillance to the park. The street however, will typically be busier than the park.

[78] Two of a parade of four similar apartment blocks are visible in this image.

This is shown in the smaller windows to the right-hand side of this block, providing a higher level of privacy as compared to the elevation facing the park, where natural surveillance is less of an issue due to the street traffic.

The table below summarises the urban design characteristics which distinguish Cambridge Station Area as a 'Lynchian' District'. There are a number of instances at-the-nodes of the case study RRCs where districts have been identified. However, this has not automatically led to transit-supportive urban design. The table below also summarises the urban design responses at Newstead. Although there is a clear district at this case study, in Lynchian legibility terms, the urban design is comparatively less transit-supportive than that at Cambridge Station area.

NORMATIVE URBAN DESIGN TRAITS OBSERVABLE AT-THE-NODE OF CAMBRIDGE STATION 'DISTRICT'	
Mixed-use Configuration	Retail Ground Floor – Residential Above. Some Commercial & Hotel Blocks
Residentially-led Tenure Mix	A Mix of Student Accommodation & Private Accommodation
Block Form	Perimeter Blocks
Human Scale	4-7 Storeys with Upper Levels Set Back
Public Realm	Grid Pattern: Cycle Friendly with Traffic Calming
Landscaping	Significant Linear Park with Courtyards between Apartment Blocks
Relationship to RRC	Adjacent to RRC & Continuous Use Heavy Rail Station

Figure 6.3 Cambridge Station Area District

This case shows that when a district is designed at-the-node of a RRC, other normative urban design traits are required in order for the place to resemble a transit-supportive typology, such as human scale considerations (Gehl, 2010). This district occurs at a node that has been categorised within the City-Inner typology. This could have increased the chances of the creation of a district that may not exist within other types of node relationships. The Cambridge Station Area has significant advantages: proximity to the centre of Cambridge, proximity to the railway station which has a regular train service to London and the relatively affluent demographics of Cambridge. This site, however, was not developed until the establishment of the CGB along the RRC, despite the positives listed above. No causality is claimed here; however, given the urban design evidence[79] collected through this research, a strong correlation is apparent. This correlation could inform future urban design

[79] Documentary evidence such as the Cambridge Areas of Major Change Plan and observations made by the researcher on-site.

configuration of districts at-the-nodes of RRCs, both those that occur at City-Inner sites and those which occur at different node typologies.

High-density residential development is cited as a core component of transit-supportive urban designs (Calthorpe & Fulton, 2001; Dittmar & Ohland, 2004; Dunphy et al., 2004) and it is argued that the closer to a conurbation's centre, the more appropriate higher densities become. The contributory benefits of high-density residential at-the-node of public transit are set out in Breheny & Rookwood's (1993) Social City Region; an impetus to improve public transport in order to serve a critical mass of population, and to concurrently increase residential densities in order to complement the high populations. Issues of human scale (Gehl, 2010) built environments are crucial in this regard. Recognising this reciprocal relationship between transport and land use in masterplanning strategies is key, although not definitive, in establishing whether or not a transit-supportive urban design is evident at-the-nodes of RRCs. High Density Residential in this research is defined as approximately 55-90 dwellings per hectare (Barton et al., 2003) and is characterised as either apartments or terraced streets (2.6).

The table below shows nine instances that exhibit either high-density new residential or the retrofitting of high-density developments at-the-nodes of the three RRCs. Four of these (highlighted) fall under the City-Inner category. Those that fall outside of this category are either within the City Centre, a New Community or within a Suburb. Those that fall under the category of suburb are mature Edwardian/Victorian suburbs.

HIGH DENSITY RESIDENTIAL DEVELOPMENT AT-THE-NODES OF RRCS		
Robin Hood Line/NET P1	Cambridge Guided Busway	Borders Rail-Waverley Line
Nottingham Station Area (CS 1.01)	CS 2.02 Trumpington (Clay Farm)	Shawfair (CS 3.07)
Basford South (CS 1.03)	Cambridge Station Area (CS 2.04)	
Basford North (CS 1.04)		
Bulwell Forest (CS 1.09)		
Hucknall (CS 1.12)		

Figure 6.4: High Density Residential Development At-the-Nodes of RRCs

This table identifies which of the case study nodes have either new or pre-existing high density residential areas at-the-node.

This research compares urban design evidence at Basford South (CS 1.03) and Cambridge Station Area (CS 2.04) from within the 'City-Inner Area' type (Breheny & Rookwood,

1993). These instances are also reflected against Shawfair (CS 3.07) which is situated within the 'City-Inner Area' (Breheny & Rookwood, 1993) of Edinburgh but has been categorised within 'Small Town & New Community' (Breheny & Rookwood, 1993) as it is uncompleted at the time of writing.

There are a number of similarities and differences between these two cases and their relationship to the RRC. Both show high-density multi-storey apartment buildings within the immediate 400m pedshed of their respective nodes. Also, these developments have been built, or are being built concurrently with the opening of the RRCs. The RRCs of these cases are duplicated in both of the instances, making for a Lynchian Edge (1960) that is acting as a barrier and therefor difficult to penetrate.

The image below shows high-density multi-storey residential apartments within the pedshed of Cambridge Railway Station. This image, taken from the railway bridge looking south, is at the approximate extent of the 400m pedshed. The apartments in view either side of the transport corridor all fall well within the 1km pedshed of the railway station node. The transition between the CGB and normal roads can be seen in this image also. Here, to allow access to the high-density residential development, the restricted section of the busway has been pushed back approximately 300m.

Figure 6.7 High-Density Residential Land Use: Cambridge Station Area

Six and seven storey apartment buildings at-the-node of Cambridge Station Area. (Author's own, 2013).

These high-density apartment buildings are, on average, circa six storeys in height (meaning they are in excess of human scale dimensions) and configured to a perimeter block arrangement with some parking provided at ground floor level. There is a mix in materials used, with Cambridgeshire brick used as the main material in the apartments to the left of

the image and similar brick, render and timber being used on the buildings the other side of the transport corridor. These high-density residential blocks also show both traditional balconies and 'Juliet' balconies. The image below shows how the high-density residential apartments at Basford South (CS 1.03) are configured in a different way to those in the image above. Although both cases have close physical relationships to a railway corridor, it is worth noting the frequency and scale of traffic; the Cambridge example is adjacent to a mainline to London whereas the heavy rail traffic at Basford is usually a two-car train at half-hourly intervals.

Figure 6.8 High-Density Residential Land Use: Basford South

Four and five storey apartments buildings in proximity to the transit node. (Author's own, 2012).

The quantity and scale of these high-density residential developments is a key difference. The example from Basford is generally two storeys shorter than the example from Cambridge meaning that the apartments, although being of a high density do not contribute as much to the potential patronage of the associated node. They are however, more akin to Gehl's (2010) human scale. The quantity at Cambridge is also higher due to the utilisation of ex-railway siding brownfield land (as discussed earlier in 5.6). Both examples are perimeter blocks, with the example from Basford fronting a pre-existing well-established street pattern. Architecturally, both demonstrate a contemporary approach to the aesthetics of the buildings, although it is debatable as to whether or not they have a similar quality of finish despite the common timber cladding.

In terms of relationship between the high-density residential plots and the transit mode, Basford has access to one form of permanent way public transit, the NET P1 tram (there is no heavy rail stop in this instance). The high-density residential apartments within the pedshed of Cambridge railway station however, have good access to three forms of

transport; the heavy rail direct link to London, the cycle lane adjacent to the Guided Busway and the Guided Busway itself.

The urban design evidence here shows that both examples have high density residential development at-the-node of their respective RRCs. These two examples however, also exhibit urban design differences; scale of block, quality of finish and connectivity to the transport node. As with other aspects of normative urban design at-the-nodes of RRCs, it is the inter-relationship and accumulation of these aspects which lead to transit-supportive places.

Shawfair (CS 3.07) through its Master Plan for the 'south east wedge' of Edinburgh (see appendix) exhibits one such inter-relationship between various normative urban design elements, with the focus being at-the-node of the RRC and utilising a high-density residential land-use typology. This is illustrated in the image below which shows the high-density residential area indicated[80] in red, surrounding the railway station which is also situated at the centre of the proposed new town.

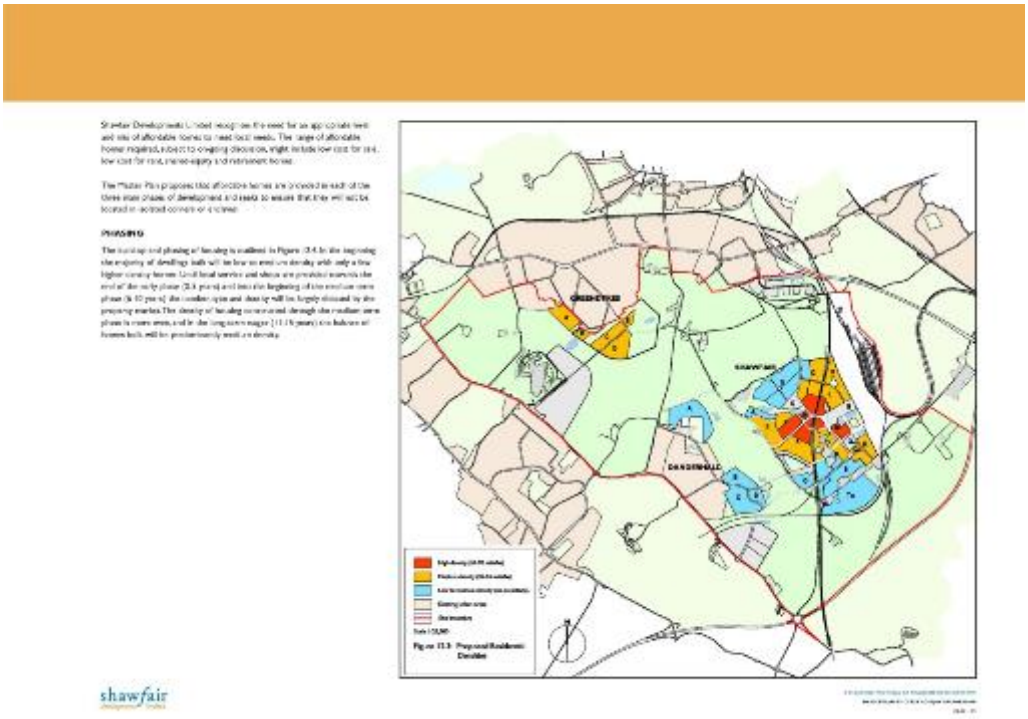


Figure 6.9 High-Density Residential Land Use: Shawfair

The image above illustrates proposed higher densities of residential accommodation centred upon the transit node. (Shawfair Developments Ltd, 2002, p. 73)

These three examples are illustrative of the opportunities for transit-supportive urban designs at-the-nodes of RRCs. They show, to varying degrees, that the City-Inner node type can accommodate high-density residential housing patterns and that these patterns in

[80] The residential strategy within this master plan includes a mix of tenures and provision for affordable homes.

combination with other complementary urban design strategies can contribute to a transit-supportive whole.

6.3 'City Suburbs' RRC Node Context

The City Suburbs node context typology, as discussed in Chapter Two, typically contains much in the way of existing residential building stock (Breheny & Rookwood, 1993). The draw of the suburbs is, according to Breheny and Rookwood, the combination of the opportunity to live in individual family homes combined with the relative proximity to the countryside. This accounts for the prevalence of a built environment configuration predominantly consisting of low-density housing, which in turn means low levels of public transport accessibility/high reliance upon automobiles. The nodes examined as part of this research under this category will focus upon the nature of the housing at-the-nodes of the RRC and how 'comfortable', in urban design terms, the pedestrian environments linking those two aspects are. The table below shows which case study nodes have been categorised under the 'City-Suburb' context.

CITY – SUBURBS CONTEXT TYPOLOGY		
CS01 Robin Hood Line/NET P1	CS02 Cambridge Guided Busway	CS03 Borders Rail-Waverley Line
Bulwell (CS 1.08)	Trumpington (CS 2.01)	Eskbank (CS 3.06)
Bulwell Forest (CS 1.09)		
Moor Bridge (CS 1.10)		
Hucknall (CS 1.12)		
% of Total Nodes Per Case Study Examined as Within the City-Suburbs Typology		
13 %	6 %	14 %

Table 6.5 Case Studies Examined Under the 'City-Suburb' Context Typology

This table shows six nodes categorised under the City-Suburb context typology; again like the City-Inner context, the nodes are not evenly spread across the three case studies. CS02 and CS03 have one example each, with four examples from CS01.

Further to the previous subchapter where the importance of high-density residential development at-the-nodes of RRCs was discussed in relation to City-Inner sites, the topic of 'Centralising Housing into the Solution' (Breheny & Rookwood, 1993) is discussed in relation to the City-Suburb identified as part of the case studies of this research. It is argued that whilst high-density residential development is appropriate the closer it is situated to the city centre, the placement, form and configuration of housing is a question closely related to the suburbs through which RRCs pass.

The two examples chosen for comparison are Hucknall (CS 1.12) on the Robin Hood Line heavy rail RRC and Trumpington (Clay Farm) (CS 2.02) on the Cambridge Guided Busway. Both have significant existing housing areas at-the-nodes (see appendix) and also new housing developments within the node's pedshed. Hucknall shows a bimodal transit stop[81] which has new residential development within the immediate 400m pedshed (1.14A see appendix). Although the immediate vicinity of the node is taken up by a surface car park (5.4), there are a number of separate housing developments within the 1km pedshed of this node.

On the other side of the track to the station is a small-scale high-density three-storey apartment block, visible to the left of the image below. This development, despite its proximity to the station,[82] has a convoluted pedestrian link to the station/stop. A lack of mindfulness exhibited in the design in terms of direct pedestrian connectivity, at the expense of 'anywhere architectural' buildings, is reflected in the 'Byron's Place' development.

Figure 6.10 Housing Adjacent to the Node: Hucknall

This image shows dense housing adjacent to the Hucknall node. It could, therefore, be argued that housing has been centralised in the regional planning. However, this housing is not well connected to the transit stop, therefore, contradicting transit-supportive theory.
(Author's own, 2011).

This development shares a high level of proximity, in its situation at-the-node of a recycled railway, with the development illustrated above. The image below illustrating this site shows

[81] The tram terminus of the NET P1 network and a heavy rail station on the Robin Hood Line – connected to the town centre with a local minibus service.
[82] An 'as the crow flies' distance no more than 20m from the station, but an actual walking distance of over five times that.

little evidence of a transit-supportive urban design, despite being housing-based and so close to the station/stop.

This development can be identified as a dendritic automobile-based mid to low density housing estate. It could be argued from a land-use pattern perspective that housing has been central to this solution. However, using finer grain through an urban design lens shows that this housing is present at the expense of both normative urban design strategies and housing configurations that can be argued as transit-supportive.

Figure 6.11 Dendritic Housing at-the-node: Hucknall

This image is taken from the railway bridge adjacent to Hucknall Station looking towards a housing development that is at the time of writing being built out. 'Byron's Place' has low levels of pedestrian connectivity and is a typical automobile prioritised form, despite being directly adjacent to a joint railway station/tram stop. (Author's own, 2011).

An example of where housing has been 'central to the solution' at-the-node of a RRC and is transit-supportive is at Trumpington (CS 2.02), to the south of Cambridge on the guided busway. Here there are a number of urban design proposals and strategies that deserve close attention, however this part of the discussion focuses upon the form, configuration and detail paid to the housing within the solution at-the-node of Trumpington. The housing provision at Hucknall was criticised for being 'anywhere architecture' but the contrary is evident in the design discussed here; a place-specific transit-supportive proposal.

The image below shows S333 Architecture + Urbanism's master plan (2015) for two plots on the Clay Farm development, the section to the foreground being adjacent to both the Cambridge Guided Busway and Hobson's Square (to the top left of the image). This configuration shows a sophisticated perimeter block arrangement at the scale of between 2½ to 5 storeys.

Figure 6.12 Dwelling & Housing Adjacent to the Node: Trumpington Clay Farm

The image above shows an extract from S333's 'Brochure' illustrating overview of their two plots at Trumpington Clay Farm. This shows a determined attitude towards not only housing, but also dwelling. (S333 Architecture + Urbanism, 2015, p.18)

Permeability is a key to this design, with six gaps in the perimeter block meaning access to the landscaped terrace area[83]. There are a variety of materials used, which in combination with the varied roof lines allow the accentuation of the aspects of the plot, differentiating between (clockwise from the top of the image) a new public square, a tight lane-type street, a linear landscaped space and the CGB. As stated below in the quotation taken from the practice's description of the plot, this configuration does not maximise the quantity of development on the site. However, the qualities of the place are considerable.

> *"The existing masterplan goes a long way in delivering a quality environment. However there is a conflict between the desire to create a dense central area of enclosure and presence, and the number of units at our disposal. Although it is possible to get more on the site, our spatial concept (working within the development constraints) is to concentrate the density and building perimeter to where it is most effective." (S333 Architecture + Urbanism, 2015, p.19)*

This quotation also emphasises the point that beyond high quality master planning, further architectural and urban design strategies make for a unique response, one that is highly place-specific, and one that would not work anywhere else other than at this specific site.

There are a number of house types which have been designed, as illustrated below, specifically to relate to their respective public realms; 'the lane', 'public realm', 'green way'

[83] This landscaped area hides car parking underneath a podium.

and of most importance to the context of this research, a specific response for where the plot addresses the guided busway.

Figure 6.13 housing & Place Qualities at-the-node: Trumpington Clay Farm

The image above shows an extract from S333's 'Brochure' illustrating the variety in housing types and place qualities of the public realm at Trumpington Clay Farm. (S333 Architecture + Urbanism, 2015, p.19)

This design exhibits a clever manipulation of localised topography in response to the RRC. The guided busway is set at a lower level to the entrance storey of the housing which provides privacy to the dwellings that face this busy thoroughfare. This privacy is increased with the planting of the landscaped strip which separates the RRC from the housing.

Whilst the housing at Clay Farm and Hucknall are both situated with proximity to their respective RRCs, at-the-nodes, the urban designs are contrasting. This contrast is exemplified when the image below, showing the public realm of the housing at Hucknall is compared with the lower image from the figure above, showing an example of the proposed public realm at Clay Farm.

Figure 6.14 Housing and Place Qualities at-the-node: Hucknall

The image above illustrates a lack of consideration for dwelling and quality of place at-the-node of Hucknall. (Author's own, 2011).

The first most striking difference is the role automobile space is given in the respective developments. At Clay Farm, the undercroft parking and its approach is subservient to the overall character of the architecture and the shared surface public realm. The opposite is the case at Hucknall, where standard traffic engineering standards have been adopted, prioritising the car. These are both key pedestrian routes between the housing and the node; however, they also differ greatly in terms of natural surveillance. The example from Hucknall shows the houses having small formal front gardens leading to the blank façade of the supermarket which separates the housing from the station/stop, a triumph of maximisation of floor space over incidental human interaction. The opposite is the case at Clay Farm. Here the houses have a 'feathered' threshold between the front door and the street. The inhabitants of this street will pass through a mixed-use flanked public square on their walk to the node of the RRC, as opposed to Hucknall where this route takes them past a blank industrial style façade and through a surface car park.

These contrasting examples show urban design traits reflecting the bespoke and the generic: place-specific urban design and 'anywhere architecture'. There is a correlation with the housing example at Clay Farm that respects normative urban design principles, with exhibiting transport-supportive urban design traits; a walkable, dense, varied environment at-the-node of a RRC. Hucknall shows a drivable, sprawling, generic environment at-the-node of the RRC. Whilst one can argue that, in land-use terms alone, housing has been central to both of these solutions, in place terms only one of these examples shows that housing and dwelling have been central to the solution at-the-node of a RRC.

The notion of comfort as an aspect of walkability at-the-nodes of RRCs is important, as the public realm is an aspect of space that can differentiate between an authentic place-specific solution and an example of the built environment as a manifestation of homogenising universalising forces. According to (Barton et al., 2003) there are three criteria for a comfortable pedestrian design: a pedestrian route that is wide enough to provide easy passing without conflict with vehicles, overlooking which provides a sense of surveillance, and good lighting design providing a sense of safety as opposed to intimidating places where the routes are featureless and poorly lit. This concept and its importance to transit-supportive urban designs at-the-node of RRCs (Oc & Tiesdell, 1997). The image above illustrating the public realm at Hucknall shows little of these qualities. Although the paths, on both sides of the road, are wide enough for people to pass without stepping onto the road, the blank wall of the supermarket is featureless and provides no sense of overlooking. There are, however, examples from the case studies in this research where comfortable pedestrian examples are evident at-the-nodes of RRCs.

Bulwell (CS 1.08), a joint node on both NET P1 and the RHL, exhibits urban design evidence of being a 'comfortable pedestrian design'. The image below illustrates these traits. Firstly, there is a wide pedestrian access between the town market place and the transit node[84]. As this photograph shows, the urban design of the surfaces shows few obstructions, although not a 'shared surface'. There are however, few steps or kerbs and barriers are kept to a minimum, meaning that the space is more conducive to wheelchair/pram use whilst still being navigable and legible, through the use differing materials, to able-bodied pedestrians and motorists.

[84] Although out of shot, Bulwell Market Place is approximately 150m from the node (1.08A see appendix), as is Bulwell Bus Station which has nine bus bays.

Figure 6.15 Comfortable Pedestrian Approach: Bulwell

The approach to Bulwell station demonstrating existing mature planting, overlooking from the public house and high quality paving materials. (Author's own, 2012).

The route between the market place and the station is overlooked by a public house and a set of offices which provides a degree of natural surveillance to both the pedestrian route and the station car park. This is not at the expense of landscaped features however, with the mature trees being kept, adding to a sense of permanence that the adjacent Victorian buildings render. Overall, it is argued that the pedestrian at-the-node of Bulwell is comfortable and 'walkable', contributing to a transit-supportive urban design.

Referring back to CS 1.12 Hucknall, it is a distinctly different scenario in terms of comfort, and the pedestrian environment is evident. The following image shows the condition towards the extent of the five-minute pedshed at-the-node in Hucknall. This condition evident in this image, it could be argued, satisfies two of the three criteria for a comfortable pedestrian design: wide footpaths and being well-lit. However, the configuration and detailed urban design of these aspects mean an automobile-prioritised environment prevails.

Figure 6.16 Comfortable Pedestrian Approach?: Bulwell

This image shows the approach to the station/stop at-the-node in Hucknall. This is a car-dominated environment with the road taking priority over the pedestrian area, and in the background a bare flanking wall of the supermarket is the only feature on the route, until you reach the surface car park which is situated between the residential area and the transport node. (Author's own, 2011).

Two pedestrian footpaths of ample width are shown. These paths go on to cross a surface car park and then to the station/stop. Where these paths pass the housing, overlooking does exist and in combination with the street lighting, some natural surveillance exists with perhaps a feeling of safety. However, looking beyond the end of the three-storey terraced housing, the big box retail supermarket can be seen to sever this route between the medium-density housing and the transport, both spatially and in terms of overlooking. This pedestrian route at-the-node of Hucknall Station passes, what is (aside from the large advertising) a long blank wall constructed using a material more frequently used on industrial units. In this specific area, although street lighting is present, due to this blank façade it is questionable whether or not this route would feel safe. This leads to it being impossible for this area to be identified as a comfortable, transit-supportive urban design at-the-node of Hucknall Station/stop.

Further to this assessment, if the other 'walkability' criteria are applied to this instance then this position is reinforced. This pedestrian environment could not be identified as convivial; is there an aesthetic enjoyment to the blunt end of the supermarket? Neither could this pedestrian environment be identified as conspicuous; can one read that one is entering the pedshed of a regional transit system? Other than the supermarket, what landmark features are there? The answer to these rhetorical questions is negative, especially considering the contrasting efforts put into the public realm at-the-node of Bulwell, four and a half kilometres up the RRC.

The urban design discussed in relation to pedestrian comfort suggests that when attention is given to the detail of the aspects purported in urban design theory, then a contribution to a sense of place at-the-node of a RRC can occur. However, the evidence presented here also shows that some comfort criteria can be met, without an overall feeling of pedestrian comfort nor a contribution to a 'walkable' transit-supportive urban design.

6.4 Small Town & New Community RRC Node Context

The Small Town & New Community node context typology has the highest number of examples of the seven contexts. This category is crucial to the conceptualisation of this research; a RRC relates to both existing and proposed building stock, each with interesting urban design conditions. A mix of uses at the confluence of regional and local transit networks (Breheny & Rookwood, 1993; Jacobson & Forsyth, 2008) were highlighted in the literature review (Chapter Two) as being crucial to this context, although residential land use is predominant. It was noted that more than one public transit node may be incorporated into a City-Suburb and this is a notion that will be examined in this subchapter.

The nodes examined as part of this research under this category will initially concentrate upon landmarks and focal points at-the-nodes. Complementary development forms will be studied by cross-case analysis concentrating upon plot and grid patterns. The mix of residential/commercial/retail land-use patterns will also be considered though a comparative analysis which will in turn lead into a discussion concerning residential defensible space and RRCs. The table below shows which case study nodes have been categorised under the Small Town & New Community context.

SMALL TOWN & NEW COMMUNITY CONTEXT TYPOLOGY		
CS01 Robin Hood Line / NET P1	CS02 Cambridge Guided Busway	CS03 Borders Rail-Waverley Line
Newstead (CS 1.13)	Trumpington Clay Farm (CS 2.02)	Tweedbank (CS 3.01)
Kirkby-in-Ashfield (CS 1.14)	Orchard Park East (CS 2.07)	Gorebridge (CS 3.04)
Shirebrook (CS 1.18)	Orchard Park West (CS 2.08)	Shawfair (CS 3.07)
Creswell (CS 1.20)	Histon (CS 2.09)	
	Oakington (CS 2.10)	
	Northstowe (CS 2.11)	
	Swavesey (CS 2.13)	
% of Total Nodes Per Case Study Examined as Within the Small Town & New Community Typology		
23 %	46 %	43 %

Table 6.6 Case Studies Examined Under the 'Small Town & New Community' Context Typology

The Small Town & New Community has fourteen case study nodes categorised under this heading, the majority of which are at CS02 where they make up just under half the total nodes for that RRC. Of these fourteen case study nodes, five are 'new towns': Trumpington Clay Farm (CS 2.02), Orchard Park East (CS 2.07), Orchard Park West (CS 2.08), Northstowe (CS 2.11), all of which are situated upon CS02, and Shawfair (CS 3.07) from CS03.

At Kirkby-in-Ashfield (CS 1.14) Station, an attempt to create a landmark at-the-node of the RRC is made, as shown in the image below. It is impossible for the station itself to act as a landmark as it is set in a cutting. However, even if the station held a prominent position, the building fabric consists of a platform and a proprietary uPVC shelter and therefore would not, as it appears in its current configuration, act as a landmark.

The landmark at Kirkby-in-Ashfield Station consists of a brick pier supporting three driving wheels of a steam engine resting upon a piece of rail, situated at the pedestrian entrance to the station's southbound platform. Whilst this structure is adjacent to an area of high quality permeable paving, it is questionable what purpose this space performs. Further, it's not entirely clear that this attempt at a landmark structure signifies the railway station, despite the overt reference to railway engineering. There is surface car parking adjacent to the platforms, a recently completed dendritic housing estate and a low-rise supermarket directly adjacent to the site. Although the station is on a bus route there is no directly corresponding bus stop. The building that sits across the road that could have acted as a landmark (previously a station hotel), however, is not a public building.

Figure 6.17 Landmark: Kirkby-in-Ashfield

This image illustrates how a nostalgic element has been used as a landmark representing the reinstated station. These wheels from a steam train act as a visual barrier to a surface car park and the entrance to the station. The literature argues that a mixed-use residentially-led development would be more appropriate here. (Author's own, 2012).

Whilst it could be argued a landmark is present at-the-node of Kirkby-in-Ashfield Station, the contribution it makes to an 'authentic' transit-supportive urban design is debatable. Considering an alternative scenario, perhaps if this area at-the-node had been configured more in line with normative urban design theories, with a prioritisation for a more walkable public realm, then this would have produced a more natural landmark. Perhaps this scenario could have included a mixed-use building incorporating the station, as opposed to the small supermarket and single storey social club (1.14E see appendix) which occupy prime locations at-the-node along this RRC. A contradictory condition exists however, where the necessity arises to signify the station through a landmark that is, in urban design terms, arguably inauthentic, bordering on the 'pastiche'.

On the Cambridge Guided Busway at-the-node of CS 2.09, Histon is an example of where a station acts as a landmark, despite its current redundancy. This shows that the anatomy of the built environment itself can act as a landmark. This is an example of an illuminatory juxtaposition between contemporary transport infrastructural buildings and those from the periods of the initial incarnations of the transport corridors, showing how one can act as a landmark and the other a ubiquitous public realm presence.

Figure 6.18 Landmark: Histon

This image is taken from the platform of the bus stop on the Cambridge Guided Busway at Histon. It illustrates the difference between historic railway architecture and contemporary transport facilities. The old railway station, even though it is still disused, acts as a landmark for the reinstated transport node, whereas the contemporary structure adds little in terms of sense of place. (Author's own, 2010).

In terms of being a landmark, the historic building is far more successful than the contemporary installation. The contemporary example of public transit infrastructure buildings exemplifies a trend beyond this particular instance across the majority of nodes

examined in the case studies[85]. As demonstrated in the image above, the cycle shelter on the platform for the guided busway is an off-the-shelf, mass-produced object.

Whilst this cycle shelter is clearly fit for purpose in a prominent position, transparent for security, easy to access and capable of protecting bikes from the elements it does not have the presence of the Victorian station building seen behind it. The cycle shelter becomes therefore a component of the ubiquitous nomenclature of street furniture that litters the average road. The Victorian station building however, although being derelict, acts as a landmark for the node at Histon on the Cambridge Guided Busway. It has a presence on both the main street through Histon and the guided busway, a presence that 'announces', makes legible, the activities that are occurring in the immediate built environment.

Although in a redundant state at the time of writing, the old station building still holds urban design potential. It could allow for activities other than alighting the transport infrastructure. The boarded-up rooms could conceivably become home to a business that would benefit from the footfall from a transport node. The contemporary platform allows for a single purpose, that of alighting the transport. However, the old station building, if brought back into use would contribute to an increase in the sense of genius loci at-the-node of this RRC. Referring back to the conceptual framework of this research (2.1), this site has potential to hold both a transit-supportive urban design and further, create a strong landmark through its design as well as its positioning and scale.

Newstead (CS 1.13) shows a similar approach to landmarks as Kirkby-in-Ashfield. At Newstead, the installation of a pit wheel at the head of the new housing situated to the edge of the ten-minute pedshed represents the site's history in a literal way, as illustrated below.

[85] The exception to proprietary shelters at-the-nodes of recycled railway corridors being at CS 2.14 Fen Drayton Lakes.

Figure 6.19 Landmark: Newstead

This image illustrates a similar attitude towards nostalgia and sense of place as Kirkby-in-Ashfield. These new houses being completed at the time of writing on the old marshalling yard of Annesley Pit commemorate the site's previous use with the pit wheel used as a sculptural element at the entrance of the site. It is questionable whether or not this achieves the creation of a sense of place as without the elements purported in the literature (a mix of uses, variety of densities, generation of activity etc.) the nostalgic landmark sits alone as a legible device. (Author's own, 2011).

However, the fact that both normative urban design and place-making strategies are absent at-the-node of the Robin Hood Line, it is argued here that they cannot be redressed by a pastiche of the region's mining heritage at the head of a dendritic housing development. There are examples within the case studies of this research where a place's specific heritage has been honoured without resorting to incongruous, simplistic design responses. Hobson's Square[86], at-the-node of Trumpington Clay Farm (CS 2.02), uses Bronze Age deforestation and field patterns to inform a place-specific response.

'PLACE Design + Planning', as illustrated in their published design work below, show a process that takes the positions of the Bronze Age landscape traces and amalgamates these with contemporary requirements for spatial structures, in order to formulate an urban design. The notion of palimpsest is central to the conception of a RRC, as discussed in the conceptual framework (2.1). In this instance the process of palimpsest is evident, but using stimuli from a very different epoch to that of the railways. The fact that this process is executed side by side, in such close proximity despite the temporal differences, indicates a complementary urban design approach.

[86] Scheme conceived by 'PLACE Design + Planning' landscape architects and urban designers.

Figure 6.20 Landmark: Trumpington Clay Farm

The above images illustrate the design process incorporating the Bronze Age history of the site of Hobson's Place into the Contemporary Design. ('PLACE Design + Planning', 2015)

Whilst the design at Hobson's Square acts as a landmark along the Cambridge Guided Busway, signifying the new development at Clay Farm through its central position and civic character, it also functions in a number of other urban design ways. As can be seen below, a number of distinct spaces are apparent within the unified whole.

Figure 6.21 Landmark: Hobson's Square Plan View

The above images of Hobson's Square in plan view, showing how this design could not work anywhere else, due to its rootedness in the site's Bronze Age history. ('PLACE Design + Planning', 2015)

There is the green landscaped area to the left of the site, with informal seating. To the right of the site is a more formal hard-landscaped space and the parking is integrated into the

design with shared surfaces and trees. A run of trees and bushes separate the guided busway that runs along the bottom of the scheme, from Hobson's Square itself.

The examples discussed from the case studies show that landmarks can manifest in differing ways, to varying degrees of success, at-the-node of RRCs. Overly literal pastiches of industrial heritage can occur which do not necessarily contribute to transit-supportive urban designs. Historic pieces of railway architecture can act as landmarks, even when they are still disused themselves and new urban designs can complement the approach to the RRCs through the use of palimpsest inherent to their conceptualisation. As with other components of transit-supportive urban design at-the-node of RRCs, the integration of a number of urban design concepts, including landmarks, can contribute to place-specific solutions.

There are similarities between a Lynchian landmark (1960) and a 'focal point', as identified by Cullen (1971). Cullen (1971) explains a focal point as somewhere that *"…crystallises the situation, which confirms 'this is the spot'*." (Cullen, 1971, p. 26). Aspects of the built environment can act simultaneously as landmarks and focal points: however, the distinction between the two ideas mean, from an urban design perspective, it is worth examining sections of the built environment that say 'this is the spot' at-the-nodes of RRCs.

An example of one such focal point, with an interesting relationship to the node of the RRC, is at Orchard Park (CS 2.07 & 2.08). The image below shows the community centre serving the Orchard Park Development. This single storey building is positioned to the edge of 0.4ha public space, bounded by dense residential development on two sides with the bus-only alignment forming the southerly boundary of the space. This is an area that, in Cullen's terms, crystallises the public realm situation at Orchard Park. The community centre has been busy at the times I have visited, with each of the defined public spaces[87] acting as focal points in their own right, as part of a whole.

[87] This area is sub-divided into a variety of landscapes that provide a focal point for a number of different uses: public play areas, open lawns, planted areas, segregated hard-landscaped areas, all with different kinds of seating available.

Figure 6.22 Focal Point: Orchard Park

This image shows a centre point in the Orchard Park development, the Orchard Park Community Centre. In line with normative urban design principles this place exhibits an increase and mix in densities, a variety of public spaces and a community building. Where it differs from theory purporting transit-supportive development is its position on the site. As opposed to being adjacent to one of the transport nodes it is approximately equidistant between the two. This separation is questionable as public spaces such as these can be conducive to public transport: however, this site is central to Orchard Park and so makes clear sense. (Author's own, 2011).

Whilst this space acts as a focal point and does have both residential and a community centre, one could argue that its strength as a focal point could be accentuated by an increase in the mix of uses, perhaps a small degree of retail/café provision. This would have been possible without much reconfiguration of the existing grain, through the strategic positioning of a handful of live/work units, perhaps on the ground floor of the apartment building in the image, taking advantage of a direct relationship to the landscaped areas.

Considering focal points at-the-nodes of RRCs, this example from Orchard Park is interesting. Whilst this public space is within the five-minute pedshed of the Orchard Park West Stop (approximately 300m) it is still somewhat disconnected, especially considering it is over 500m from the Orchard Park East Stop. This is due to the community centre being situated, perfectly reasonably, at the centre of the site. This however means the positioning of this focal point is difficult to argue as a transit-supportive urban design aspect of Orchard Park. One remedy to this might be to add in a transit node between the two existing stops. Whilst this would mean three nodes in relatively high proximity to each other, this frequency would not be unheard of for a bus network, especially considering the medium-high density of that part of the site. Perhaps a small pavilion-like building at a new node could house a café/retail provision, meaning an increase in amenity, transit provision and a strengthening of a focal point aspect of Orchard Park. This urban design evidence shows that focal points can be successful in developments that relate to RRCs. However, an opportunity is

highlighted where the configuration of nodes and focal points in tandem could produce a place where amenity and transit provision would be mutually reinforcing.

Plot patterns and street grid patterns are closely interlinked concepts and have significant influence over one another. These aspects are crucial to the solution at-the-node of RRCs. A plot pattern, as discussed in the literature review, can generally be distinguished by two overall categories, the dendritic plot pattern and the grid plot pattern (Marshall, 2005). A grid plot pattern (or a derivation thereof) is conducive to walking, choice of routes and an increase in opportunity for commercial or sociable encounters. Conversely, a dendritic plot pattern is difficult to penetrate, has relatively fewer choice (if any) of routes and lends itself to mono-use land patterns.

An example of a dendritic plot pattern is evident at Newstead (CS 1.13). This new settlement on the edge of the pedshed shows a derivation of a dendritic tree-like street pattern; one single point of entrance/exit which is equitable with a tree trunk and a series of distributor routes similar to branches, as seen in the planning application master plan below. Newstead does show one physical break in this pattern, a pedestrian link from the western side of the plot which cuts through to the main road. However, this is a pedestrian link, not a street. Whilst this does increase convenience somewhat, the fact that this cut-through is connected to a dendritic plot pattern means that the benefits are negligible to the whole site.

Orchard Park (CS 2.07 & 2.08) on the Cambridge Guided Busway is an example of a plot pattern that, whilst not being configured to a strict rectilinear grid, is of the grid family (2.08/09A see appendix). This means that there is a variety of routes available to pedestrians across the site, meaning a high degree of choice. As is characterised by grid patterns, Orchard Park is high in permeability. It is an example of how a grid street pattern can be manipulated to suit a variety of land uses, densities and street/place typologies, whereas the example in Newstead shows no such flexibility.

These two plot patterns, as with other urban design criteria discussed in this research, illustrate contrasting examples of plot pattern at-the-node of RRCs with differing urban design implications. Newstead shows that a dendritic plot pattern can increase the time and distance between a certain point with any new settlement and a transit node, a form un-conducive to transit-supportive urban design. Conversely, the grid plot pattern as evidenced at Orchard Park shows that variety and choice is offered, which is more conducive to a walkable environment.

The literature review (2.6) highlights that there are a variety of different types of street pattern (Marshall, 2005) that can broadly be categorised as a grid: the linear grid, a tributary grid, a radial grid, etc. In this regard, Newstead showed two contrasting street patterns, from developments of differing epochs, both within the pedshed at-the-node of the

RRC. The image below shows the historic core of Newstead and the grid street pattern comprising terraced housing.

Figure 6.23 Grid Street Pattern: Newstead

The image above shows a proportion of Newstead that is aligned on a grid street pattern, the Victorian era mining cottages. (Author's own, 2013).

This grid contains five rows of ex-mining cottages, all set out on a true grid. These mining cottages are within the five-minute pedshed at-the-node of Newstead Station and are amongst the closest houses to the station. This image also shows how a grid pattern can be articulated to provide a residentially weighted mix of uses – the ubiquitous corner shop. This is in contrast to the new residential development being completed on site at the time of writing of this research, situated on the extent of the 10-minute pedshed. The image below shows the master plan to the site, taken from publicly available planning application data.

Figure 6.24 Dendritic Street Pattern: Newstead

The image above shows the street pattern and 'Jasmine Gardens' in Newstead. Although visually it looks grid-like there is only one particular entrance to the site, little permeability or coherence; more of a dendritic street pattern than a grid. (Persimmon, 2008).

Although this plot is subdivided by the streets indicating a rectilinear structure in plan, this street pattern (especially when viewed from outside the block) exhibits the tendencies of a dendritic structure. There is one entrance to the site for vehicles (and one other pedestrian

entrance) by which all the other roads are oriented. It is impossible to either walk or drive from one end of the site to the other. The blocks created within the development site cannot be crossed and although there are a variety of materials used in the street surface this development resembles a dendritic 'trunk and branch' structure. It is especially interesting that these differing approaches coexist in such proximity: moreover, that the street pattern that was constructed in the time before the motor car should correlate far more closely to current normative urban design theories than the development being completed at the time of writing.

These instances of differing grid patterns at Newstead reinforce urban design theory (Calthorpe, 1993; Dittmar, 2008) that argues grid street patterns should have primacy at-the-node of public transit networks. The permeable nature of the street pattern surrounding the Victorian mining cottages contributes to a relatively better walking environment than the development currently under construction. Further to this, the way in which the new development has only one key pedestrian and vehicular access point (at almost the furthest possible point from the transport node) and one further pedestrian point of access/egress shows how the design of the street pattern can inhibit the relationship between areas of development and transport nodes. In comparison, these two examples demonstrate how to make a street pattern transport-supportive, and how not to make a street pattern transport-supportive at-the-node of a RRC.

The discussion surrounding RRCs from an urban design perspective has already covered mixed-use development. However, at differing contexts differing combinations of mixed uses are appropriate. Here, mixed use as configured to include residential-commercial-retail uses is considered at-the-nodes of RRCs. This mix of residential and commercial in proximity to a transit node is a key building block of a transit-supportive urban design, (Breheny & Rookwood, 1993; Calthorpe & Fulton, 2001; Dittmar & Ohland, 2004; Hall & Ward, 1998). This use configuration can occur at either an existing conurbation or at a new community. The examples discussed here are taken from existing small towns along the case study RRCs.

Histon (CS 2.09), an established small town on the Cambridge Guided Busway, is an example of where a mix of uses occurs at-the-node. Whilst the predominant land-use type throughout Histon is residential, there is a mix of uses situated at the transport node. The node at Histon is also positioned along the main road passing through the town. Small-scale retail live-work units; a pub, a small office park and both 'sport and leisure' uses are all visible at-the-node in Histon. These elements can be seen in the images below, and cross-referenced against the pedshed figure ground (2.09A see appendix).

Figure 6.25 Residential-Commercial-Retail Mix: Histon

The image to the left shows a public house and the entrance to an office park to the right, directly adjacent to the transit node at Histon. The image to the right shows where the Cambridge Guided Busway and the main road in Histon cross; high street shops with residential accommodation above can be seen, which continue for circa fifty metres beyond the frame of the photograph. (Author's own, 2010 & 2010).

One of the urban design advantages of a guided bus configuration of a RRC is evident here; the lack of grade separation at interconnecting junctions. If this were a heavy rail transport mode the necessity of a level crossing would cause a much greater sense of separation between either side of the RRC. This example is also compact in nature without being overly dense or intensive – a balance between the three land-use forces of residential-commercial-retail creating an animated space with variety of use at-the-node of Histon. This configuration is not ubiquitous throughout the case studies.

Kirkby-in-Ashfield (CS 1.14) also has a mix of residential, commercial and retail land-use types at-the-node of the RRC. However, the configuration and specific occupants contribute to a less transit-supportive urban design than that seen at Histon. To the west of the station, as shown in the figure below, a mixture of residential densities are seen; Victorian semi-detached houses to the north of the road crossing the railway line, and more substantial detached properties from the same period are also identified in close proximity to the station also (1.14A see appendix).

Figure 6.26 Residential-Commercial-Retail Mix: Kirkby in Ashfield

The image to the left shows the Victorian residential housing at-the-node of Kirkby-in-Ashfield station. The image to the right illustrates the condition adjacent to Kirkby-in-Ashfield railway station looking in the opposite direction; a social club with the surface car park in front. (Author's own, 2012 & 2012).

There is also residential to the east of the RRC; a 1980s dendritic pattern housing estate. A social club, supermarket and the council offices are all within the 400m pedshed of the

station node[88], as are substantial industrial works that occupy land mainly to the south and the south-east of the station. These two images and the figure ground pedshed drawing show that a mix of uses (residential-commercial-retail) is present at-the-node of Kirkby-in-Ashfield railway station. However, this mix of uses is of non-transit supportive elements; dendritic housing, automobile favourable big-box retail and office commercial. This is despite the node's proximity to a Victorian grid street pattern containing medium-density housing.

Both of these examples show an integration of the RRC node with the existing urban fabric. Histon demonstrates the proximity of large commercial offices (previously the home of the East of England Development Agency), a public house and some residential above a retail unit. Kirkby, however, demonstrates more segregation between the uses; although the street is mixed-use the buildings are themselves mono-use with the Victorian terraced housing being visible beyond the station and a social club beyond the car park.

Whilst there are similarities between these two examples, it is argued that Kirkby-in-Ashfield, due to the detailed urban design of the particular plots, does not exhibit a transit-supportive urban design. Both of the examples discussed here exhibit a mix of residential, commercial and retail properties (amongst other uses) and therefore resemble the normative urban design literature at some levels. However, when examined in closer detail, potential for transit-supportive urban design strategies to be employed are evident at both. Histon might benefit from some residential-led densification at the node and re-use of the existing station buildings (see above). Kirkby-in-Ashfield would also benefit from densification directly adjacent to the transit and through the use of the brownfield land which exists within the immediate pedshed. Also, the immediate buildings at Kirkby-in-Ashfield station are questionable in terms of their appropriateness. A differing denser configuration, whilst still retaining their retail/commercial uses, could occupy the space directly at-the-node.

Whilst considering residential dwelling houses at-the-nodes of RRCs, the notion of defensible space is crucial to the success of the relationship between the public realm, the transit corridor and the buildings. Defensible space is the extent of the built environment attributed to a certain property that exhibits legible signals of possession towards that property. It can be a defining element of the walkability of a place, and therefore is crucial to the notion of transit-supportive urban design at-the-node of RRCs. Defensible space is a concept applicable to dwelling houses in a number of contexts along-the-line of RRCs. The nature of normative urban design at-the-nodes of RRCs means a number of dwellings are to be expected in proximity to both nodes and corridors of RRCs.

[88] Which all occupy brownfield land left over from previous railway sidings.

The two examples highlighted in the section of the discussion show contrasting attitudes to the idea of defensible space, and perhaps crucially in this matter is the idea of a timescale: when the dwelling was built and when the RRC came back in to use. The image below at Histon (CS 2.09) shows the opposite of a textbook defensible space, arguably a defensive space. In terms of the chronology, there would have been a railway here which was closed before the construction of the dwellings. After this the dwellings were constructed and occupied for a number of years. Then the proposal and execution of the Cambridge Guided Busway happened and as part of these works two fences of approximately 3m in height have been erected between the busway, the cycleway and the private gardens.

Figure 6.27 Defensible Space: Histon

The image above shows a large fence erected in Histon between existing dwellings and the RRC. This is the opposite of designing for defensible space. (Author's own, 2010).

It is assumed that these fences are in place to provide privacy and an acoustic barrier between the dwellings and the RRC. It is this kind of defensive reaction that the theories behind defensible space attempt to counter. There is now no natural supervision evident to the cycleway, which in turn has been provided a space that is poorly lit and is difficult to navigate due to the slight curve of the route in this position. Further to this, it is also questionable whether these barriers perform their duties in visual/privacy terms; is the top deck of a double-decker bus still not capable of achieving a line of sight between the upper level windows/gardens? This shows that conflicts occur at-the-nodes of RRCs: privacy versus natural surveillance.

The example at Orchard Park East (CS 2.07) shows a different urban design response with regard to the designing of defensible space and a public transit route. These

two examples are less than a kilometre and a half apart, but due to the chronology of the respective building sequences a different approach is evident.

Figure 6.28 Defensible Space: Orchard Park East

The image above (less than the kilometre away from the previous image) shows a very different treatment in terms of defensible space. Here landscaping, a fence and the cycle path are what separate the public transit system from people's windows. (Author's own, 2011).

The dwelling in the image above and the guided busway were occupied and opened at a similar point in time. Whilst in the previous example measures have been put in place to retain the privacy of the established residents, anyone who occupies this dwelling does so in the knowledge that there is already a public transit route adjacent to the property. This configuration demonstrates a hierarchy of design techniques that articulate the defensible space. Working towards the property from the grade-separated route, there is first a pavement/cycleway, then there is a landscaped area (immature landscaping in the image) measuring between 1.5 and 3m wide, then after this a clear boundary-defining element signified by the metal fencing. Behind these elements, where space allowed, there is further planting and then the entrance to the dwelling.

Where this succeeds in terms of the design of defensible space is the way in which the area is not dissected visually for pedestrians by high-level fencing. There are areas that are clearly defined as public and private which are separated by visually permeable elements such as fencing and landscaping, although these elements are difficult to physically cross. This does leave privacy issues as all floors of the property are visually accessible by either pedestrians or bus users. However, this may suit some people and the condition is arguably preferable, in terms of defensible space, for example a terraced street.

These two pieces of contrasting evidence show that there are different approaches applied to protecting private areas from RRCs and that these can be dependent upon whether or not the dwelling has grown up with a public transit route or if the public transit route is being reinstated. What would be ideal in terms of exploring these ideas is to listen to the opinions of the respective residents. Is privacy a significant issue to them? Are they satisfied with the current conditions? How does the differing approach to defensible space affect their use of their private space, if at all?

6.5 Mixed Urban-Rural RRC Node Context

The Mixed Urban-Rural node context typology, according to the Breheny and Rookwood (1993) diagram (2.6) accounts for the peri-urban areas in-between cities and small towns which can exhibit intersections between a variety of local and regional transit networks. In this context urban design issues relating to walkability will be examined. The pedshed will be juxtaposed against the notion of a 180° station (Jacobson & Forsyth, 2008), which will lead into a discussion concerning issues of pedestrian connectivity. The table below shows which case study nodes have been categorised under the Mixed Urban-Rural context.

MIXED URBAN-RURAL CONTEXT TYPOLOGY		
CS01 Robin Hood Line / NET P1	CS02 Cambridge Guided Busway	CS03 Borders Rail - Waverley Line
Butler's Hill (CS 1.11)	St Ives (CS 2.15)	Galashiels (CS 3.02)
Mansfield Woodhouse (CS 1.17)		Newtongrange (CS 3.05)
Whitwell (CS 1.21)		
Worksop (CS 1.22)		
% of Total Nodes Per Case Study Within the Mixed Urban-Rural Typology		
13 %	6 %	28 %

Table 6.7 Case Studies Examined Under the 'Mixed Urban-Rural' Context Typology

Of the seven nodes under this category of context typology, the two from CS03 make up the greater percentage of their respective case study at just under a third. Of the remaining five the majority are within CS01, with one instance within CS02.

CS 1.11 Butlers Hill has previously been discussed in chapter 5.1 with regards to the agriculture adjacent to the node. This means that the station only relates to one side of the RRC, hence it could be argued a 180° station (1.11A see appendix). This area could be given over to development given the natural constraints (river Leen) to the far side of the RRC, without significant loss of agricultural land to the region as a whole. This opportunity however, is not present at Galashiels. The topography of this node, as discussed in 5.8,

shows a large retaining wall with the RRC at its foot. This prevents any transit supportive urban expansion in that direction although the node is situated to the centre of the large town in the opposite direction. Similarly, the St Ives (CS 2.15) node is constrained as a 180° station due to its topography but instead of the large retaining wall as seen in Galasheils the ex-mineral extraction activities have left pits to one side of the RRC, which have since become lakes, constraining any form of archetypal transit supportive urban design in that direction. Despite these constraints, Galasheils and St Ives do demonstrate many traits of transit supportive urban design. Peculiarly, Worksop (CS 1.22) is central within a built up area to either side of the RRC but transit supportive urban design traits are observed on only one side of the corridor. This indicates that the combination of transit supportive urban design criteria is highly context specific. Where some urban design aspects are observed the whole cannot be described as transit supportive. Paradoxically, if the balance of criteria specific to the direct contexts within which they sit, some of the criteria set out in T.O.D. theory may be absent yet the summation of aspects can still be argued as a transit supportive whole.

Conviviality (Barton et al., 2003) in the sense of walkability as discussed in chapter 2.6 is observed in limited examples throughout the case studies at-the-nodes of RRCs, despite such a notion being of importance to a walkable transit-supportive urban design.

The two images below illustrate how Mansfield Woodhouse (CS 1.17) on the RHL achieves a convivial environment at-the-node through urban design and landscaping. The path that runs parallel to the station is illustrated, which connects the main entrance to the platforms towards the town in a southerly direction and a recently completed dendritic housing development to the north (1.17A see appendix). The other side of this path from the railway station is an established industrial area. Without the attention that has been paid to this (approximately) 10m wide swathe of land, this area could have easily become an unwelcoming separating element between the majority of the Mansfield Woodhouse conurbation and its railway station.

There is a piece of community signage (although at the time of visiting yet to be populated with information) at the junction between the two paths towards the station from the adjacent residential development and the main entrance of the station. Here (although not illustrated) signage is situated pointing visitors to the country park (reclaimed mining land) to the far side of the station. This goes some way to negating the impact of the railway as a ‘barrier edge’ between the town and the ‘riparian zone’. Thus, a variety of landscapes are evident where conceivably, because of the footfall generated at-the-node of the station, casual meetings could occur.

Figure 6.29 Conviviality: Mansfield Woodhouse

The image above shows the high degree of attention given to the space directly adjacent to Mansfield Woodhouse station; high quality paving materials, lighting and significant careful landscaping. (Author's own, 2013).

Continuing along this path, through the landscaped area consisting of low bushes which allow for visibility (therefore not impeding a sense of security) and semi-mature trees, are a set of benches, a feature which could also allow for such 'casual meetings in comfort from fumes and noise' (Barton et al., 2003). The combination of these aspects point to a definite consideration regarding the sense of place at-the-node of Mansfield Woodhouse station. One aspect that perhaps has the intention of adding to this sense of place is the huge mural dominating the left of the picture below. This welcomes people to Mansfield Woodhouse (although the trees block this being viewed from the station itself) and depicts a variety of elements of local pride.

Figure 6.30 Potential Meeting Places: Mansfield Woodhouse

The image to the right shows further attention to the environment directly adjacent to Mansfield Woodhouse station. Again, care and attention in the planting, high quality seating and a visual shield between the station and the industry to the left of the image; a large advertising hoarding promoting the history of the area. (Author's own, 2013).

Whilst this sign acts as a visual barrier between the station and the industrial site behind (although not in audible and olfactory terms unfortunately) it is perhaps a trite attempt at place making. This might be better achieved through a strategic adoption of some of the other criteria put forward in transit-supportive urban design theory; an addition of some services to the mix of uses to the station area perhaps? A contrasting example where aspects of conviviality are absent is observed at-the-node of Worksop (CS 1.22).

As seen in the image below, the pedestrian route to the platform has little scope for people to dwell should they happen upon a 'casual meeting'. Excessive noise and fumes would be produced by either the car park which pedestrians must walk through to reach the station, or the builders merchants adjacent to the station.

Figure 6.31 Absence of Conviviality: Worksop

The image above shows a building site, builders merchant and a surface car park dominating the pedestrian experience at the northern platform of Worksop station. (Author's own, 2011).

Whilst technically there is a variety of landscapes evident in this image, the only feature of aesthetic enjoyment is in the historic features of the railway bridge from which this photograph was taken. The builder's merchants, surface car park and building site[89] are arguably contributory factors to an un-convivial place at-the-node of Worksop station.

The observations made at Mansfield Woodhouse and Worksop identify both positive and negative environments at-the-nodes of RRCs in terms of conviviality as an aspect of walkability. The landscaping, visibility and seating at the node of Mansfield Woodhouse make for an environment with some aesthetic interest. However, this does not negate the negative aspects of this situation that prevent this example from being a transit-supportive urban design: the adjacent industrial and dendritic residential land uses. Worksop, to the northern platform approach, shows the opposite of a convivial pedestrian landscape; prioritised to the automobile with land uses directly adjacent to the station which are more appropriate to an industrial estate than a transit node situated at the junction of three pan-regional railway routes.

[89] A supermarket is under construction in this position.

6.6 'Remote Rural' RRC Node Context

The Remote Rural node context typology focuses upon villages and small villages (Breheny & Rookwood, 1993) situated along the RRCs under examination. The analysis within this subchapter will examine, in urban design terms, the prominence of the transit node in the context of these sparsely built-up areas. This examination will show whether or not the nodes in this research's case studies within the 'Remote Rural' (Breheny & Rookwood, 1993) context exhibit traits of being 'introverted' or 'extroverted' (Richer & Hasiak, 2014). The table below shows which case study nodes have been categorised under the Remote Rural context.

REMOTE RURAL CONTEXT TYPOLOGY		
CS01 Robin Hood Line / NET P1	CS02 Cambridge Guided Busway	CS03 Borders Rail-Waverley Line
Langwith-Whaley Thorns (CS 1.19)		Stow (CS 3.03)
% of Total Nodes Per Case Study Examined as Within the Remote Rural Typology		
4 %	0 %	14 %

Table 6.8 Case Studies Examined Under the 'Remote-Rural' Context Typology

There are two nodes within the three case studies categorised under the Remote Rural context typology, one within CS01 and one within CS03. Although this is the fewest number of nodes of all the contexts, it is argued the urban designs in these positions are equally as important as in the other contexts, as these 'Remote Rural' (Breheny & Rookwood, 1993) contexts can arguably benefit greatly from increased connectivity, potentially in both outward commuting and inward tourism.

Theory championing transit-supportive urban design, as adopted in this research in the context of RRCs, calls for nodes to be 'extroverted', not 'introverted' (Richer & Hasiak, 2014) (2.6). This is reflected in normative urban design theory that calls for walkable built environments to be conspicuous (Barton et al., 2003). A sense of presence in the pedestrian environment surrounding the stations at-the-node of RRCs, could foster a mutually reinforcing transit-supportive configuration.

Langwith-Whaley Thorns (CS 1.19) is a node along the RHL in a Remote Rural setting which exhibits traits of being an introverted, as opposed to an extroverted, station with an inconspicuous as opposed to conspicuous pedestrian environment. The image below shows Langwith-Whaley Thorns station within its immediate topography, situated at the foot of a railway cutting. Immediately this is problematic as the site form contributes to the creation of an introverted spatial configuration. Although the mature trees to either side of the tracks are valuable ecological features, especially considering this nodes situation within

a country park, their presence here is counter-productive in introverted/ extroverted station terms.

Figure 6.32 'Introverted' Station: Langwith-Whaley Thorns

The image above shows a Langwith-Whaley Thorns station set into a cutting and hidden from the town by the mature trees. (Author's own, 2012).

The introverted characteristics of Langwith-Whaley Thorns station are exacerbated by the station's relationship to the village and the urban design characteristics of the station approach. There is a swathe of undeveloped land between the Robin Hood Line and the housing that constitutes the village (1.19A, B see appendix). When one approaches the station on foot the townscape is bare was little in the way of natural supervision. Not only does the mature vegetation seen below create a visual barrier between the station and the village, but also reduces any feeling of natural supervision in the station approach.

Figure 6.33 Lack of Natural Supervision: Langwith-Whaley Thorns

The two images above show the main pedestrian route from the town to the station with little in the way natural supervision. (Author's own, 2012 & 2012).

Further, the winding nature of the paths between the village and the station mean that pedestrians using the spaces cannot see particularly far ahead. These factors combine

together, making a highly inconspicuous public realm. The image below illustrates two artificial features aimed at increasing safety and legibility; CCTV and street signage.

Figure 6.34 CCTV in Lieu of Natural Supervision: Langwith-Whaley Thorns

The image above shows a prominent CCTV tower situated between the town and the station, illustrative of an inconspicuous environment low in traits of walkability. (Author's own, 2011).

Unfortunately, the attempts of these aspects to remedy the lack of natural surveillance and legibility (Lynch, 1960) in the public realm are mitigated by the presence of discarded needles, prophylactics and smashed alcohol bottles observed in the adjacent carpark. This example illustrates that an inconspicuous walkable environment (Barton et al., 2003) in combination with an introverted station (Richer & Hasiak, 2014) can create a public realm at odds with transit supportive urban design principles; an environment that can reasonably be considered, and certainly felt to the researcher unsafe (during the middle of bright day) with little advantage taken of the urban design opportunities present at the node of a recycled railway corridor (adjacent country park / adjacent undeveloped land).

6.7 Anomalous RRC Node Contexts

The following subchapter briefly considers all the nodes that did not fit into Breheny and Rookwood's Social City Region area types, (1993) in urban design terms already highlighted previously in this research. There are a variety of differing types of places within this category: park-and-ride sites, a science park, a further education campus, a hospital/medical research campus and a nature reserve.

ANOMALOUS CONTEXT TYPOLOGY		
CS01 Robin Hood Line / NET P1	CS02 Cambridge Guided Busway	CS03 Borders Rail-Waverley Line
Phoenix Park (CS 1.07)	Cambridge Science Park (CS 2.05)	none
Sutton Parkway (CS 1.15)	Cambridge Regional College (CS 2.06)	
	Addenbrooke's Hospital (CS 2.03)	
	Longstanton P&R (CS 2.12)	
	Fen Drayton Lakes (CS 2.14)	
% of Total Nodes Per Case Study Examined as Within the Anomalous Typology		
4 %	20 %	0 %

Table 6.9 Case Studies Examined Under the 'Anomalous' Context Typology

Whilst these anomalous typologies made up relatively small proportion of CS01 and CS03's nodes (4% and 0% respectively), a fifth of the nodes along CS02 are atypical contexts.

Both of the examples from CS01 are park-and-ride sites, although they are very different in urban design character. A comparative analysis (5.6) including both of these nodes has been carried out in a previous chapter, where it was observed that urban design opportunities had been achieved to a greater degree at Phoenix Park (CS 1.07) than at Sutton Parkway (CS 1.15). This was done through a skilful mix of uses incorporating an integration between commercial and industrial land uses, despite the potential conflict between high-sided freight access to industrial units and the overhead electric wires of the tram network.

Cambridge Science Park (CS 2.05) and Cambridge Regional College (CS 2.06) are situated adjacent to one another, to the northern edge of Cambridge, with the CGB forming the southern boundary of both sites. These are both campus sites each with dedicated nodes along the CGB, although both are separated from the adjacent residential areas (King's Hedges and Orchard Park) by the combined width of the guided busway and in part the container road of the adjacent housing (Lynch, 1960). Cambridge Science Park (CS 2.05) is oriented around two perpendicular linear landscaped elements that include a number of ponds. Addenbrooke's Hospital has a spur off the RRC, which crosses the continually used

railway alignment, increasing the accessibility to the hospital in terms of public transport and cycling. Due to this particular transit mode, the broader road network can be accessed here thus also acting as a point of integration between the RRC and the wider bus network. Longstanton P&R (CS 2.12) serves both as a park-and-ride site alleviating traffic from the A14 and the small village of Longstanton. Once Northstowe is completed, this node and this development will butt up against each other. Fen Drayton Lakes (CS 2.14), as discussed previously (Chapter 5.1) is a disused gravel pit that has been repurposed as a nature reserve, with a bespoke, place-sensitive urban design at-the-node.

Summary: Urban Design At-the-Node of Recycled Railway Corridors

This chapter, categorised in line with Breheny and Rookwood's (1993) node context typologies of a Social City Region, examined normative urban design criteria at-the-nodes of RRCs. In the City-Centre context, 'major transport interchanges' were examined taking the examples of Nottingham (CS 1.01) and Mansfield (CS 1.16). In these two instances, both natural and engineered topographies were crucial in the resolution of walkable urban design solutions. In the City Inner-Area context, Lynchian districts and High Density Residentially-led Development were focused upon as key aspects of transit-supportive places appropriate to this land-use area. The Cambridge Railway Station Area (CS 2.04) was examined as an example of where a number of land-use planning and urban design traits coincide to resemble a distinct legible district. The role of high-density residentially-led development in this area is then compared against the example from Basford South (CS 1.03), where although high-density residential buildings are extant, very differing place characteristics are apparent. The next context examined in this chapter is that of the City-Suburb where the notion of centralising housing into a region-wide solution is coupled with a finer-grain discussion of comfortable pedestrian environments at-the-node of RRCs. Here Hucknall (CS 1.12) is compared unfavourably with both Bulwell (CS 1.08) and Trumpington Clay Farm (CS 2.02), despite housing being present at-the-node of Hucknall's RRC stations.

The next contextual element examined at-the-node of RRCs is that of Small Towns & New Communities. Here the following normative urban design/land use criteria were examined:

- 'Lynchian Landmarks';
- Focal Point;
- Complementary Development Forms;
- Plot Pattern;
- Mix of Residential/Commercial/Retail;
- Grid Street Pattern; and
- Defensible Space.

This part of the discussion focused around Newstead (CS 1.13) and Orchard Park (CS 2.07 & 2.08), making other cross-case comparisons with Kirkby-in-Ashfield (CS 1.14), Shirebrook (CS 1.18) and Histon (CS 2.09). A variety of findings at-the-node of Small Town & New Community contexts supported the apparent trend that the urban design criteria under examination often existed at the specific node. However, what is becoming increasingly apparent is that it is the combination of normative urban design factors, which dictate whether or not the places at-the-node of RRCs show traits of being transit-supportive, as evident in the differences between Newstead and Orchard Park.

The Mixed Urban-Rural context featured convivial and connected pedestrian environment considerations as the focus of this section of the discussion. Mansfield Woodhouse (CS 1.17) is compared favourably with Whitwell (CS 1.21) and Worksop (CS 1.22) where a high degree of difference is seen in the pedestrian urban design at-the-node of these stations, despite them being in relative proximity along the RHL. The final context considered is Remote Rural, where Langwith-Whaley Thorns (CS 1.19) and Stow (CS 3.03) are compared in terms introverted/extroverted stations and the conspicuous urban environs inherent in these conceptualisations. In urban design terms, Langwith-Whaley Thorns is effectively hidden: ‘inconspicuous’ and ‘introverted’.

Overall, the conclusions drawn from this chapter are that when taken in isolation many of the case studies resemble individual aspects of normative urban design theory. However, this does not necessarily mean a transit-supportive urban design at-the-node of a RRC has occurred in these instances. Where these transit-supportive urban designs have come to fruition, a combination of a number of the normative urban design theories examined, in considered and deliberate relationships with one another, have combined to achieve a sophisticated and arguably successful place. This approach also means that a dogmatic replication of the raw principles of transit-oriented development is avoided, in preference of place-specific yet still transit-supportive urban design at-the-nodes of RRCs.

7. An Urban Design Perspective on Recycled Railway Corridors

The relationship between urban design and public transit has much in the way of applicable theory. However, very little focus has, at the time of writing, been applied to the RRC context. Therefore, the aim of this research was to set out an urban design perspective on RRCs. This research has been necessarily broad and whilst it is acknowledged that urban design operates at a number of overlapping scales, two key scales have been focused upon in order to examine RRCs: the regional scale and the neighbourhood scale. This conclusion summarises, through reflection on the theoretical foundations laid down in the conceptual framework, the findings from the comparative cross-case analysis carried out in this research.

Urban design is *"…the process by which the built environment comes about"* (Carmona & Tiesdell, 2007, p. 1) and this process and manifestation is considered at the two key scales noted above by examining the first two research questions outlined below. These questions are taken in turn in this conclusion:

How can urban design contribute to place qualities in the context of recycled railway corridors, at the regional scale?

How can urban design contribute to place qualities in the context of recycled railway corridors, at the neighbourhood scale?

How does the urban design differ across a variety of transport modes used in recycled railway corridors?

What techniques/approaches, applied to the varying territories of built environments along recycled railway corridors, can be used to survey, describe and interpret the urban designs?

Across these two scales, it was observed that the different transport modes utilised in the respective recycled railway case studies held differing urban design implications which is considered in Research Question Three. Research Question Four reflects upon the research techniques with regard to the surveying, description and interpretation of the urban design of RRCs. This chapter then concludes by addressing the broad research aim: to provide an urban design perspective on RRCs.

One of the foci of this research is urban design of RRCs at the regional scale. This was addressed by focusing upon place qualities along-the-line of RRCs. The implicit paradox of considering detailed level urban design considerations at the regional scale was discussed in Chapter Five. Topographical responses as signifiers of regional identity was a key thread throughout this research, considered via the collection and analysis of urban design evidence. Site-specific place-based design responses cannot by definition ignore topography and the responses gathered in this research proved interesting and varied. Examples such as the retention and reuse of a viaduct across a valley, the utilisation of pre-existing railway tunnels or the conversion of previous mineral extraction sites into country parks all resemble sophisticated responses to their respective topographies. In each instance, the process of recycling the railway corridor is interconnected with a topographical response. These built environment artefacts also contribute to the relationship between any regional identity and the urban design: the recycling of the railway corridor as the physical manifestation of, to varying degrees in each of the cases, a cultural, economic and political will (Frampton, 1992).

There are numerous examples discussed in this research where the RRC has shown resistance through its urban designs to 'processes that lead to a loss of contextual identity'. Ecological features observed in this research bear out a clear relationship to the urban design along-the-line of RRCs. Fen Drayton Lakes (CS 2.14) is a clear example of where a nature reserve is connected to the regional centre (Cambridge) by public transit (although much more difficult by car) exhibiting a bespoke, place-unique urban design. An urban example can be seen at Bulwell (CS 1.08), where a public amenity space is combined with flood attenuation measures of the River Leen, the course of which the RRC follows to a significant extent. The example at Newstead (CS 1.13) however, shows the utilisation of a man-made topography as a country park but with weak urban design links between the node along-the-line of the RRC, which could conceivably be strengthened through urban design attention to the public realm.

A policy review of the three case studies shows a disparity between the cases in terms of the organisation of strategic growth. RRCs can be entirely absent from regional planning diagrams, yet are significant elements in others, whilst also being crucial to some lower hierarchy sub-regional strategies, but absent in others. This is reflected in the number of new communities planned or built along the respective case study RRCs. CS01 RHL/NET P1, where strategic development organised along the RRC was absent, has no large-scale new communities and few small-scale developments relative to its corridors either at the time of writing nor at the time of the corridor's inception (1993-1998). Conversely, CS02 CGB, where the RRC was important in the strategic plans, had a far greater number of new

communities built/planned relative to the guided busway alignment, despite the fact that CS02 is the shortest RRC studied.

Morphologically, RRCs often acted as 'legible edges', forming the definition of, and seams between, various districts along-the-line of the case studies' RRCs. This is evident across the densest Urban contexts and the Remote Rural contexts. There was also the example in Trumpington Clay Farm (CS 2.02) where the RRC acted as an 'urban seam' binding together two parts of the development through which the RRC runs. This research also found that redundant railway alignments also acted as 'legible edges' even when rail usage ceased some years previously. The transport mode has further legibility and permeability implications along-the-line of the case study RRCs; the heavier the transport mode, the more difficult the corridor becomes to traverse, meaning a loss of permeability but a strengthening in terms of district image. The continued evolution of the respective RRC urban morphologies includes dormant periods, which evidently had profound implications for both the routes available for recycling, and the urban design opportunities inherent in the corridors. One example is where the NET P1 takes a deviated city running route from the RRC (CS 1.01). Here the previous alignment is blocked due to development; however, this network benefits from a closer relationship with the city centre because of this deviation.

In each of the case study RRCs elements of the previous railway network, related to the corridors used, remain unused for public transit purposes. This can be a hangover from the development of the railway network where duplication of route was common, as in the RHL at Newstead (CS 1.13) where the current line serves an area that once housed three parallel lines. In addition, these unused corridors can be used as strategic elements, as can be seen in Cambridge Science Park (CS 2.05) where the disused railway alignment is left dormant as the new network configuration leaves the disused route in order to utilise street-running advantages across the city centre.

These RRC case studies all exhibit sophisticated relationships with the regional main road network within which they coexist. In the instance of the CS02 CGB, congestion issues on the parallel A14 trunk road were a significant driver to the conceptualisation of the scheme. A further close relationship, but for very differing reasons, is seen in CS03 BR-WL. In this instance, the RRC uses the same valley as the A7 trunk road through the difficult topography of the Scottish Borders.

Automobile usage and the configuration of urban design also has a close link to RRCs. This is observed through the configuration and balance of car parking as seen in the case studies. Multi-storey car parks are present in city centre locations. Further out, surface car parking features more prominently and in the most transit-supportive instances this is balanced in the public realm, with walkability not being subsumed into a car-dominated

space, for example at Bulwell (CS 1.08) and St Ives (CS 2.15). There are however, examples (Hucknall (CS 1.12), Newstead (CS 1.13), etc.) where surface car parking dominates the public realm along-the-line and at-the-node of RRCs.

Urban regeneration occurred in a number of differing ways along-the-line of the case study RRCs. The evidence at the RHL was primarily of economic regeneration with a number of the previous railway stations being converted into 'business centres'. The CGB, however, used the RRC to structure selected expansion with circa fifteen thousand new homes either built or planned at sites along-the-line. Those developments are mixed-use and of a transit-supportive nature, for example at Orchard Park (CS 2.07 & 2.08). This specific example is interesting in terms of its planning history, where a refusal was made over a previous application for an out-of-town retail typology development. In its place, the relatively dense, residentially-led, transit-supportive mixed-use development closely integrated with the RRC is, at the time of writing, nearing full completion.

There are a high number of brownfield sites along-the-line of the RRCs, these are categorised as ex-railway land, ex-factory land, ex-mining/mineral extraction land and ex-military land. Some remain undeveloped (Basford South CS 1.03), some are at the time of writing being developed to transit-supportive urban design principles (Cambridge Station Area (CS 2.04), and some have commencement on site forthcoming (Northstowe (CS 2.11)/Shawfair (CS 3.07).

Although each of the case study RRCs held the opportunity to accommodate a cycle path along their length, only the CGB makes the most of this opportunity. This contributes greatly to the degree to which the developments along-the-line of this RRC relate to urban design criteria posited in human locomotion theory.

The evidence presented in this research shows differences across the cases in terms of 'joined-up thinking' between the transport planning and the urban design of the RRCs. Where urban design has been considered concurrently with the transport infrastructure regionally rooted, medium-high density, human scale, walkable places have been created. In the instances where this connection between the transport planning and the urban design has not been made, these qualities are lacking.

7.2 Recycled railway corridors at the neighbourhood scale

A further foci of this research is urban design of RRCs at the neighbourhood scale. The urban design at-the-nodes of RRCs is argued here as one of the two key scales at which the built environment can be examined in this context. Referring back to the conceptual framework of this research (Chapter Two), authenticity in urban design can be linked with transit-supportive urban design: the configuration of the buildings and public spaces surrounding the stations/stops. This research observes such issues as use/tenure, density, and aesthetics in order to examine cases independently and interdependently at-the-nodes of RRCs.

This research gathered urban design evidence showing instances where the 'shelter' associated with RRCs has exhibited an expression of local identity (Nesbitt, 1996), such as Cambridge Station Area (CS 2.04) and Trumpington Clay Farm (CS 2.02). Essences of the site through such characteristics as the materiality of building can be seen in the evidence collected in this research in these places; the vernacular cladding material employed or the influences of archaeological truths carried forward into contemporary landscapes. This research also presented evidence of the opposing position where generic built environment solutions have been applied without consideration for either authenticity or place-specificity, such as in Hucknall (CS 1.12) and Newstead (CS 1.13).

The archaeological references mentioned above inform the urban design without exhibiting nostalgia. The process of recycling railway corridors is heavily informed by previous patterns and events, without strict adherence to erstwhile conditions. A parallel process to the archaeologically-inspired public space configuration evident in Hobson's Square at Trumpington Clay Farm (CS 2.02). Not all the urban designs at-the-nodes of the case studies adhere to this paradigm however, with Kirkby-in-Ashfield (CS 1.14) exhibiting traits of nostalgia in lieu of authenticity, which in turn has close connection with an urban design lacking in transit-supportive traits.

The urban design territory at-the-node of RRCs is argued in this research to be the prime foci where inhabitants and users of RRCs engage with the built environment; where policy, culture, and political intentions become manifest. Further, and importantly, not all contexts at-the-nodes of RRCs are the same despite the common close relationship to RRCs. In fact, none are identical yet they do hold commonalities, which is why they are discussed in this research in typology context categories. The premise of this research was built upon one of the core aspects of critical regionalism in this regard, that an authentic urban design rejects the 'universal megalopolis'.

The differing settlement context typologies and their respective reflections made through the urban design lens used in this research, show that when considered

interdependently but part of an overall regional whole, urban design conditions at-the-node of RRCs exhibit differentiated built conditions linked through certain place-based commonalities. Common features are walkable public realms, respect for vernacular materials and topographies, and densities that strike a balance between the immediate spatial context and the transit node situation.

Within the City Centre context at-the-nodes of RRCs, evidence was collected regarding major transport interchanges. In this context, the topography, both man-made and natural, was observed to be influential in the urban design. Mixed-use developments surrounding a 'grand-hall' archetypal transport architectural design featured in direct relationship with the RRC node at Mansfield (CS 1.16). Legible Districts also correlate with the nodes of City Centre, Inner City and City Suburb contexts across all three of the case study RRCs, with perhaps Cambridge Station Area (CS 2.04) being the most pronounced example.

High-density residential developments were observed at the City Inner contexts at-the-nodes of RRCs. There were differences between the examples examined however, where urban design issues such as connectivity to the node, and scale and use of regionally-specific building material meant some instances illustrated traits of authentic, place-specific, transit-supportive urban design. Where lower density residential land uses were observed at the City Suburb context of RRC nodes, the concept of dwelling was seen to be crucial to the considerations on whether or not housing had been 'central to the solution' at-the-nodes of RRCs. Walkable, dense, varied examples of housing were discussed using the example at Trumpington Clay Farm (CS 2.02), whereas car-oriented, dendritic sprawl was observed at such examples as Hucknall (CS 1.12) and Newstead (CS 1.13). These configurations had significant implications for the comfort of the pedestrian environment at-the-node of the respective examples.

There were a number of legible landmark elements witnessed at-the-node of RRCs; however, the characteristics of these varied greatly in terms of kitsch and authenticity. Overtly literal pastiches of industrial heritage were common at-the-nodes along the RHL, whereas other cases, such as Trumpington Clay Farm (CS 2.02), illustrate a deeply considered utilisation of the process of palimpsest. In doing so, these cases exhibited authentic place-specific designs at-the-node of the recycled CGB corridor. Focal points were given a similar amount of attention to landmarks. Instances were observed with focal points being seen in the case study examples, but disconnected from the nodes of RRCs such as at Newstead (CS 1.13). The example of a focal point disconnected from either of the development's two nodes at Orchard Park (CS 2.07 & 2.08) prompted a possibility to consider, hypothetically, the introduction of a further transit node situated to the centre of the development, in order to serve the central focal point of the site directly. Given the transit

mode operating along this specific RRC (bus), three bus stops along such 1.3km spur would not be unreasonable. A bus network can have a dense concentration of nodes, meaning an extra node in this situation would not be detrimental to service provision, yet highly beneficial in urban design terms.

The plot pattern at-the-nodes of the RRCs is seen as a crucial aspect to any transit-supportive urban design. Evidence of both dendritic and grid plot patterns are seen throughout this research. Where grid street patterns were analysed, such as in Newstead (CS 1.13), walking distances to and from the node were shorter and the public realm was more conducive to a walkable environment than compared to where dendritic street patterns were evident. Newstead (CS 1.13) exhibited both grid and dendritic street patterns within its pedshed. These examples of Hucknall (CS 1.12) and Newstead (CS 1.13) show increased walking distances and public realms oriented to the automobile, which in relation to the other discussed urban criteria exhibited, indicate a trend away from transit-supportive urban design.

The mix of residential/commercial/retail at-the-node of RRCs was examined through the cases at Kirkby-in-Ashfield (CS 1.14) and Histon (CS 2.09). A contrast between the urban designs was observed at-the-nodes of these small towns situated along RRCs, despite each exhibiting a mix of the aforementioned land uses. Each case could benefit however, from a fine grain urban design analysis and scenario testing, including a densification of residential uses at-the-node of Histon (CS 2.09) and the development of brownfield land directly at-the-node of Kirkby-in-Ashfield (CS 1.14).

When residential land uses were considered at-the-node of the RRC case studies, issues of privacy arose. Defensible spaces were examined and contrasting strategies were observed between Orchard Park (CS 2.07 & 2.08) and Histon (CS 2.09). These differences correlated with the chronology of the opening of the RRC. At Histon, where housing predated the opening of the CGB, high fences were used to protect the privacy of the existing housing stock. Unfortunately, this strategy had the effect of reducing natural surveillance to areas at-the-node. This contrasted with Orchard Park (CS 2.07 & 2.08) where the houses that were built concurrently with the opening of the CGB have more sophisticated urban design responses to the protection of privacy through the careful articulation of defensible spaces.

The accumulation of urban design evidence relating to the spaces at-the-node of the RRC case studies reaffirms the point made previously with regard to ‘joined-up thinking’ between the transport planning and the urban design of the RRCs. Where a number of urban design issues were realised in concert with each other, walkable, human scale, transit-supportive urban designs were apparent. In the instances where these considerations were

lacking, routine, superficial ‘anywhere’ places were apparent with little in the way of design traits recognising the opportunities inherent in place-specificity or transit-supportive design.

7.3 How urban design differs across a variety of transport modes used in recycled railway corridors

A further aspect of these three broad case studies is that they give an insight into the variety of different transport methods in respect to their urban design implications: Heavy Rail, Light Rail, Guided Bus, and segregated Cycle Paths all have differently responsive urban designs. Each transit method has a visceral, tangible and cyclical relationship with the built spaces within which they exist. These public transit modes and their respective infrastructure have been identified through the evidence presented in this research to be significant contributory factors in the place identity of the built environment of RRCs.

Differing transit modes, as three-dimensional objects in their own right within the built environment, exert an influence over place; for example, the difference between the soundscape of a heavy railway and a cycle path is pronounced. When built environments are considered through all the senses, such soundscapes cannot be ignored. However, due to scope and presentation restrictions, this research focused upon the integration of these three-dimensional objects and the urban design fabric across the three case studies.

There are a variety of considerations taken into account when analysing these differing transit modes through an urban design lens. At the neighbourhood scale the station/stop platform is a good example, it is the crucial moment where people integrate from an 'urban environment' to a 'transport environment'. How this threshold is articulated, from an urban design perspective, can be considered just as crucial as the seminal moments of architecture; the threshold between public realm/private dwelling or the liminal fields of inside/outside public buildings.

This moment between the urban environment and the transport environment is identified in the most basic descriptive terms: a train requires a platform, a tram requires a smaller platform but one that is larger than the pavement, and a guided bus requires a pavement like a standard motor vehicle. Whilst these have significant practical urban design implications in such terms as land use, landscaping and detailed design, there are further more subjective criteria such as authenticity and regional identity that are of importance in this research context too. Where Cullen speaks of 'enclosure' as where the inhabitant of the space says 'I am here', so too that moment exists at the threshold between the transit realm and the public realm – a moment not overlooked in this research.

There are some examples of where the opportunity for place-specificity at RRCs were realised at this transitional moment; the flexible 'market' area at St Ives (CS 2.15), the bespoke timber platforms at Fen Drayton Lakes (CS 2.14). Mostly however, the examples at-the-node of RRCs exhibited few urban design characteristics celebrating the uniqueness

of the respective transit stops, instead electing proprietary shelters as the norm with little consideration for authenticity in regional identity. Even where characterful existing ex-railway infrastructure remained, such as Histon (CS 2.09), the urban designs tend not to utilise such structures, the problem being perhaps one of differentiation between transit modes. The old station building is physically linked to the old railway platform, which is circa half a metre too high for the contemporary guided bus, necessitating a new adjacent platform.

The differing transit modes examined in this research do not have the same statutory requirements as each other, in terms of segregation and protection of corridor. Under UK law, a heavy rail corridor must be guarded by a fence; however, this does not apply to light rail nor guided busway. This leads to the peculiar situation, from an urban design perspective, at the joint nodes of Bulwell (CS 1.08) and Hucknall (CS 1.12) where the tram stops are accessed by pedestrians walking across the tracks, whereas the adjacent heavy rail platforms require stepped bridges to traverse the tracks, despite the lesser frequency of traffic. Ethically, it is made clear these are observations only, as over the course of this research there have been fatal accidents along both the heavy rail and light rail sections of this network. However, the disparity between the principles behind the two conditions does appear to warrant more in-depth investigation.

The guided busway also has no such fencing requirement and is traversed with many pedestrian crossings along its length, despite double-decker buses reaching speeds of circa fifty miles per hour along some sections. One such example of a pedestrian crossing (2.00N, O, Q see appendix) is where a community forest is linked across the guided busway to a residential area. Along-the-line this can be seen as a detrimental aspect, however once in the more built-up contexts of at-the-nodes, the permeability of the lighter forms of transit mean significant urban design advantages over heavy rail. The fact that both light rail and guided bus networks can operate at grade within the wider road networks means the nodes need not be 180° stations (Orchard Park CS 2.07 & 2.08). The platforms can more readily be integrated into the overall urban design (Cambridge Station Area CS 2.04) and the close integration with public spaces can provide an extra sense of animation, prominence or permanence to the otherwise pedestrian-dominated environments (Trumpington Clay Farm (CS 2.02), Northstowe CS 2.11).

The configuration of the transit mode combinations adopted also has significant urban design implications; public transit systems take large amounts of space and the cross-sectional measurement of the corridor can be significant, especially in the context of dense city centre/city suburb contexts. The case seen at Basford North/South (CS 1.03 & 1.04) shows a four-track configuration doubling the width of the transit corridor. If a Karlsruhe Tram-Train model (Hall & Ward, 2014) had been adopted, then the extra space could have

been used as a cycleway or a linear park, benefiting from the adjacent course of the River Leen. The configuration of the CGB is illustrative of how cycle paths can be integrated into the cross-sectional design of the RRC.

The type of transit mode adopted along a RRC can be crucial to the manner in which development is structured at a regional level. The instance of the CGB shows a correlation between the most flexible of the public transit modes examined in this research, the guided bus, and the cases with the highest amount of associated development: (Trumpington P&R CS 2.01, Trumpington Clay Farm CS 2.02, Cambridge Station Area CS 2.04, Orchard Park CS 2.07 & 2.08, Northstowe CS 2.11). Whilst no causal relationship is claimed between these two spatial aspects, there is certainly correlation. It is hard to envisage such quantities of development adjacent to a railway corridor which would be without the inherent flexibility of the guided bus and its ability to spur-off from the previous railway alignment.

In terms of 'joined-up thinking' between transport planning and urban design, the evidence collected regarding how urban design differs across a variety of transport modes used in RRCs correlates with the observations made at the regional and neighbourhood scales. CS02 CGB, though the cyclepath adjacent to the guided busway, shows a consideration beyond transport planning. This case study also shows the greatest amount of development associated with the RRC. Further, this case study exhibits instances of place-specific and transit-supportive urban design: 'joining up' transport planning, regional scale urban design and neighbourhood scale urban design.

7.4 The generation of urban design knowledge regarding recycled railway corridors

It is argued that these findings, through the careful attention paid to the conceptualisation, design and implementation of this research, have a level of validity and usefulness appropriate to urban design. There are further actions that could increase the validity of the findings of this research, in terms of possible future research/operations that are discussed below. The appropriateness of 'visual thinking' to a piece of research concerning RRCs from an urban design perspective is discussed in Chapter Three. This argument is made through reference to and consideration of construct validity, external validity and reliability inherent to the procedures adopted within this research.

In relation to construct validity, the findings of this research can be deemed credible and trustworthy due to the way in which the adopted operational methods are attuned to three aspects: the research questions, the case study protocols and the worldview of the researcher. This means a considered level of construct validity is ingrained in this research. The data collection plan and data collection procedures (Chapter Three) explain the handling of the subjective data sources collected. The issue of bias in the process of observation through photography has been carefully considered in Chapter 3.4. A further tactic to increase the construct validity of this research has been to use a broad range of data sources (pedshed figure ground drawings, photographic images) that have their convergence at the territory of inquiry. The findings of this research are applicable both to urban design at RRCs and the field of urban design as a whole, meaning a degree of external validity is present in this research. Place-specificity at RRCs is an underlying theme throughout this research and this concept is embedded in normative urban design theory. The use of three case studies and the interdependent nature of the comparative analyses made between these cases (Chapter 3.6) furthers the argument that this research holds external validity through what Yin (2009) terms, analytical generalisation. Reliability is addressed in this research through the way in which the data collection procedures and protocols (Chapter 3.5) are made explicit, meaning the study is replicable. Situatedness however, is crucial to urban design and epistemologically complex; to make relevant urban design conclusions there ought to be some degree of difference if the study were repeated, although not at all levels of complexity. Despite this, consistency is achieved through the 'thick description' evident in the case study database, which as well as facilitating the cross-case analysis performed in this research, also acts as a permanent record of the case study environs at a specific point in time, which are by their nature in constant flux.

It is argued that this research has been carried out in an honest and dutiful manner, focused upon finding truth in urban design at RRCs, without any maleficence to others. However, the following measures could be taken in future in order to make the findings potentially more robust and to expand the territory of inquiry beyond the three case studies

used in this research. In order to increase the robustness of this research's findings, the scope of further study could be expanded to engage with users and inhabitants of RRCs. This research identified a number of cases with contrasting urban design conditions at-the-nodes of the respective RRCs. Post-occupancy surveys could be used as a model to inquire how, for example, the respective residents of Orchard Park and Newstead perceive the connections between their homes and the RRC, whether or not palimpsest and urban design influence housing choice and transit habits of the residents of Trumpington Clay Farm. Further questionnaires and focus groups might be conducted in order to find out how Hucknall/Newstead residents might react to a transit-supportive urban design intervention at those respective nodes. The territory of inquiry could be expanded beyond the three cases within this research. Using the data collection method alluded to above, each node along all the UK's RRCs could be catalogued in visual walkable terms. This could also be expanded to forthcoming RRCs such as East-West rail, or even further to cover all disused railways in the UK with a view to creating a repository of urban design walkable data, ready to support any further scenario analysis which may in future take cues from the urban design of such RRCs as the CGB.

7.5 The importance of urban design in the case of the UK's Recycled Railway Corridors

The overarching analyses culminating in this urban design perspective of RRCs is predicated upon the idea that urban design, or *'that which constitutes a characteristic of a town or city'* (Carmona & Tiesdell, 2007), can be observed and analysed by an individual in isolation. Whilst this means that this research does not make claim to definitive fact, it does claim to uncover certain truths pertaining to the built environment at RRCs. The conceptual framework of this research has stated that enquiry would be made as to whether 'enclaves of resistance' to the place-less rapacity of the universal megalopolis have occurred in the cases of RRCs. The conclusion is that there are a mix of results in this respect. Having reviewed the evidence collected in this research, there are clear examples of where the avarice of alienating consumerism has subsumed the built environment at the case study RRCs. There are also however, examples of 'enclaves of resistance' where the value of place-specific, transit-supportive urban design has been recognised, centralised and executed at the recycled railway context.

There are examples along the case study RRCs where homogenising factors have manifested in the built environment; the automobile-dominated landscape at Hucknall (CS 1.12) node for example. This resembles an instance when normative urban design qualities are generally absent, making for a typified antithesis to a regionally-specific environment tailored through a transit-supportive public realm. There are further instances to this, where the vernacular design elements have been used stylistically in a counterpoint to what critical regionalism would argue as authentic place making. The example at Newstead (CS 1.13) shows a cynical use of a disused colliery wheel which, when considered in conjunction with the adjacent relationship to the 'anywhere place' housing isolated from the node on the RRC, exhibits little in terms of authenticity. There are however certain cases identified within this research that perform as exemplars of a critically regionalist design approach to the solution of developing, inhabiting and dwelling along RRCs. Trumpington Clay Farm (CS 2.02) represents an instance where an authentically designed, transit-supportive, specificity-of-place centric built environment has occurred.

These claims are based on evidence collected that is appropriate considering the conceptual framework; one that reflects the sophisticated nature of the empirical contexts under study and that can lead to truths at a variety of built environment scales. Aspects of the built environment were considered both independently and interdependently of each other. These interdependencies were carried out at a variety of conditions: interdependencies within case study nodes; interdependencies across case study nodes within the same overall case study; interdependencies between nodes across different case studies; and interdependencies across overall case studies.

A sense of either self-reflexivity or self-reference in terms of situated-ness of place is crucial to the critical aspects of a critically regionalist urban design response. Explicit statements exhibiting a commitment to place are demonstrated in examples along the Cambridge Guided Busway, such as the use of the vernacular Cambridgeshire Gault brick as a non-load-bearing cladding of the multi-storey residentially-led mixed-use buildings that constitute the Cambridge Station Area district (CS 2.04). Although rare, implicit meta-statements exist in the design at the nodes of the case study RRCs. Palimpsest, through the drawing forward of Bronze Age field patterns into the configuration of the public space at Hobson's Square, Trumpington Clay Farm (CS 2.02), is an archetypal piece of place-specific urban design. This square's close spatial relationship to the guided busway is fascinating; both aspects having adopted the process of drawing forward spatial aspects dependent on historic patterns, although generating their respective palimpsest from vastly differing epochs. These two examples show how a combination of deep architectural theory, normative urban design theory and a conscious effort to reflect the specificities of sites can combine in a transit-supportive response to a RRC.

The urban design perspective on RRCs set out in this research reflects the complex nature of the evidence observed in the data collected. Significantly, and unfortunately, a high proportion of the cases examined in this research illustrate a perfunctory response to the urban design of RRCs. In an epoch where resilience and sustainability are of paramount importance, opportunities to utilise the extensive resource that is dormant sections of post-industrial landscapes extend beyond the sphere of transport planning, into and including urban design. The examples of the brownfield sites examined in this research are cited as being illuminatory in this respect. Although the transport planning opportunity has been fulfilled through the utilisation of RRCs, the broader opportunity has been missed with many sites still under/undeveloped. Place-specific urban design strategies at these instances could remedy this situation, potentially adding considerable value to both the transport network occupying the RRC and the region within which the corridor exists. There are, however, examples observed in this research where such place-specific urban designs have occurred. These examples, where the RRC has been conceived beyond the terms of purely transport planning considerations, illustrate sophisticated urban design responses, which are reflective of regional place specificities. These are the places where transit-supportive urban design has occurred. Further, through careful consideration of both site and transit opportunities, these urban designs have resisted becoming dogmatic representations of transport-oriented design theory. These urban designs, through significant and careful 'joined-up thinking' are simultaneously transit-supportive urban designs and urban designs, which in their own right, are also supportive of the transit system occupying the recycled railway corridors.

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